# Distributed Energy Resource Provider Straw Proposal

**Expanding Metering and Telemetry Options**
**Technical Stakeholder Initiative**

**11/10/2014**

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## 1.0 INTRODUCTION

California and other states are experiencing rapid growth in the number of resources interconnecting to the distribution grid. These distributed energy resources may include, among others, conventional generation, solar, storage, electric vehicles, as well as demand response. The potential exists for these distributed energy resources to play a role in the reliability of the transmission grid through wholesale market resource participation. To meet the ISO's minimum resource capacity requirement of 0.5 MW, these distributed energy resources may need to aggregate into a consolidated resource. Such a resource may consist of large numbers of individual sub-resources which are geographically disbursed on the distribution grid. Currently, the ISO's tariff may not offer a clear platform for these resources to participate in the ISO's markets. This straw proposal explores a framework for them to participate in available market products through an individual entity or multiple entities that would provide various services such as resource aggregation, scheduling, bidding, revenue and real time data management as a resource owner or on behalf of resources. The ISO invites comments from interested stakeholders on this framework.

## 2.0 BACKGROUND AND OVERVIEW

In 2013, the ISO facilitated an "Expanding Metering and Telemetry Options" technical stakeholder" initiative to address stakeholders' experiences and issues with current metering and telemetry requirements. These meetings provided a forum for the ISO to learn about different stakeholder perspectives on perceived barriers to meet existing ISO requirements for wholesale market participation.

At the working sessions, participants discussed and evaluated additional technical and configuration options for metering and telemetry to reduce barriers for current resource participation and to support emerging business models for resources interconnecting to the distribution grid. Upon concluding the 2013 initiative, the ISO advanced implementation of phase 1 proposals throughout 2014. In parallel to phase 1 implementation efforts, the ISO has assessed the need to further develop and advance the proposal for the use of data concentrators to provide distributed energy resource aggregation, data concentration and control signal disaggregation services.

As a result of this assessment, the ISO believes a need exists to recognize the emergence of additional participant entities that would facilitate the development and participation of aggregated distributed energy resources. While not resolving all stakeholder issues, the ISO has developed this proposal with the aim of maximizing the ability of distributed energy resources to participate in the ISO wholesale markets while complying with all participation requirements.

## 3.0 ISO OBJECTIVE AND SCOPE

The objective of this initiative is to establish a framework for greater participation in the ISO's markets by distributed energy resource technologies. The ISO is proposing to define a new market participant called a Distributed Energy Resource Provider, and to identify the roles and responsibilities of this new participant.

A Distributed Energy Resource Provider is the analog of other existing market participants defined in the ISO tariff, namely a Participating Generator, a Participating Load, and a Demand Response Provider. Like these other market participants, the Distributed Energy Resource Provider will offer energy and ancillary services into the ISO market through a scheduling coordinator from distribution (non-ISO transmission) connected resources. The Distributed Energy Resource Provider will execute a new Distributed Energy Resource Provider Agreement. The agreement will be a FERC approved *pro-forma* agreement signed by entities owning or controlling distributed energy resources that wish to participate through bidding, scheduling and settling transactions involving these resources in the ISO market. To accomplish these activities, entities owning or controlling resources will use a scheduling coordinator similar to other participating resources. The distributed energy resource provider agreement will bind an entity that owns or controls distributed energy resources to the ISO tariff and business practice manuals that establish roles, responsibilities and technical requirements for market participation.

## 4.0 DISTRIBUTED ENERGY RESOURCE PROVIDER AGREEMENT

Distributed energy resources may currently participate in the ISO's energy and ancillary services markets as participating generators, non-generator resources, participating loads or proxy demand resources if they meet minimum capacity requirements. Additional requirements for after the real time monitoring and control along with after the fact metering are vital to daily operation of the transmission grid under the ISO's control and to ensure accurate market transaction settlements. The ISO recognizes, however, that a growing need may exist to aggregate distributed energy resources into a single resource that is eligible to participate in the ISO market. Under this model, an entity could aggregate distributed energy resources in order to increase the size of the participating resource or manage the cost and risk of participating in the ISO's markets on behalf of individual resources. To accommodate the aggregation of distributed energy resources, and upon board approval the ISO will post the *pro forma* distributed energy resource provider agreement. The ISO also believes the distributed energy resource provider role may

complement data concentrator functionality for distributed energy resources under which an entity would provide a data service to disaggregate ISO signals to sub-resources to obtain a resource response and to aggregate sub-resource operational and settlement meter data to submit to the ISO under the auspices of a scheduling coordinator.

