California ISO
Shaping a Renewed Future

Energy storage and distributed energy resources (ESDER) stakeholder initiative

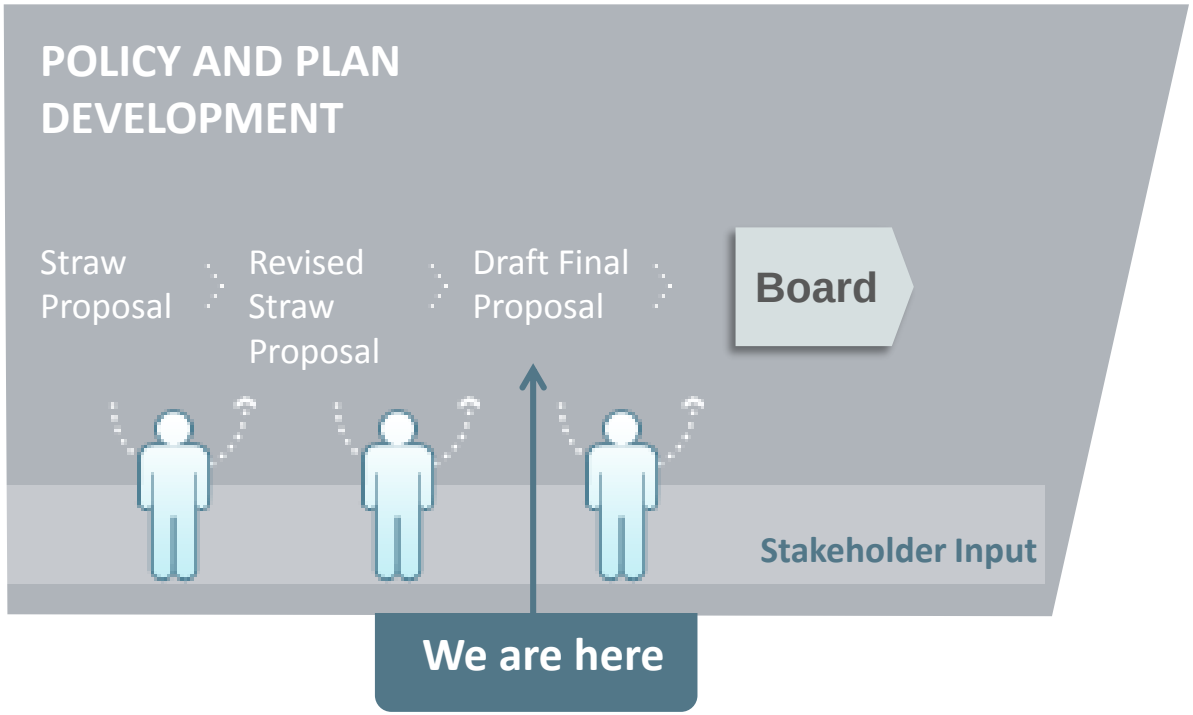
Draft Final Proposal

Stakeholder web conference
November 9, 2015
1:00 p.m.-4:00 p.m.

Agenda

Time	Agenda Item	Speaker
1:00-1:10	Introduction, Stakeholder Process	Tom Cuccia
1:10-2:00	NGR enhancements	Peter Klauer
2:00-3:00	PDR/RDRR enhancements	Jill Powers
3:00-3:50	Multiple use applications	Lorenzo Kristov
3:50-4:00	Next Steps	Tom Cuccia

ISO Stakeholder Initiative Process (policy development phase)



Stakeholder process schedule

Step	Date	Event
Education Forum	April 16 & 23	Hold education forums
Proposed ESDER Scope & Schedule	May 13	Post proposed scope & schedule
	May 21	Stakeholder web conference
	May 29	Stakeholder comments due
Revised ESDER Scope & Schedule	June 10	Post revised scope & schedule
	June 17	Stakeholder comments due
Issue Paper & Straw Proposal	July 30	Post issue paper and straw proposal
	August 6	Stakeholder web conference
	August 18	Stakeholder comments due
ESDER Working Group	August 27	ESDER working group web conference
	September 3	Stakeholder comments due
Revised Straw Proposal	September 17	Post revised straw proposal
	September 28	Stakeholder web conference
	October 9	Stakeholder comments due
ESDER Working Group	October 12	ESDER working group meeting
	October 19	Stakeholder comments due
ESDER Working Group	October 27	ESDER working group web conference
	October 29	Stakeholder comments due
Draft Final Proposal	November 2	Post draft final proposal
	November 9	Stakeholder web conference
	November 16	Stakeholder comments due
Board Approval	December 17-18	ISO Board meeting

2015 scope of issues addresses three topic areas

- Enhancements to the non-generator resources (“NGR”) market participation model.
- Enhancements to demand response performance measures and statistical sampling for the proxy demand resource (“PDR”)/reliability demand response resource (“RDRR”) market participation models.
- Clarifications to rules for non-resource adequacy multiple-use applications (provision of retail, distribution and wholesale services by the same resource).

