Standard Distribution Services Contract

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Disclaimer

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1.0 Introduction

The utilization of Distributed Energy Resources (DERs)[1] is increasingly being pursued to enable greater flexibility, sustainability, and resilience in both the distribution grid and bulk power system. At distribution, DERs can actively manage voltage levels and mitigate grid congestion, while also offering bulk power services such as frequency regulation and operating reserves. Efforts by several states over the past decade have advanced the use of DER as an alternative to traditional grid solutions. This has included distribution grid services procurements and related distribution services[2] contracts (DSC). However, while the number of contracted services has been modest to date, the expectation is that the scale and diversity of uses for DER Aggregations (DERA) will grow over the coming decade. This is due to growing capacity constraints on distribution systems in areas with transportation electrification and the continued development of distributed solar and storage.

A key challenge to achieving the desired scale of DERA-provided services is that currently, distribution service contracts can vary by type of DER, by utility, and by state, and therefore are difficult to scale quickly. More specifically, no standard service contracts nor codes of conduct exist today that specify discrete services and related performance expectations from independent DER Aggregators (Aggregator)[3], including requirements for asset visibility, operational coordination, compensation and performance evaluation, and customer engagement.[4] This distribution services contract (DSC) is an agreement between the distribution utility and aggregators for the provision of distribution grid services.

Additionally, FERC Order 2222 serves as a key enabler of expanded DER services in wholesale markets coordinated with distribution utilization. As such, synergizing DERA participation in both wholesale markets and distribution grid services requires market and operational coordination as reflected in FERC 2222. This also necessitates addressing a spectrum of related challenges to achieving the scale desired.[5]

The DSC structure and elements as discussed in this paper provide the basis to establish consistent terms for the provision of services as well as address required market and operational coordination requirements stemming from FERC 2222 implementation. This DSC framework is based on industry insights from aggregators, utility practitioners, and regulators, as well as new FERC 2222 coordination requirements. The intent is to provide a blueprint for a standardized pro-forma DSC contract applicable nationally.

This paper focuses on the distribution services contract between an electric distribution utility (utility) and an aggregator. As such, this paper does not address wholesale market tariffs/contracts, contracting between aggregators and customers, or contracts between utilities and DER program administrators[6].

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1 DER Definition: Distributed energy resource is "any resource located on the distribution system, any subsystem thereof or behind a customer meter." FERC Order 2222, p. 91, issued on September 17, 2020, in Docket No. RM18-9-000

2 "Grid Services Definitions" US DOE Office of Electricity, July 2023

3 DER Aggregator Definition: "The entity that aggregates one or more distributed energy resources for purposes of participation in the capacity, energy and/or ancillary service markets of the regional transmission organizations and/or independent system operators." FERC Order 2222, p.93, issued on September 17, 2020, in Docket No. RM18-9-000

4 Pathways to Commercial Liftoff: Virtual Power Plants, US DOE, September 2023

5 "Challenges and Issues for DER Utilization (VPP Version)" US DOE Office of Electricity, June 2023, in draft.

6 DER Program Administrators agreements typically involve distinct roles, responsibilities and risk assignment than DERA agreements. DER Program Administrator contracts and DERA-Customer contracts will be addressed in subsequent papers.

The remainder of the paper is organized into three sections. Section 2 below summarizes key steps in the overall lifecycle for DERA provision of distribution grid services to provide relational context for the DSC. Section 3 introduces the DSC structure and discusses key contractual elements and related forms/agreements for consideration. Section 4 provides suggested actions for retail electricity regulators, utilities, DERA, and relevant standards organizations.

2.0 Distribution Grid Services Lifecycle

A DSC reflects inputs from the business process steps that precede the contracting phase as well as the ongoing provision of grid services through the contract term. As such, it is important to understand the lifecycle of distribution grid services and its relation to the DSC. At a prominent level, there are 4 stages of the distribution grid services lifecycle encompassing A) grid needs and requirements, B) sourcing C) implementation, and D) operations. This lifecycle is continuous as the results of the operations stage provides input in the next planning cycle and the related grid needs assessment in Stage A. The steps within each of these phases involve activity by and between a utility, Aggregator, and customers/DER owners. Figure 1 below illustrates key steps in the lifecycles that are reflected in a DSC.