The distributed energy resource provider agreement will establish the terms and conditions under which the ISO and distributed energy resource provider will discharge their respective duties and responsibilities under the ISO tariff. The terms of the agreement shall be subject to the ISO tariff. Similar to other *pro forma* agreements for participating entities, the ISO proposes that the participating distributed energy resource provider agreement will contain standard terms and conditions addressing the term of the agreement as well as termination rights under the agreement. The agreement will also include general terms relating to the distributed energy resource provider's participation requirements such as the provision of technical and operational information to the ISO, metering and communications requirements, submission of economic bids and self-schedules and provision of ancillary services. The ISO also proposes to incorporate other standards terms and conditions from its existing *pro forma* participating agreements that address issues such as penalties and sanctions, cost responsibility for fulfilling the terms of the agreement, dispute resolution, representations and warranties, liability, uncontrollable forces and other miscellaneous terms.

Similar to a participating generator agreement, the ISO proposes that a distributed energy resource provider agreement would identify each and every sub-resource subject to the agreement as part of a schedule to the agreement.

## 5.0 THE FUNCTIONS OF A DISTRIBUTED ENERGY RESOURCE PROVIDER

A distributed energy resource provider will accept certain responsibilities and obligations to ensure the distributed energy resources it owns or controls will participate in the ISO's energy and/or ancillary services market through a scheduling coordinator in conformance with the ISO tariff.[1] As the party responsible for certain identified resources listed in the distributed energy resource agreement, the distributed energy resource provider will, among other things, provide the ISO with accurate information concerning the resources it owns or represents, and to update this information when changes occur. This information includes changes to resource attributes as well as accurate meter and telemetry data for settlement and operational purposes. The distributed energy resource provider will also be responsible for operating and maintaining its distributed energy resources consistent

[1] The distributed energy resource provider could serve as its own scheduling coordinator or hire the services of a scheduling coordinator. The scheduling coordinator is an entity that accepts certain responsibilities through formal agreement with the ISO associated with bidding, scheduling and settling resources in the ISO market.

with applicable provisions of the ISO tariff (e.g. ISO dispatch instructions and operating orders).

### 5.1 General Roles and Responsibilities

Under the framework the ISO is proposing, a distributed energy resource provider would need to operate its resource pursuant to relevant provisions of the ISO tariff and ISO operating procedures. Distributed energy resource providers will also need to comply with applicable utility distribution company tariffs, requirements of the Local Regulatory Authority, as well as interconnection requirements, if any. The ISO will work with DERPA's to coordinate with the utility distribution company to avoid conflicting operational directives. The ISO also plans to specify responsibilities specific to a distributed energy resource provider, including the responsibility to maintain interface systems, communications access and secure availability for distributed energy resources.

The distributed energy resource provider will need to provide data identifying each of its resources and such information regarding the capacity, the operating characteristics of the resource, and configuration as may be reasonably requested from time to time by the ISO. All information provided to the ISO regarding the operational and technical constraints must be accurate and actually based on physical characteristics of the resources and configuration. Distributed energy resource providers will need to comply with applicable outage requirements as well as any applicable reliability criteria.

The ISO requests comments from interested stakeholders regarding general roles and responsibilities that would apply to a distributed energy resource provider.

## 6.0 PROVISION FOR DISTRIBUTED ENERGY RESOURCES TO SUBMIT SETTLEMENT QUALITY METER DATA

To participate in the ISO's markets, all resources must have metering mechanisms in order for the ISO markets to compensate the resource for the services it provides. The ISO's current tariff recognizes two metering approaches – ISO metered entities (ISOME) and scheduling coordinator metered entities (SCME). The first involves a direct metering arrangement between the resource and the ISO; the second involves a metering arrangement between the scheduling coordinator and the resource or load. Under the second approach, the scheduling coordinator submits meter data to the ISO for use in settlements. If distributed energy resources engage in a direct metering arrangement with the ISO this arrangement could create a significant burden for distributed energy resources aggregated to participate in the ISO's markets.

Under the framework proposed here, aggregated distributed energy resources owned or represented by distributed energy resource providers will be scheduling coordinator metered entities under the ISO's tariff. The scheduling coordinator that is representing these scheduling coordinator metered entities (i.e. the distributed energy resources) is expected to, or obtain the services to, aggregate settlement quality meter data (SQMD) from all of the underlying sub-resources that make up the distributed energy resource and provide that data to the ISO as SQMD meeting all established data submittal timelines. This proposal does not preclude the distributed energy resource provider from providing the service as an SC or on behalf of the SC representing them as a Scheduling Coordinator Metered Entity (SCME).