Enhancements to the non-generator resources (NGR) market participation model

Enhancements to the NGR model benefit both grid-connected storage and distributed energy resources

- Update NGR documentation in the BPMs.
- Clarify how the ISO uses state of charge (SOC) in the market optimization.
- Allow resources to submit the initial state of charge as a day-ahead parameter.
- Allow option for resource owners to self-manage energy constraints and not use constraints in ISO co-optimization and dispatch.

NGR documentation

- The ISO proposes to follow established method of utilizing BPMs to provide detailed rules, procedures and examples consistent with the ISO tariff.
- The ISO does not create stand-alone model specific documentation but relies on BPMs.
- The ISO will include content that distinguishes differences in requirements between NGR and NGR Regulation Energy Management (REM).
- Relevant BPMs may include Market Operations, Market Instruments, Direct Telemetry, Metering, Outage Management, Reliability Requirements, and Settlements and Billing.

Clarification about how the ISO uses state of charge in the market optimization

- ISO proposes to provide clarity by updating ISO BPMs
- Describe how state of charge
  - influences model optimization
  - impacts mathematical formulation of economic dispatch
  - impacts the interplay of capacity and energy over several market intervals
  - is used in AGC calculations for NGR REM resources
- Clarify use and timing of the telemetered state of charge values

Allow initial state of charge (SOC) as a daily bid parameter in the day-ahead market

- The initial day-ahead SOC value used for the trading day is the ending SOC from the previous day's day-ahead awards.
- If there are no previous day-ahead awards, the ISO assumes the initial SOC is 50%.
- This requires the resource to be at this initial SOC value or risk being awarded bids that create infeasible dispatches in the trading day.
- The ISO proposes to allow the ability to submit a daily SOC bid parameter to initialize the ISO day-ahead market system.

Allow an option to not provide energy limits or have the ISO co-optimize an NGR based on state of charge (SOC)

- Stakeholders foresee situations where having the ISO optimize and dispatch a resource based on SOC is less desirable than having the resource owner self-manage participation based on their understanding of the resource's capabilities.
- The ISO proposes to allow an option for NGRs that do not have SOC energy limits or where the resource owner choses to self-manage the SOC constraint, to not use those constraints in ISO co-optimization or dispatch.
- NGRs with a SOC that is self-managed must still provide telemetry SOC values for ISO resource monitoring and auditing.
- This option would not apply to NGRs participating under Regulation Energy Management (REM).

PDR/RDRR Enhancements

Proxy Demand Resource and Reliability Demand Response Resource

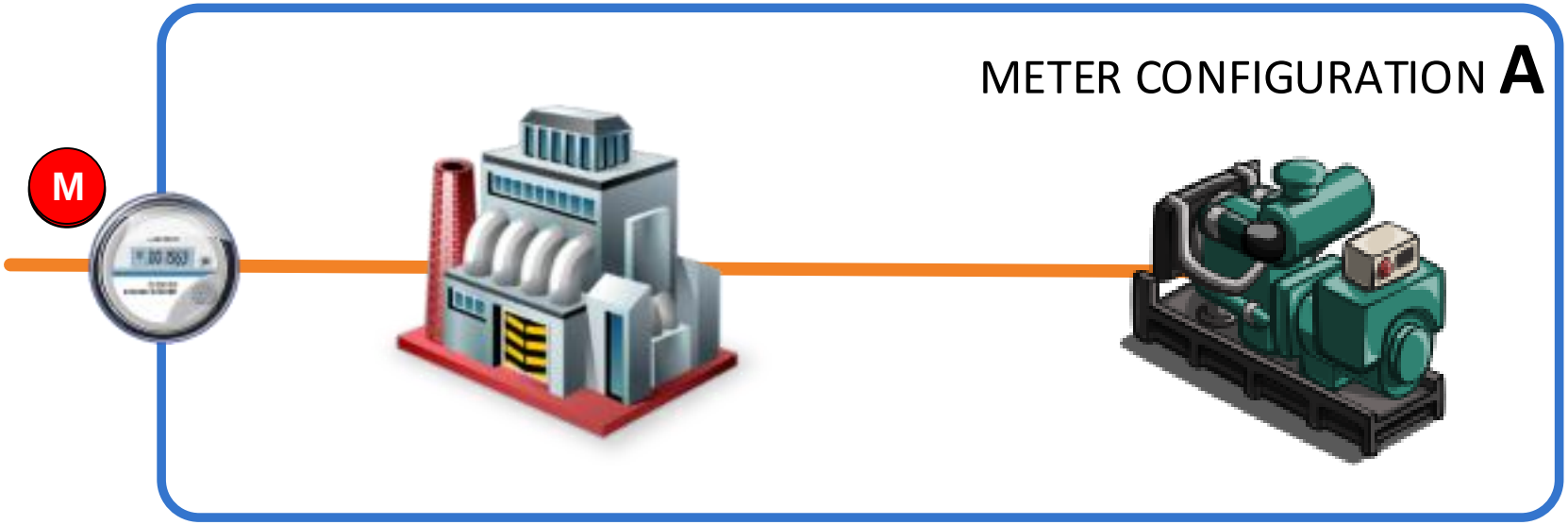
Proposed enhancements to performance measures and statistical sampling for PDR/RDRR will benefit demand response.

