Energy storage and distributed energy resources (ESDER) stakeholder initiative

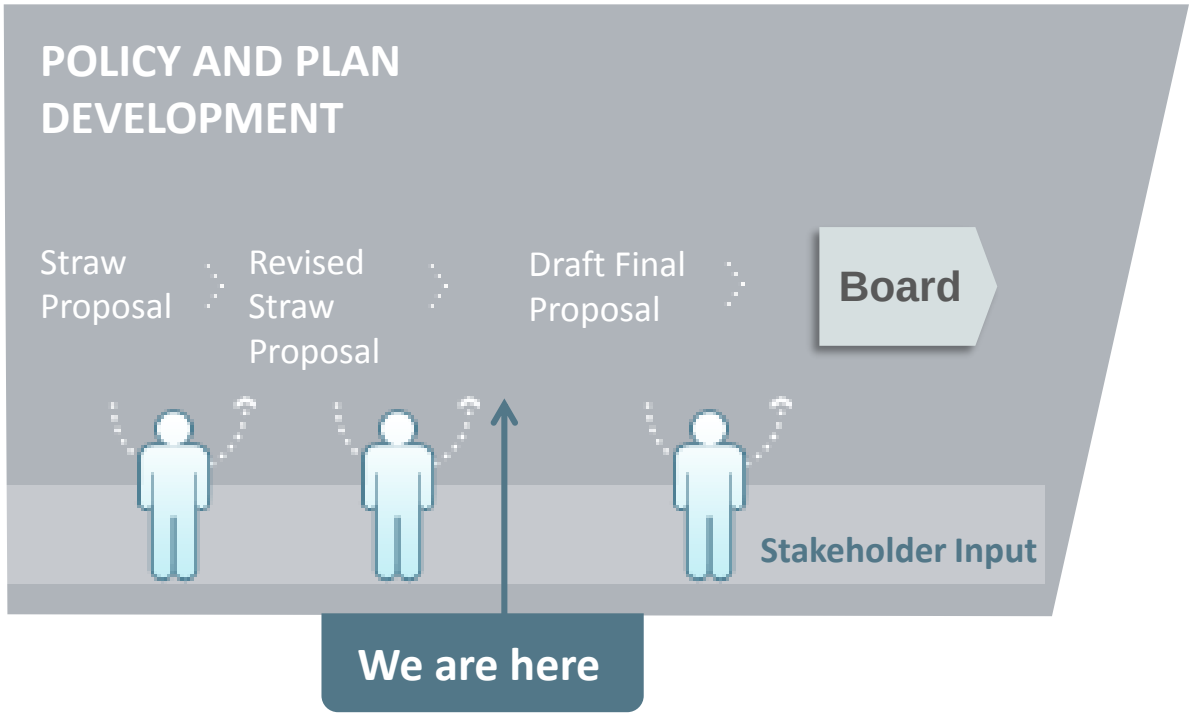
Alternative Performance Evaluation Methodologies

Working Group Meeting
October 12, 2015
10:00 a.m.-3:00 p.m. (pacific)

Agenda

Time	Agenda Item	Speaker
9:00-9:10	Introduction, Stakeholder Process	Tom Cuccia
9:10-9:20	Background on PDR/RDRR enhancements topic in ESDER	Tom Flynn
9:20-10:00	Review stakeholder comments received October 9	Ali Miremadi
10:00-12:00	Consideration of alternative performance evaluation methodologies	Ali Miremadi
12:00-1:00	Lunch break	All
1:00-2:50	Development of additional detail regarding use of statistical sampling	Ali Miremadi
2:50-3:00	Next Steps	Tom Cuccia

ISO Stakeholder Initiative Process (policy development phase)



Stakeholder process schedule leading up to this point

Step	Date	Event
Clarification of existing ISO requirements, rules, market products and model for storage and DER	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
Revised Straw Proposal	September 17	Post revised straw proposal
	September 28	Stakeholder web conference
	October 9	Stakeholder comments due

Stakeholder process schedule now and going forward

Step	Date	Event
ESDER Working Group	October 12	ESDER working group meeting
	October 19	Stakeholder comments due
Draft Final Proposal	November 5	Post draft final proposal
	November 9	Stakeholder web conference
	November 20	Stakeholder comments due
Board approval	December 17-18	ISO Board meeting

Background on PDR/RDRR enhancements topic in ESDER

Proposed PDR/RDRR enhancements in 2015 scope of ESDER

Refresher on what was in scope for 2015:

- Evaluate the inclusion of baselines that meet North American Energy Standards Board (NAESB) measurement and validation standards.
- Clarify how to enable alternative baselines that meet NAESB standards and specify tariff provisions to define alternative baselines in ISO business practice manuals (BPMs).

Principles applied in developing alternative baseline methodologies

- Accuracy – must provide a more accurate estimate of performance than current ISO baseline methodologies for use case in consideration.
- Auditability – must provide the ability for ISO to audit fundamental parameters.
- Ease of implementation – ISO systems and processes must be able to implement the alternative baseline.
- Compliance with NAESB standards – must be compliant with NAESB standards and exist within NAESB approved parameters.

