Expanded Metering and Telemetry Options Phase 2

Distributed Energy Resource Provider (DERP)

Draft Final Proposal

June 10, 2015

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1 Introduction

Advancements in technologies and products are changing the way energy is generated, transmitted and stored, and how consumers make decisions about their energy uses and sources. These advancements will provide opportunities to make the electric system more secure and sustainable.

Distributed energy resources – i.e., resources on the customer side or the distribution grid side of the electric system, such as rooftop solar, energy storage, plug-in electric vehicles, and demand response – are growing and will represent an increasingly important part of the future resource mix. Integrating these new, distributed resources will help lower carbon emissions and can offer operational benefits. The ISO is therefore working to facilitate their participation in wholesale markets, consistent with reliable system operations.

Currently, the ISO's tariff may not offer a clear platform or guidance for smaller distributed energy resources (DER) to participate effectively in ISO markets. In light of the rapid changes and transformation occurring in our industry, this initiative seeks to clarify and advance the ISO tariff and business processes to support the participation of DER in the ISO markets. For instance, in order for traditional supply resources to participate in ISO markets, they must meet the ISO's minimum size requirement of 0.5

MW. This requirement equally applies to DER that wish to participate in ISO markets. However, unlike traditional supply resources, individual DER may be too small to meet this minimum size requirement – for example, at the residential level a rooftop photovoltaic solar system may have a maximum generation capacity of 5 kilowatts and a battery storage system may have a maximum discharge capacity of 2-3 kilowatts. In this example, these resources are clearly much too small to meet the ISO's minimum supply resource participation requirement of 500 kilowatts. Fortunately, the proper aggregation of multiple DER can overcome this challenge.

Through this initiative, the ISO is taking a first step by proposing a framework to enable a DER provider ("DERP") to aggregate DER to meet the ISO's 0.5 MW minimum participation requirement and thereby opening a pathway for aggregated DER to participate in the wholesale market. The ISO believes this proposed framework represents a significant step forward. To ensure that these enhancements can be implemented quickly, the ISO will rely on existing market models and tariff rules to the maximum extent possible. Taking this approach means that the ISO and market participants can avoid major market system changes and the associated time required to implement those changes. This approach also means that this first step comes with some limitations more fully discussed in this paper. That said, the ISO is committed to consider further enhancements to offer greater flexibility in participating in the ISO markets. Some of these enhancements are being explored this year under the "Energy Storage and DER" (ESDER) initiative, and others in 2016 and beyond as the ISO gains operational experience with DER aggregations.

2 Summary of key advances, revisions to the revised straw proposal and response to comments

2.1 Key advances

This draft final proposal makes several key advances in facilitating market participation of DER. These are summarized below.

- **DER aggregation.** The ISO's proposal provides a framework for the aggregation of DER to meet the ISO's 0.5 MW minimum participation requirement and participate in ISO wholesale markets as an aggregated resource. Refer to section 5.1 for more details.
- **Metering.** The ISO's proposal provides that a DERP aggregation will be a scheduling coordinator metered entity (SCME). The SCME construct avoids having each sub-resource in a DERP aggregation engaged in a direct metering arrangement with the ISO. Refer to section 5.2.
- **Data concentration.** The ISO is proposing to allow DER to rely on data concentration services to interact with the ISO through one point of contact. This permits the use of one data transport mechanism in the provision of data to and from multiple market resources. Refer to section 5.8.

2.2 Revisions to the revised straw proposal and response to comments

In this draft final proposal, the ISO has made several clarifications and revisions relative to the revised straw proposal based stakeholder comments received. These are summarized below.

- **Sub-LAP constraint.** Several stakeholders expressed concern that DERP aggregations will be limited to a single sub-LAP. The ISO proposes to retain this design element and provides its reasoning in section 5.3.1.
- **Mixing sub-resource types.** Many stakeholders expressed concern that the ISO proposal will not permit mixing of sub-resource types in a DERP aggregation. The ISO is now proposing to relax this limitation for DERP aggregations limited to a single PNode. The ISO, however, is proposing to retain this limitation for DERP aggregations that span across more than one PNode and provides its reasoning in section 5.5.2.
- **Role of demand response in the DERP aggregation framework.** Several stakeholders requested clarification about the role of demand response in the DERP aggregation framework. In section 5.6, the ISO clarifies that demand response can participate in a DERP aggregation with the stipulation that direct

metering apply to all sub-resources in DERP aggregations as opposed to use of a baseline methodology to measure performance. The ISO is not prepared to mix DER types within a single aggregation, where some sub-resources are direct metered while others such as Proxy Demand Response resources rely on a baseline for performance measurement.