- Develop an alternative performance evaluation methodology based on North American Energy Standards Board (NAESB) metering generator output (MGO) concepts.
- Develop additional detail regarding use of statistical sampling.

Sign convention used in this proposal

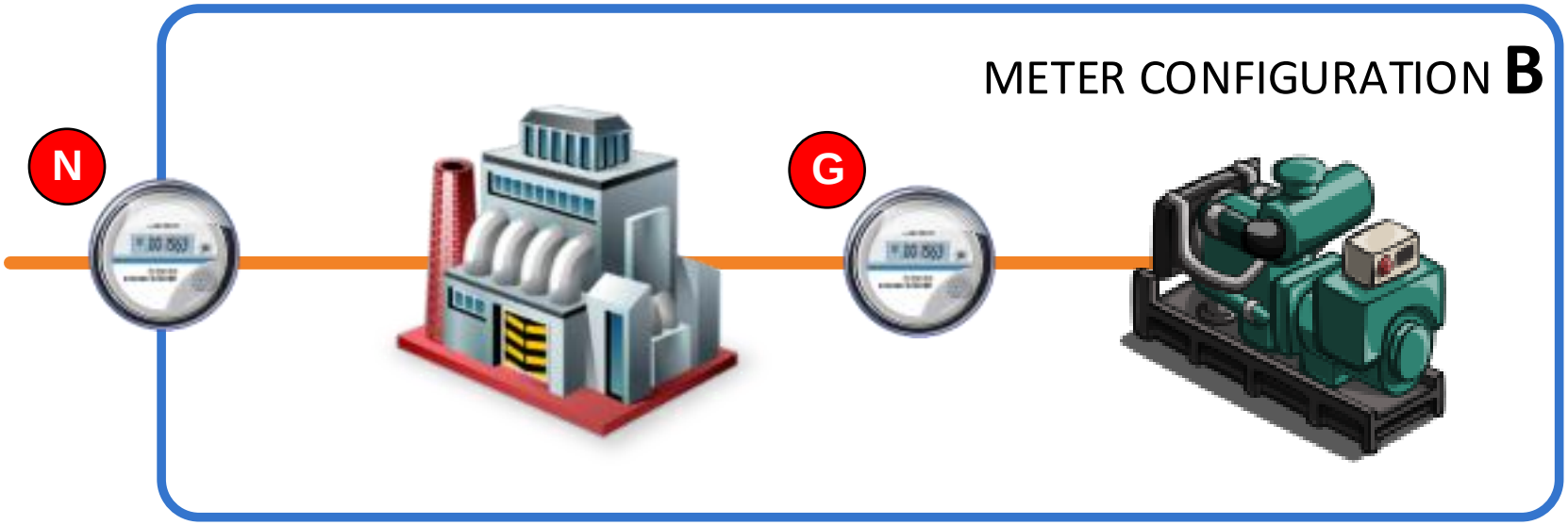
- Load is expressed as a positive quantity.
- The output of the generation device – or energy storage in discharging mode – is a negative quantity.

Metering configuration A recognizes a behind the meter generator or “device”



- A PDR/RDRR may opt to keep the status-quo and continue with this configuration
  - supported by current ISO rules
  - any negative M value is set to zero by the SCME
  - may result in less accurate baseline and difficult to derive a reasonable resource performance

Metering configuration B enables using the MGO performance evaluation method



- Enables load consumption to be derived separate from the generator/device.
- Directly measure performance of generator output with MGO by reading the physical meter G.