NAESB performance evaluation methods for demand response

The following performance evaluation methods are defined by NAESB:

1. Baseline Type-I
2. Baseline Type-II
3. Maximum Base Load (“MBL”)
4. Meter Before / Meter After (“MB/MA”)
5. Metering Generator Output (“MGO”)

- All are performance evaluation models
- Only Baseline Type-I and Baseline Type-II employ “baselines”

Performance evaluation methods for PDR/RDRR have provisions in the ISO tariff

- Customer baseline methodology required to be detailed in the ISO tariff
  - ISO tariff section 4.13.4
  - NAESB Baseline Type-I
  - Referred to as “ISO Type 1” in Sep 17 paper

- Provision of statistically derived meter data
  - ISO tariff section 10.1.7
  - NAESB Baseline Type-II
  - Referred to as “ISO Type 2” in Sep 17 paper

Proposed PDR/RDRR enhancements in 2015 scope of ESDER

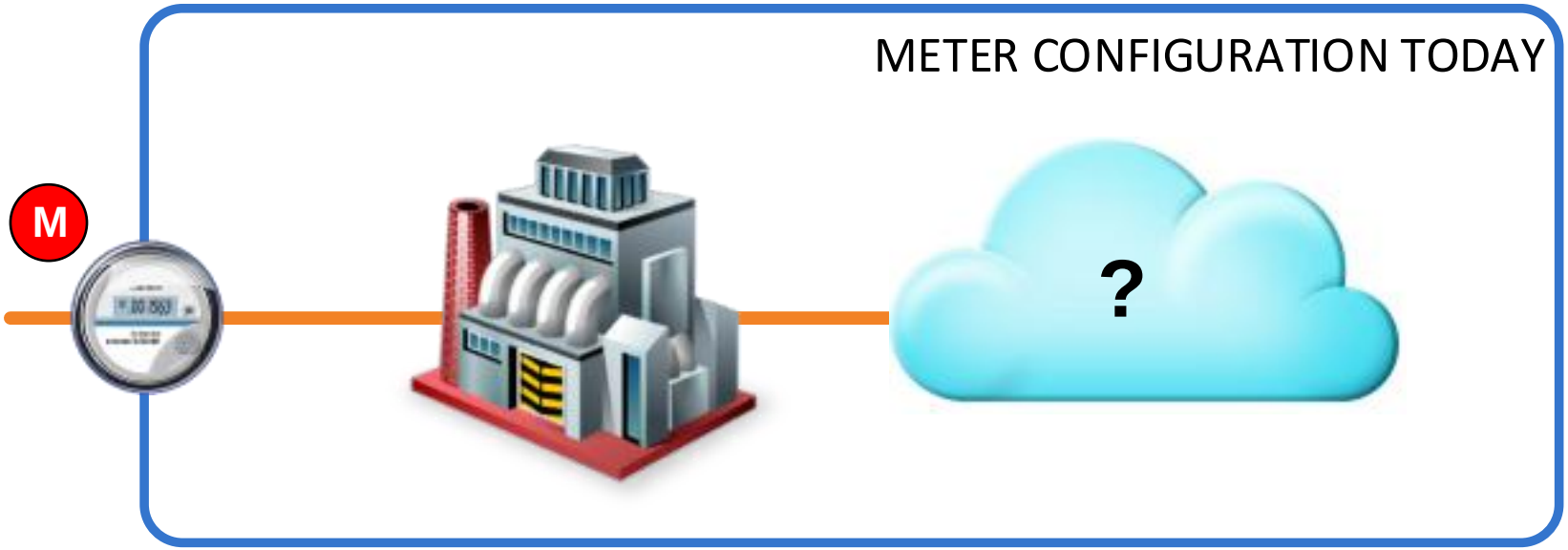
The ISO recognizes the need to expand approved performance evaluation methodologies to accommodate more demand response (PDR/RDRR) use cases.

Through the ESDER initiative the ISO has proposed to:

- Evaluate and develop an alternative performance evaluation methodology based on NAESB meter generator output (MGO)concepts
- Develop additional detail regarding use of statistical sampling and document that in the appropriate BPMs