- **Eligibility requirements for DERP sub-resources.** The ISO clarifies which types of DER the DERP aggregation framework will accommodate. These clarifications can be found throughout the proposal.
- **DERP agreement.** PG&E requested that the ISO provide a draft of the DERP agreement with this draft final proposal. The ISO cannot provide a draft DERP agreement at this time for the reasons provided in section 5.8, but plans to share any draft with stakeholders during any tariff stakeholder process the ISO undertakes in connection with this initiative. Olivine expressed concern about the proposed requirement that the DERP agreement must identify individual sub-resources in a DERP aggregation, and requested a straw proposal with service level agreements that ensure that the ISO can administer updates to a DERP agreement within a timeframe that is equivalent to the master file update process. The ISO has not included such a straw proposal in this paper but believes the ISO and market participants can address these issues during implementation under existing tariff rules.
- **Consideration of ESDER topics in the DERP initiative.** A few stakeholders requested that the ISO consider in this initiative several topics the ISO has proposed for consideration in its energy storage and distributed energy resources ("ESDER") stakeholder initiative (e.g., alternative baselines for PDR, alignment between distribution level interconnection and the ISO New Resource Implementation process). The ISO understands the importance of these topics, but believes it is important to move forward with its proposed platform for DERP aggregation as an initial step in order to ensure tariff rules for market participation are in place.
- **Metering requirements being considered by the CPUC's DR integration working groups.** EnerNOC and Johnson Controls jointly commented that they believe it is premature to consider metering and telemetry changes that could

impact demand response in advance of what comes out of the CPUC Working Group process discussing the telemetry threshold. The scope of discussion on telemetry in this initiative (see section 5.8.3 of this paper) is limited to enabling the scalable transport of larger amounts of telemetry data for multiple resources over one energy communication network link to the ISO. This initiative relies on the existing MW threshold for telemetry requirements. Changes to that threshold are beyond the scope of this initiative.

- **Use of public internet for metering.** Some stakeholders requested that additional clarification be provided regarding Phase 1 Technical Proposal items 1 and 2. The ISO confirms that the intent of the proposals reflects use of the "public" internet where references to the internet are used. The proposals expand the use of the internet as an alternative to establishing a directly connected interface between the ISO and a resource through the ISO's energy communication network (ECN) for provision of real-time telemetry data and for the polling of revenue meter data from ISO metered entities. Stakeholders have misinterpreted the relevance of Phase 1 proposal items 1 and 2 with what is being proposed in the DERP aggregation framework which focuses on DER including establishing new metering and telemetry requirements specific to their participation as outlined in sections 5.2, 5.8.2 and 5.8.3. Under the framework proposed in this paper, a DERP aggregation will be SCME. This means that the metering arrangement is between the scheduling coordinator and the underlying sub-resources, which avoids having the sub-resources engage in a direct metering arrangement with the ISO. Additionally, the proposal provides the ability for DER to rely on data concentration services to interact with the ISO through one point of contact. With a data concentrator construct, the ISO believes that market participants can manage the costs to utilize the ECN in the provision of market resource real-time data. The ISO is not prescribing what communication networks or protocols are used between the DERP and its sub-resources. As suggested by stakeholders, this would allow for use of other communication networking solutions between the DERP and its sub-resources. Additional suggestions made by stakeholders regarding increases in telemetry scan rates between the DERP and its sub-resources are

being considered in the development of Business Practice Manual (BPM) language in support of this proposal.

3 Background

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

The ISO formed technical working groups to identify issues, business requirements and current rules, and specify business practice manual changes. At the working sessions, participants discussed and evaluated additional technical and configuration options to reduce metering and telemetry barriers for current resource participation and to support emerging business models for resources interconnecting to the distribution grid. Technical proposals addressing five topic areas were developed, as detailed in Table 1. This work constituted phase one of the initiative.

Upon concluding the 2013 initiative, the ISO advanced implementation of the phase 1 technical proposals throughout 2014. The technical proposals and their current status are presented below in Table 1.

Table 1 – Phase 1 technical proposals

No.	Proposal	Status
1	Use of internet for telemetry and ISOME meter data bridging to the ISO energy communication network (ECN)	Implemented
2	Use of internet for telemetry with secure socket layer (SSL) and meter data transport directly to the ISO without SSL	Implemented; additional point of contact for secure meter data transport in progress
3	Expand the use of inter-control center communications protocol (ICCP) as an allowable option for RIG aggregators (telemetry only)	Development of BPM language and process alignment underway

Table 1 – Phase 1 technical proposals		
No.	**Proposal**	**Status**
4	Expand the ability for resources to submit settlement quality meter data (SQMD)	General guidelines have been developed; detailed business practices to be developed
5	Remove limitations on RIG aggregator resource ownership and location.	The ISO will address this issue through the proposed DERP agreement

In parallel to phase 1 implementation efforts, the ISO assessed the need to develop and advance a proposal for the use of data concentrators to provide DER aggregation, data concentration, and control signal disaggregation services. This assessment resulted in the proposed concept of a new market participant called a distributed energy resource provider or "DERP." Development of the DERP role and its responsibilities constitutes phase 2 of this initiative and is the subject of this draft final proposal.