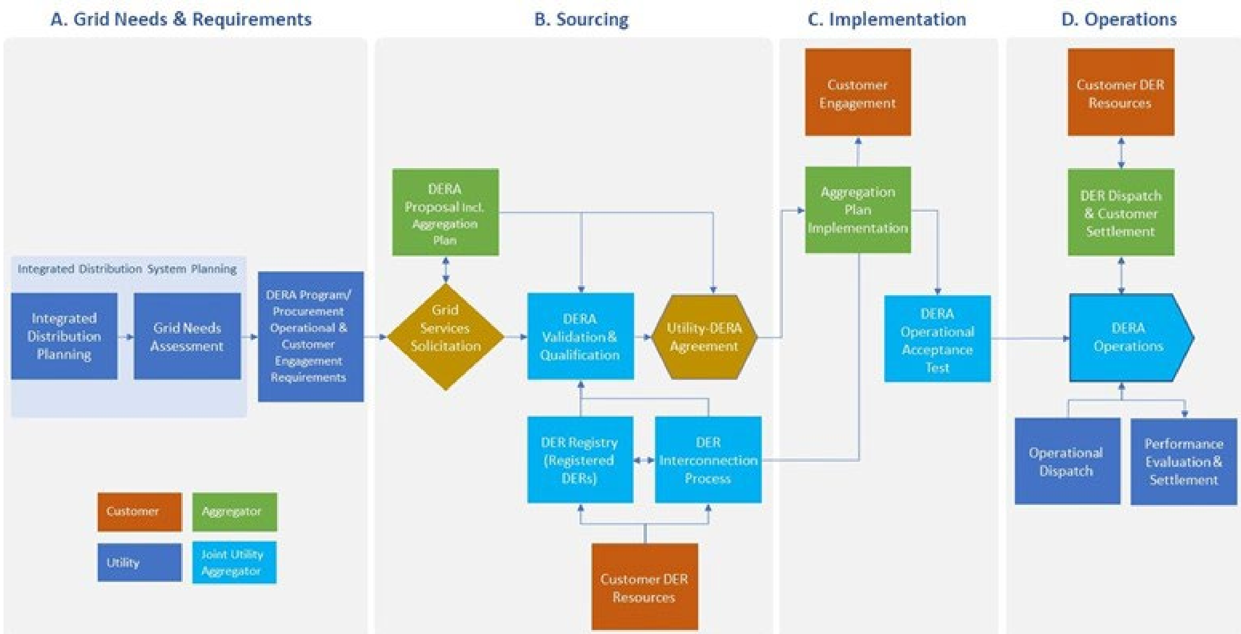

Figure 1. Summary Distribution Grid Services Lifecycle Process

A. The lifecycle commences with the **grid needs identification** phase, driven through *grid needs assessment* to identify current and future grid constraints derived from *integrated distribution planning* through distribution planning studies. The grid needs identified provide the DER technology neutral performance requirements for the requisite grid services. The specific grid needs and related distribution grid services[7] are published. This includes the specific operational performance requirements as well as requirements for asset visibility, operational coordination, compensation and performance evaluation, and customer engagement.

B. **Sourcing** involves the solicitation of market proposals from Aggregators. The previously

[7] "Grid Services Definitions" US DOE Office of Electricity, July 2023

identified grid services and performance requirements are combined with DER eligibility, customer engagement and Aggregator organizational wherewithal requirements into the market solicitation. DER eligibility requirements, particularly under FERC 2222, are a critical pre-contract consideration. These requirements will also be reflected in the subsequent DSC, post-procurement. Upon receiving market proposals, sourcing involves the evaluation of proposals received including assessment of the proposed aggregation plan, eligibility of proposed DER to provide services, and confirmation of interconnection agreements as may be required.

C. **Implementation** phase involves the implementation of the Aggregator-utility mutually agreed aggregation implementation plan, including the achievement of key milestones regarding contracted size, composition, and operational schedule. Acceptance testing is also included to validate operational performance prior to permission to operate is granted. This aggregation plan is a major aspect of the DSC. This plan also addresses the engagement and solicitation of customers and other DER owners to participate in the aggregation. Adherence to a governing code of conduct incorporated in the DSC ensures appropriate customer engagement and solicitation.

D. **Operations** phase involves the actual provision of distribution grid services including scheduling, dispatch, operational changes, and settlement. There are also contract management functions involved during the term of the contract and in the contract closeout. This is the longest of the phases and may span 5-10 years from permission to operate until DSC termination and closeout. The many dimensions of the operations phase form other key aspects of the DSC.

3.0 Distribution Services Contract Framework

The proposed structure of the contract can be visualized and utilized as a tool used by utilities and regulators as an important part of system design considerations, helping stakeholders to advance best practices for grid investment while accommodating higher penetration of DERs. This is especially crucial in integrated distribution system planning (IDSP), where the contract and its elements can inform decision-making around DER integration and optimization. With a DER service agreement contract in place, utilities can better strategize grid functions and improve their overall distribution system design as well as better coordinate and inform transmission operators with system needs.