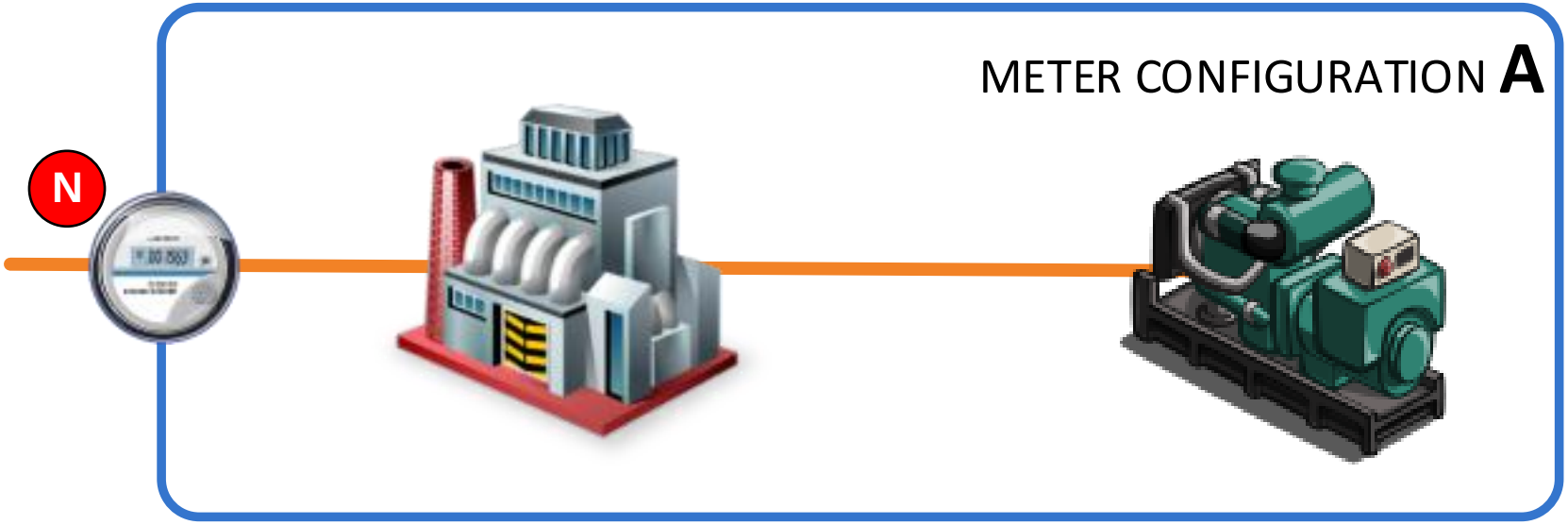
Consideration of Alternative Performance Evaluation Methodologies

The ISO is unaware of behind-the-meter devices under today's PDR/RDRR resource metering configuration



- With this configuration, there is no way to separate pure load from anything that may be modifying the load
- The resource baseline and performance is measured using data from meter labeled M

Metering configuration A does not separately account for the load modifying effects of a behind the meter generator or “device”



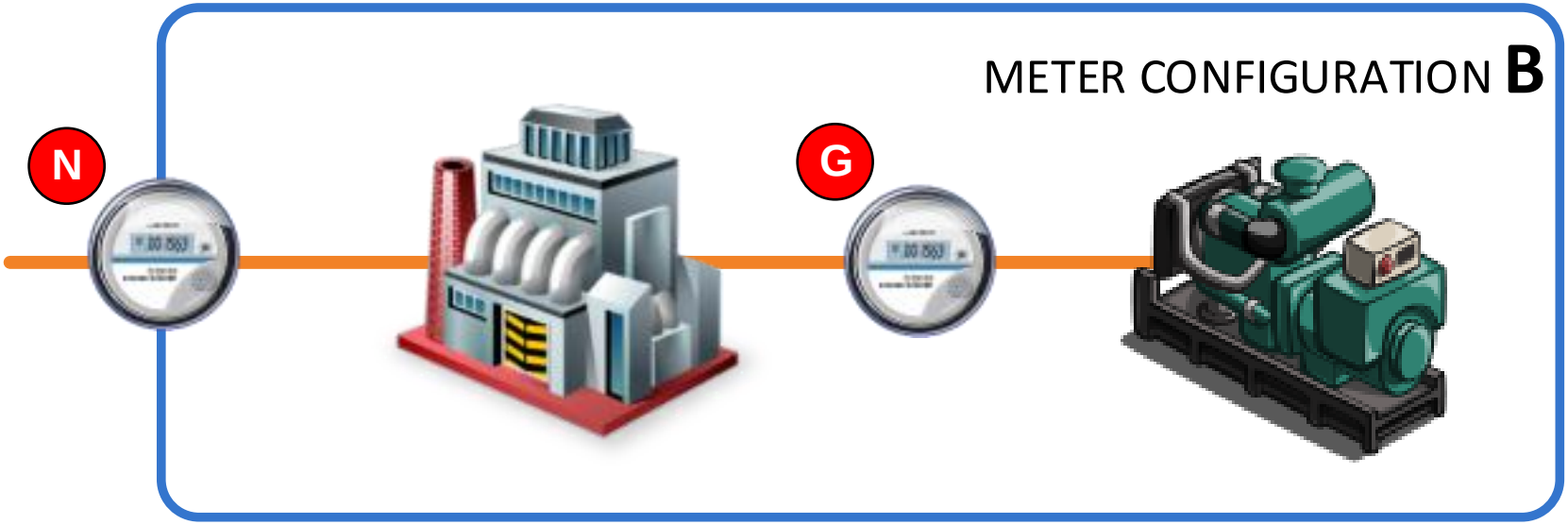
- A PDR/RDRR may opt to keep the status-quo metering and baseline evaluation under this configuration
  - supported by current ISO rules
  - Will not derive the performance of the generator or device separate and distinct from the load

Meter Generator Output requires review of various metering configurations

MGO is “a performance evaluation methodology, used when a generation asset is located behind the demand resource’s revenue meter, in which the demand reduction value is based on the output of the generation asset”