4 Stakeholder process

The ISO published its initial DERP proposal with the posting of a straw proposal on November 10, 2014. A stakeholder web conference was held on November 13 and written stakeholder comments were received November 20.

The ISO developed several clarifications and changes to its previous proposal based on a consideration of the stakeholder comments received. On May 12, the ISO published the resulting revised straw proposal in a slide presentation format.[1] A web conference was held on May 19 to discuss the revised straw proposal with stakeholders and written stakeholder comments were received May 27.

[1] A copy of that presentation is available on the ISO's website at: http://www.caiso.com/Documents/Presentation-ExpandingMeteringandTelemetryOptions-DistributedEnergyResourceParticipation-RevisedStrawProposal051215.pdf

After considering the May 27 stakeholder comments, the ISO developed further refinements to its proposed DERP framework and presents these in this draft final proposal.

The ISO has scheduled a stakeholder web conference for June 17 from 9:00 a.m. to 12:00 a.m. (Pacific) to discuss this draft final proposal with stakeholders. Following the call, the ISO requests that stakeholders submit written comments on this phase of the initiative to InitiativeComments@caiso.com by 5:00 p.m. (Pacific) on June 24. Following receipt of this final set of stakeholder comments, the ISO plans to present its proposal to the ISO Board of Governors at its July meeting.

Table 2 outlines the schedule for the policy development portion of this stakeholder initiative.

Table 2 – Stakeholder process schedule

Step	Date	Activity
Straw proposal	November 10, 2014	Post straw proposal
	November 13, 2014	Stakeholder web conference
	November 20, 2014	Stakeholder comments due
Revised straw proposal	May 12, 2015	Post revised straw proposal (posted as a slide presentation)
	May 19, 2015	Stakeholder web conference
	May 27, 2015	Stakeholder comments due
Draft final proposal	June 10, 2015	Post draft final proposal
	June 17, 2015	Stakeholder web conference
	June 24, 2015	Stakeholder comments due
Board approval	July 16-17, 2015	ISO Board meeting

5 Draft final proposal

The following sections describe and clarify the final elements of the DERP aggregation framework.

5.1 Distributed Energy Resource Provider

The ISO proposes to classify a distributed energy resource provider or "DERP" as the owner/operator of one or more aggregations of individual distributed energy resources[2] (DER) that participate in the ISO market as an aggregate resource rather than as individual resources. The DERP represents a new type of market participant, analogous to a participating generator or participating load. The DERP can also be thought of as analogous to the demand response provider (DRP) construct currently used for providers of PDR and RDRR in the ISO market.

A DERP will accept certain responsibilities and obligations under the ISO tariff to ensure the distributed energy resources it controls will participate in the ISO's energy and/or ancillary services market through a scheduling coordinator.[3] As the party responsible for certain identified resources listed in a DERP agreement (more on this agreement in section 5.9), the DERP will, among other things, provide the ISO with accurate information for the DER it controls, and to timely update this information when changes to these resources occur. This information will include changes to resource attributes as well as accurate meter and telemetry data for settlement and operational purposes. The DERP will also be responsible for operating and maintaining its DER consistent with

[2] For purposes of this initiative, the ISO uses the term "distributed energy resource" or "DER" to mean any distribution connected resource, regardless of size or whether it is connected behind or in front of the end-use customer meter. "Distribution connected" means connected to distribution facilities controlled by a distribution utility, regardless of voltage level, and served by the ISO grid. Examples of distributed energy resources include generation such as rooftop solar, energy storage, plug-in electric vehicles, and demand response.

[3] A DERP 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.

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

Once registered as part of a DERP aggregation[4], individual sub-resources in a DERP aggregation must remain and participate as part of the aggregation and not as individual resources.

Under this framework, a DERP must operate its resource(s) pursuant to relevant provisions of the ISO tariff and ISO operating procedures. A DERP will also need to comply with applicable utility distribution company tariffs, requirements of the applicable Local Regulatory Authority, as well as interconnection requirements, if any.

An entity that executes a DERP agreement with the ISO may have two or more aggregations and resource IDs under the same DERP agreement. For each aggregation the DERP will need to provide data identifying the resource and its attributes, including total capacity, operating characteristics, locations and configurations, as well as a schedule of the sub-resources that comprise the aggregated resource. All information provided to the ISO regarding the operational and technical characteristics must be accurate and based on physical resource characteristics and configurations. DERPs will need to comply with applicable outage requirements as well as any applicable reliability criteria.