ISO is proposing to support three demand response participation options under metering configuration B, each with its own performance evaluation method

- Option B1 – load reduction only
- Option B2 – generation offset only
- Option B3 – load reduction and generation offset

Proposal for Option B1

- Only the load would be registered in the PDR/RDRR.
- Demand response performance would be evaluated using a load baseline B_{N-G} determined from (N-G) values for comparable non-dispatch hours.
- Actual demand reduction of the load in response to an ISO dispatch in interval (t) would be calculated as:

$$DR_{LOAD}(t) = B_{N-G} – [N(t) – G(t)]$$

- A net export check is not necessary.

- Note sign convention: Load values are positive, generation values are negative.

Proposal for Option B2

- Only the generation device would be registered in the PDR/RDRR.
- Demand response performance would be evaluated based on G for dispatch interval t, or G(t), adjusted by a quantity G_{LM} representing an estimation of typical retail load modifying behavior of the generation device (see next slide).
- The demand response performance attributed to a PDR/RDRR supply dispatch would be calculated as:

$$DR_{SUPPLY}(t) = - [G(t) – G_{LM}]$$

- If N< 0, then the megawatt-hour amount settled in that interval is the megawatt-hours delivered up to N=0.

Details on adjustment for typical retail load modifying behavior, G_{LM}

- 10-in-10 non-event day selection method (an average of G in the last 10 eligible non-event days for the applicable event-day hour(s) or interval(s)).
- A look back window will be 45 calendar days from which the 10 most recent eligible days will be selected.
- The selection of this load modifying “baseline” data will include the most recent eligible days, excluding different day-types and previous event days.

Details on adjustment for typical retail load modifying behavior, G_{LM} *(continued)*

- Two different day-types will be supported:

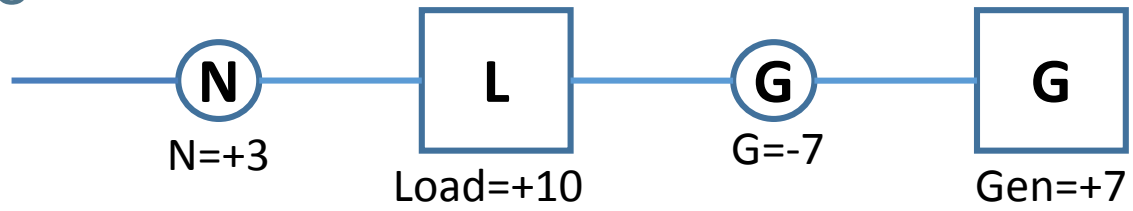
  Weekday (Monday through Friday)
  Weekend/Holiday (Saturday, Sunday, or any NERC holiday)

- A previous event day is a day on which there was either a PDR event, RDRR event, or an outage recorded in OMS (charging is not categorized as an event day).
- The selection of days used is performed by iterating backward through the acceptable days prior to the event day.
- Once the target number of days is reached, selection ends.

Details on adjustment for typical retail load modifying behavior, G_{LM} *(continued)*

- If the target number of days is not reached, but the minimum number of days is reached, the baseline is calculated on the selected days.
- If the minimum is not reached, then G_{LM} equals zero.
- Target and minimum days will adhere to existing ISO Type 1 rules:
  - Weekday = 10 days target; 5 days minimum
  - Weekend/Holiday = 4 days target; 4 days minimum

Example 1 – applying net export rule to an Option B2 scenario



Values shown are for interval t

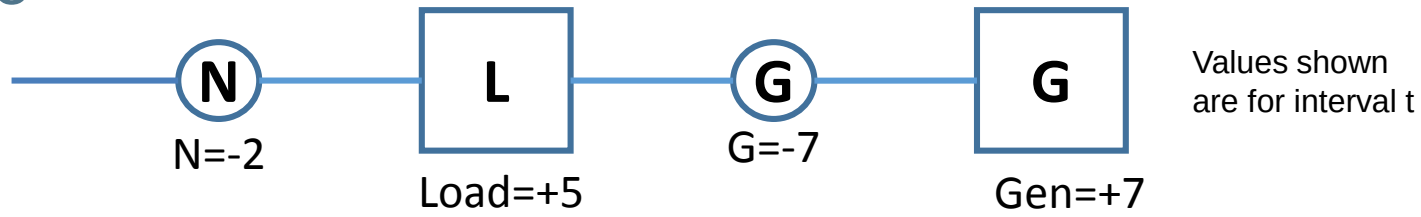
Example:

- In performing look back, suppose G = -1 in all non-event hours selected. Then G_{LM} = -1.
- Next suppose G(t) = -7 and N(t) = +3 for the dispatch interval, satisfying the net export rule. Then for calculating $DR_{SUPPLY}(t)$ we use G(t) = -7.

