

# Achieving Large-Scale Resource Flexibility from Distributed Energy Resources

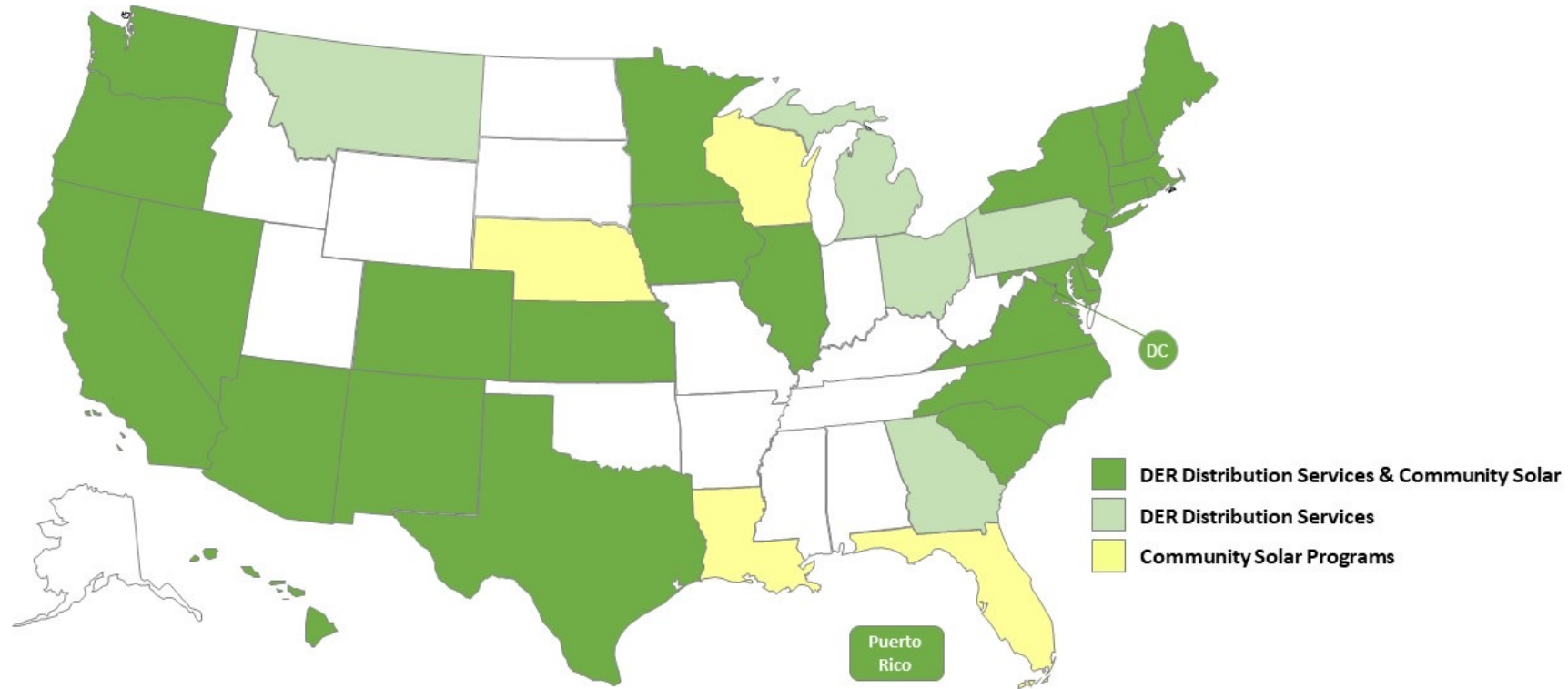
**Samir Succar, Senior Director  
ICF**

**Presented NASUCA 2024 Mid-Year Meeting**

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# Distribution Grid Transformation is Underway

State legislatures, regulators, and utilities are advancing electrification, the use of DER to manage distribution operations, and community solar development



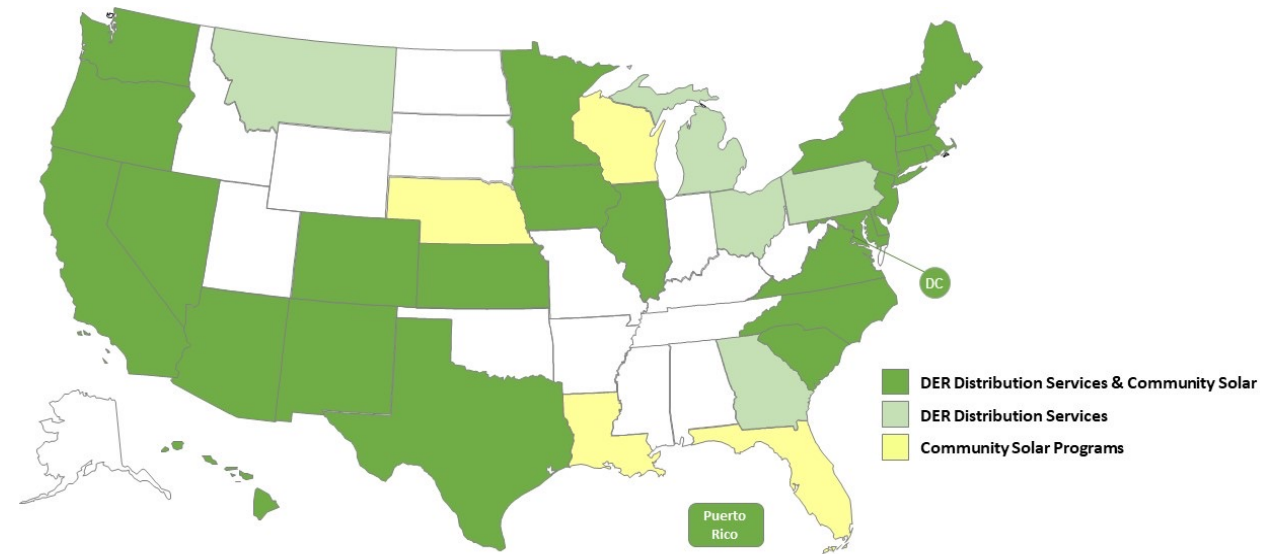
Sources: Newport Consulting, NREL Sharing the Sun Program, and North Carolina DSIRE Program

***“The Grid We Have is Not the Grid We Need”*** Hawaiian Electric

# Operational Coordination of DER Services is Critical

State legislatures, regulators and utilities are advancing the use of DER to manage distribution operations and reduce the need for grid upgrades

- Over 30 states have enabled the use of distributed energy resources (DER) to provide services to specifically manage the distribution grid.
- FERC through a series of rulings, including Order 2222, has continued to expand opportunities for DER to provide alternatives to transmission investment and bulk power services.
- The result of these actions is the potential for DER aggregations to provide both distribution services and wholesale services in many of the largest US population centers.
- This requires effective coordination of DER market participation and operational dual use of these DER services.

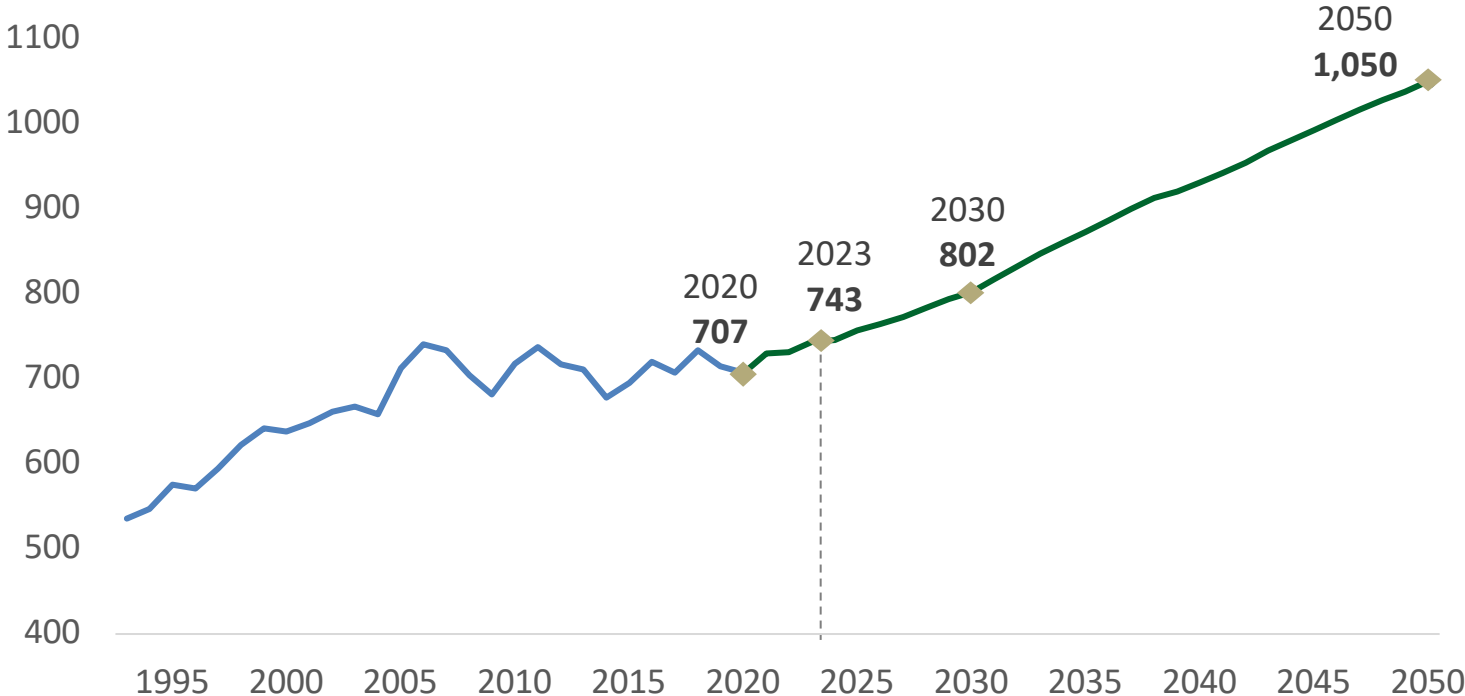


Sources: Newport Consulting, NREL Sharing the Sun Program, and North Carolina DSIRE Program