5.2 Metering

To participate in the ISO market, all resources must have revenue quality metering for the ISO markets to financially settle the resource for the services it provides or consumes. The ISO's current tariff recognizes two metering approaches – ISO metered entities ("ISOME") and scheduling coordinator metered entities ("SCME"). ISOME involves a direct metering arrangement between the resource and the ISO. SCME involves a metering arrangement between the scheduling coordinator and the resource or load. Under the SCME approach, the scheduling coordinator submits settlement quality meter data to the ISO for settlement purposes.

[4] The ISO uses the terms "DERP aggregation" to refer to the single market resource (i.e., a non-physical virtual or logical resource) made up of one or more underlying physical sub-resources.

The ISO recognizes that a direct metering arrangement between the ISO and each underlying sub-resource in a DERP aggregation could create a significant burden for DERPs and their sub-resources. Thus, under the DERP framework, a DERP aggregation will be a SCME. This means that meter and meter data arrangements are between the scheduling coordinator and the underlying sub-resources operated by the DERP. The SCME construct avoids having each sub-resource in a DERP aggregation engaged in a direct metering arrangement with the ISO. This does not mean, however, that each sub-resource in a DERP aggregation is exempt from being metered – each sub-resource must be metered per local regulatory authority or ISO standards (more on this below, as well as in Appendix A to the November 10, 2014 draft straw proposal[5]). Moreover, all sub-resources in a DERP aggregation must be direct metered and not rely on a baseline methodology to measure performance. DERP aggregations can produce and/or consumer energy, unlike Demand Response Provider (DRP) aggregations using models for the curtailment of energy only (e.g., PDR or RDRR).

The ISO expects scheduling coordinators to produce, or obtain services to produce, aggregate settlement quality meter data (SQMD) from all of the underlying sub-resources that make up the DERP aggregation and provide that data to the ISO as SQMD – meeting all established data submittal timelines – for settlement. This proposal allows for the DERP to become its own scheduling coordinator or hire a scheduling coordinator to implement the SCME requirements.

Scheduling coordinators for SCME must conduct scheduling coordinator self-audits annually. The ISO is proposing that scheduling coordinators for a DERP aggregation must have the capability to disaggregate resource level SQMD from the DERP aggregation to the 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.

[5] A copy of the November 10, 2014 draft straw proposal is available at the following link: http://www.caiso.com/Documents/DraftStrawProposal_ExpandingMeteringTelemetryOptions_DistributedEnergyResourcesParticipationAgreement.pdf

If an existing participating generator elects to become a sub-resource in a DERP aggregation, then this generating resource would no longer be an ISOME and would become a constituent element of an SCME, registered as a sub-resource under an applicable DERP agreement. The ISO would terminate the resource's established participating generator agreement provisions and ISOME status. If a sub-resource wants to return as a stand-alone participating generator, then the sub-resource would need to re-execute a participating generator agreement and the metering service agreement and recertify metering to meet ISOME metering requirements.

Currently, for distribution connected load and generation participation in the ISO wholesale markets, the scheduling coordinator self-audit validates compliance with requirements established by the local regulatory authorities. ISO Tariff Section 10.3.10.1 "Requirement for Audit and Testing", 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.

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 DERP wishing to participate in ISO markets. Under these cases, the ISO proposes to establish default requirements as discussed in Appendix A to the November 10, 2014 draft straw proposal.

5.3 Locational dispersion of DERP aggregations

5.3.1 Sub-LAPs

DERP aggregations must be within a single sub load aggregation point ("sub-LAP")[6]. Sub-LAPs are defined by historic congestion patterns where price divergence result in the formation of a sub-LAP boundary. For example, consider a DERP aggregation across multiple pricing nodes ("PNodes")[7] with sub-resources in two adjoining sub-LAPs. If in a market run a constraint is identified between these two sub-LAPs, then the DERP aggregation would be simultaneously on the "right" side and on the "wrong" side of the constraint.[8] Thus, the potential exists that a dispatch instruction issued to this DERP aggregation to alleviate a constraint between these two sub-LAPs may actually exacerbate the problem.

5.3.2 Single or multiple locations

DERP aggregations may consist of one or more sub-resources at single or multiple locations. Multiple location aggregation refers to multiple sub-resources geographically distributed across multiple PNodes but operated as a single market resource within a sub-LAP. Single location aggregation refers to multiple sub-resources aggregated behind a single PNode operated as a single market resource within a sub-LAP.

5.3.3 Multiple PNodes

DERP aggregations may be across multiple PNodes within a single sub-LAP. This means that a DERP aggregation may consist of one or more sub-resources at several PNodes, as

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[6] A sub-LAP is an ISO defined subset of pricing nodes (see next footnote) within a default LAP. A default LAP is the LAP defined for the transmission access charge area at which all bids for demand shall be submitted and settled, except as provided in tariff sections 27.2.1 and 30.5.3.2.

