Energy storage and distributed energy resources (ESDER) stakeholder initiative

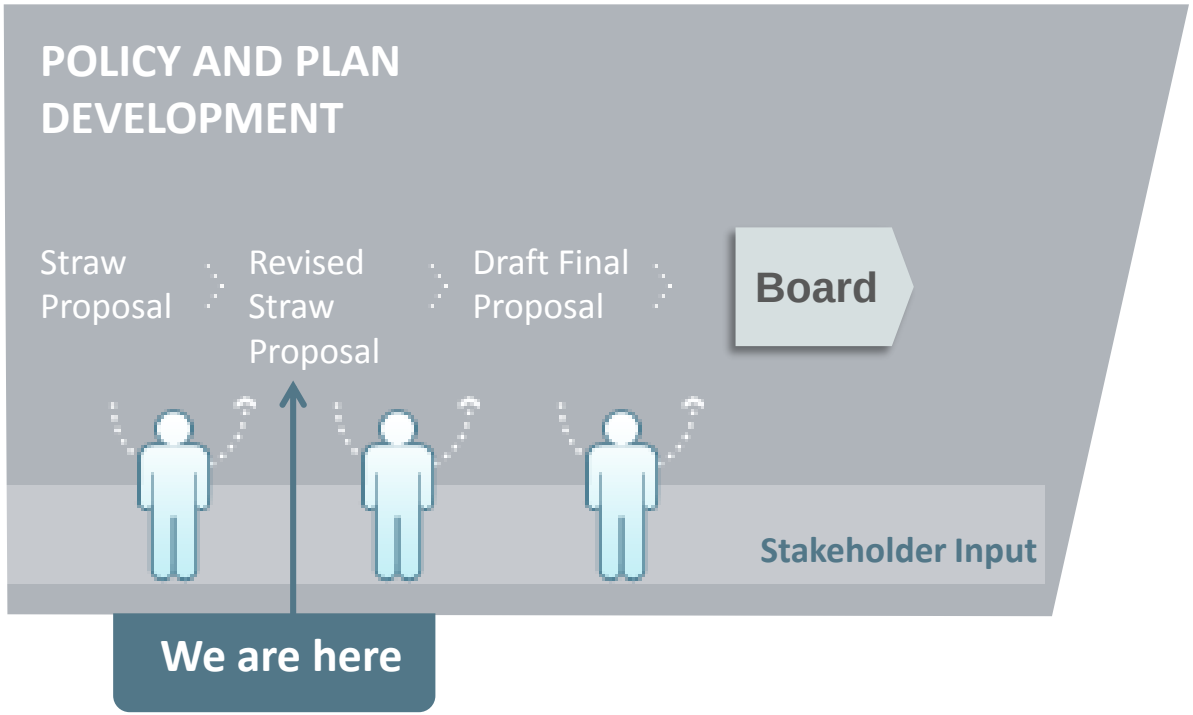
Revised Straw Proposal

Stakeholder web conference
September 28, 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 Scott Coe
3:00-3:50	Multiple use applications	Lorenzo Kristov
3:50-4:00	Next Steps	Tom Flynn

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

Stakeholder process schedule now and going forward

Step	Date	Event
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
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

Non-generator resources (NGR) enhancements

Proposed NGR enhancements in 2015 scope of ESDER

- Updated NGR documentation
- Clarification about how ISO uses state of charge (SOC) in the market optimization
- Allow initial state of charge as a daily bid parameter in the day-ahead market
- Allow an option to not provide energy limits or have the ISO co-optimize an NGR based on state of charge

NGR documentation

- ISO proposes to follow established method of utilizing BPMs to provide detailed rules, procedures and examples consistent with the ISO tariff
- ISO does not create stand-alone model specific documentation but relies on BPMs
- 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%.
- Requires the resource to be at this initial SOC value or risk being awarded bids that create infeasible dispatches in the trading day
- 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 have suggested that NGRs should not be required to provide energy limits or have the ISO co-optimize the resource based on SOC.
- In this case, the SC would self-manage the SOC constraint in the real-time market to avoid non-performance conditions.
- ISO proposes to allow an option for NGRs that do not have SOC energy limits or chose to self-manage their SOC within resource energy limits, to not use energy limit constraints and SOC in co-optimization or dispatch
- NGRs that self-manage their SOC, must still provide telemetry SOC values for ISO resource monitoring.
- 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 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