Thus:

- $DR_{SUPPLY}(t) = -[-7-(-1)] = +6$

Example 2 – applying net export rule to an Option B2 scenario



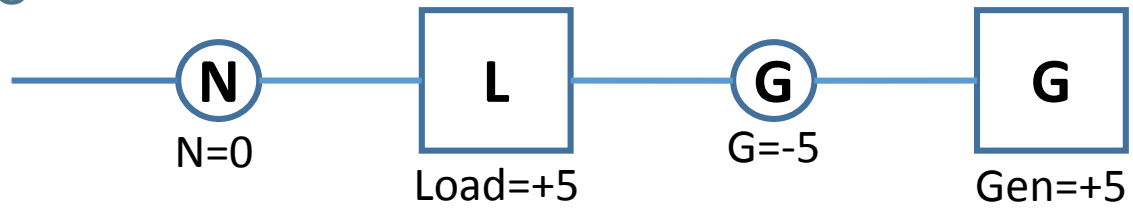
Example:

- In performing look back, suppose G = -1 in all non-event hours selected. Then G_{LM} = -1.
- Next suppose G(t) = -7 and N(t) = -2 for the dispatch interval, violating the net export rule. Then for calculating $DR_{SUPPLY}(t)$ we use G(t) = -5.

Thus:

- $DR_{SUPPLY}(t) = -[-5-(-1)] = +4$

Example 3 – applying net export rule to an Option B2 scenario



Values shown are for interval t

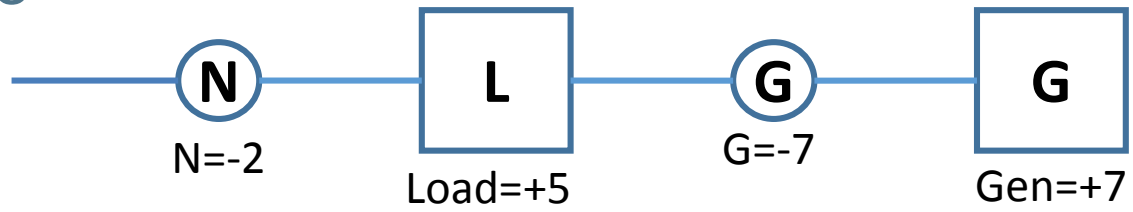
Example:

- In performing look back, suppose G = -1 in all non-event hours selected. Then G_{LM} = -1.
- Next suppose G(t) = -5 and N(t) = 0 for the dispatch interval, satisfying the net export rule. Then for calculating $DR_{SUPPLY}(t)$ we use G(t) = -5.

Thus:

- $DR_{SUPPLY}(t) = -[-5-(-1)] = +4$

Example 4 – applying net export rule to an Option B2 scenario



Values shown are for interval t

Example:

- In performing look back, suppose G = -7 in all non-event hours selected. Then G_{LM} = -7.
- Next suppose G(t) = -7 and N(t) = -2 for the dispatch interval, violating the net export rule. Then for calculating $DR_{SUPPLY}(t)$ we use G(t) = -5.

Thus:

- Unadjusted meter data would say $DR_{SUPPLY}(t) = -[-5-(-7)] = -2$ (i.e., exporting)
- But since demand response cannot be negative (net generation) for settlement we use $DR_{SUPPLY}(t) = 0$.

Proposal for Option B3

- Both the load and generation device would be registered in the PDR/RDRR.
- Demand response performance would be the combined demand responses attributed to $DR_{LOAD}(t)$ and $DR_{SUPPLY}(t)$, as detailed under Options B1 and B2, respectively.
- The total demand response reduction would be calculated as:

$$DR_{TOTAL}(t) = DR_{LOAD}(t) + DR_{SUPPLY}(t)$$

- The net export rule must be applied to $DR_{SUPPLY}(t)$, consistent with B2.
  - If N< 0, then the megawatt-hour amount settled in that interval is the megawatt-hours delivered up to N=0.