Scheduling coordinators for scheduling coordinator metered entities must conduct scheduling coordinator (SC) self-audits annually. Additionally, scheduling coordinators will need the capability to disaggregate resource level SQMD from the representative distributed energy resources to their underlying sub-resources for audit purposes. As with other SCMEs, the ISO will maintain the authority to audit and test the metering facilities and data handling and processing procedures of the scheduling coordinator and the distributed energy resource provider.

Currently, for distribution connected load and generation participation in the ISO wholesale markets, the SC self audit points to compliance of requirements established by the Local Regulatory Authorities (LRA). ISO Tariff Section 10.3.10.1 "Requirement for Audit and Testing", currently states that:

> Each Scheduling Coordinator shall at least annually conduct (or engage an independent, qualified entity to conduct) audits and tests of the metering facilities of the scheduling coordinator metered entities that it represents and the meter data provided to the scheduling coordinator in order to ensure compliance with all applicable requirements of any relevant Local Regulatory Authority. Scheduling Coordinators shall undertake any other actions that are reasonable (and) necessary to ensure the accuracy and integrity of the Settlement Quality Meter Data provided by them to the CAISO.

Key aspects of this requirement are that the Scheduling Coordinators are responsible for performing audits and tests annually to ensure compliance with all applicable Local Regulatory Authority requirements. The ISO anticipates that there may be cases in which a Local Regulatory Authority has not established requirements for a distributed energy resource provider wishing to participate in the ISO's wholesale market. Under these cases, the ISO proposes to establish default requirements. Section 8.1.2 of this proposal discusses the development of these requirements.

## 7.0 ACCEPTABLE DISTRIBUTED ENERGY RESOURCE PROVIDER AGGREGATIONS

As explained, a distributed energy resource provider may want to aggregate multiple sub-resources into a single resource. The ISO proposes to allow distributed energy resource providers to aggregate sub-resources within a sub load aggregation point (Sub-Lap) to meet the ISO's minimal resource participation requirements. This option would be applicable to resources that are multi[2] or single[3] location aggregations and less than 10 MWs in aggregated capacity.

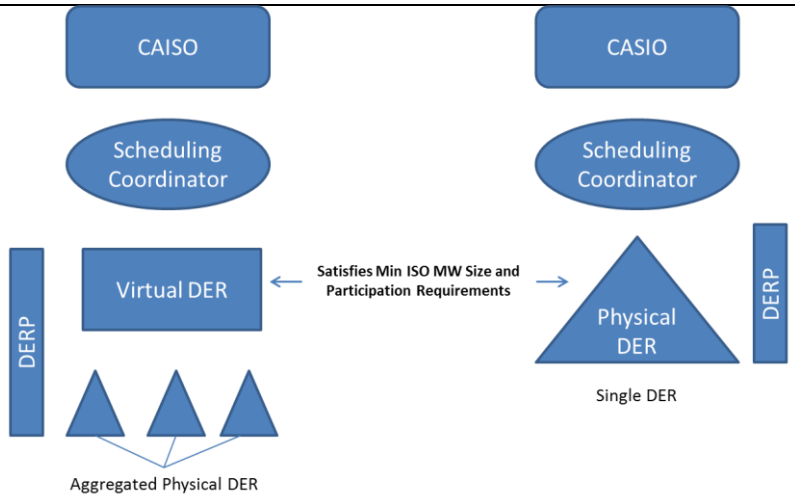
This approach would allow a distributed energy resource provider to aggregate physical sub-resource locations with different connectivity nodes to the grid (i.e. multiple pricing nodes) within a Sub-Lap and represent those sub-resources as a single market resource located at a custom load aggregation point (Custom LAP) specific to the aggregated resource. A Custom LAP may be as small as a single resource settled at a pricing node within a Sub-Lap or represent multiple sub-resources that the ISO would settle based on generation distribution factors (GDFs) across specific pricing nodes that reflect the distribution of the sub-resources. This type of aggregated resource requires the use of generation distribution factors (GDFs) between the aggregated node and the individual nodes in order to reflect the distribution of power among the individual nodes.

Under this framework, distributed energy resources providers would identify and provide sufficient data during the ISO's new resource implementation process to enable the ISO to determine the appropriate distribution factors for each distributed energy resource to allow the ISO to model the configuration of the resource in its full network model.

As illustrated in the Figure 1, a distributed energy resource provider may offer energy and ancillary services through a scheduling coordinator into the ISO market as a single physical distribution connected resource or as a single "virtual" resource made up of an aggregation of smaller distributed energy resources within a Sub-Lap.[4]

Figure 7.1 – Possible Configurations of a Distributed Energy Resource

[2] For purposes of this paper, multi-location aggregation refers to multiple sub-resources geographically distributed but combined, within a sub-LAP, into a single resource.
[3] For purposes of this paper, single-location aggregation refers to multiple sub-resources within a single location or facility, representing a single resource.
[4] The ISO intends to address the extension of permissible geographic distribution of aggregated distributed energy resources beyond a Sub-Lap in a separate initiative.