On August 27, the ISO facilitated an ESDER DR baseline working group discussion

- MGO concepts being evaluated and considered as a new ISO-approved performance evaluation method by the ISO were shared
- Detail for an approved ISO Type 2 statistical sampling methodology was proposed

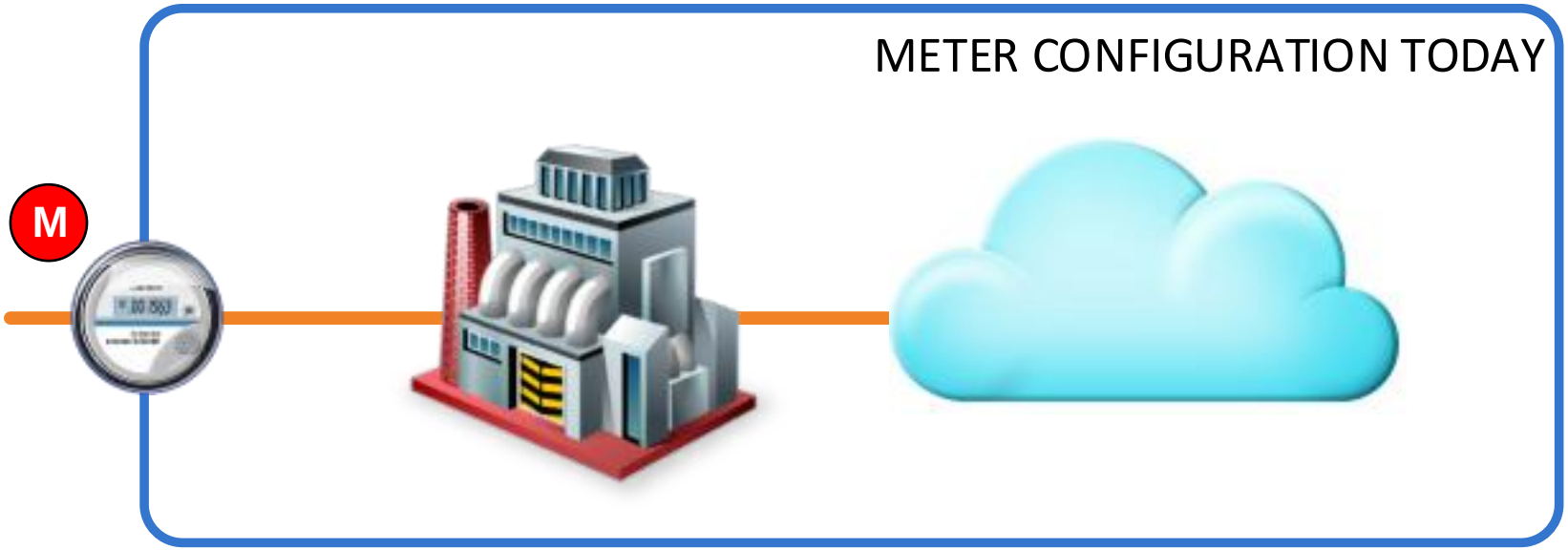
Working group feedback on the information shared was received and incorporated into what is included in the ESDER Sep 17 paper

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”