-NAESB business practices for Wholesale Demand Response

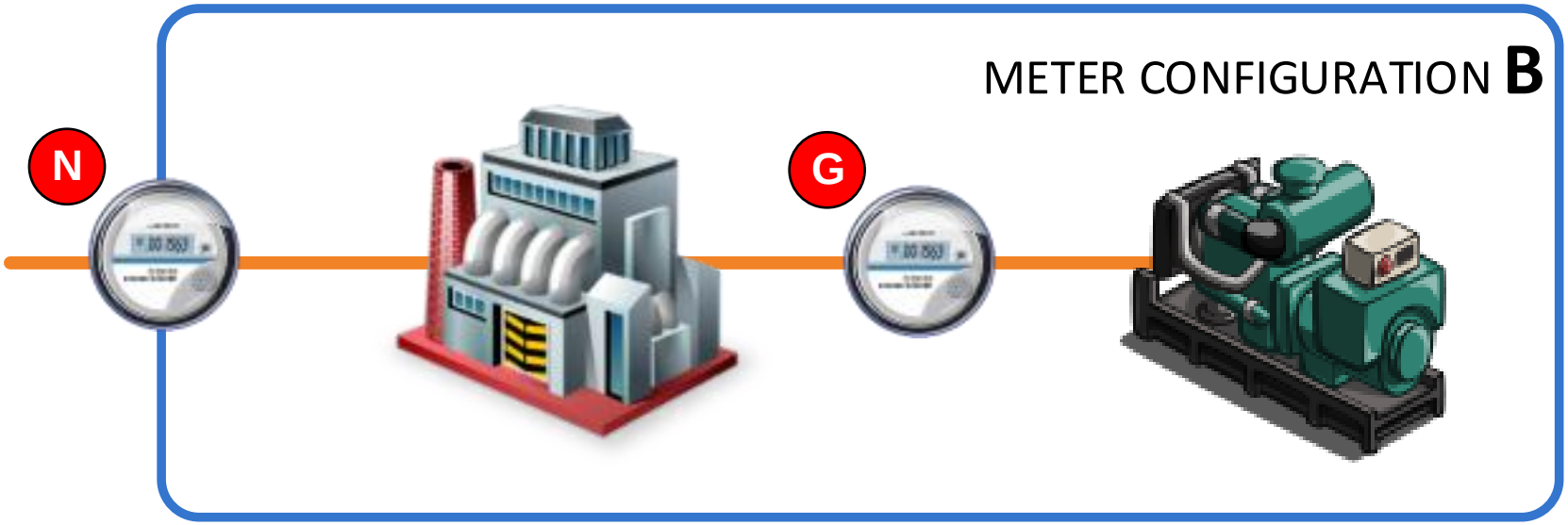
Metering configuration B adds a sub-meter G enabling load and generation performance to be derived distinctly



- Actual load consumption is derived as the difference between the net meter (N) and the device meter (G), i.e. (N-G)
- For example, if N = 8MWh, G = -2MWh*
  - Actual load consumption = N-G = (8)-(-2) = 10 MWh

**assumes a sign convention where load = +, Generation= -*

Metering configuration B enables using the MGO performance evaluation method



- Enables load consumption to be derived separate from the generator/device (as described in previous slide)
- Directly measure performance of generator output with MGO by reading the physical meter (G)

Metering configuration B provides for the possibility of three participation options each with its own performance evaluation methodology

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

Metering configuration B – Option B1 (load reduction only)

- Only the load would be a registered asset in the PDR/RDRR.
- Demand response performance would be evaluated using a baseline (B) developed using (N-G) metered quantities for comparable non-dispatch hours/intervals.
- Baseline (B) would be derived using an ISO approved and tariff provisioned baseline method (i.e., 10-in-10).
- For ISO dispatch interval t,

  Performance Measurement = (B – (Nt – Gt))

Metering configuration B – Option B2 (generation offset only)

- Only the generation device would be a registered asset in the PDR/RDRR.
- Demand response performance would be evaluated using the metered quantity G (i.e., metered generator output or “MGO”).
- For ISO dispatch interval t,
  Performance Measurement = Gt
- However, MGO cannot distinguish dual use, i.e., a PDR/RDRR dispatch response and a coincident retail response (e.g., provision of demand management services to the on-site load).

Metering configuration B – Option B3 (load and generation)

- Both the load and generation device would be registered assets in the PDR/RDRR.
- Demand response performance would be evaluated using both the Option B1 and Option B2 methods.
- For ISO dispatch interval t,

  Load Performance Measurement = (B – (Nt – Gt))

  Generation Performance Measurement = Gt
- Thus, total performance measurement would be

  ((B – (Nt – Gt)) + Gt
- This has the same issue as was noted under option B2.

Distinguishing the quantity of output in response to a PDR/RDRR dispatch from that for retail purposes introduces a retail-adjusted G value called $Gt_{adjusted}$

- The ISO believes that for Options B2 and B3, the quantity G_t should be adjusted to remove the energy output used for retail purposes.
- This $Gt_{adjusted}$ would be calculated as Gt minus the portion of the energy output in interval t used for retail purposes.
- Thus, the performance measurement would instead be:

  Option B2: $Gt_{adjusted}$

  Option B3: $((B – (Nt – Gt)) + Gt_{adjusted}$

Possible methods for estimating the adjusted generation output used for retail purposes in interval t

Using a baseline:

Establish a “baseline” of the generation device’s output using (G) metered quantities during non-dispatch intervals. Non-dispatch intervals could be selected by:

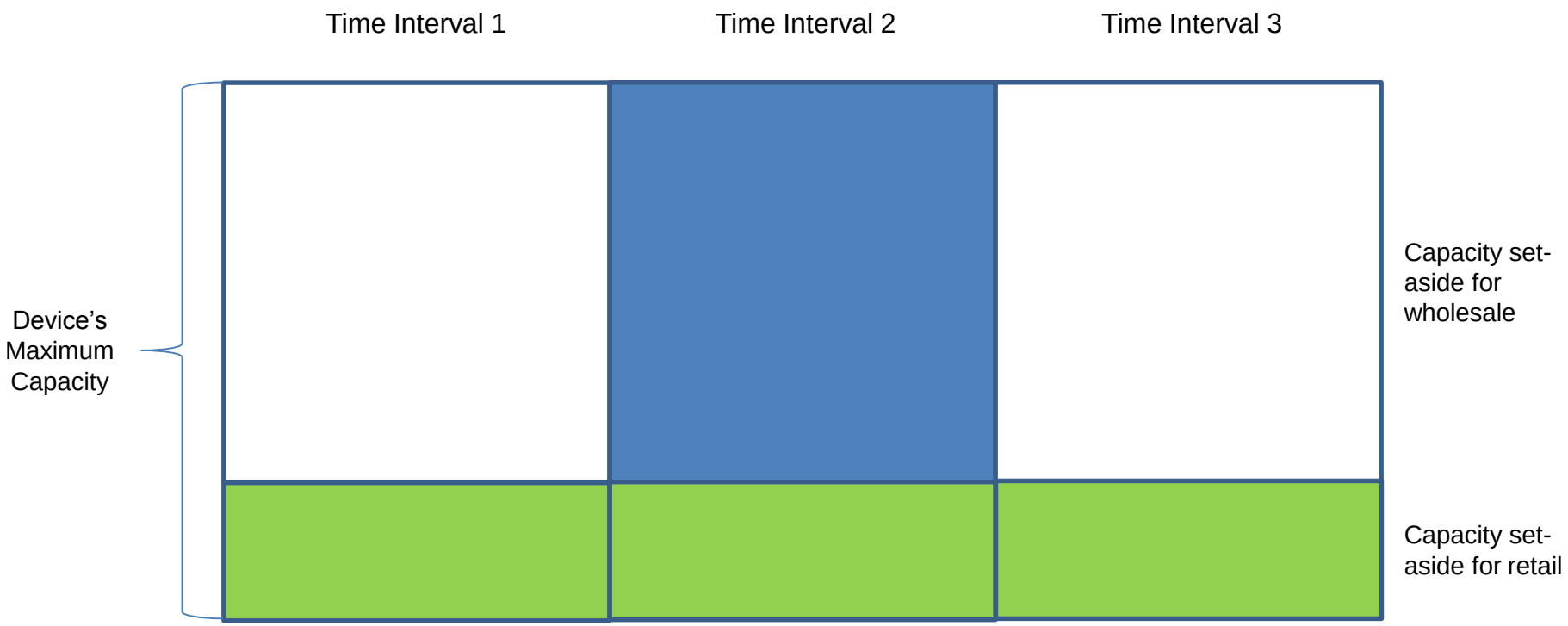
a. Conducting a “look back” of comparable non-dispatch intervals (e.g., 45 days using 10-in-10), or

b. Random selection to establish a baseline.

Employing a capacity set-aside:

Multiply the portion of the device’s retail set-aside capacity specified at registration by interval t and subtract from Gt metered energy use.

MGO - Example for Employing a Capacity Set-Aside



In the above example, CASIO will provide a dispatch instruction for Time Interval 2 to the generator. Gt will be the area under the Time Interval 2 (Blue and Green). $Gt_{adjusted}$ will be the blue area only.

Determining the capacity of the generation device for resource adequacy purposes

- Due to the must offer requirement for resource adequacy (RA) resources, the capacity counted for RA purposes should not overlap with the capacity of the device “set-aside” for retail activities.
- To make this transparent, a portion of the generation device’s capacity would be “reserved” or “set aside” for resource adequacy purposes with the remaining portion of its capacity dedicated to retail activities.
- This reservation or set aside would be specified at registration.

Current PDR/RDRR rules that must be considered when evaluating performance methodology options

1. A single meter cannot be shared between two PDR/RDRR resources
2. Each registration has (or can have) its own performance evaluation method
3. A PDR/RDRR cannot “export” energy to the grid, including the underlying resources.
4. While not a currently specified rule: Performance methodologies utilized by assets at the same location (e.g., a load and a device) must be within the same PDR/RDRR under a single DRP. The load and device can’t be segregated into two resources served by separate DRPs.

The following MGO example compares resulting performance measurements for Options A and Options B1- B3 utilizing 2 variants for baseline development

- Configuration: Simple Load with behind-the-meter generation
- Physical Meters: N, G
- Calculated Meter: L = N – G

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
N	40	40	40	5	40	40	5	⇦ Measured
G	0	0	0	-30	0	0	-30	⇦ Measured
L = N - G	40	40	40	35	40	40	35	⇦ Calculated

* Assumes generation behind the meter is dedicated to the wholesale market only.