DER Services for Distribution include those from 3<sup>rd</sup> party providers and utility owned or operated DER (e.g., demand response and batteries)

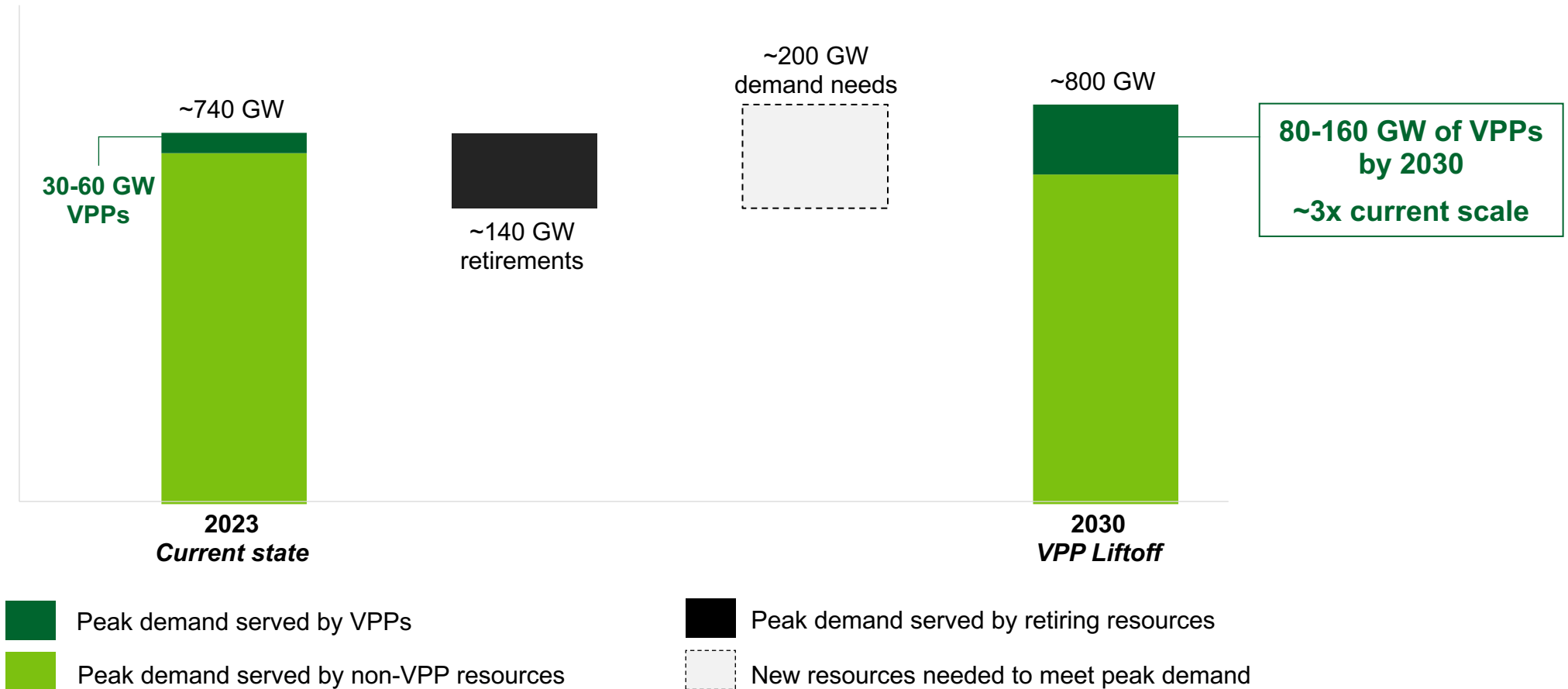
# US peak demand is expected to grow by ~60 GW by 2030

US system peak demand, historical and projected, 1995-2050 (GW)



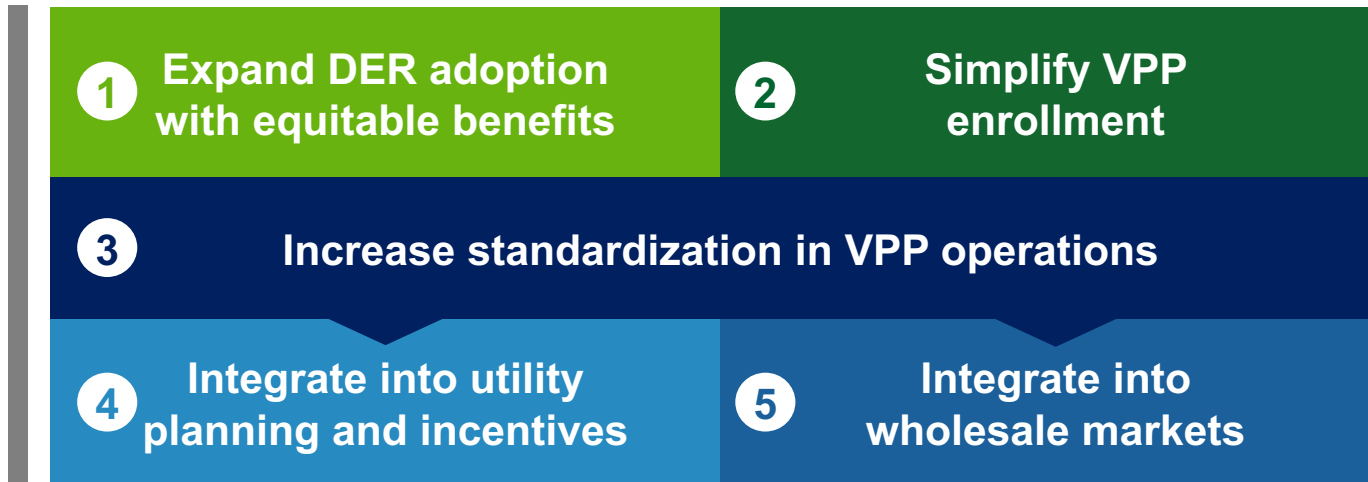
# Tripling current VPP scale by 2030 could address 10-20% of peak load nationally while saving ~\$10B per year in grid spending

U.S. peak electricity demand, GW



# The DOE Loan Program Office Outlined Some Key Imperatives Related to VPP Commercial Liftoff – Today We Want to Build on this Discussion

Imperatives for  
VPP liftoff



# Key Challenge: Sourcing DER Services for Distribution

## Distribution non-wires alternatives (NWA) procurements haven't met regulator, utility, or aggregator expectations

### Aggregator Themes:

- Aggregators spend considerable cost negotiating and administrating non-standard DER services contracts unique to each utility. Standard form contract (incl. terms and definitions) would be a major improvement.
- Be realistic about the performance requirements for DER portfolios and whether specific DER types may be able to perform. A “distribution grid resource specification” would be useful to identify preferred DER types to address specific distribution grid service requirements.
- Performance assessment and settlement need to be DER technology-specific. For example, applying methods for demand response to batteries is not effective.
- Utility performance penalties and related revenue recognition issues have resulted in uneconomic contracts and “no bid” situations.

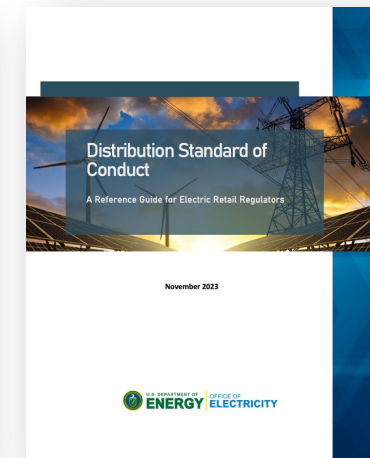
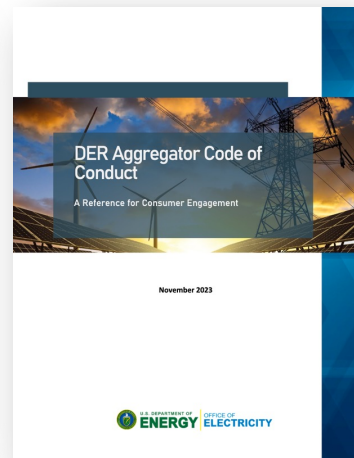
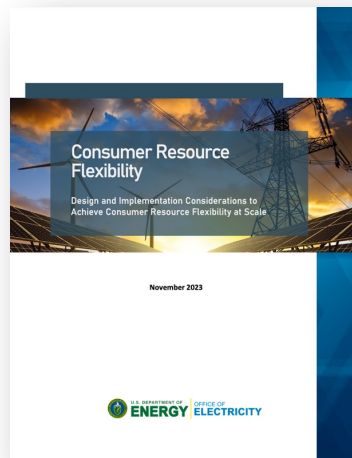
### Utility Themes:

- Aggregator performance for distribution services has not met expectations as in some instances the performance assessment methods do not align with the physical requirements.
- Aggregations of customer DER for residential and small commercial take a long time to aggregate and may ultimately be insufficient to meet the grid need and performance requirements.
- Administrative costs to manage the NWA opportunity screening, procurement, operations, and settlement of contracted DER services outweigh the value derived given the relatively low number of opportunities and fewer valid proposals.
- Aggregator contract defaults are an issue that is exacerbated by performance assurance (penalty) provisions.
- Standardized contracting based on industry best practices are welcomed to reduce negotiations and administrative costs.