Provision of statistical sampling to estimate load meter data under ISO tariff section 10.1.7

- ISO Type 2 provides for statistical sampling of a demand response resource's energy usage data to derive the settlement quality meter data SQMD submitted to the ISO representing the total energy usage, in aggregate, for the demand response resource.
- Stakeholders have requested
  - detail on an approved methodology
  - clarification on applicability of this section, particularly what constitutes "interval metering is not available"

ISO proposal on use of statistical sampling

- ISO is proposing to support the use of statistical sampling for real-time and ancillary services participation when interval metering installed at all underlying resource locations is not recorded in 5- or 15-minute intervals.
- ISO is not proposing to support use of statistical sampling for day-ahead participation when hourly interval metering is installed at all underlying resource locations but RQMD is not available or accessible to DRPs or their SCs for all underlying locations in the established timelines required to meet ISO SQMD submission timelines.

ISO Type 2 requires the development of "Virtual" settlement quality meter data from a randomly sampled fraction of revenue quality meter data

The scaled SQMD value is termed the **Virtual** SQMD and is calculated as:

$$m_{VIRTUAL} = \frac{N}{n} \cdot \sum_{i=1}^{n} m_i$$

where: $N = Total\ Number\ of\ Locations\ Participating$

$n = Number\ of\ Metered\ Locations$

$m_i = SQMD\ for\ Location\ i$

$n \in N\ (Metered\ Locations\ are\ a\ subset\ of\ Locations\ Participating)$

- Sample (n) must be selected at random from within the population (N), with no bias to any factor such as size, location, or customer type.

Determining ISO Type 2 sample size for infinite and finite populations

For an infinite population, the required sample size is given as:

$$n' = \left(\frac{z}{e_{REL}}\right)^2 \cdot \left(\frac{1-p}{p}\right)$$

Where: $e_{REL} = Relative\ Precision\ Level$

$z = Value\ based\ on\ Level\ Of\ Confidence$

$p = True\ Population\ Proportion$

For a finite population, the sample fraction can be calculated as:

$$\frac{n}{N} = \frac{n'}{N + n'}$$

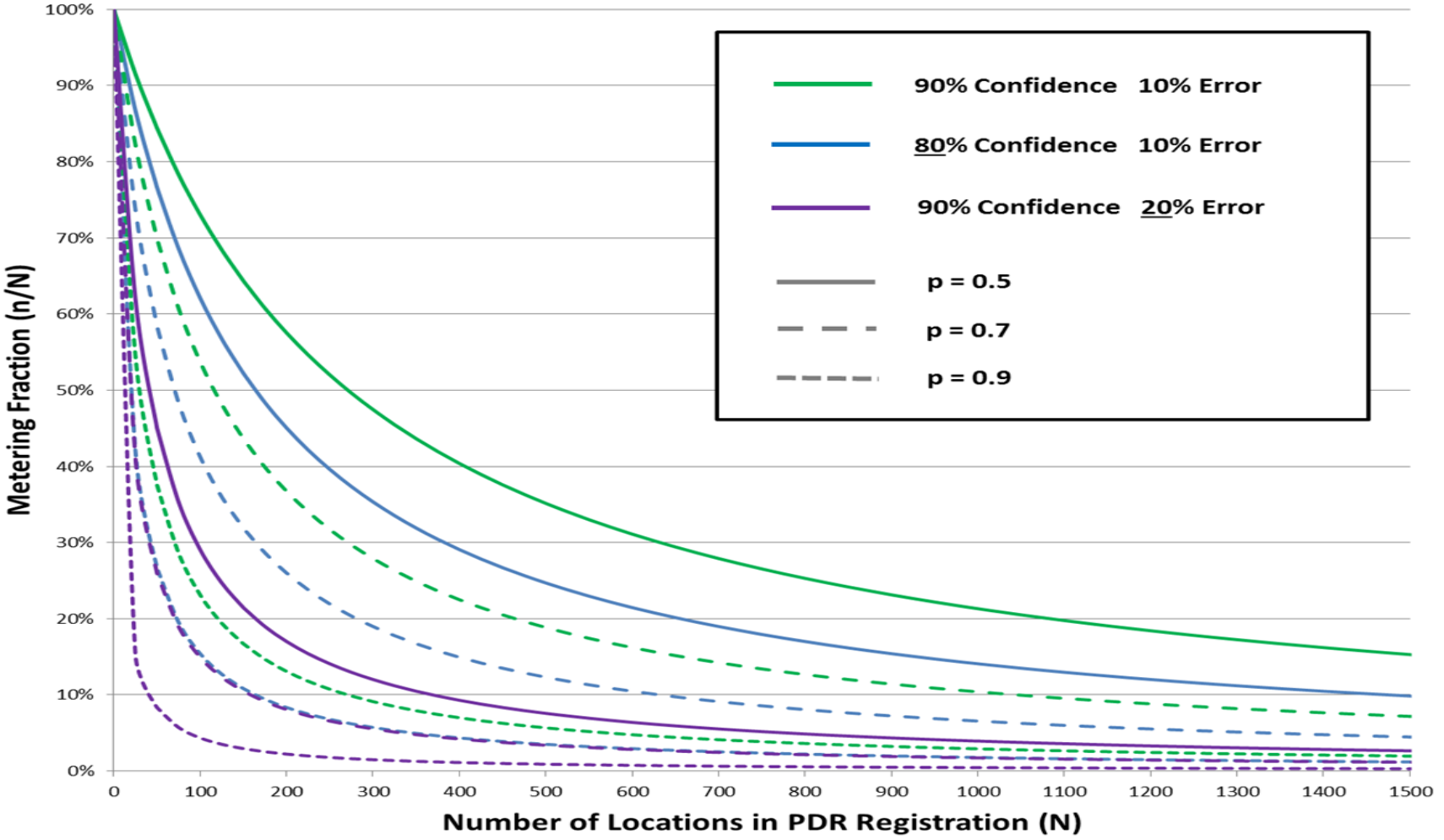
ISO Type 2 suggested formulation is employed by many ISOs and RTOs