Baselines can differ depending on exclusion rules and metering used in developing them

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
N	40	40	40	5	40	40	5	⇦ Measured
G	0	0	0	-30	0	0	-30	⇦ Measured
L = N - G	40	40	40	35	40	40	35	⇦ Calculated

- Assume ISO dispatch on Day 7
- Consider two scenarios: (1) No Prior ISO Event Days and (2) Day-4 also an ISO Event Day (dispatch/outage)
- Two baselines: Based on “N” and based on “L”

Baseline

5-in-5 (N)	33
5-in-5 (L)	39

Baseline with Day 4 Prior Event

5-in-5 (N)	40
5-in-5 (L)	40

* Assumes generation behind the meter is dedicated to the wholesale market only.

Comparison of performance evaluations for A and B options utilizing different baselines

- Resulting performance evaluations based on the two scenarios for prior events days and the meter registration type used “N vs L”

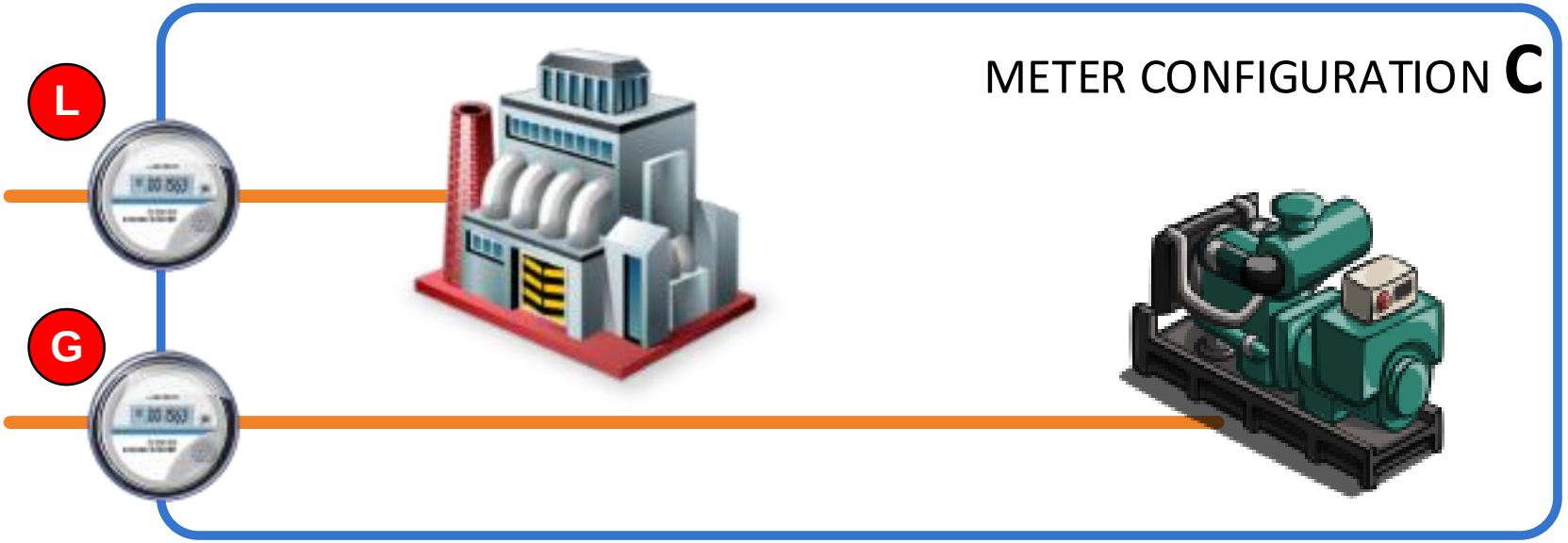
		Day 4 Event	No Prior Events
Option B 1 (Load)	= Baseline (L) - L	40 - 35 = **5**	39 - 35 = **4**
Option B 2 (Gen)	= MGO (G)	**30**	**30**
Option B 3 (Both)	= B1 + B2	30 + 5 = **35**	30 + 4 = **34**
Option A (Net Meter)	= Baseline (N) - N	40 - 5 = **35**	33 - 5 = **28**

* Assumes generation behind the meter is dedicated to the wholesale market only.

Summary of meter configurations A & B

	Meter Configuration A	Meter Configuration B		
		B3 – Load and Generation	B1 – Load Only	B2 – Generation Only
Demand Response Providers	Single DRP	Single DRP	Single DRP	Single DRP
Resources	Single PDR/RDRR	Single DRP	Single PDR/RDRR	Single PDR/RDRR
Registrations	Net Facility	(1) Load (2) Generation	Load	Generation
Locations (SANs)	Net Facility	(1) Load (2) Generation	Load	Generation
Performance Evaluation Methodology	Baseline (N)	Baseline (N-G) plus MGO ($G_{adjusted}$)	Baseline (N-G)	MGO ($G_{adjusted}$)
Export Check	All Intervals $N \geq 0$	All Intervals $N \geq 0$	All Intervals $N \geq 0$	All Intervals $N \geq 0$

Metering configuration C



- Required if separate participants are independently managing the load and generation device; two separate SCs required.
- If load and generation not combined in the same PDR/RDRR, the generation source alone cannot be considered; it must be considered a Non-Generator Resource (NGR) or a Participating Generator (PG)

Summary of meter configuration C

	Meter Configuration C	
	Load Only	**Generation Only**
Demand Response Providers	Single DRP (May be different from generation owner)	Cannot be PDR/RDRR but would participate in the ISO market as a non-generator resource (NGR) or participating generator (PG).
Resources	Single PDR/RDRR	
Registrations	Load	
Locations (SANs)	Load	
Performance Evaluation Methodology	ISO Type 1 Baseline (L)	

ISO is considering offering each of the following performance evaluation methodology options

- Meter configuration A
- Meter configuration B Option B1 – Load Only
- Meter configuration B Option B2 – Generation Only
- Meter configuration B Option B3 – Load and Generation
- Meter configuration C – Load Only

Limitations may be imposed on these options until such time that the system and processes associated with its use can accommodate many registrations to one resource capability.