What is the most effective mechanism (e.g., bilateral contract, program, or tariff) and DER technology(s) for a specific grid need?

# Meeting the scalability challenge mean addressing sourcing

1. Consumer Resource Flexibility
2. DER Aggregator Code of Conduct
3. Standard Distribution Aggregation Services Contracts
4. Market and Operational Coordination Requirements
5. Distribution Standard Code of Conduct

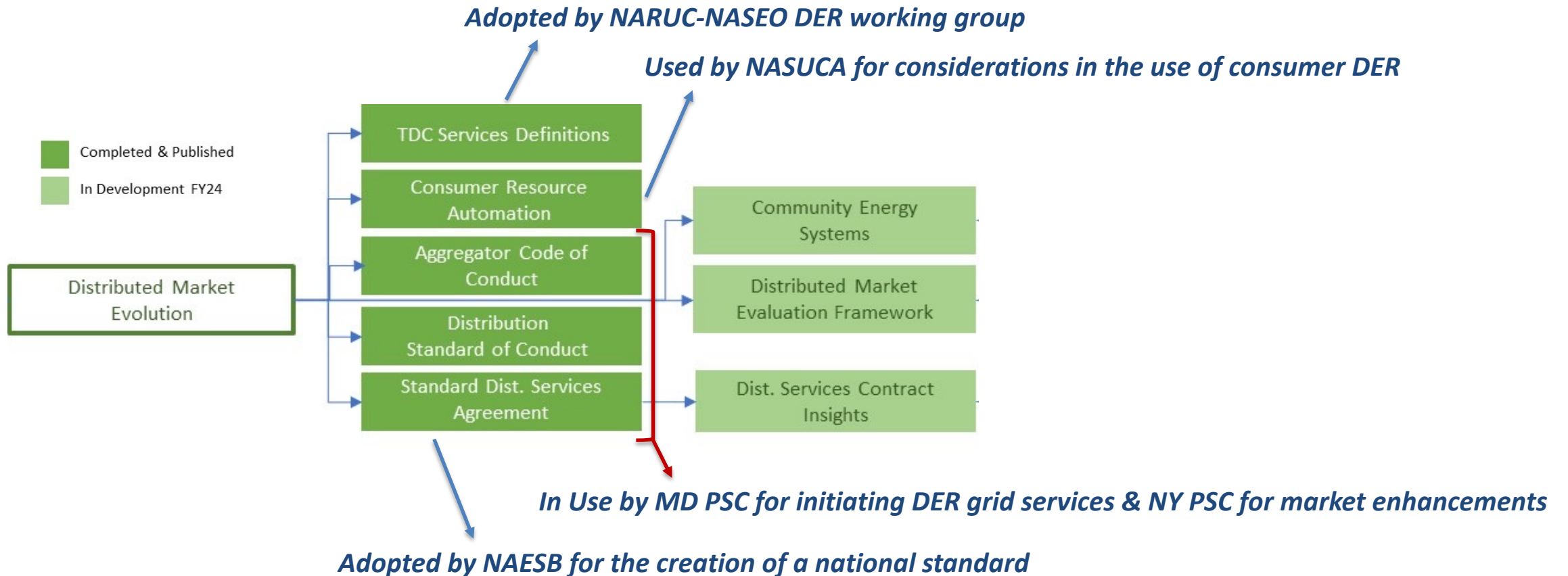


[www.energy.gov/distribution-grid](http://www.energy.gov/distribution-grid) under “operational coordination”



# Distributed Market Work Products & Initial Adoption

These work products address regulatory and utility business practices in decision support guides for the use of DER services based on industry insights and best practices drawn from interviews and US and global research



# The Team Behind This Work

## *Acknowledging the Team and the Support*

- **Joe Paladino (DOE OE)**
- **Paul de Martini (Newport)**
- **The ICF/Newport Team**
  - Surhud Vaidya
  - Saumil Patel
  - Dale Murdock
  - Andrew de Martini
  - Rosalie Yu

Go to: [www.energy.gov/distribution-grid](http://www.energy.gov/distribution-grid) under “operational coordination”



# 1. CONSUMER RESOURCE FLEXIBILITY

# Consumer Resource Flexibility – Task Purpose and Scope

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## What is Consumer Resource Flexibility?

- Consumer energy resources (DER owned by consumers) are increasingly sought to utilize for the benefit of the power system
- This includes Bring Your Own Device (BYOD) and/or responsive load/managed charging programs with automated signals to dispatch consumers' devices.
- Certain grid flexibility uses (e.g., ramping and regulation) involve daily, continuous dispatch for extended periods.

## Objectives

- Identify consumer behavioral considerations for the use of their distributed resources and changes in consumers' use of electricity under increasing electrification to enable greater participation.
- Develop guidance for consumer BYOD programs that involve utility, ISO, 3<sup>rd</sup> party automated use of consumer devices particularly for flexibility services.
- Draw upon customer behavioral research and insights from responsive demand program evaluations. Leverage insights from international efforts regarding Social License to Automate (IEA and Australia).
- Develop a reference DER Aggregator Code of Conduct for consideration by regulators and industry extending existing state DER Aggregator rules adapting international aggregator codes of conduct (UK) in recognition of existing US state regulations.



# Consumer Behavior Considerations

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Based on Consumer Behavioral Research that identified several categories of considerations in the context of a prevalence for consumer risk avoidance in their decision making

- **Functional Considerations**
  - Will the automation actually perform as planned – is it imperceptible or could it be disruptive to the consumer?
- **Physical Considerations**
  - Consumer’s perception about their personal health and safety of the use of demand response during extreme weather events, for example extreme heat.
- **Financial Considerations**
  - Consumer’s perception of the value proposition in terms of the monetary benefit-cost. This includes both the perceived savings/payments received they are expecting in terms of the co-production opportunity in relation to their original personal benefits/costs decision for buying resources.
- **Social & Psychological Considerations**
  - Social consideration is the consumer’s perception of the potential community benefit in providing a service from their resources
  - Psychological consideration is consumers’ perception of their aggregation services partner and the relationship and outcomes of the service provision
- **Complexity Considerations**
  - Consumer’s perception of the knowledge and effort required to understand, make decisions and engage in the co-production of the grid service/s.



## 2. DER Aggregator Code of Conduct

# DER Aggregator Code of Conduct

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**A reference DER Aggregator Code of Conduct for consideration by retail regulators and industry extending existing state DER Aggregator rules adapting international aggregator codes of conduct (UK).**

## **Consumer Enrollment**

- Advertising & promotion
- Sales behavior
- Competition
- Proposals (customer financial benefit, any costs and assigned risks)
- Contracting

## **Flexible Services Operations**

- Communications & channels (before, during and after)
- Automation transparency (process & technology)
- Control options (opt-in, opt-out, turn-off)
- Operational parameters for consumer health & safety
- Performance metrics and feedback
- Customer benefit
- Societal benefit

## **Administrative**

- Settlement & Billing
- Complaints & Dispute Resolution
- Privacy
- Cybersecurity

## **DER Aggregator Governance**

- Oversight
- Reporting & Auditing

# 3. STANDARD DISTRIBUTION AGGREGATION SERVICES CONTRACT



# Distribution Aggregation Services (DAS) Agreement Framework

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## What is a DAS Agreement?

- A Distribution Aggregation Services agreement is between DER Aggregator and Distribution Utility consisting of (1) types of distribution services available for procurement, (2) performance specifications, (3) compensation mechanisms, (4) operational procedures, (5) coordination requirements, (6) data, and (7) visibility requirements that DER service providers must abide by
- They strive to ensure the safe, reliable, and economic functioning of the distribution system while enabling higher penetration of DERs and DER services.

## Key Considerations

- Currently distribution grid service contracts vary by type of DER, by utility, and by state. No standard service contracts nor exist today that specify discrete services and related performance expectations from independent Aggregators.
- **This standardized framework focuses on the key contractual elements to design and implement uniform distribution services** contracts between DER service providers and Distribution Operators applicable across the US, to ensure a consistent and transparent process in contracting for distribution grid services from DER Aggregators.
- This framework also addresses important elements of FERC Order No. 2222 (FERC 2222) implementation plans filed by the ISO/RTOs to enable effective coordination between DER Service Providers, Distribution Operators and ISOs.