The ISO recognizes that aggregators may wish to mitigate the performance risk of an aggregated resource by expanding the area that encompasses their aggregated sub-resources. From a system reliability perspective, however, the ISO uses Sub-Lap(s) points to manage physical congestion. The ISO does not intend to examine relaxing the constraints of Sub Lap resource aggregations in this initiative.

## 8.0 SCHEDULING COORDINATOR SERVICES FOR DISTRIBUTED ENERGY RESOURCE PROVIDERS

Under this proposal, the owner or resource representative would enter into a distributed energy resource provider agreement in order to represent distributed energy resources that are comprised of sub-resource aggregations.

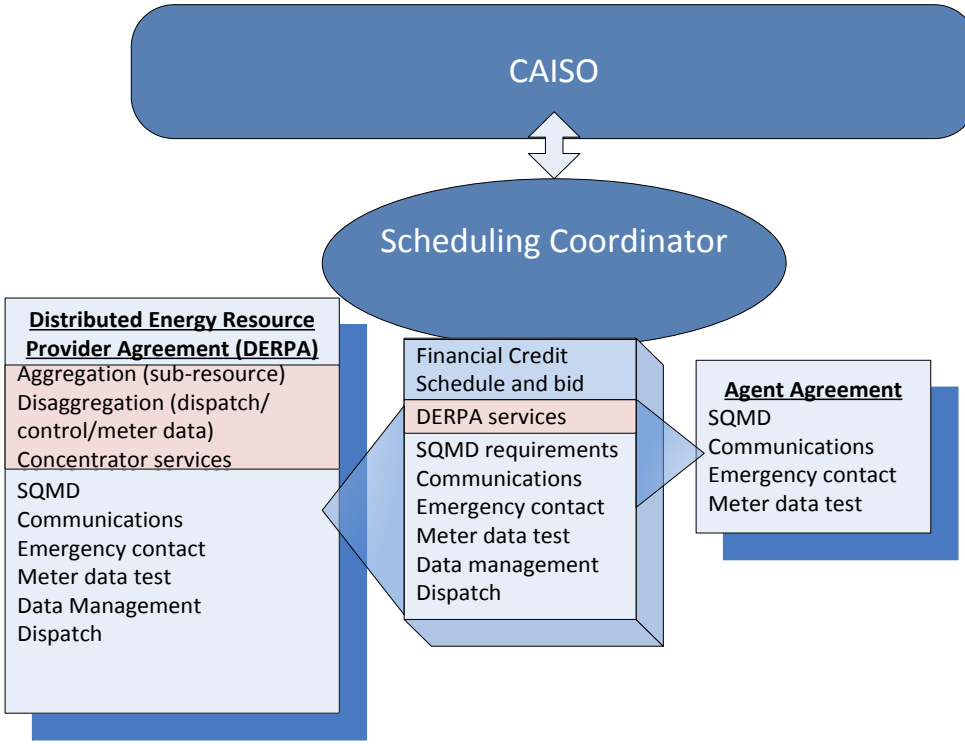
A distributed energy resource provider's scheduling coordinator must meet the certification requirements for a scheduling coordinator and all other applicable obligations inclusive of having a meter service agreement for scheduling coordinators providing the ability to represent scheduling coordinator metered entities. Scheduling coordinators are ultimately responsible for the scheduling, bidding, real time telemetry, control signal disaggregation, settlement quality meter data submittal and settlement of the participating resources they represent, but are not precluded from obtaining some of these services from other parties, inclusive of a distributed energy resource provider, to meet these responsibilities.

The a distributed energy resource provider may choose to be a scheduling coordinator or obtain the services of a scheduling coordinator to meet their responsibility for ensuring that ISO dispatch and control signals are received and responded to by the appropriate

resources. Therefore, the distributed energy resource provider will have a relationship with a scheduling coordinator who serves as the agent for the distributed energy resource provider to perform certain ISO functions.

To illustrate this relationship, Figure 8.1 provides the current "agent" relationship and proposed distributed energy resource provider relationship that would be available to scheduling coordinators representing distributed energy resources.