[7] A pricing node or "PNode" is a single network node or subset of network nodes where a physical injection or withdrawal is modeled and for which a locational marginal price is calculated and used for financial settlements.

[8] Also, as discussed further in sections 5.4.2 and 5.5.2, the sub-resources in a DERP aggregation across multiple PNodes must move in the same direction as the ISO dispatch instruction.

long as all of these PNodes are within the same sub-LAP. The ISO is not proposing a limit on the number of PNodes within a sub-LAP that may be involved in a single DERP aggregation.

5.4 Capacity of DERP aggregations and their sub-resources

5.4.1 Sub-resources

There is no minimum size limitation on the individual sub-resources in a DERP aggregation. This means that individual sub-resources may exceed the ISO's minimum participation requirement of 0.5 MW. The maximum allowable size of individual sub-resources in a DERP aggregation across multiple PNodes is limited by the rule on aggregation size presented below in section 5.4.2.

5.4.2 DERP aggregations

DERP aggregations across multiple PNodes may not exceed 20 MW. However, in the case of DERP aggregations limited to a single PNode, there is no MW size limitation. For DERP aggregations 10 MW or greater or certified to provide ancillary services, tariff section 7.6.1(d) would apply.[9]

The ISO recognizes that some stakeholders may want to develop DERP aggregations across multiple PNodes that are larger than 20 MW and that this limitation precludes such aggregations, at least for the near term.

After further deliberation, the ISO was able to conclude that the 20 MW size limit could be relaxed for DERP aggregations limited to a single PNode. But, for DERP aggregations across multiple PNodes, the ISO needs to gain operational experience to assess the impacts that DERP aggregations may have on congestion management.

[9] This tariff section concerns the provision of communications, telemetry and direct control requirements, including the establishment of a direct communication link from the control room of the generator to the ISO in a manner that ensures that the ISO will have the ability, consistent with this ISO tariff, to direct the operations of the generator as necessary to maintain the reliability of the ISO controlled grid.

When a DERP resource is at a single PNode, its effect on congestion management can be evaluated through well-defined deterministic methods, simply because the location of the resource's response to dispatch is known precisely. However, when a DERP resource is spread across multiple PNodes, the distribution of the resource's response to an ISO dispatch and hence its effect on congestion management cannot be known and modeled precisely ex ante. The effect of the DERP aggregation's dispatch on congestion management will depend on how the ISO dispatch signal is disaggregated or decomposed by the DERP and how the sub-resources at different PNodes respond to the signal. This uncertainty can be somewhat reduced by requiring that all of the sub-resources move in a single direction, consistent with the direction of the dispatch. However, the full impact of these aggregations on reliability and congestion management can only be evaluated through operational experience.

The ISO is proposing to reevaluate the appropriateness of the 20 MW limitation after gaining a full 12 months of operational experience with several DERP aggregations of sufficient size (i.e. between 10 and 20 MW) across multiple PNodes. Until such time as the ISO has gained this experience, the ISO believes it is prudent to place an initial limit on their size and believes that 20 MW represents a reasonable starting place.

5.5 Mixing sub-resource types

5.5.1 DERP aggregations limited to one PNode

For DERP aggregations limited to one PNode, the sub-resources may be heterogeneous – that is, a mixture of sub-resource types is permitted. Further, it is not required that all of the sub-resources move in the same direction as the ISO dispatch instruction. Rather, it is only necessary that the net movement of the aggregate of the sub-resources equate to the ISO dispatch instruction.

The ISO proposes this flexibility for DERP aggregations at a single PNode because the ISO can know precisely the location of the DERP aggregation's response to dispatch and hence can evaluate its effect on congestion management through deterministic methods.

5.5.2 DERP aggregations across multiple PNodes

For DERP aggregations across multiple PNodes, all sub-resources must be homogenous and all sub-resources must move in the same direction as the ISO dispatch instruction. The following homogenous aggregations are allowed: (1) all sub-resources are generation; (2) all sub-resources are energy storage; or, (3) all sub-resources are load whose performance is direct measured rather than assessed under a baseline methodology (see discussion below in section 5.6 regarding demand response in DERP aggregations). Moreover, for aggregations of energy storage, all sub-resources must be operating in the same mode (i.e., charging or discharging, but not a mix of the two) in response to an ISO dispatch.

These limitations are necessary to limit the adverse effects that DERP aggregations across multiple PNodes may have on the ISO's ability to accurately assess congestion and identify critical constraints.