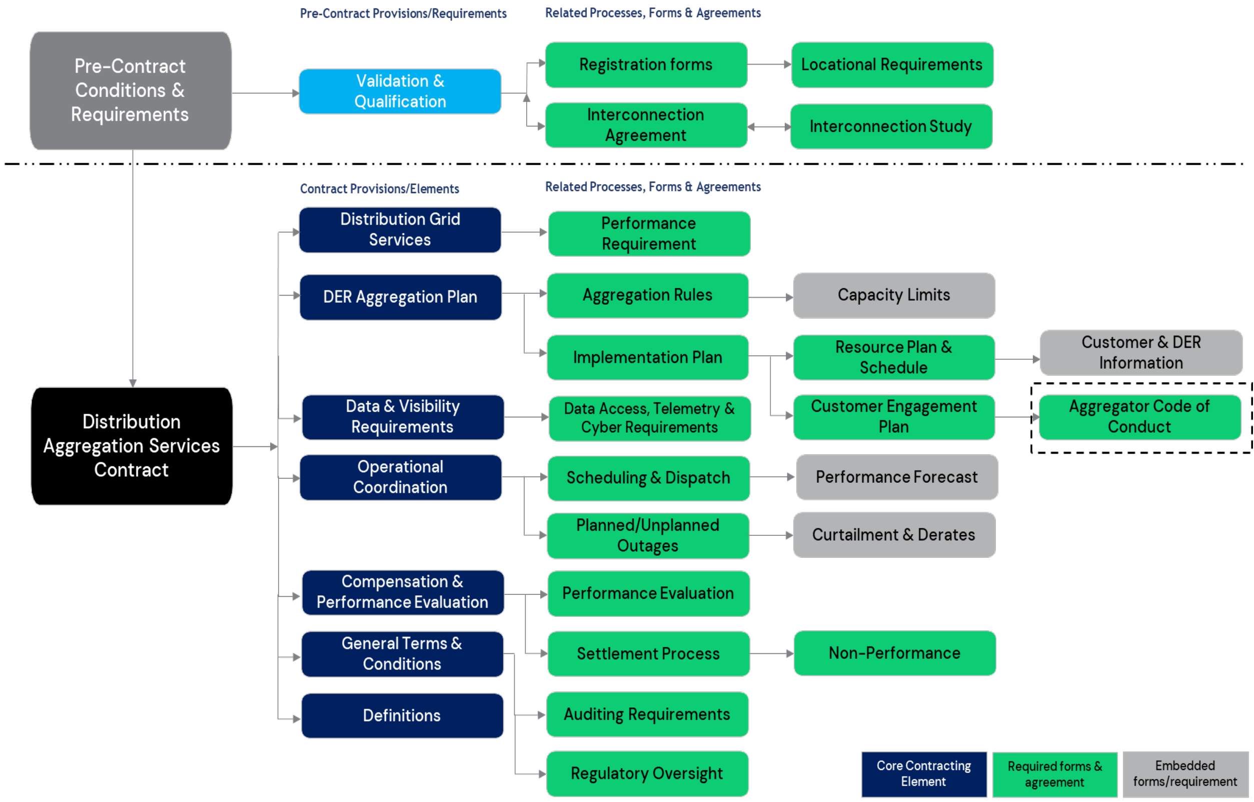

Figure 2. Standard Distribution Aggregation Services Contract Framework[8]

At its core, the standardized contracting framework encompasses the essential contracting elements or provisions. These contracting elements collectively form the cornerstone of the agreement, delineating the rights, responsibilities, and obligations of all involved parties.

Each of these contracting elements is linked to a network of related processes, forms, and agreements that collectively reinforce the contractual landscape. These associated components, while distinct in their documentation, play a collaborative role in providing valuable insight and support to the requisites of the core contracting elements. Furthermore, several of these related processes, forms, and agreements encompass embedded secondary forms that extend additional layers of support to the contracting. The following section headings and subheadings are color coded blue and green consistent with Figure 2.

This interwoven structure not only underlines the transparency and comprehensiveness of the contract but also ensures that each party involved comprehends the contractual obligations and procedures with clarity. By having these documents affiliated with the overall contract provisions, critical tasks owned by distribution utilities, Aggregators or both can be completed in a consistent, efficient, and repeatable manner from initial DER service registration to the end of the DER service lifecycle. Relevant required and supporting forms and processes will support the terms and conditions of the services contract including the qualifications, responsibilities, and rights of each party involved.

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[8] Note –As part of the overall TDC project, work products have already been developed for each highlighted element (Links for these completed documents will be provided once documents become available to utilize).

3.1 Validation & Qualification

The Validation and Qualification for an Aggregator seeking to register a DERA for distribution services is a critical pre-contracting component between Aggregators and host utilities. The eligibility requirements establish transparent guidelines, clearly defining the required information from Aggregators, and outlining the roles of the Aggregators, Utility, and Regulators at each stage of the registration process.

The registration process may include three phases: 1) initial notification, 2) eligibility confirmation, and 3) registration and activation. During the initial notification phase, the Aggregator must provide contact information and a general description of the DER facility, including its location, size, technologies, type, planned markets, intended participation model, and desired target activation date through the utility-established ***registration forms***. DER requiring an ***interconnection agreement*** must have completed the required interconnection process, including ***interconnection studies*** and potential grid changes, resulting in permission to operate, prior to inclusion in a DERA.

Once the Aggregator submits the initial notification, the Utility has sixty calendar days[9] to review each DER's eligibility to participate in the DERA. During the eligibility confirmation phase, the Aggregator confirms with the Utility the finalized list of a DERA's constituent DERs, provides and confirms additional required details, and ensures that all DERs comprising the DERA are in the appropriate metering domain. In the final registration and activation phase, the Utility confirms ***locational requirements*** and limitations to the Aggregators. This information pertains to the specific locations where the DERs comprising the DERA are expected to be located within the distribution network. The utility communicates any historic locational constraints and planned locational requirements (i.e., planned upgrades or reconfigurations) that may impact the performance of the DERA, either through curtailment or planned/unplanned outages. This ensures that the Aggregators have a clear understanding of the utility's expectations regarding the DERA's placement within the distribution system.

Once the eligibility of each DER within the aggregation plan is confirmed, utility and aggregators are engaged in the contracting if the Aggregator decides to move forward with their proposed DERA project. This contract outlines the roadmap for preoperational steps like DER aggregation plan implementation, operational coordination requirements, and communication protocols, as well as post operational stages like settlement mechanisms, minimum performance benchmarks for performance audits, and dispute resolution processes. The contract serves as a strategic framework that ensures the seamless execution of the DER aggregation plan as submitted by the aggregators. Similarly, the Interconnection Agreement must be signed prior to the project progressing to the Contracting and Development Stage.