Figure 8.1 – Scheduling coordinator obtains services to meet certification requirements




## 8.1 Data Management Services

The following sections discuss proposed options for distributed energy resource providers to meet requirements for providing both operational data and market settlement data

### 8.1.1 Data Concentration

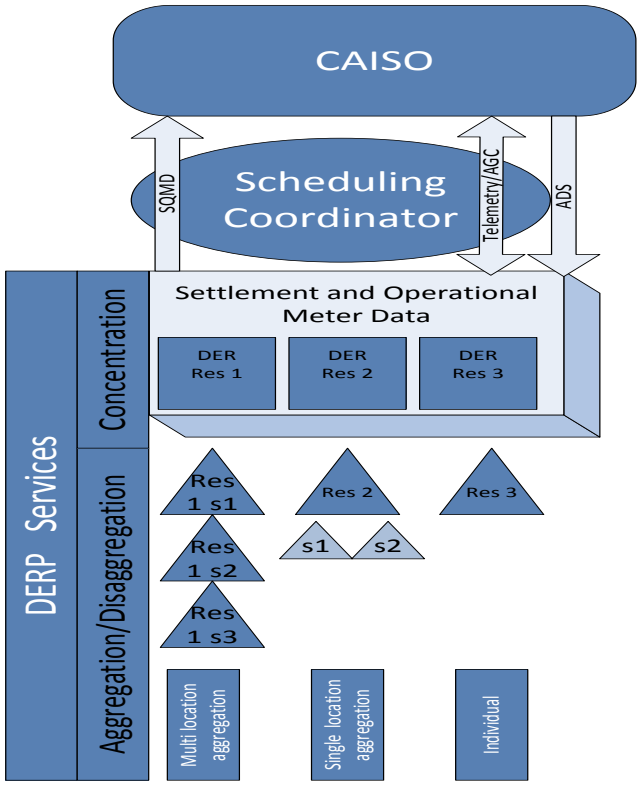
The ISO is proposing to allow distributed energy resources to rely on data concentration services to interact with the ISO through one point of contact. Pursuant to this approach, the ISO would maintain visibility to and interact with distributed energy resources (and sub-resources) at the data concentration point at which sub-resources would be

aggregated as a single market resource. Scheduling coordinators or distributed energy resource providers providing services to them would perform any necessary mapping of data behind the aggregated resource.

This option would apply to the provision of settlement meter data, telemetry data and control signaling (aggregation and disaggregation) for distributed energy resources comprised of single or multi-resource location aggregations.

Figure 8.2 depicts how distributed energy resources would interact with the ISO under this model.

Figure 8.2 – Distributed Energy Resource Provider Interaction[5]




Concentration: The ISO maintains visibility to, control of and interaction with individual ISO market resources at the data concentration point.

[5] Figure is only an illustrative and does not depict all applicable interfaces and/or requirements to participate in the ISO market.

Aggregation: The ISO views aggregations as a single resource and the ISO does not interact directly with the individual sub-resources behind the point of concentration. The distributed energy resource provider maps any data behind that point and manages the aggregation.

Disaggregation: The ISO dispatches the aggregated resource as a single resource. The distributed energy resource provider disaggregates dispatch instructions and control signals to individual sub-resources. The ISO monitors the response from the single aggregated resource.

The following characteristics would apply to any mapping of data that occurs behind an aggregation of distributed energy resources by a scheduling coordinator.

- Security
    - Security requirements would apply at the aggregated or concentration points of interaction.
- Availability
    - Availability and timeliness requirements would apply to the provision of data.
    - Provision of concentrated data would be subject to metrics and penalties associated with accuracy and timeliness.
- Redundancy
    - Requirements will apply based on options used for communication transport between the distributed energy resource provider's concentration point and the ISO.

As explained above, a distributed energy resource provider would need to use, or become, a scheduling coordinator to interact with the ISO on the behalf of multiple resources and to provide the aggregated settlement quality meter data, and real time telemetry data for those participating distributed energy resources they own, or represent. The ISO has successfully implemented a similar model for demand response providers that allows theses resources to meet requirements for real time operational and settlement meter data through the provision of aggregation, data concentration and control signaling services for each of the demand resources they own, or represent.

Although interacting with the ISO through a scheduling coordinator, this proposal anticipates that a distributed energy provider may undertake to provide data concentrator services to the scheduling coordinator. The scheduling coordinator

would be ultimately responsible for the provision of the real time operational data and settlement quality meter data. This responsibility includes maintaining all interface systems, communications access to the ISO's Energy Management System (EMS) for the provision of real time resource visibility and secure availability for those resources they represent, but there is nothing to prevent the scheduling coordinator from contracting with the distributed energy resource provider to perform these services. Scheduling coordinators will continue to remain responsible for all costs and other consequences with the unavailability or inability to provide settlement quality meter data or to exchange data with the ISO's EMS. Any such failure may result in penalties under the ISO tariff. Scheduling coordinators and distributed energy resource providers would have to allocate any risks arising from these obligations between themselves.