To help illustrate the point, consider the example of a DERP aggregation across multiple PNodes consisting only of generation. If this DERP aggregation receives a dispatch instruction to increase output by 10 MW, we know that the DERP will "decompose" the dispatch instruction across the physical sub-resources in the aggregation. We also know that each sub-resource the DERP decides to use to comply with a dispatch instruction will increase its output (rather than increasing some while decreasing others) due to the ISO's proposed rule that they move in the same direction as the dispatch instruction. What we don't know is which sub-resources in the aggregation the DERP will use and the proportion of 10 MW each will be directed to provide. This illustrates part of the challenge.

But backing up a bit, prior to issuing that dispatch instruction the ISO would have performed a network analysis (power flow calculation, contingency analysis, critical constraint identification, etc.) as part of its congestion management assessment in running the optimal dispatch. To perform this network analysis, the ISO market systems use two types of factors: shift factors and distribution factors. Shift factors express the percentage of power flow a marginal injection at a PNode contributes to a transmission line. For example, if a given PNode has a 10% shift factor on a particular transmission line, a 10 MW injection at that PNode will result in a 1 MW increase in flow over that line. The shift factors can thus be used to calculate the flow effects of resource

schedules and dispatch instructions on specific transmission constraints for congestion management. Distribution factors, in contrast, reflect the PNode distribution of the sub-resources in an aggregation and are used to distribute the schedule or dispatch of an aggregation to the PNodes comprising the aggregation. Returning to the DERP resource example, the distribution factors for the resource will tell us the amount by which each PNode at which there are sub-resources will increase to comply with the +10 MW dispatch instruction.

In the case of a DERP aggregation that is across multiple PNodes, the impact of an ISO dispatch on congestion management utilizes both shift factors and distribution factors. The shift factor for such an aggregation with respect to a particular transmission line is a combination of the shift factors of the PNodes comprising the aggregation. More precisely, the shift factor combination is a weighted average of the individual PNode shift factors, weighted by the distribution factors that express how the dispatch response of the DERP aggregation is distributed to these PNodes. The market optimization must assume that the sub-resources will respond in accordance with the specific distribution factors specified for the aggregation, but in practice the actual response of the DERP aggregation may have a different distribution. If the variability of the distribution is small, then the assumed distribution factors will be close to the actual response and the estimated impacts on congestion will be sufficiently accurate. However, if the variability of the PNode distribution of the DERP aggregation's response is large, then the congestion impacts estimated in the network analysis will be off. The potential for variability of the actual distribution factors is why it is important to limit the size of DERP aggregations until sufficient operational experience has been gained to ascertain whether this is significant problem or not. This is also why it is important that the sub-resources in a DERP aggregation move in the same direction as the ISO dispatch instruction.

Now consider the hypothetical example of a DERP aggregation across multiple PNodes consisting of generation and load (which the current proposal does not allow, but nevertheless discussed here to help illustrate a point). The previous discussion did not reveal that there are actually two kinds of distribution factors – generation distribution factors ("GDFs") for when the constituent sub-resources are generators, and load distribution factors ("LDFs") for when the sub-resources are loads. In the previous example, only GDFs were relevant. In this hypothetical example, both GDFs and LDFs

would have to be used to perform the same network analysis. However, this introduces a new problem due to a current limitation in the ISO's market systems that an aggregated resource can only have one type of distribution factors for a given scheduling or dispatch interval – i.e., GDFs or LDFs, but not both used simultaneously. To remove this system limitation would require complex technology modeling and implementation issues. This is why DERP aggregations across multiple PNodes cannot at this time consist of heterogeneous resource types.

The same is true for a DERP aggregation consisting of generation and battery storage. If such an aggregation were issued the same +10 MW dispatch instruction as the previous generation-only example, there could be no assurance that some individual energy storage sub-resources would not be in charge mode (for which LDFs would be required) at the same time the generation sub-resources would increase output (and GDFs would be used). The inability to mix LDFs and GDFs is also the reason why a DERP resource consisting entirely of energy storage across multiple PNodes must ensure that all sub-resources are operating in the same mode – charging or discharging, but not a mix of both – in each dispatch interval.

The ISO recognizes that there is great interest in aggregating mixtures of rooftop solar, energy storage, plug-in electric vehicles, and demand response across multiple PNodes, without all the limitations required in this proposal. The ISO plans to examine such options in subsequent initiatives.

5.6 Proxy Demand Resource (PDR)/Reliability Demand Response Resource (RDRR) and DERP aggregations

Stakeholders have asked whether a DERP aggregation may consist of PDR resources. In response, the ISO clarifies that demand response participating as PDR or RDRR is not part of the DERP proposal. Demand response participating as PDR or RDRR would continue to participate under its existing demand response framework and not under the DERP framework.

The existing PDR and RDRR framework already provides for market participation of aggregated demand response. This existing framework is designed to accommodate load reducing resources whose performance is assessed under a baseline methodology. In contrast, the ISO has developed the DERP framework to accommodate market

participation of aggregated sub-resources whose performance is directly measured and does not rely on a baseline.