The following table summarizes typical values used:

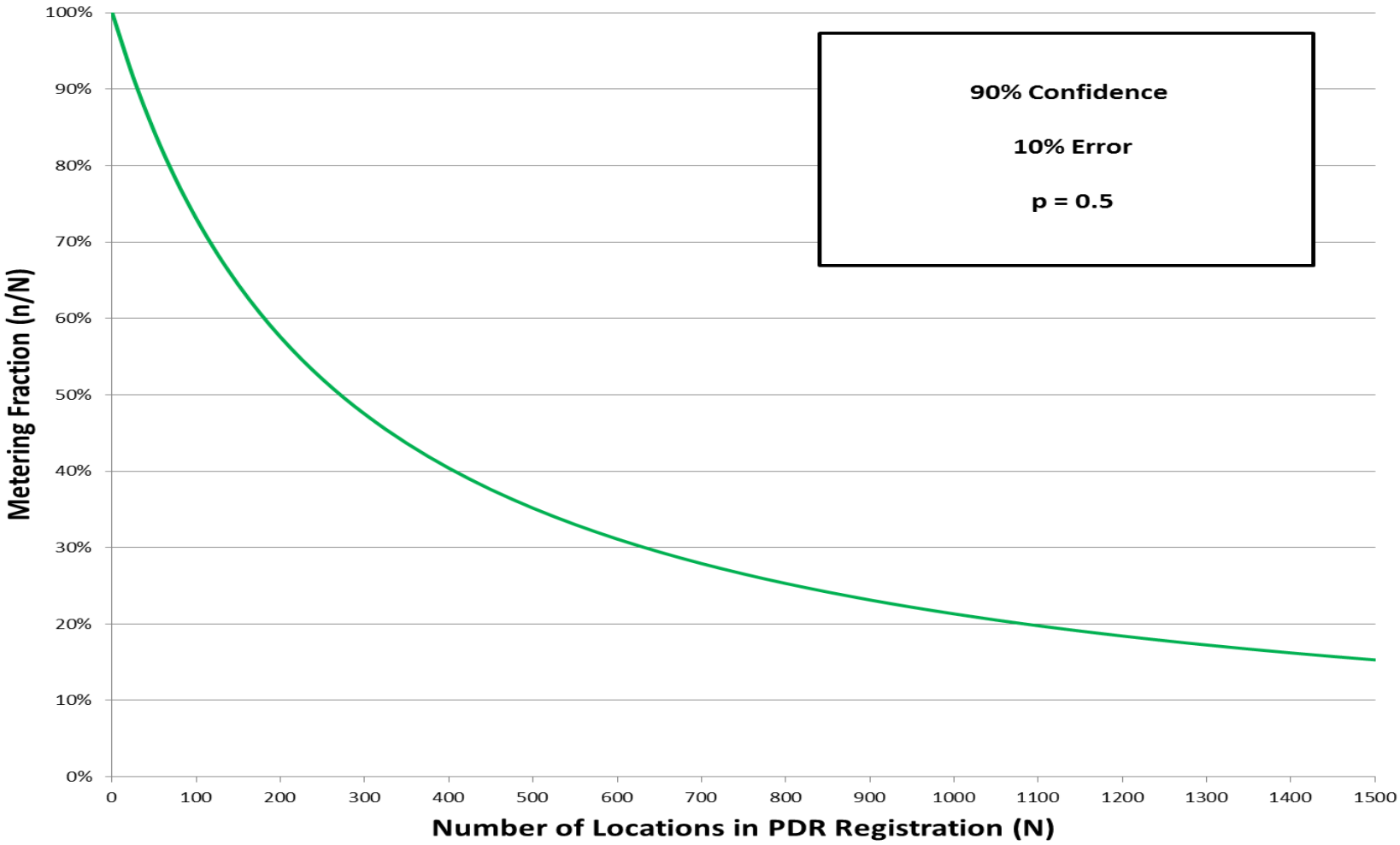
	Relative Precision Level	Level Of Confidence
PJM	10%	90% (z=1.645)
ISO New England	10%	80% (z=1.282)
NYISO	10%	90% (z=1.282)