3.2 Distribution Grid Services

The DER grid services element of the contract defines and describes the specific DER-provided distribution grid services that are being contracted by the utility. These services may be contracted with an individual DER or with a DERA. This section of the agreement serves as a reference point for the Aggregator and facilitates alignment between the utility's needs and related grid service performance requirements. The following are the typical distribution-level services under consideration.[10]

1. Distribution Capacity: This refers to a supply or load modifying service that allows for the reduction or increase of power or load in a manner that reliably and consistently reduces the

[9] The FERC 60-day limit refers to the timeframe within which a host utility is required to review the eligibility of distributed energy resources (DERs) for participation in a Distributed Energy Resource Aggregation (DERA) program in the wholesale market (FERC 2222). This may vary depending on local/state regulations for services procurement in the retail market.

[10] "Grid Services Definitions" US DOE Office of Electricity, July 2023.

net loading on the desired distribution infrastructure.

2. Voltage-Reactive Power: DERA provides leading and lagging reactive power within the system to maintain appropriate voltage levels and acceptable voltage bandwidths as needed.
3. Reliability: The DERA provides supply-based services to address local distribution reliability needs.
4. Resilience: The DERA provides supply-based services to address local distribution resiliency needs.
5. Energy: DERA provides increased energy supply or reduced energy consumption over a period of time, measured in kilowatt-hours (kWh), megawatt-hours (MWh), or gigawatt-hours (GWh).
6. Power Quality: DERA provides services to address power quality needs.

3.2.1 Performance Requirements

The utility establishes minimum ***performance requirements*** for each grid service. These requirements are designed to align with the operational needs of the distribution network and the specific services the DERA is intended to provide. Performance requirements can encompass various aspects, such as response times to dispatch signals, capacity utilization, efficiency levels, grid stability contributions, and adherence to regulatory standards. These are based on specific requirements for each of the technologies involved, the scale of the DERA, services provided, and the operational characteristics of the distribution system.

The utility and Aggregator enter into an agreement that outlines the performance expectations for the DERA, including any exceptions or limitations that may apply during specific time periods or seasons. This agreement ensures clarity and sets the basis for the future evaluation and measurement of the DERA's performance and settlement with Aggregators using the agreed-upon requirements.

3.3 DER Aggregation Plan

The DER aggregation plan serves as a comprehensive roadmap for the aggregation of resources and outlines the detailed strategy, implementation approach, and technical specifications for how the registering DERA will provide each specific distribution grid service planned. It delineates how the DER aggregators will aggregate and coordinate the contributions of individual DERs to meet the established performance requirements and operational needs of the utility's distribution network.

The DER Aggregation Plan[11] consists of two main components 1) Technical specification & 2) Implementation strategy and plan. The technical specification addresses the technical aspects of how the aggregated DERs will work together, including their interactions, control strategies, and response mechanisms to various grid conditions and signals. The implementation plan outlines the schedule of activities to form a DERA including, for example, customer engagement, development of resources (e.g., battery energy storage system) and commissioning tests. This includes the specific locational breakdown of DERs, key milestones between DER aggregators and utilities, and the DER aggregator's customer engagement plan. This plan also accommodates flexibility for potential changes in the DERA structure, DER modifications, and adjustments based on changing grid conditions or regulatory requirements.

3.3.1 Aggregation Rules

Aggregation rules within the DER Aggregation Plan are specific guidelines and parameters that govern how individual DERs are aggregated and operated collectively as part of the DERA. Aggregation rules encompass considerations for technical, operational, and regulatory aspects. These rules are typically technology specific.[12] They address how the DERs within the DERA will respond to various dispatch signals, ramp rates for changing power output, voltage and frequency regulation, synchronization of responses, and grid stability measures. These rules also dictate consistency in communication protocols, data exchange requirements, and cybersecurity measures to ensure safe and reliable operation. Aggregation rules are governed by local regulatory bodies including reviewing and approving these rules to ensure compliance with safety standards and grid regulations.

3.3.2 Capacity Limits

Aggregation rules will also address any capacity limits regarding the minimum and/or maximum amount of capacity that each individual DER or DERA may have in order to qualify for participation. There are three dimensions that are often considered.

1. Wholesale market rules may set a minimum DER capacity size for participation (e.g., 100kW minimum).
2. State regulations may limit the size (i.e., installed capacity) of a distributed resource under certain retail tariffs and programs.
3. Distribution network physical operating limits. The distribution operating limit may determine if curtailment or derate may be required of individual DERs or DERA during planned/unplanned grid outages.

3.3.3 Implementation Plan

In an Implementation Plan, several key elements are typically addressed. First, it defines the composition of aggregated resources, specifying the types and capacities of DERs involved, their technologies, and their intended roles in providing specific services. Furthermore, the plan describes how and when the aggregation will be formed, including a customer and DER engagement plan and key milestones to support the utility's timing requirements for in-service operations. Participation models, such as individual services or a combination of different services, are typically structured within the Implementation plan to ensure flexibility and adaptability to changing grid conditions or regulatory requirements.

3.3.4 Resource Plan & Schedule

A Resource Plan and schedule are incorporated to identify the various DERs within the aggregation to meet utility performance requirements and operational needs of the utility's distribution grid. It outlines the strategy and details for managing the DERs that make up the DERA. It serves as a blueprint for how the DERs will be deployed, coordinated, and utilized to provide specific grid services. Key components of the Resource Plan typically include:

1. Resource Capabilities: Describes the technical capabilities of each DER, including its ability to respond to grid signals, ramp up or down power output, control voltage or frequency, and meet other grid specific performance criteria.
2. Aggregation Strategy: Outlines the approach to aggregating resources to provide grid services efficiently. This may involve grouping similar resources or coordinating their operation to achieve specific grid service objectives.
3. Service Allocation: Specifies which grid services each resource or group of resources will provide. It ensures that resources are strategically assigned to meet the utility's grid needs.