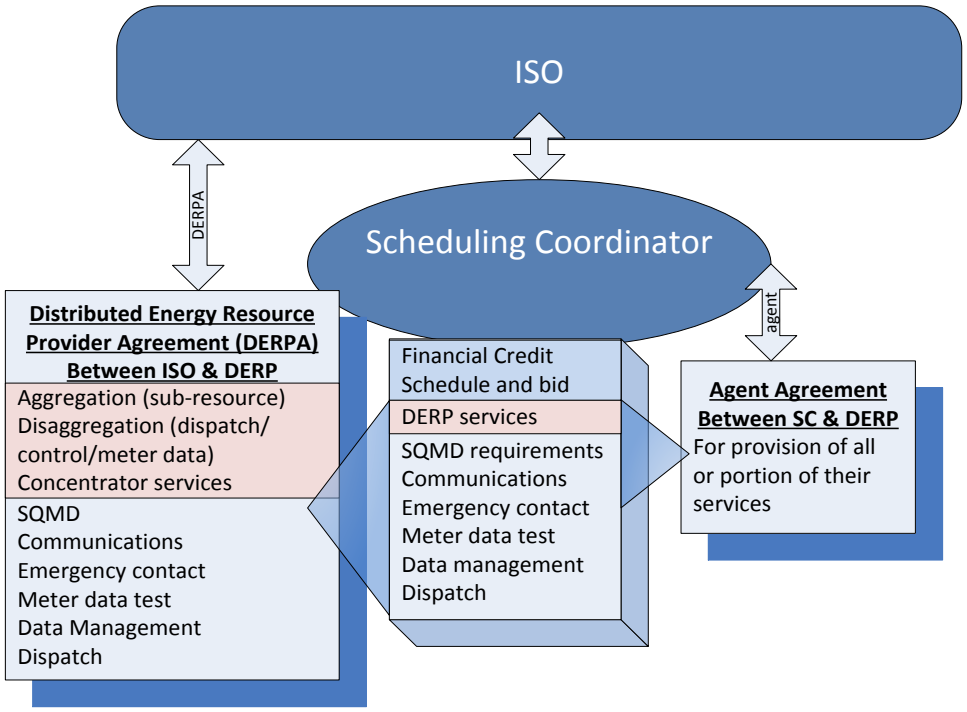
To reiterate, all sub-resources in DERP aggregations must be direct metered and not rely on a baseline methodology to measure performance. DERP aggregations can produce and/or consumer energy, unlike Demand Response Provider (DRP) aggregations using models for the curtailment of energy only (e.g., PDR or RDRR).

5.7 Scheduling Coordinator services

A DERP's scheduling coordinator must meet the ISO's scheduling coordinator certification requirements and all other applicable obligations inclusive of having a meter service agreement for scheduling coordinators 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 they are not precluded from obtaining some of these services from other parties, including a DERP, to meet these responsibilities.

Just as the DERP may choose to be a scheduling coordinator, a scheduling coordinator may choose to be a DERP or obtain the services of a DERP to meet their responsibility for ensuring that ISO dispatch and control signals are received and responded to by the DER they own or represent. Therefore, the DERP may have a relationship comparable to an "agent" relationship under which the DERP serves as the agent for the scheduling coordinator to perform certain functions. This relationship would be established through an agent agreement between the scheduling coordinator and the DERP. While terms and conditions of the relationship between the ISO and a DERP will be established through the DERP agreement discussed in section 5.9, the ISO will expect the scheduling coordinator to be responsible for managing the risk of this "agent" relationship with a DERP.

To illustrate this relationship, the figure below illustrates the "agent" relationship and proposed DERP relationship that would be available to scheduling coordinators representing DER.



5.8 Data management services

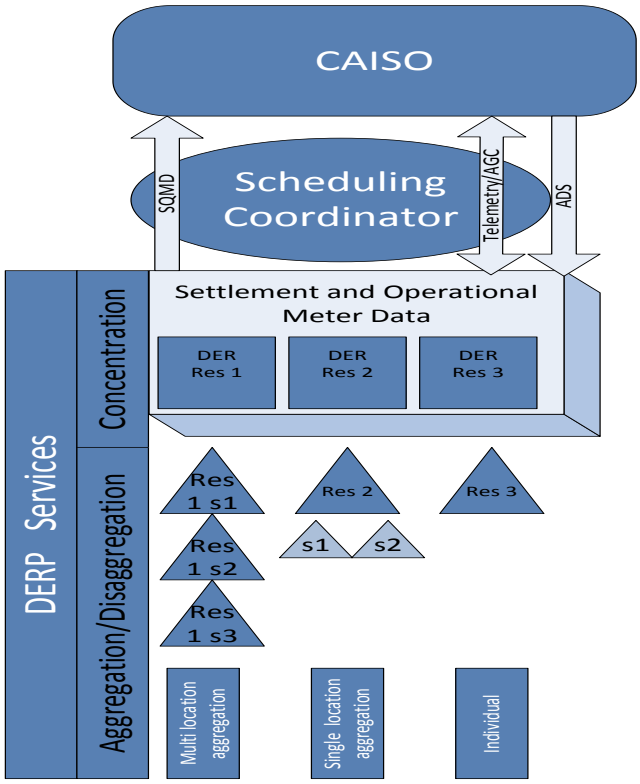
The following sections discuss proposed options for DERPs to meet requirements for providing both operational data and market settlement data.