# Distribution Aggregation Services Agreement - Framework

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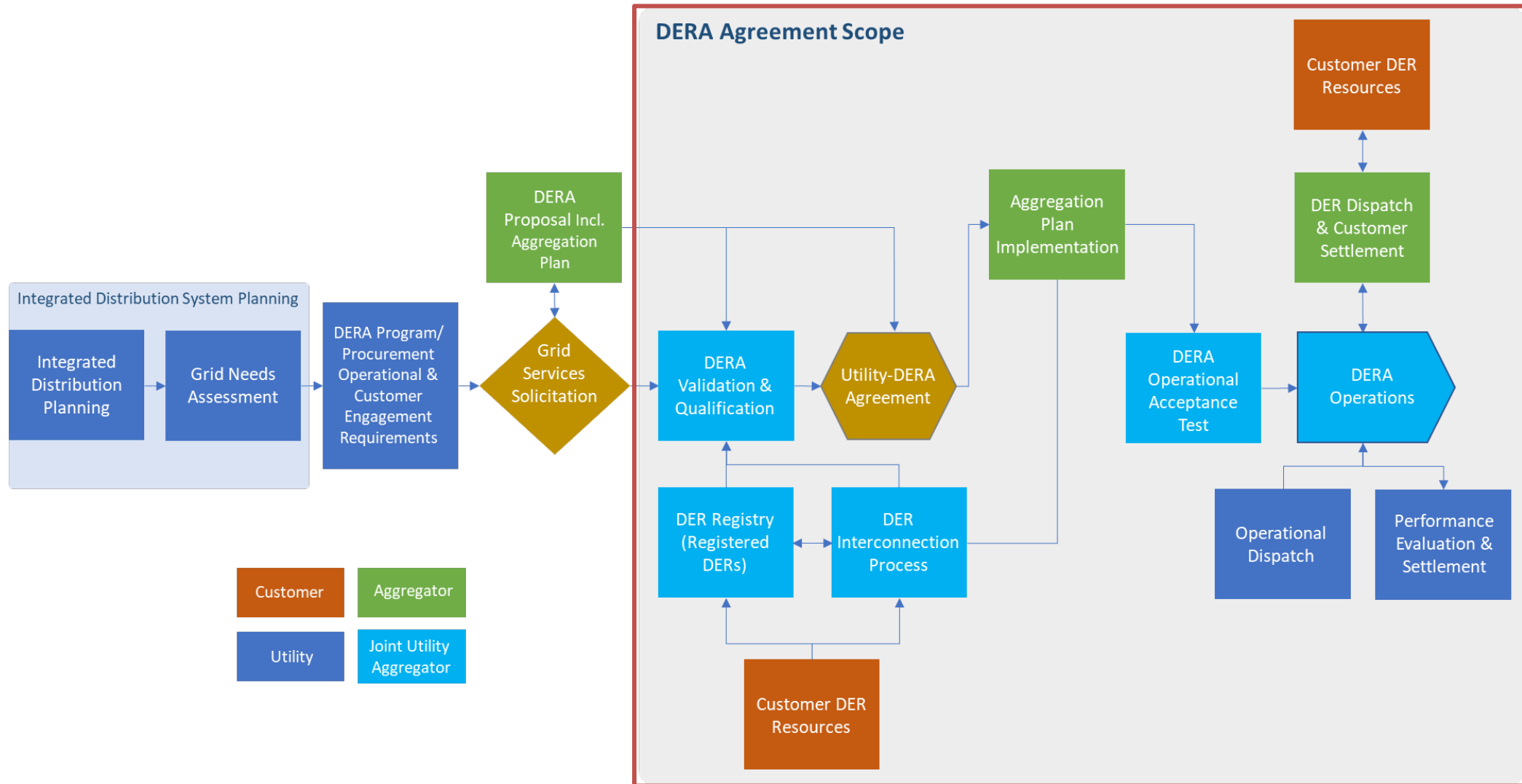
## DAS Agreement - Core Elements

- **Standard pro-forma structure** for a DER Aggregation services contract for distribution services between DER Service Providers and Distribution Utilities.
- **Reduces market barriers and ensures consistent application** of key provisions by providing a foundation for distribution utilities, DER Aggregators, and regulators to build a standard pro-forma services agreement.
- **Common language and structure** to define and describe DER services including eligibility, functionalities, service quality measures, compensation framework, participation, and coordination models.

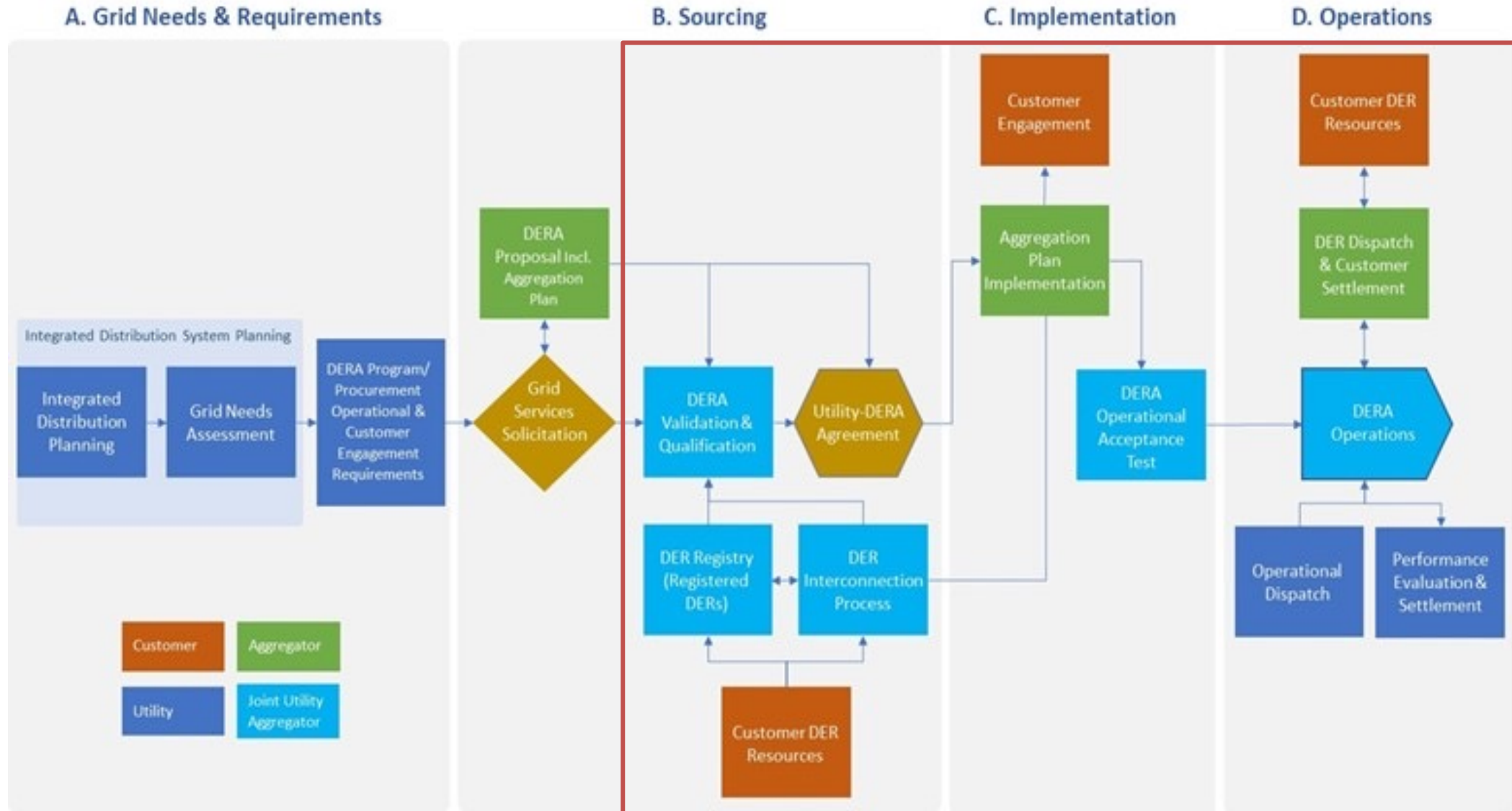
## DAS Agreement – Related Process, Forms, and Agreements

- **Supporting forms or agreements and processes** for aggregation services contract support efficient and effective provision of DER services while ensuring the reliability of the distribution network.
- Enable distribution utilities and DER Aggregators to **consistently, efficiently and repeatably complete critical tasks** across the DER service lifecycle by having these associated documents identified with the overall contract provisions.
- Relevant forms and processes will **support the DERA services contract's** terms and conditions, including qualification, responsibilities and rights of each party involved.