[12] Aggregation and Dual Participation – NYISO

A Resource Schedule is a timeline that details when and how resources within the DERA will be activated, utilized, and managed to provide grid services effectively. It considers factors such as resource availability, operational hours, and the timing of grid service requirements. Key aspects of the Schedule include:

1. Activation Timing: Specifies when each resource or group of resources will be activated to provide grid services. This may involve adjusting resource output based on grid signals or operational schedules as agreed with the utility.
2. Resource Availability: Accounts for the availability of resources, including their operating hours, maintenance schedules, and any seasonal variations that may impact their contribution to the aggregation.
3. Dispatch Response: Details how resources will respond to dispatch instructions. It ensures that resources act in real-time or near-real-time to support grid stability and reliability, as required for the specific distribution services provided under the services contract.

3.3.5 Customer and DER Information

Customer & DER information can be treated as a separate form or standardized questionnaire as part of the overall implementation plan that Aggregators are required to submit. The form typically includes level 2 details related to participating DERs compared to information submitted during the initial registration process.[13] The form typically includes:

Customer Information – Contacts, account numbers, and DER ownership details

DER technical Information – DER types, technology types, capacity, and service-specific technical information

Locational Data – Geographical and grid locations of DER

Operational Information – Operational hours by each DER, response capabilities, and any seasonal variations in the operation

3.3.6 Customer Engagement Plan

A Customer Engagement Plan[14] outlines how DER aggregators intend to interact with and engage the customers whose DERs (or DER owners) are aggregated as part of the DERA. The plan typically includes a communication strategy that defines how and when communication will occur between the Aggregators, customers, and the utility. This involves regular updates, notifications, and information sharing regarding DERA activities and benefits. The plan outlines initiatives for educating customers about the DERA, including its objectives, the benefits of participation, and any changes or impacts on their DERs and loads.

Additionally, the Customer Engagement Plan addresses customer support services, providing a point of contact for inquiries, issues, or assistance related to DERA participation. The Customer Engagement Plan should include a discussion of how individual customer data will be collected, stored, utilized, and shared. It also explains how customer consent for DERA participation is obtained and how customers can opt-out if they choose not to participate in the program. To protect customer data and privacy rights, the plan includes measures to ensure compliance with relevant regulations.

[13] See section "Validation & Qualification" of this document.
[14] AMI customer engagement plan, National Grid, May 2021

The plan's compliance and reporting procedures enable the monitoring of customer compliance with DERA requirements and reporting any non-compliance issues, ensuring that DER aggregators adhere to the contractual obligations related to customer engagement and communication, as specified in the DSC.

3.3.7 Aggregator Code of Conduct

Establishing a consumer-oriented Aggregator Code of Conduct[15] should be considered as part of the overall customer engagement plan as most consumers are at a significant knowledge disadvantage related to DER services. An aggregator code of conduct addresses consumer engagement considerations for consumers and/or communities in the design, commissioning, and operation of DERA Grid Services as well as the collection, storage, utilization, and sharing of customer data. Such a code should facilitate consumer trust by setting standards of conduct and encouraging best practices for aggregator-provided grid services. Additionally, this code would identify incremental requirements to existing US regulatory rules for aggregators.[16]

3.4 Data and Visibility Requirements

Real-time data and visibility requirements within DERA can be achieved through different approaches. These requirements may exist at a single point of interface, at various nodes within the DERA infrastructure, or at the DERA periphery depending on the needs and operational characteristics of the distribution system. It is important to note that these real-time telemetry needs for distribution services complement the already installed revenue and SCADA (Supervisory Control and Data Acquisition) meters at the point of interconnection (POI) for each DER within the DERA.

To ensure interoperability and compatibility, the data and telemetry requirements are designed to be technology neutral. This means that the DERA (and may involve requirements for specific DER in a DERA) utilize communication and monitoring systems that comply with the standards defined by the local regulatory RERRA. FERC refers to these entities as the Relevant Electric Retail Regulatory Authority (RERRA). Meeting the data and visibility requirements involves several key capabilities for DERs. One essential capability is the ability of the DERA to communicate with the grid operator's operational systems, such as a distributed energy resource management system (DERMS), using a standardized communication protocol. Additionally, DERs should provide telemetry data in real-time or near real-time, ensuring the timely availability of accurate and reliable data. This data includes information on energy production, netload response availability, capacity, and overall availability. DERs within DERA should also be able to respond promptly to dispatch signals from the grid operator or via the aggregator. The recommended standard for monitoring, control, and data management is the IEEE 2030.5 standard, which enables a consistent approach and helps avoid redundant overlapping requirements for DERAs seeking to participate in both wholesale and distribution markets. This facilitates seamless data exchange and integration between the DERA and the broader grid infrastructure. In addition to meeting the technical requirements, data and visibility considerations must also address communication and security aspects. This includes communication between customers and aggregators at the edge of the system. Ensuring secure and reliable data transmission and protecting against cyber threats and data vulnerabilities are crucial components of a comprehensive approach to data and visibility requirements for DERAs.

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[15] "DER Aggregator Code of Conduct" US DOE Office of Electricity, August 2023.