### 8.1.2 Revenue Metering

Under the ISO's proposed framework, the ISO will require settlement metering for all distributed energy resources. Scheduling Coordinators representing distributed energy resource providers must ensure their meters or revenue measuring devices meet the requirements of the appropriate Local Regulatory Authority. If the relevant Local Regulatory Authority has not prescribed any certification criteria for the metering facilities of distributed energy resources, scheduling coordinators must ensure their meters or revenue measuring devices meet the default requirements established by the ISO tariff and applicable Business Practice Manual. These requirements will include both a set of metering characteristics and method for validating, editing and estimating (VEE) data. The ISO is currently examining and developing acceptable criteria based on NAESB and ANSI standards for meter and meter equipment used to meet these characteristics and to align with appropriate technical requirements defined in the ISO's business practice manual for metering inclusive of VEE. The ISO proposes to work with stakeholders to understand how distributed energy resources will operate to interpolate data output required for validation measures and metering requirements. Therefore, the ISO requests comments from interested stakeholders regarding whether and how emerging measurement devices will support VEE.

All standards and/or requirements outlined for scheduling coordinator metered entities will apply. The responsible scheduling coordinator must assure that the meter data is adjusted by a distribution system loss factor. Meter data associated with SCMEs must be submitted according to current submittal formats and time periods captured within ISO Metering Business Practice Manual. Additionally, as indicated, if no Local Regulatory Authority standards exist, SQMD will need to comply with a set of requirements that the ISO will incorporate into the ISO Metering Business Practice Manual. See Appendix A

Similar to other participating resources, the ISO proposes a 5-minute metering interval in order to reduce neutrality and provide a more accurate settlement of uninstructed imbalanced energy. However, if a SCME distributed energy resource is associated with a

15-minute interval, the submitted value must reflect such granularity, which will then be divided into three 5-minute meter values calculated the by CAISO. Granularity levels cannot be changed and submitted lower than what is currently programmable within the meter or revenue measuring device.

### 8.1.3 Telemetry

A distributed energy resource can participate in the ISO wholesale market offering a variety of services as long as it meets the eligibility standards for that service inclusive of the provision of telemetry. In general, a distributed energy resource participating in the ISO's markets will not be required to provide telemetry if they are under 10 MW in size. However, to participate in ISO's ancillary services and regulation markets a resource of any size is required to provide and maintain real-time visibility, and regulation control, with the ISO's Energy Management System ("EMS").

A distributed energy resource must securely convey telemetry to the ISO's EMS over the Energy Communication Network (ECN) using one of the ISO approved protocol methods including DNP 3.0 -level 2, ICCP, or through a secure internet connection using PKI/SSL. Under this proposal the distributed energy resource provider will interact with the ISO at a data concentration point, as described in section 8.1.1, in the provision of real time visibility and control for each individual resource they represent.

Communication options identified in the Expanding Metering and Telemetry Options stakeholder initiative have greater benefit in combination with the proposal to permit a distributed energy resource provider to concentrate data from sub-resources. The ISO believes that market participants can manage the costs to utilize the ECN with the data concentration option identified in this proposal. This effort will enable the scalable transport of larger amounts of telemetry data for multiple resources over one ECN link to the ISO.

## 9.0 NEXT STEPS

Participants should submit written comments on the Distributed Energy Resource Model Proposal Paper to MTOptions@caiso.com by November 10, 2014. The following provides a proposed timetable for this stakeholder process.

| ITEM | DATE |
|---|---|
| Post Draft Straw Proposal | November 10, 2014 |
| Stakeholder Kickoff Meeting | November 13, 2014 8-10am |
| Stakeholder Comments Due | November 20, 2014 |

| | |
|---|---|
| Post Final Draft Proposal | December 5, 2014 |
| Stakeholder Conference Call | December 3, 2014 |
| Update Stakeholders on final version | December 12, 2014 |
| Post Draft Final Proposal | December 16, 2014 |

## 0 APPENDIX A

# DISTRIBUTED ENERGY RESOURCE (DER) PROPOSED REQUIREMENTS FOR SETTLEMENT QUALITY METER DATA (SQMD)

**Draft**
**10/30/2014**

# Attachment 1

# PROPOSED TECHNICAL SPECIFICATIONS FOR DER DEVICES

# Proposed Technical Specifications for DER Devices

## I. Device Configuration Criteria

### A. Standard Device Memory Channel Assignments

The Device shall have at least 2 channels, preferably 4. The device shall be capable of measuring both load and generation.