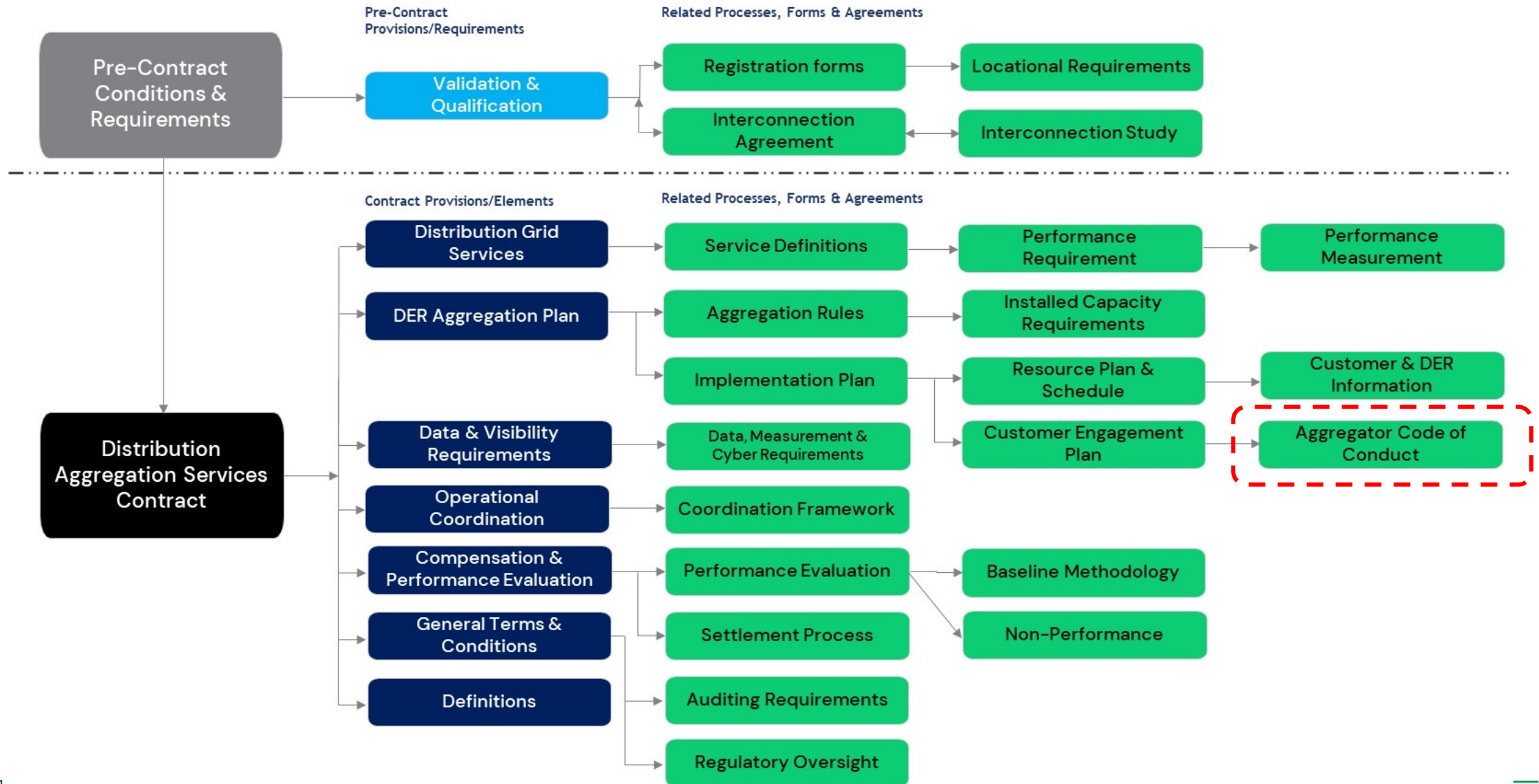
# Agreement Process Flow



# Agreement Process Flow



# Distribution Aggregation Services Contract Layout



## Validation & Qualification

Eligibility requirements will include the information and data that a DER service provider seeking to register a DERA for distribution services must provide to ensure DER facilities are validated and qualified before contracting commences. **The registration process may include three phases:**

(1) initial notification; (2) eligibility confirmation; and 3) registration and activation.

Overall, the eligibility establishes transparent requirements, clearly states **the required information from DER service providers, and defines the roles** of the DER service providers, Host Utility, and Retail Regulators in each stage.

- DER Service provider must provide contact information and a general description of the DERA facility (location(s), size(s), technologies, type, planned markets, intended participation model, and desired target activation date). To submit a registration, each DER comprising the DERA must have an executed interconnection agreement, where state rules require the DER to have an interconnection agreement, or if an interconnection agreement is not required, the DER service provider must provide the information needed to conduct any studies that may be necessary to identify distribution system impacts of the DERA. The DER service provider's initial notification triggers the 60-calendar day deadline for the Host Utility to review each DER for eligibility to participate in a DERA.
- DER service provider confirms with the Host Utility the finalized list of a DERA's constituent DERs; the DER service provider provides/confirms additional required details; and the Host Utility confirms "location" information that all DERs comprising the DERA are in the appropriate metering domain. Host utility must provide any historic locational constraints and planned locational requirements that may impact the performance of DERA (either by curtailment or planned/unplanned outages).

## Related processes, forms, and agreement

- Registration forms – DER Service providers to submit to the host utility for initiating registration of DERA for distribution service
- Locational requirements – Host utility to provide locational requirements/limitations to DER service providers for normal and contingency network configurations
- Interconnection Agreement – Executed interconnection agreement for each participating DERs of DERA including Interconnection study

See, e.g. [https://www.iso-ne.com/static-assets/documents/2022/02/order\\_no\\_2222\\_filing.pdf](https://www.iso-ne.com/static-assets/documents/2022/02/order_no_2222_filing.pdf), at P24, 25, 29, 39, 41



## Distribution Grid Services

- **This contract element will define and describe eligible distribution grid services offered by DERA to the host utility. The framework will outline available services in the host utility territory that DERA can participate in and describe minimum performance requirements by each DERs or cluster of DERs/DERA. These services may include but are not limited to:**
  - Distribution Capacity – Refers to a non-wires alternative (NWA) supply and/or a load modifying service that provides as required via reduction or increase of power or load that is capable of reliably and consistently reducing net loading (current flow) on desired distribution infrastructure.
  - Voltage-Reactive Power – Refers to the ability to control leading and lagging reactive power on the system to maintain appropriate voltage levels and acceptable voltage bandwidths (ANSI C84.1), to maximize the efficient transfer of real power to the load under normal and contingency conditions and provide for operational flexibility under normal and abnormal conditions.
  - Reliability – Refers to supply based services capable of improving local distribution reliability. This service may also involve fast reconnection and availability of excess reserves to reduce demand when restoring customers abnormal configurations.
  - Resilience – Refers to supply based services capable of improving local distribution resiliency. This service may also involve fast reconnection and availability of excess reserves to reduce demand when restoring customers abnormal configurations.
  - Energy – Refers to the capability to export electric power by a distributed resource over a period of time, expressed in kilowatt-hours (kWh) or megawatt-hours (MWh) as transported within a distribution system
  - Power Quality – Refers to services that satisfy power quality requirements regarding flicker and harmonics should be within acceptable levels.

## Related processes, forms, and agreement

- Service Definitions – Host utility to specify each available grid service that DERA can supply/participate in. These services can be outlined for individual DERs or DERA.
- Service Performance Requirements – Host utility to specify minimum performance requirements for each grid service. These requirements are customized for each registering DERA with an agreement between the DER service provider and host utility on DERA's performance exceptions and limitations.

See, e.g. [https://www.iso-ne.com/static-assets/documents/2022/02/order\\_no\\_2222\\_filing.pdf](https://www.iso-ne.com/static-assets/documents/2022/02/order_no_2222_filing.pdf), at P11



# Contract Provision - DER Aggregation Implementation Plan

In development

## DERA Implementation Plan

- Provides **details regarding the composition of aggregated resources** that address the performance and technical requirements for each service.
- Describes a plan for aggregation formation, including a **customer/DER engagement plan and key milestones** to support the Host Utility identified timing requirements for in-service operations.
- Each DERA plan includes **aggregation, and technical requirements** that are appropriate for the services being provided by DERA to the host utility.
- DERA plans may also include performance auditing and baseline deviation requirements to meet unique system needs. Participation models can be structured for individual services and a combination of different services (i.e., dual participation).

## Related processes, forms, and agreement

- Aggregation Compliance Rules – Retail regulators to specify aggregation rules, baseline performance, and deviation requirements to DER service providers
- DERA Implementation Plan – DER Aggregator to provide implementation details including key milestones, including acceptance testing (This may include customer engagement plan)
- Resource Plan & Schedule – DER Aggregator to provide details on DER mixture in an aggregation including schedule for customer engagement and enrollment
- Customer and DER Information Form – DER Aggregator to provide details on the type, location, technical characteristics, customer details and other relevant information as needed
- Agreement to adhere to Aggregator Code of Conduct throughout the lifecycle from customer solicitation and enrollment through operations and settlement of the DERA service/s.

See, e.g. [https://www.iso-ne.com/static-assets/documents/2022/02/order\\_no\\_2222\\_filing.pdf](https://www.iso-ne.com/static-assets/documents/2022/02/order_no_2222_filing.pdf), at P10, 29, 32





# Contract Provision - Data & Visibility Requirements

In development

## Data Requirements

- Real-time data and visibility requirements for DERA can either be at a single point of interface, or at various nodes within the DERA, or on the DERA periphery. These Real-time telemetry requirements for distribution services may well be in addition to existing installed revenue and SCADA meters at the point of interconnection (POI) of each DERs within DERA.
- Data and visibility requirements should be technology-neutral but using certified standards. Meaning that DERs can use communication and monitoring systems that meet the standards defined by the regulatory jurisdiction. For example, utilizing IEEE 2030.5 standard (Smart energy profile application protocol) to monitor, control and manage data ensures consistent approach and avoids redundant overlapping requirements for DERA aiming to participate in dual markets.
- For example, this may include the ability to:
  - Communicate with the grid operator's network management system (e.g., EMS/ADMS) using a standardized communication protocol.
  - Provide measurement data in real-time or near real-time as required for the specific service/s provided.
  - Provide accurate and reliable data, including data on energy production av/net load response availability, capacity, and availability.
  - Respond to dispatch signals from the grid operator in a timely manner.
- **Data and visibility requirements must also address considerations for communication at edge – between customers and aggregators as well as cyber and data security requirements.**

## Related processes, forms, and agreement

- Data, Measurement, Communications and, Cyber Requirements – Jurisdiction to specify data sharing, telemetry, cybersecurity, and related standards required depending on aggregation composition, DER technology type, system size, and/or other considerations.

See, e.g. [https://www.iso-ne.com/static-assets/documents/2022/02/order\\_no\\_2222\\_filing.pdf](https://www.iso-ne.com/static-assets/documents/2022/02/order_no_2222_filing.pdf), at P10, 29, 32



## Coordination Framework

- **Active DERA participation in the retail market creates complex challenges for system operators/host utility to maintain reliability and necessitates an operational coordination framework, communications plan, and sufficient visibility between DER service providers and host utility to effectively, safely, and reliably operate and manage host utility's distribution networks.**
- **The coordination framework has three main sub-provisions in the contract -**
  1. **Role and responsibilities of host utility:**

The host utility establishes a communication framework with DER service providers to communicate planned/unplanned outages, system violations and required derating or curtailment events that affect the participation of DERA in the host utility's retail market.
  2. **Role and responsibilities of DER service providers -**

DER service providers communicate limitations or unavailability of DERA to host utility that affects system reliability. If there are certain fundamental changes to DERA structure/architecture (registration changes of DERs, technology being added/removed, etc.), it is the responsibility of DER service providers to notify the host utility of possible changes.
  3. **Dispatch instructions –**

Host utility institutes a framework on how each DER within DERA will be controlled and dispatched during each grid service provision by DERA. These dispatching instructions are agreed upon with DER service providers. Dispatching instructions may vary depending on the visibility and control requirements of each technology type of DER within registered DERA as well as by different participation models. Any changes in the network or participation model may require revision of dispatching instructions.