5.8.1 Data concentration

The ISO is proposing to allow DER to rely on data concentration services to interact with the ISO through one point of contact permitting the use of one data transport mechanism in the provision of data to and from multiple market resources. Pursuant to this approach, the ISO would maintain visibility to and interact with DER at the data concentration point where single market resources would represent an aggregation. Scheduling coordinators or DERPs providing services to them would perform any necessary mapping of data behind the aggregation.

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

The figure below depicts how DERs would interact, through a scheduling coordinator, with the ISO under this model.



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

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 DERP maps any data behind that point and manages the aggregation.

Disaggregation: The ISO dispatches the aggregation as a single resource. The DERP 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.

- Data and Cyber-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 DERP would need to contract with, 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 DERP may perform the role 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. The scheduling coordinator 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 through an agent agreement with the DERP 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 DERPs would have to allocate any risks arising from these obligations between themselves.

5.8.2 Revenue metering

Under the ISO's proposed framework, the ISO will require settlement metering for all DER. Scheduling coordinators representing DERPs 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 DER, scheduling coordinators must ensure their meters or revenue measuring devices meet the default requirements established by the ISO. These requirements will include both a set of metering characteristics and method for validating, estimating and editing (VEE) data. The ISO is currently examining and developing acceptable criteria based on North American Energy Standards Board (NAESB) and American National Standards Institute (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 DER will operate to interpolate data output required for validation measures and metering requirements.

All standards and/or requirements outlined for SCME 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 of the November 10, 2014, draft straw proposal for technical specifications (attachment 1) and validation, estimation and editing (VEE) (attachment 2) proposed for DER devices.

Similar to other participating resources, the ISO proposes to apply a 5-minute metering interval requirement in order to reduce settlement neutrality charges 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. Upon submission, the ISO will divide the 15-minute interval into three 5-minute interval meter values to meet the 5-minute metering interval requirement. Granularity levels must not be changed and submitted lower than what is currently programmable within the meter or revenue measuring device.

5.8.3 Telemetry

A DER 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 DER 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 markets a resource of any size is required to provide and maintain real-time visibility, and in the case of regulation, respond to the ISO's the ISO's Energy Management System ("EMS") control signal. [10]

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 DERP will interact with the ISO at a data concentration point, as described in section 5.8.1, in the provision of real time visibility and control for each individual resource they represent.

Communication options identified in phase 1 of this stakeholder initiative have greater benefit in combination with the proposal to permit a DERP to concentrate data from multiple market resources that are comprised of aggregated 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.

[10] See previous footnote 9.

5.9 DERP Agreement

The DERP agreement will establish the terms and conditions under which the ISO and DERP 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 DERP 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 DERP's participation requirements such as the provision of technical and operational information to the ISO, metering and communications requirements, and submission of economic bids and self-schedules and provision of ancillary services. The ISO also proposes to incorporate other standard 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 DERP agreement would identify each and every sub-resource subject to the agreement as part of a schedule to the agreement. Individual sub-resources in DERP aggregations must be identified and updated in this schedule.

Each DERP, regardless of how many aggregations it has, will only execute a single DERP agreement. The single agreement allows the DERP to have multiple aggregated resources, each with its own resource ID.

Individual sub-resources in DERP aggregations would not enter into an additional participation agreement such as a participating generator agreement or participating load agreement. In fact, individual sub-resources in DERP aggregations would not be allowed to participate in the ISO markets as separate resources apart from their participation in the aggregated resource. Further, individual sub-resources cannot participate in more than one DERP aggregation.

Some stakeholders have asked whether a draft DERP agreement could be provided as part of this stakeholder initiative. In response the ISO believes that it would not be fruitful to draft a DERP agreement until such time that the proposed tariff language has been developed to implement the DERP aggregation framework. Following Board

approval of this policy proposal, the ISO will initiate a tariff development stakeholder process and work with stakeholders to develop the necessary tariff amendments. Once those tariff amendments are clarified, the ISO will develop a draft DERP agreement and share that with stakeholders to solicit feedback.