## II. Standards for DER Devices

The standards referred to in this section apply to DER Devices when the relevant Local Regulatory Authority has not set any standards.

### A. General Standards

Devices must meet the following general standards:

- They must be revenue quality with a 0.2 Accuracy Class.
- They must be remotely accessible, reliable, 60 Hz, three phase, bi-directional, programmable and multifunction electronic Devices certified for correct operation at the service voltage.
- They must be capable of measuring kWh and kVARh and providing calculated three phase values for kVAh, kVA.
- They must have a demand function including cumulative, rolling, block interval demand calculation and maximum demand peaks.
- There must be battery backup for maintaining RAM and a real-time clock during outages of up to 60 days.
- They must be capable of being powered either internally or externally from an AC source. It is recommended that all meters have an auxiliary source or emergency backup source of power to avoid loss of data.
- They must be capable of providing data to the data collection system used by the Scheduling Coordinator.

- They must be capable of 60 days storage of kWh, KVARh, and/or 4 quadrant interval data.

## B. ACCURACY

### 1. Factory Calibration

The Device shall be calibrated to provide the following level of accuracy:

a) 0.2% at full load at power factor of 100%;

b) ± 0.25% at full load at power factor of 50% lag;

c) ± 0.25% at full load power factor at 50% lead; and

d) ± 0.25% at light load at power factor of 100%.

### 2. Test Equipment

Device accuracy and calibration tests, both for shop and field, require only standard test equipment that have an accuracy of at least ± 0.05% or better. The Device standard is a very accurate energy meter of substantially greater accuracy than the revenue billing Device being tested, or five times greater in accuracy. All the Devices used on the system are required to have accuracy of at least ± 0.25%. No special laboratory-type test equipment or test procedures are required to assure the accuracy of the Device.

### 3. Accuracy Test

This test confirms the accuracy of the Device:

a) The accuracy of the Device is tested for all combinations of the following conditions:

(1) at ambient temperature, 85°C and -20°C;

(2) at power factors of 100%, 50% lag and 50% lead; and

(3) at 0% to 120% of class current;

b) Accuracy curves are provided for all combinations of the conditions; and

c) To pass this test, the Device has the indicated accuracy at ambient temperature for the following load conditions:

(1) ± 0.2% at Full load at power factor of 100%;

(2) ± 0.25% at Full load at power factor of 50% lag;

(3) ± 0.25% at Full load at power factor of 50% lead; and

(4) ± 0.25% at Light load at power factor of 100%.

## C. SAFETY

### 1. Hazardous Voltage

Hazardous voltages are not easily accessible with the Device cover removed.

### 2. Grounding

All accessible conductive parts on the exterior of the Device and conductive parts that are accessible upon removal of the Device cover are to be electrically connected to the Device grounding tabs. All connections in the grounding circuit are made with an effective bonding technique.

### 3. Toxic Materials

No materials that are toxic to life or harmful to the environment are exposed in the Device during normal use.

### 4. Fire Hazard

Materials used in the construction of the Device do not create a fire hazard.

# Attachment 2

# PROPOSED DATA VALIDATION, ESTIMATION AND EDITING (VEE) FOR DER DEVICES

**Proposed Data Validation, Estimation and Editing (VEE) for DER Devices**
This attachment provides guidelines that Scheduling Coordinators can utilize to perform VEE on DER Device data in the absence of LRA criteria for a type of given DER. The SC should use its best judgment to select the validation routines used. Described below are the validations that are required by CAISO, as well as suggested validations. The CAISO will from time to time review the validation routines being used to assure that VEE objectives are being achieved and update this BPM.

## I. Validation

### A. Timing of Validation

Device data should be retrieved on an appropriate cycle to give the SC adequate time to complete VEE prior to submitting to the CAISO.

### B. Data Validation Conditions of Device Hardware

The validation system used shall detect the following conditions so that erroneous data is not used for Settlement or billing purposes.

Validation shall detect the following hardware failures:

- Hardware/firmware failures
- Communication errors
- Data which is recorded during Device tests
- Mismatches between the Device configuration and host system, if applicable
- Measuring Device change outs
- Gaps in data
- Overflow of data within an interval
- ROM/RAM errors reported by the Device
- Alarms/phase errors reported by the Device

## C. Validation Failure

Data that fails validation shall be flagged with the reason for the failure, where applicable. Data that fails checks shall be identified so that manual intervention can be used to estimate the correct values in order to edit the data or to manually accept the data.