[16] California PUC Demand Response Provider requirements: https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/electric-costs/demand-response-dr/registered-demand-response-providers-drps-aggregators-and-faq

3.4.1 Data Access, Telemetry, and Cybersecurity Requirements

The RERRA sets forth guidelines and regulations that govern the data access (and sharing policies), telemetry, and cybersecurity requirements within the participating DER aggregation. This includes determining the level of access that the distribution utility, grid operator, and other authorized entities have to the telemetry data generated by the aggregated DERs. The RERRA also defines the technical requirements and standards for telemetry, ensuring that the communication and monitoring systems employed by the individual DERs to meet the necessary criteria for data transmission and reliability.[17]

Data access requirements establish guidelines for stakeholders' access to data, what data can be accessed, and for what purposes. Data access requirements are determined by RERRA and provisions typically cover:

- **Authorized Parties:** Specifying who is allowed to access DERA data, which may include Aggregators, the utility, regulatory authorities, and other relevant stakeholders.
- **Data Types:** Defining the types of data that can be accessed, which may include real-time telemetry data, historical performance data, customer information, and operational data related to the DERs.
- **Access Procedures:** Outlining the procedures and protocols for requesting and granting data access, including any necessary permissions or approvals for certain or all the data types.

Telemetry requirements pertain to the real-time monitoring and reporting of data (typically SCADA and AMI) from DERs within the DERA. Telemetry requirements are utility-specific and determined by specific grid service and the utility's available operational technology (OT). These provisions include:

- **Telemetry Data:** Defining the specific telemetry data that must be collected and transmitted by the DERs, which may include power output (kW, kVAr), voltage levels, frequency, and operational status.
- **Communication Standards:** Specifying the communication protocols and standards that must be followed to transmit these telemetry data, ensuring compatibility and consistency with local regulatory standards.
- **Frequency of Reporting:** Establishing how often telemetry data should be reported, whether in real-time or near real-time, to support grid management.

Cybersecurity requirements are essential for protecting the DERA's data and operations from cyber threats and vulnerabilities, and by extension the utilities operational and information systems. These requirements are also necessary to protect consumer privacy and may include:

- **Data Encryption:** Requiring the encryption of sensitive data to prevent unauthorized access or tampering during transmission or storage.
- **Access Control:** Defining access controls and authentication mechanisms to ensure that only authorized individuals or systems can access DERA data.
- **Incident Response:** Establishing procedures for detecting, reporting, and responding to cybersecurity incidents, including data breaches or unauthorized access.

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[17] See Pg 1 (Data Requirements), Con Edison's Performance Verification Plan

- **Compliance Standards:** Ensuring compliance with relevant cybersecurity standards and regulations to protect the DERA against emerging threats.
- **Data Backups:** Requiring regular data backups and disaster recovery plans to safeguard data integrity.

3.5 Operational Coordination

The active participation of DERAs in both wholesale and provision of distribution services poses significant challenges for distribution grid operators in maintaining reliability. To address these challenges, an operational coordination framework, a communications plan, DERA performance forecasting, and sufficient visibility between Aggregators and the utility are essential for the effective, safe, and reliable operation and management of the distribution networks.

The coordination framework outlined in the contract includes specific provisions to delineate the roles and responsibilities of both the utility and the Aggregators during the grid service operation of DERA. The utility establishes a communication framework to facilitate the exchange of information with the Aggregators. This includes timely notifications regarding planned or unplanned outages, system violations, and events that may require derating or curtailing the DERA's participation in the utility's retail market. By establishing effective communication channels, the utility ensures that both parties are aware of any operational constraints or limitations that may impact the DERA's performance and grid reliability.

On the other hand, the Aggregators have the responsibility to communicate any limitations or unavailability of the DERA to the utility that may affect system reliability. If there are significant changes to the structure or architecture of the DERA, such as changes in the registration of DERs or the addition/removal of technologies, it is the responsibility of the Aggregators to notify the utility of these possible changes. This proactive communication enables the utility to make informed decisions and adjustments to maintain system reliability and optimize the operation of the distribution network.

In addition to the responsibilities described above, during the DERA Operational Term, the Host Utility may test the DERA operational coordination performance periodically to confirm it can safely operate. Other tests might need to be scheduled at the utility’s discretion. Any issue identified during the testing may require the Aggregator to develop a plan to address the issue that caused the failure to operational coordination.

3.5.1 Scheduling and Dispatch

Another important aspect of the coordination framework is the establishment of dispatch instructions (scheduling + dispatching). The utility, in collaboration with the Aggregators, defines a framework for controlling and dispatching each DER within the DERA specific to each grid service provision. These dispatching instructions are tailored to the specific visibility and control requirements of each technology type within the registered DERA, as well as the different aggregation models. The Aggregator must specify the procedures for resource allocation, specifying which resources with DERA will be scheduled and when they will be activated, in alignment with grid service needs. This allocation may occur at varying frequencies, depending on the service and Utility specified operational requirements, ranging from real-time scheduling to daily or event-based scheduling.

Dispatching instructions may need to be revised if there are changes in the network configuration or participation model to ensure that the DERs are effectively controlled and coordinated to support the required grid services.

Dispatch instructions describe protocols for DER control, including power output, voltage levels, and frequency response, ensuring that each DER behaves as required during service provision. Furthermore, the aggregator, in agreement with utility must define provisions for emergency and contingency dispatch, outlining procedures for responding to grid disturbances or unforeseen events necessitating immediate action from aggregators.