See, e.g. [https://www.iso-ne.com/static-assets/documents/2022/02/order\\_no\\_2222\\_filing.pdf](https://www.iso-ne.com/static-assets/documents/2022/02/order_no_2222_filing.pdf), at P35

# Contract Provision - Compensation & Performance Evaluation

In development

## Compensation

- Distribution grid services compensation mechanism is a process that provides financial compensation to DER service providers for their participation in supporting the stability and reliability of the host utility grid through DERA.
- Established compensation mechanisms in the service contract are critical for aligning DER service providers' behavior with host utility needs. Having a robust structure around the compensation mechanism for each grid service and a combination of services offered by different DER technologies, the final settlement process between DER service providers and host utility becomes efficient.

## Performance Evaluation

- DERA performance will be evaluated based on service requirements defined in the DERA Agreement against actual performance. This may involve the use of baselining methods for net load response, for example. A standard method for baselining applicable to all DERA agreements is recommended.
- Non performance provision is an important element to ensure DERA performance meets contract requirements and addresses the ratepayer risks for not performing. There have been a variety of approaches to addressing financial penalties/liquidated damages, compensation clawbacks, etc. None have been entirely successful and careful thought should be given to achieving a reasonable balance in terms of the risk of financial consequences for non-performance in relation to overall compensation potential. In other words, the DERA's risk should not outweigh the reward for a successful DERA contract.

## Related processes, forms, and agreement

- Baseline Methodology – Host utility and Regulators to specify baseline performance requirements and minimum offer price for each eligible service based on the baseline capacity of DERA
- Settlement Process – Host utility and Regulators to specify the settlement process (through this contractual agreement or other service purchase agreement) and payment structure for DER Service Providers
- Audit Requirements – Regulators to specify audit requirements and processes for all the settlements and transactions between Host utility and DER Service Providers

See, e.g. [https://www.iso-ne.com/static-assets/documents/2022/02/order\\_no\\_2222\\_filing.pdf](https://www.iso-ne.com/static-assets/documents/2022/02/order_no_2222_filing.pdf), at P27



# Standard Distribution Services Contract Insights



# Approach and Methods

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## Review of Example Contracts

- Collect some illustrative examples of existing distribution grid services contracts
- Review the provisions of these contracts, noting what is included and what is not relative to the proposed DSC framework

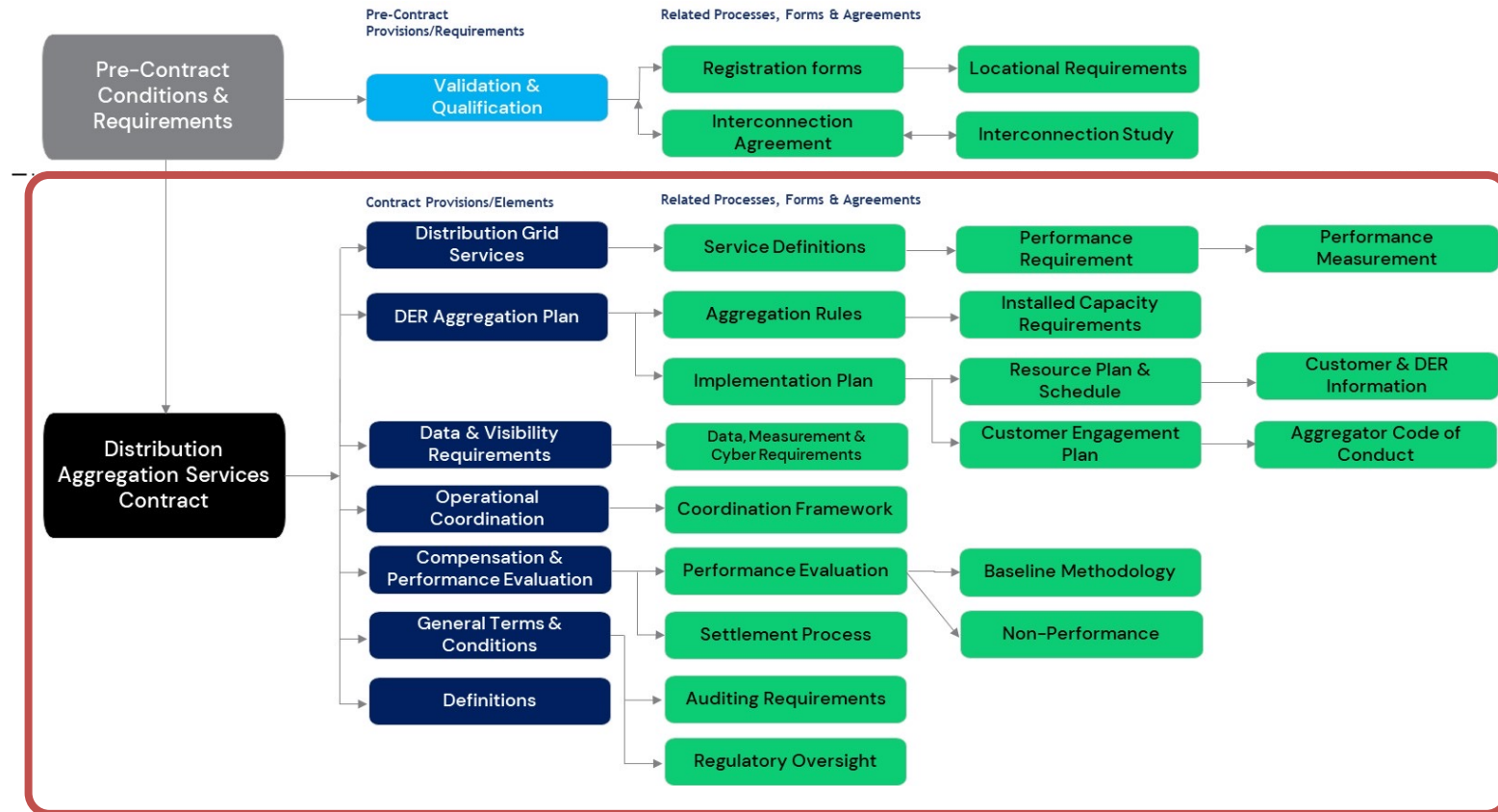
## Engagement with industry SMEs

- Initiated engagement with DER Aggregators, Distribution Utilities and regulators/policy makers
- Identify leading contracting practices and gather industry lessons on successes and challenges for developing DSCs that improve operational coordination and commercial performance of DERs providing distribution grid services
- Seek additional feedback and insights on the need for, and further development of a standard DSC
- Identify key contracting issues that regulators/policymakers should consider e.g.:
  - Tariffs, rules practices that may constrain greater value creation from DERs
  - Open communication standards (APIs) and common information models that could normalize data exchange
- The paper will propose recommendations based on gaps and issues identified

# Standard Distribution Services Contract (DSC)

## Purpose of the Second Paper

- Explore aspects of the DSC framework in greater detail, **providing examples of contract terms** from existing DSC-type contracts
- Describe **what is working and what are challenges with existing contracts** for distribution grid services including impacts from upstream processes (e.g. grid planning & procurement)
- Specify and **outline discrete services, related performance expectations,** requirements for asset visibility, operational coordination, performance evaluation & assurance, and customer engagement.
- Provide **guidance to regulators** on the development of pro forma contracts and potential need for standards
- Focus on implementation, operations and performance assurance



# Comparison of DSC Framework Provisions & Elements to Select Existing Grid Service Contracts

In development

Standard DSC Framework		Grid Services Pro Forma Contracts				
Provisions & Elements	Processes, Forms & Agreements	HECO Grid Service Purchase Agreement <sup>9</sup>	PG&E DIDF Service Agreement <sup>10</sup>	UK Electricity <u>North West</u> Limited, Flexibility Services Standard Agreement <sup>11</sup>	Xcel Energy NWA Agreement <sup>12</sup>	NYSEG Java Substation NWA Agreement <sup>13</sup>
<b>Distribution Grid Services</b>	Performance Requirements	●	●	◐	●	◐
<b>DER Aggregation Plan</b>	Aggregation Rules	●	◐	◐	NA*	NA
	Implementation Plan	●	◐	◐	NA	NA
	Resource Plan & Schedule	●	◐	◐	NA	NA
	Customer Engagement Plan	●	◐	◐	◐ or NA	◐ or NA
	Aggregator Code of Conduct	●	◐	◐	NA	NA
<b>Data Visibility Requirements</b>	Data Access, Telemetry & Cyber Requirements	●	●	◐	◐	○
<b>Operational Coordination</b>	Scheduling & dispatch	●	◐	◐	◐ or NA	◐ or NA
	Planned/Unplanned Outages	●	●	◐	◐ or NA	◐ or NA
<b>Compensation &amp; Performance Evaluation</b>	Performance Evaluation	●	●	◐	◐	◐
	Settlement Process	●	●	●	●	●
	Non-Performance	●	●	●	◐	◐
<b>General Terms &amp; Conditions</b>	Auditing Requirements	●	●	◐	◐	◐
	Regulatory Oversight	●	●	◐	◐	◐

Comparison of DSC Framework Provisions & Elements to Select Existing Grid Service Contracts