- The value of z is derived from a distribution of samples with 10% of the high samples and 10% of the low samples in the two respective tails of a Gaussian distribution.

Different Metering Fraction curves as a function of the two variables and the population size (N) and the True Population Proportion (p)



ISO Type 2: ISO proposes a level of confidence of 90% and relative precision level of 10%



ISO Type 2: ISO proposes to require that every resource employing ISO Type 2 have a sample fraction:

$$f = \frac{n}{N} = \frac{n'}{N + n'} = \frac{271}{N + 271}$$

The following table shows a number values for the fraction based on the number of locations

PDR Locations	Minimum Sample Fraction
10	96%
25	92%
50	84%
75	78%
100	73%
125	68%
150	64%
175	61%
200	58%
250	52%
300	47%
350	44%
400	40%
500	35%
750	27%
1000	21%
1500	15%
2000	12%

Non-resource adequacy (non-RA) multiple use applications

Scope

Multiple use applications are those in which an energy resource or facility provides services to and receives compensation from more than one entity.

- Type 1 – the resource provides services to the distribution system and participates in the ISO wholesale market
- Type 2 – the resource provides services to end-use customers and participates in the ISO wholesale market

Focus on DER and DER aggregations (DERA) as the resources most prevalently engaged in multiple uses

“Non-RA” status is assessed monthly, based on whether the resource is identified in an LSE’s monthly RA plan.

Key assumptions underlying this proposal

1. Consistency with upcoming DERP filing
   - ISO intends to relax the original DERP requirement that all sub-resources of a multi-pnode DERA must be the same type and move in the same direction when dispatched
   - Instead, net movement of sub-resources at each pnode must be in same direction and aligned with distribution factors (DFs) when dispatched
   - SC may bid DFs for the DERA hourly, or rely on default DFs on file for the DERA
2. Metering and ISO settlement in all hours
   - Except for PDR & RDRR, all DER and DERA participating in the ISO markets must provide settlement quality meter data (via their SC) and will be settled in all market intervals, not just those in which they bid and were dispatched
   - In response to stakeholder requests, ISO will consider possible relaxation of this requirement in 2016 ESDER scope.

Type 1 – Distribution system service provision and wholesale market participation

Question 1: Potential conflicts between distribution system needs and ISO dispatch instruction

- Proposal: ISO will treat deviations from ISO dispatch instructions as uninstructed imbalance energy (UIE)

Question 2: Potential double payment to DER for providing distribution system services while following ISO dispatch

- Proposal: ISO will not implement provisions at this time to address potential double payment
- ISO will consider revisiting this question when distribution system services are defined

Type 1 continued

Question 3: Provision of distribution system services by sub-resources of a DER aggregation

- Proposal: ISO does not propose to impose any such limitations at this time
- Under DERP proposal, DERA may combine diverse DER types as sub-resources, even for multi-pnode DERA
- ISO will require that a multi-pnode DERA given ISO dispatch must provide net response at each pnode that is in the direction of the dispatch and aligned with distribution factors

Type 2: Services to end-use customers and wholesale market participation

- ISO does not believe there are issues that need to be addressed at this time on this topic, beyond the issues being addressed under the PDR/RDRR topic.
- Developing new enhancements to PDR, or creating a new PDR-NGR hybrid, are not feasible in 2015, but may be considered as part of 2016 ESDER scope.

Next Steps

Request for stakeholder comments by November 16, 2015

Comments mailbox initiativecomments@caiso.com

Step	Date	Event
Draft Final Proposal	November 5	Post draft final proposal
	November 9	Stakeholder web conference
	November 16	Stakeholder comments due
Board approval	December 17-18	ISO Board meeting