3.5.2 Performance Forecast

From the utilities and regulators' perspective, DERA performance forecasting enables utilities to accurately plan DERA requirements, optimize grid operations, and maintain a reliable supply-demand balance. These performance forecasts may have different time horizons from long term (months to year) that can support system planning to day-ahead or even shorter to assist with operational decisions. With reliable DERA performance forecasts, utilities can make informed decisions regarding load management, grid stability measures, and the integration of intermittent DER generation. DERA performance forecasting helps utilities meet their regulatory obligations and commitments. By establishing DERA performance targets and benchmarks based on forecasted energy output, utilities can hold DER aggregators accountable for delivering the committed generation levels. Furthermore, accurate forecasting allows utilities to efficiently plan for DERA grid integration, capacity expansion, and infrastructure investments, and enables utilities to anticipate the growth of DER capacity, and strategically plan for grid reinforcement. From a regulatory perspective, including DERA performance forecasting in contracts provides a mechanism to evaluate DER aggregators' performance against their forecasted generation levels, ensuring adherence to energy procurement contracts and market participation obligations. By incentivizing accurate forecasting and penalizing underperformance, regulators encourage the efficient utilization of DERAs and support the development of competitive and transparent energy markets.

3.5.3 Planned and Unplanned Outage

Planned outages, whether instigated by the Aggregator or the utility, require a coordinated approach governed by the contract. Aggregators are responsible for notifying the utility in advance of any planned outages initiated on their end. This notification should include crucial details such as the scheduled outage date and time, expected duration, the underlying reason (e.g., routine maintenance, equipment upgrades), and any contingency or mitigation plans in place. Simultaneously, the utility may also schedule planned outages for grid maintenance or other purposes, and they must communicate these outages to the aggregator. Unplanned outages, arising from unforeseen events such as equipment failures or grid disturbances, necessitate immediate reporting. The DSC must explicitly mandate that aggregators and the utility promptly communicate the outage's nature, specify which DERs or components are affected, and provide an estimate of the outage duration, if known. Additionally, details about any immediate actions taken to address the outage should be included in the notification.

The DSC then defines how these planned and unplanned outages, whether originating from DER aggregators or the utility, will impact service commitments, compensation arrangements, and scheduling within the aggregation.

3.5.4 Curtailment and Derates

Like outages, curtailment, and derating conditions of DERs within DERA must be agreed between parties and specified in the contract. Curtailment and derating, which is the deliberate reduction of DER power output or operational capacity, typically occur in response to grid constraints or operational needs. The contract must specify the triggering conditions for curtailment, which may include grid congestion or voltage instability, and mandates swift communication between aggregators and the utility as specified in the operation coordination framework.

3.6 Compensation & Performance Evaluation

The DSC includes the DERA compensation mechanism(s) and specifics on how aggregators would be compensated for a specific service, or a combination of services provided by DERA. Establishing compensation mechanisms in the DSC is critical for aligning aggregators' behavior with the utility's needs. The contract must thoroughly outline each applied compensation mechanism, encompassing tariff-based structures, market-driven pricing, program-specific incentives, and procurement-related pricing depending on region-specific utility-designed programs. The DSC must also link compensation with performance of the DERA including potential penalties due to non-performance.

Performance evaluation and non-performance remedies are essential components in effectively managing a DSC. These integral aspects ensure that the DER aggregation services for distribution grid operation are not only reliable but also aligned with the defined contractual obligations. This is a critical consideration for a distribution utility procuring DERA services since unlike the wholesale market, there are no reserve resources to call upon to back-up non-performance. Non-performance of an aggregator can jeopardize the reliability and safety of the network and may cause grid instability. For example, failure of a DERA to perform could result in a circuit overload causing distribution equipment failure (e.g., wire burn down, transformer explosion) and associated public safety issues. As such, the contract typically includes performance assurance requirements including potential liquidated damage due to non-performance.

3.6.1 Performance Evaluation

The process of performance evaluation involves a thorough and systematic assessment of how well a DER aggregation performs in comparison to established benchmarks. These benchmarks essentially serve as the baseline performance requirements which are established by the utility and regulators for each grid service. The baseline methodology defines the performance requirements for each eligible service based on the baseline capacity of the DERA. It provides a benchmark against which the aggregators' performance is evaluated,[18] and compensation is determined. The contract must also outline monitoring and reporting obligations, requiring aggregators to continually monitor the performance of their DERs and submit regular performance data to the utility, typically in real-time or near-real-time.

3.6.2 Settlement Process

The utility and regulators specify the settlement process with the aggregators, either through the contractual agreement or other service purchase agreements. This process outlines the procedures for calculating and disbursing payments to the aggregators. It includes details such as the frequency of settlements,[19] the data and documentation required for settlement calculations, and the timelines for payment disbursement. This process must also outline how the compensation should be adjusted when deviation from specified performance requirements occurs.

The overall process will be governed and overseen by the relevant regulatory authority to address any potential disagreements and disputes between the utility and aggregator.