Performance evaluation methodologies and multiple use issues

A provider with a generator or device behind-the-meter may want to use the device to provide other retail demand management services for the load.

- Should information about its performance in intervals prior to being dispatched as a PDR/RDRR be available to measure its actual response?
- Should a portion of its capacity be dedicated to retail demand management services with the remainder eligible for wholesale participation as a PDR/RDRR?
- ISO is recommending a modified MGO to account for, and subtract out, retail capacity and energy use.

Development of additional detail regarding use of statistical sampling

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 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:

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

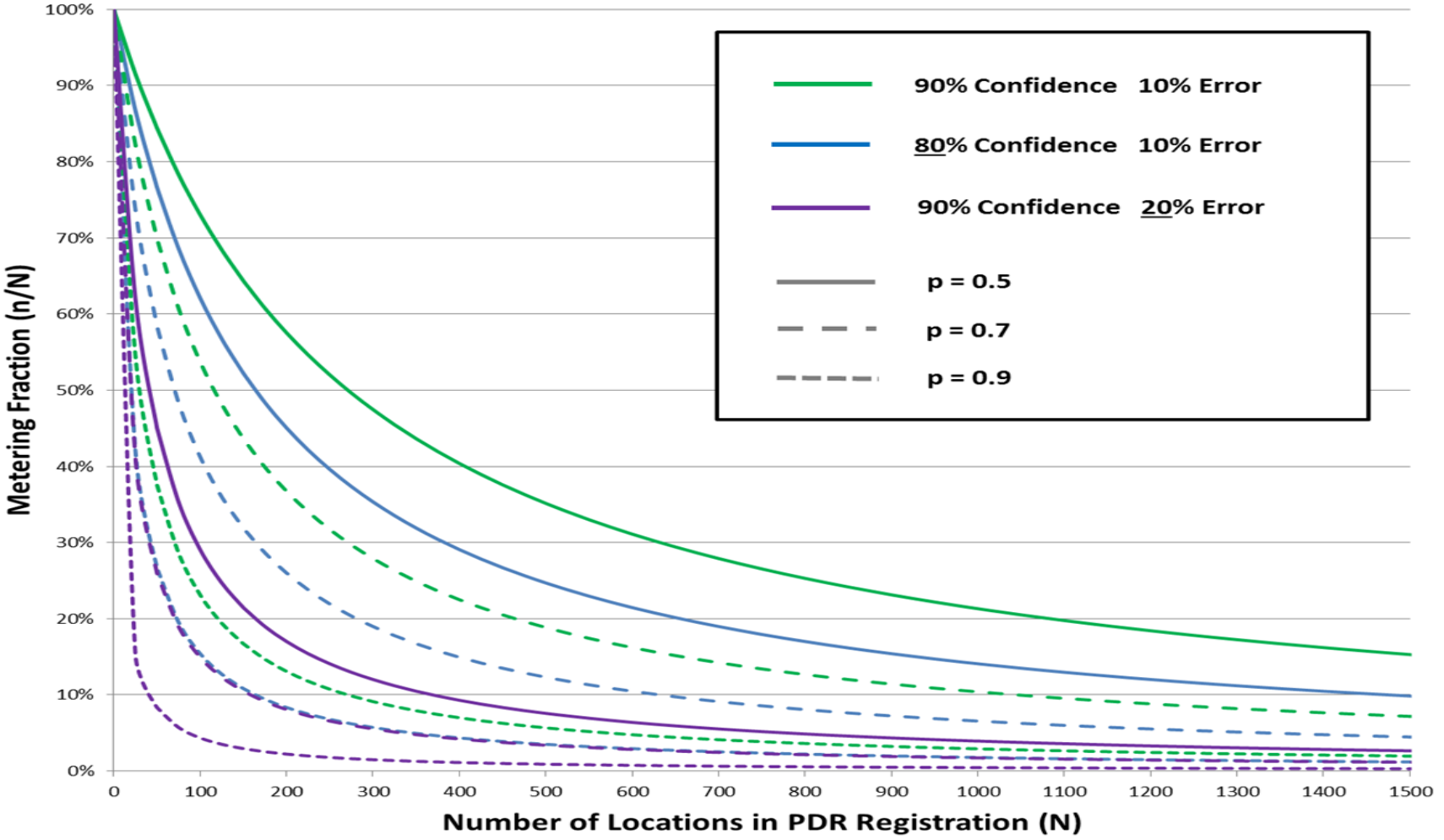
ISO Type 2 suggested formulation is employed by many ISOs and RTOs

The following table summarizes typical values used:

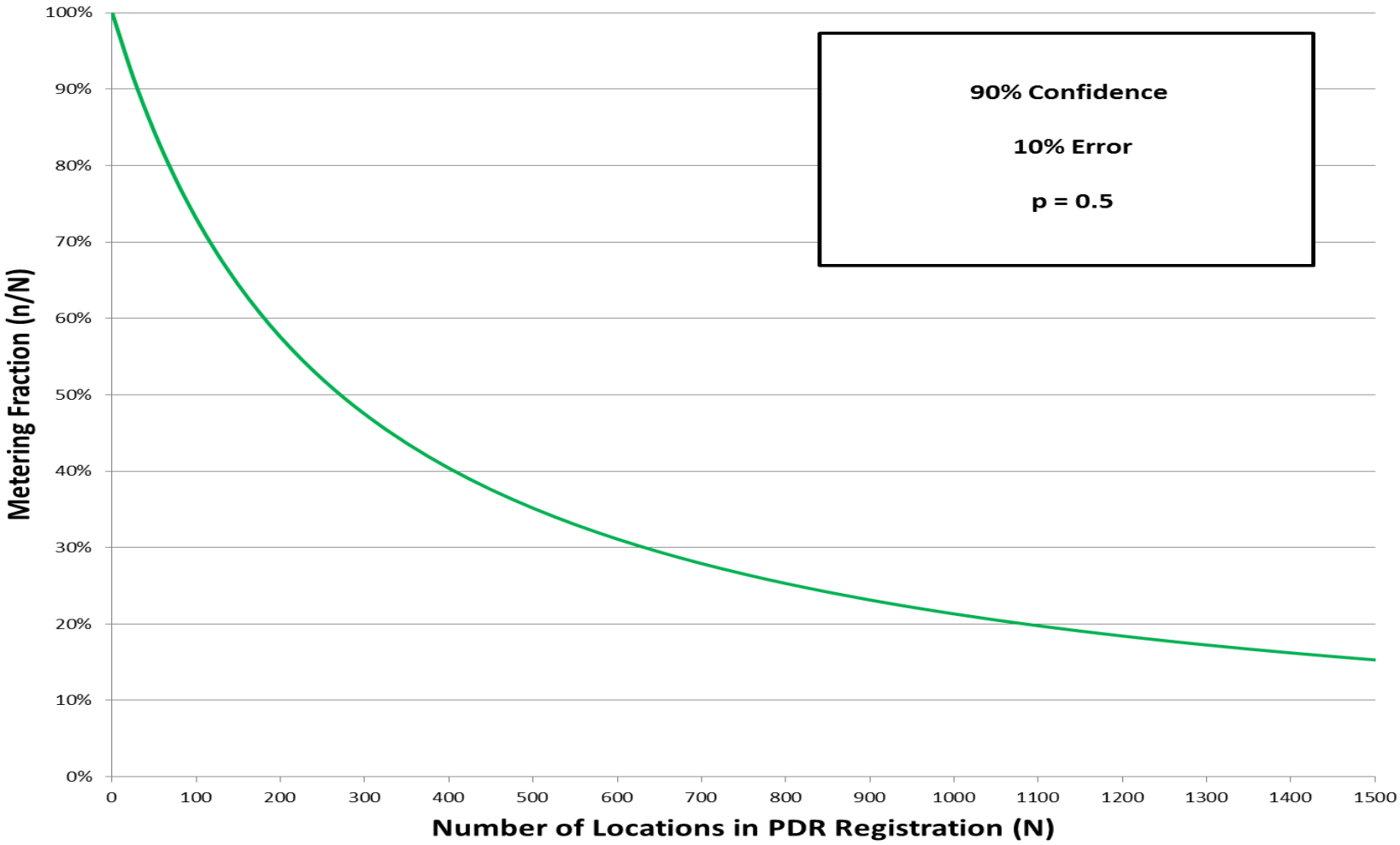
	Relative Precision Level	Level Of Confidence
PJM	10%	90% (z=1.645)
ISO New England	10%	80% (z=1.282)
NYISO	10%	90% (z=1.282)

- For PJM and ISO New England, the value of z is derived from a distribution of samples with a single tail while in the case of New York ISO both tails are considered effectively making the Level of Confidence 80% for direct comparison.

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%

Currently ISO proposes use of statistical sampling for participation that requires a maximum of 15 minute interval metering

The ISO believes the language as written in section 10.1.7 of the ISO Tariff supports the use of statistical sampling in the following case:

- 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.

At this time, ISO is further considering but not proposing supporting the use of statistical sampling for participation requiring hourly interval metering

- ISO has reservations supporting the use of statistical sampling in the following case:
  - For day-ahead participation, when hourly interval metering is installed at all underlying resource locations but revenue quality meter data RQMD is not available to meet ISO Settlement Quality Meter Data SQMD submission timelines.
- The ISO invites additional stakeholder feedback on the ISO concerns outlined in paper including:
  - tariff section need to be expanded
  - LSE ability to meet ISO SQMD submission timelines
  - SC compliance with standards established by the LRA per section 10.3.7 of the Tariff

Next Steps

Request for stakeholder comments by October 19, 2015

Comments mailbox initiativecomments@caiso.com

Step	Date	Event
ESDER Working Group	October 12	ESDER working group meeting
	October 19	**Stakeholder comments due**
Draft Final Proposal	November 5	Post draft final proposal
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