# 4. Market and Operational Coordination Requirements



# Market & Operational Coordination Platform Paper

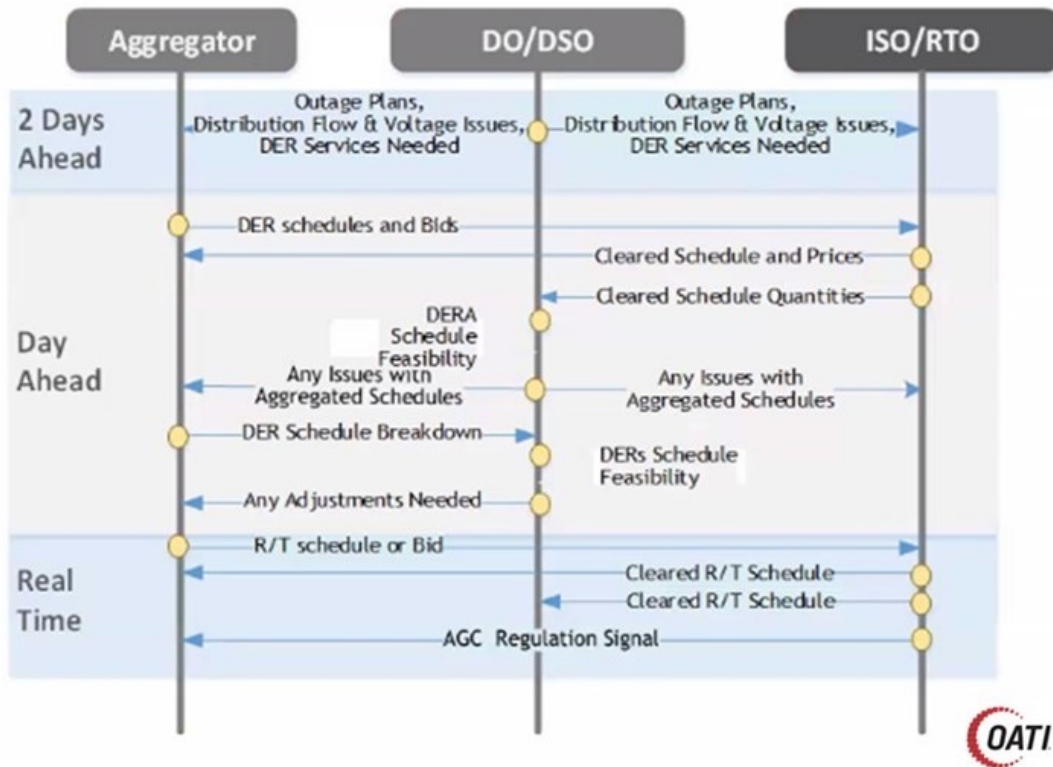
- Coordination on the business requirements, and rationale for a common market and operational coordination platform is needed
- It is critical to **engage** regulators, ISO/RTOs, distribution system operators and DER aggregators, consumer advocatres, and other stakeholders
- **A common platform** can enable the reliable and efficient use of DER services for both the bulk power system and distribution grid operations.
- **A conceptual architecture** for a scalable market and operational coordination (MOC) platform approach highlights the **information interfaces** required for the operation, market coordination, and settlement of DERs among Aggregators, TSOs, and DSOs



# Translating Operational Processes into High-Level Functionality

Based on FERC requirements, ISO compliance plans, and interviews and secondary research developed a set of high level functional and cross-cutting requirements

## Example Operational Processes



## Example Market Coordination Functionality

### Market Participation Coordination

ID	Functionality	Description
M1	DER Services Registration	Register specific services offered by DER aggregations
M2	DER Services Opportunities	A list (or a map) with details on opportunities to provide wholesale and distribution services
M3	Market Participation Rules validation	Validation to ensure DERAs adhere to specific market participation rules, such as bidding procedures, pricing structures, and pre-determined operational constraints
M4	Dual Participation Validation	Validation of DER participation in both retail and wholesale markets, ensuring there are no conflicts or issues arising from their dual involvement.
M5	Day-ahead Distribution Operator Validation of Wholesale	Distribution operator confirmation that DERs are capable of delivering on their wholesale market commitments.
M6	Automated Services Bidding	Automated system for multiple wholesale market and distribution services bidding
M7	DER State Information & Readiness	Captures real-time information on the state and readiness of each DER, including its availability, current operating capacity, and potential issues affecting performance
M8	DER Asset Outage & Curtailment Management	Manages DER asset outages and curtailment including derations, notification procedures, and coordination of response strategies
M9	Coordination of Dispatch Instructions	Coordination of bulk system and distribution dispatch instructions to ensure optimal use of DERAs including real-time adjustments based on system conditions
M10	Market Conflict Identification	If one asset is participating in two markets (and is operating within the defined market rules), and there is a conflict, users are alerted to it.
M11	Reporting on DER Bidding, Dispatch, Changes and Performance	Provide transparency on dispatch instructions, changes to dispatch and performance.
M12	Market Monitoring	Enable continuous observation of wholesale and distribution market activities to enable identification of regulatory issues, market faults and security issues via analytics processes.

# Operational Coordination – Visibility, Optimization

## Operational Coordination

ID	Functionality	Description
O1	<b>Real-Time T-D Node Visibility</b>	Visibility into the Transmission-Distribution (T-D) interface with real-time data on node performance, energy flows, and potential constraints
O2	<b>DER Reliability Monitoring</b>	DER Compliance with technical standards for interconnection and performance to ensure reliability and safety of the grid.
O3	<b>Distribution Grid State Information</b>	Real-time operationing information on specific distribution grid outages, curtailments and other changes to deliverability including affected locations and expected duration
O4	<b>T&amp;D Deliverability Optimisation</b>	Capability to enable optimising demand and supply (e.g., constraints) across transmission and distribution
O5	<b>Operational Instructions Record</b>	Real-time operational log of actions involving changes in deliverability of DER services due to changes in grid conditions (e.g., outages, line derates, circuit switching, etc.).

# Resource Registration: Attributes, Constraints, etc.

## DER Registration

ID	Functionality	Description
R1	<b>Asset Registration</b>	DER Aggregator register DER assets (“once”), including detailed technical specifications (asset type, location, size and connection point) and ownership details common to all services and markets
R2	<b>Operating Parameters &amp; Characteristics</b>	Details about the operational aspects of DER assets including performance characteristics, metering, telemetry, and control capabilities.
R3	<b>Interconnection and Operational Constraints</b>	DER interconnection and deliverability parameters, including interconnection requirements and any specific market access limitations (e.g., export limits and temporal constraints).
R4	<b>DER Aggregation Information</b>	Detailed data about DER aggregations including DER composition (e.g., flexible load, distributed generation, and battery storage) and aggregate operational characteristics.
R5	<b>DER Aggregator &amp; DER Owner Registration</b>	Registration of DER Aggregators and participating DER owners including relevant company information (e.g., ownership, contacts and any required regulatory certifications).
R6	<b>Bulk System Operator, Distribution Utility, and Retail Regulatory Jurisdiction Information</b>	Identification of relevant distribution utilities, retail regulatory jurisdiction/s, and wholesale market operators, including market and operational contact information and relevant market and operational rules, tariffs and other information associated with the provision of DER services.
R7	<b>Aggregation Rules and Market Participation Rules Pre-qualification</b>	Enable initial qualification based on wholesale and retail rules for aggregating DERs and provision of DER services for wholesale markets and/or distribution.

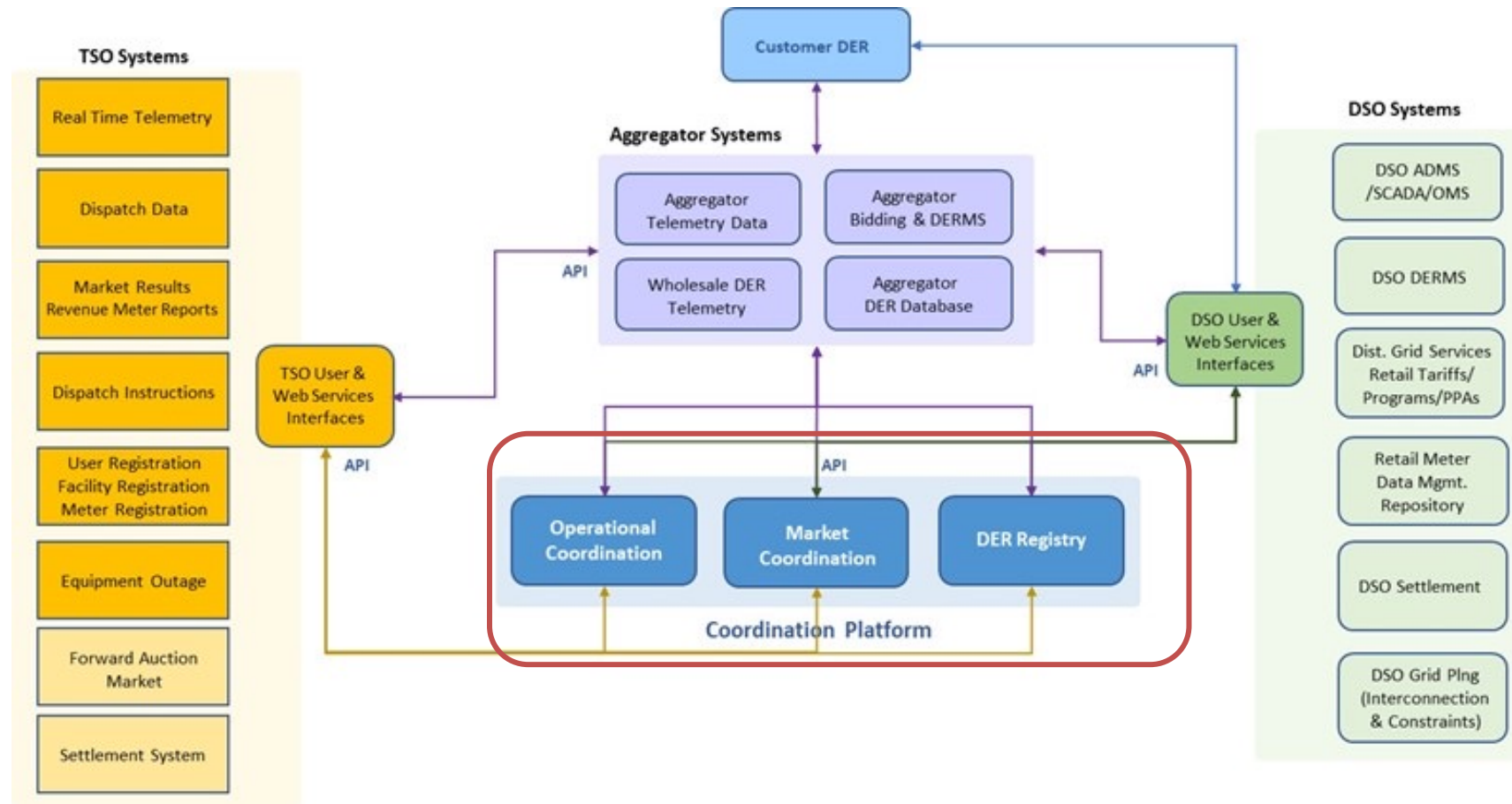
# Cross-Cutting: Standard Data Model, Access, Management, etc.