3.6.3 Non-Performance

In situations where DER aggregators do not meet their contractual commitments, non-performance remedies come into play. These utility-specific approaches are thoughtfully designed to address instances of underperformance, maintaining the integrity of grid services and incentivizing aggregators to consistently meet the predetermined expectations. Financial penalties play a role as a deterrent,

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[18] See Pg 2 (Performance Assessment), Con Edison's Performance Verification Plan 2.0

[19] See Pg 4 (Incentive Amounts), Con Edison's NWA Sample Program Agreement

motivating aggregators to prioritize and uphold their obligations. It also incentivizes aggregators to be realistic in their projected performance so that utilities can plan their system (both short and long term) accordingly. Corrective action plans offer a structured and methodical approach to rectifying any performance deficiencies, thereby restoring compliance. Moreover, performance improvement measures, such as enhanced training or reporting mechanisms, contribute to encouraging the capabilities of DER aggregators, improving their overall performance. In cases of chronic non-performance, contracts should provide the provision for the termination of the agreement. This step ensures that consistently subpar performance does not compromise distribution grid stability or reliability.

To maintain transparency and accountability, regulators may also specify ***audit requirements*** for all settlements and transactions between the utility and aggregators. These audit requirements outline the necessary procedures, documentation, and reporting mechanisms to ensure compliance with the compensation agreements. By incorporating these compensation mechanisms and necessary supporting agreements into the contract, the aggregators and the utility establish a transparent and fair process for determining and settling the financial compensation associated with the provision of distribution grid services.

3.7 General Terms & Conditions

3.7.1 Regulatory Oversight

The overarching purpose of regulatory oversight is to ensure that all aspects of utility and aggregator activities align with applicable laws, regulations, contractual obligations, and industry standards. In jurisdictions where an aggregator may not be a regulated entity, regulatory accountability may fall on the utility through the provisions of the DSC as they are governed by the RERRA. As such, the contract must ensure the applicable roles and responsibilities of the RERRA are well defined throughout the lifecycle of grid services from initial procurement to settlement. This is particularly important for jurisdictions in an ISO/RTO area given the potential governance roles identified in FERC Order 2222 for RERRAs. For example, RERRA adjudication of disputes arising from distribution operator curtailments or derates of DERA participation in wholesale markets. To enforce compliance, the contract must delineate consequences and actions to be taken in response to governance violations or non-compliance.

3.7.2 Auditing Requirements

To maintain transparency and accountability, regulators must specify audit requirements for all settlements and transactions between the utility and aggregators in the contract. These audit requirements outline the necessary procedures, documentation, and reporting mechanisms to ensure compliance with the contractual agreements. The scope of audits typically encompasses a range of aspects such as performance benchmarks, financial records, telemetry data, and any other significant information. These audits may be conducted periodically, annually, or triggered by specific events like significant performance deviations. Auditing requirements within the contract closely align with the performance evaluation framework, ensuring that compensation is directly tied to actual performance metrics. Furthermore, the emphasis on transparency and the requirement of corrective actions contribute to maintaining contractual integrity and promoting accountability among all involved parties.

4.0 Market Adoption & Next Steps

The use of DERs is increasingly being pursued to enable greater flexibility, sustainability, and resilience in both the distribution grid and bulk power system. A key challenge to achieving the desired scale of DERA services is that current distribution grid service contracts can vary by type of DER, by utility, and by state, and therefore are difficult to scale quickly. More specifically, no standard service contracts nor codes of conduct exist today that specify discrete services and related performance expectations from DER aggregators, including requirements for asset visibility, operational coordination, compensation and performance evaluation, and customer engagement.[20]

The proposed distribution services contract framework discussed in this paper is intended to support the development of a pro-forma standard utility aggregator distribution services contract. This standard framework incorporates FERC Order 2222 coordination elements and insights from the early experiences of distribution utilities and aggregators in the provision of distribution grid services.

Recommended Actions

1. For the utilities and relevant regulator(s) in an ISO/RTO market, any existing utility aggregator distribution grid services contracts may need additions/changes for alignment with the respective FERC 2222 implementation plan. The recommendation is to begin the review and or development of a new DSC to align with FERC requirements that flow down to new distribution operations and related regulatory activity requirements. This activity will require time to conduct the proper review in line with process changes as well as consideration of stakeholder input. The timing of this need by utilities and their regulators is linked with the specific ISO/RTO implementation timelines applicable in their area.
2. The industry has learned quite a lot from the early distribution grid services contracts and related implementation and operation of DER aggregations. The opportunity exists today to consider how these insights (e.g., what has not worked and the successful practices and contract terms) may inform revisions to existing or development of new DSCs. These types of changes can help advance the use of flexible DERs in distribution systems. Review of existing DSCs and/or new DSC development will benefit from these early lessons learned.
3. The DSC structure and elements as discussed in this paper provide the basis to establish consistent terms for the provision of services as well as address required market and operational coordination requirements stemming from FERC 2222 implementation. As noted, this DSC framework is based on industry insights with the intent to provide a blueprint for a standardized pro-forma DSC contract applicable nationally. In this regard, a logical next step is for an industry standards organization, such as the North American Energy Standards Board (NAESB), to pursue the development of a standardized pro forma agreement. This has been done successfully by NAESB for wholesale markets and competitive retail energy services. A model for this activity is a similar effort underway in the U.K. to develop a standard grid services agreement.[21]

These three actions can address the need to standardize and improve distribution services contracting to achieve the significant potential for flexible DERs to contribute to a sustainable and resilient electric

[20] Pathways to Commercial Liftoff: Virtual Power Plants, US DOE, September 2023

[21] UK Energy Networks Association – Flexibility Services Agreement effort: https://www.energynetworks.org/newsroom/why-gb-networks-need-a-common-and-standardised-agreement-for-flexibility-services

system in the U.S.