## D. Validation Elements

### 1. Required Validation Elements

The DER owner shall set and monitor the following validation criteria within their data collection system:

| Term | Description |
|---|---|
| Energy Tolerance | Comparison of two separate measurements i.e. meter readings (start/stop) vs. recorder data (pulses) for any given time period. |
| Intervals Found vs. Intervals Expected | The data collection system shall calculate the expected number of time intervals between the start and stop time of the data profile file and compare that number against the actual number of time intervals found in the data file. The calculation used to determine the expected number of time intervals will take into account the size or duration of the actual time intervals for the particular Device/data file (5 min or 15 min interval sizes). |
| Time Tolerance | When the data collection system retrieves data from Device, the data collection system workstation clock is compared against the Device clock. A time tolerance parameter (in seconds) shall indicate the allowable difference between the workstation clock and the Device clock. |
| Power Outage Intervals | Device shall record a time stamped event for each occurrence of a loss of AC power and a restoration of AC power. During the data retrieval process, the data collection system shall flag each interval between occurrences of AC power loss and AC power restoration with a power outage status bit. |
| Missing Intervals | The validation process shall compare the stop and start times of two consecutive pulse data files for a Device and report if a missing interval/gap exists. |
| High/Low Limit Check on Interval Demand | The validation process shall compare the Demand High/Low Limits entered by the data collection system operator on a Device basis in the Device table against the actual values collected from the Device. This comparison is performed on an interval-by-interval basis. If the actual values are either less than the Low Limit or greater than the High Limit, then the validation process fails. |
| CRC/ROM/RAM Checksum Error | A CRC (cyclic redundancy check) or checksum is used to ensure that the data sent and received with the device being interrogated is correctly transferred. A CRC/checksum error may indicate a problem with the physical connection with the meter or the communication |

| Term | Description |
|---|---|
| | channel is too noisy to allow an interrogation to complete. |
| Meter Clock Error | This Device hardware error condition can occur whenever an internal hardware clock error results in an invalid time, day, month, year, etc. |
| Hardware Reset Occurred | This Device hardware error condition occurs whenever an internal Device hardware reset occurs. |
| Watchdog Timeout | This feature watches for Device inactivity, indicating a possible failure. |
| Time Reset Occurred | Code or flag shall indicate that the Device time has been reset. See Time Tolerance. |
| Data Overflow in Interval | Code or flag occurs when the amount of data in an interval exceeds the memory capabilities of the Device to store the data. This alerts the data collection system that there is corrupt data for the interval. |

## 2. Suggested Data Validation Elements

The data elements below are not required but should be considered when selecting/creating a data collection Device.

| Term | Description |
|---|---|
| Parity Error | Parity error is another indicator of corrupted data. |
| Alarms (From Device) | The data collection system is capable of producing a validation alarm failure based on parameters being monitored. |
| Load Factor Limit | The validation process shall compare the daily Load Factor to the limit entered by the operator. The data collection system shall prompt the operator to investigate data integrity if the limit is out of tolerance. |
| Main vs. Backup Device Tolerance | The main and check Backup Devices can be configured in the data collection system to be compared on a channel by channel basis to the Backup Device ID, channel number, percent tolerance allowance and the type of check. Interval or daily Device Data is entered into the corresponding Main Device channel table record. This information remains constant unless:<br>□ A Device change out occurs at the site<br>□ The percent tolerance allowance needs adjusting<br>□ The type of check is switched<br>If the percentage difference between the main channel interval Demand and the check channel interval Demand exceeds the Percent Tolerance allowed, the validation fails. If, after applying this validation test, the percentage difference between the main channel total Energy and the check channel total Energy for each Trading Day exceeds the allowed percentage, the validation fails. In both cases, if the percentage difference is less than the Percent Tolerance allowed, the validation is accepted. |

| Term | Description |
|---|---|
| Percent Change Between Intervals | The validation process can utilize the Interval Percent Change Tolerance set by the data collection system operator on a Device channel basis in the Device channel table to compare the percentage change in the pulses for the channel between two consecutive intervals. If the percent change exceeds the Interval Percent Change Tolerance set for that channel, the validation process fails. |

## II. Data Estimation

When interval data is missing due to there not being any response from the Device or the Device reports it as missing, estimated data for the missing intervals should be based on the guidelines discussed below.

- If a Backup Device is available and that data is valid, the data from the Backup Device is used to replace the invalid or missing data from the Main Device.
- When interrogating Devices on a frequency basis, the point-to-point linear interpolation method is used to estimate the current interval(s) of data. This method should only be used when estimating one hour or less of contiguous missing interval data when the previous and next intervals are actual values from the Device.
- Historical data, plant logs, *schedules (if available), real time data (I),* or load profiles (if applicable) can be used for missing data associated with extended time periods when performing VEE.
- For auditing/tracking purposes all edit intervals should be tagged