## Cross-Cutting Requirements

ID	Functionality	Description
N1	<b>Standard Data Model</b>	Standard data model that underpins asset, product, and market participant definitions that are used to categorise, describe, and harmonise them across multiple markets thereby helping participants to find each other and comparing products and assets.
N2	<b>User Registration</b>	Registration of users onto the exchange facilitating access to multiple markets through a unified experience.
N3	<b>Role-Based Access Control System</b>	Enable management of user read/write privileges (e.g., Aggregators, DSOs, ISOs, Regulators) with secure access protocols
N4	<b>Transaction Logging and Historical Data Archiving</b>	Maintain record of all data on prices, volumes, dispatch, trades, metering and settlement as well as interactions and changes within the registry for audit and analysis.
N5	<b>Data Management</b>	Provide efficient, standardized management of data related to DER performance, market transactions, operational activity, and compliance.
N6	<b>Reporting</b>	Provide user defined reports on DER participation and performance, market and operational activity, and related compliance information
N7	<b>Transparency and Accessibility</b>	Ensure that market participation is transparent and accessible to all qualified DERs and aggregators, without undue barriers.
N8	<b>System of Systems Interoperability</b>	Interoperability with DER Aggregator, ISO/RTO and distribution utility systems through implementation of secure Application Programming Interfaces (APIs) using open standard protocols to facilitate seamless communication and operational coordination.
N9	<b>Telemetry Interfaces</b>	Enable interfaces with required telemetry, which can be at the individual DER or a DER Aggregation level. The level of telemetry required may depend on the nature of the DER's participation in the wholesale market and market rules.
N10	<b>Secure and Reliable Communication Channels</b>	Enable robust communication channels for the exchange of operational data, market signals, and dispatch instructions.
N11	<b>Business Process and Approval Functions</b>	System enables the process mechanisms to ensure implementation of markets and operational processes, and related approval processes.
N12	<b>Security and Privacy Protections</b>	System enables compliance with security and privacy standards for market and operational data and DER registry information.
N13	<b>Flexibility and Scalability</b>	System can accommodate millions of DER involving a wide range of technologies and aggregation compositions, and adapting to evolving market conditions and technological advancements.

# Market & Operational Coordination Platform Conceptual Architecture

Based on requirements, developed a conceptual architecture for a shared coordination platform that facilitates the information exchange between ISO/RTO, distribution operator and DER Aggregator.



# Key Takeaways on Shared Market Platforms

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- **Market & Operational Coordination is necessary** between ISO/RTOs, distribution operators and DER Aggregators. Coordination through a daisy chain of phone calls among the parties is not effective to maintain a reliable system.
  - A shared MOC Platform addresses the need for system/s that ensures consistent information is exchanged in real-time, so all parties have the same information at the same time.
  - A shared platform for coordination with an ISO/RTO avoids the complexity risks and costs of ad hoc implementation of disparate systems by each utility.
  - A common platform ensures adherence to regulatory requirements, enabling efficient and equitable participation of DER aggregations in the wholesale market and distribution services.
- **This is a starting point** to stimulate discussion among policymakers, regulators, and stakeholders to guide the consideration of a shared MOC platform.
- Evaluation and development of such a platform will necessarily **start with the identification of detailed functional and technical requirements** based on the specifics of each ISO/RTO, state, and utility.

# 5. DISTRIBUTION STANDARD CODE OF CONDUCT



# Distribution Standard of Conduct – Task Purpose and Scope

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## What is a DSoC?

- Growing need for utility distribution regulatory authorities to consider enhancing existing distribution utility rules to address the need for **greater open access and non-discriminatory distribution operations** in the utilization of distributed energy resources (DER).
- This is being driven, in large part, by a) the use of DER for bulk power and distribution services, and b) FERC Order 2222 recognition of the state regulatory governance responsibilities over Distribution Service Providers and DER.
- A Distribution Standard of Conduct (DSOC) that involves **functional separation of distribution functions from the retail marketing functions** within a utility is an important consideration to ensure open access and non-discriminatory distribution operations if independent DER aggregation and wholesale market participation is desired.

## Objective

- Provide a reference document that **describes the context for why a DSoC may be desirable** in the context of FERC 2222 and greater use of independent DER aggregations and DER participation in bulk power markets and distribution services.
- **Provide a sample DSoC framework** adapting applicable elements of the existing FERC required Transmission Standard of Conduct that has been widely adopted by investor-owned utilities and many municipal and community owned utilities. A DSoC will necessarily need to recognize existing retail rules regarding affiliates/partners, non-discriminatory DER interconnection, and service provision.



# Distribution Standard of Conduct

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**Development of a DSoC may consider four categories adapted from the transmission standard of conduct rules associated with FERC's Open Access Transmission Tariff<sup>1</sup> as summarized below.**

**Non-Discrimination.** A Distribution Service Provider should treat all distribution customers, affiliated and non-affiliated, on a non-discriminatory basis, and should not make or grant any undue preference or advantage to any person or subject any person to any undue prejudice or disadvantage with respect to Distribution Service.

**Independent Functioning.** A Distribution Service Provider's Distribution Function personnel should operate and make decisions independently from its Marketing Function personnel, unless permitted by the jurisdictional regulation.

**No conduit.** A Distribution Service Provider and its personnel, contractors, consultants, and agents are prohibited from disclosing, or using a conduit to disclose, non-public Distribution Function information to the Distribution Service Provider's Marketing Function personnel.

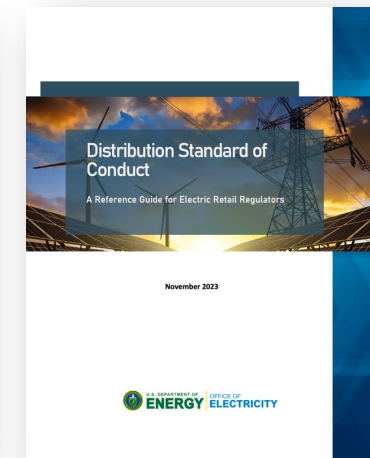
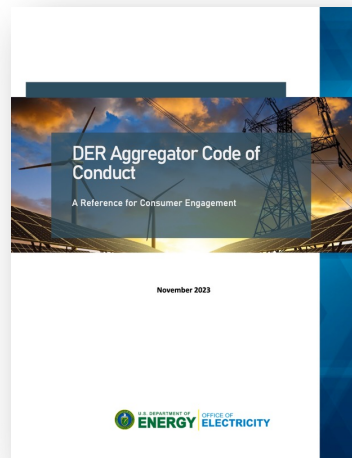
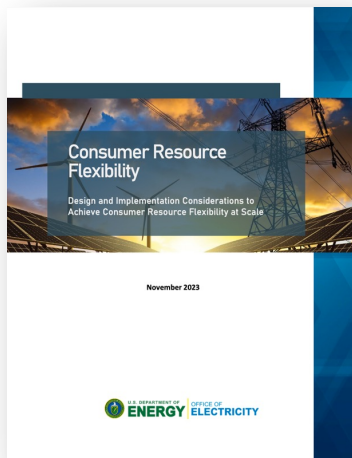
**Transparency.** A Distribution Service Provider should **provide equal access to public Distribution Function information** to all its Distribution Function customers, affiliated and non-affiliated, as defined by jurisdictional regulation.

<sup>1</sup> FERC Order No. 717, Standards of Conduct for Transmission Providers



# Meeting the scalability challenge mean addressing sourcing

1. Consumer Resource Flexibility
2. DER Aggregator Code of Conduct
3. Standard Distribution Aggregation Services Contracts
4. Market and Operational Coordination Requirements
5. Distribution Standard Code of Conduct



[www.energy.gov/distribution-grid](http://www.energy.gov/distribution-grid) under “operational coordination”

# Thank you for your time

We welcome additional feedback after this session

- Email [samir.succar@icf.com](mailto:samir.succar@icf.com) with thoughts or questions
- All the papers described today are available at [www.energy.gov/distribution-grid](http://www.energy.gov/distribution-grid) under “operational coordination”