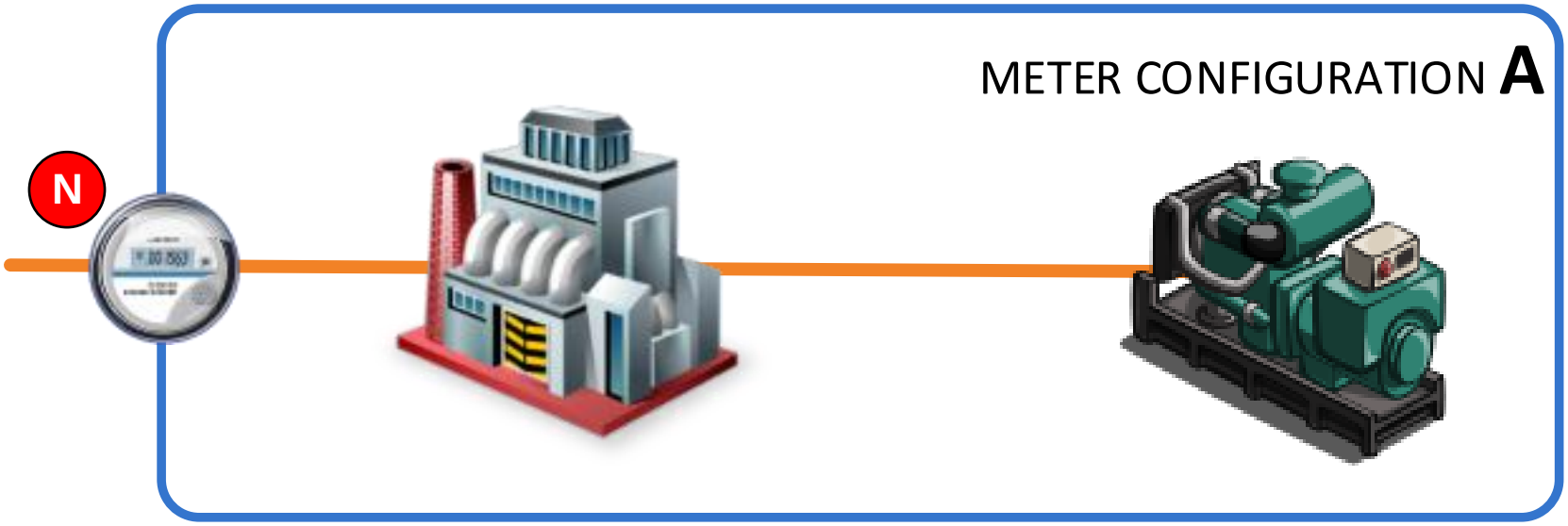
-NAESB business practices for Wholesale Demand Response

The ISO is unaware of load offsetting devices under today's PDR/RDRR resource metering configuration



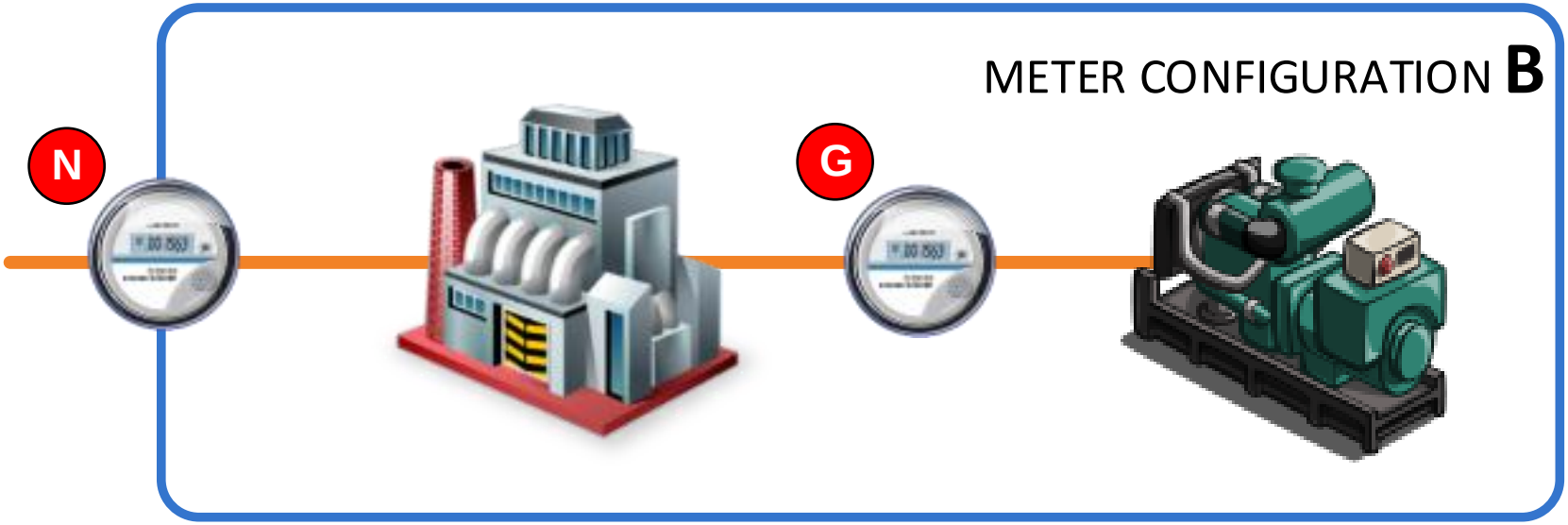
- With this configuration, there is no way to separate pure load from anything that may be offsetting the load
- The resource baseline and performance is measured using data from meter labeled M

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
  - may result in less accurate baseline and difficult to derive a reasonable resource performance

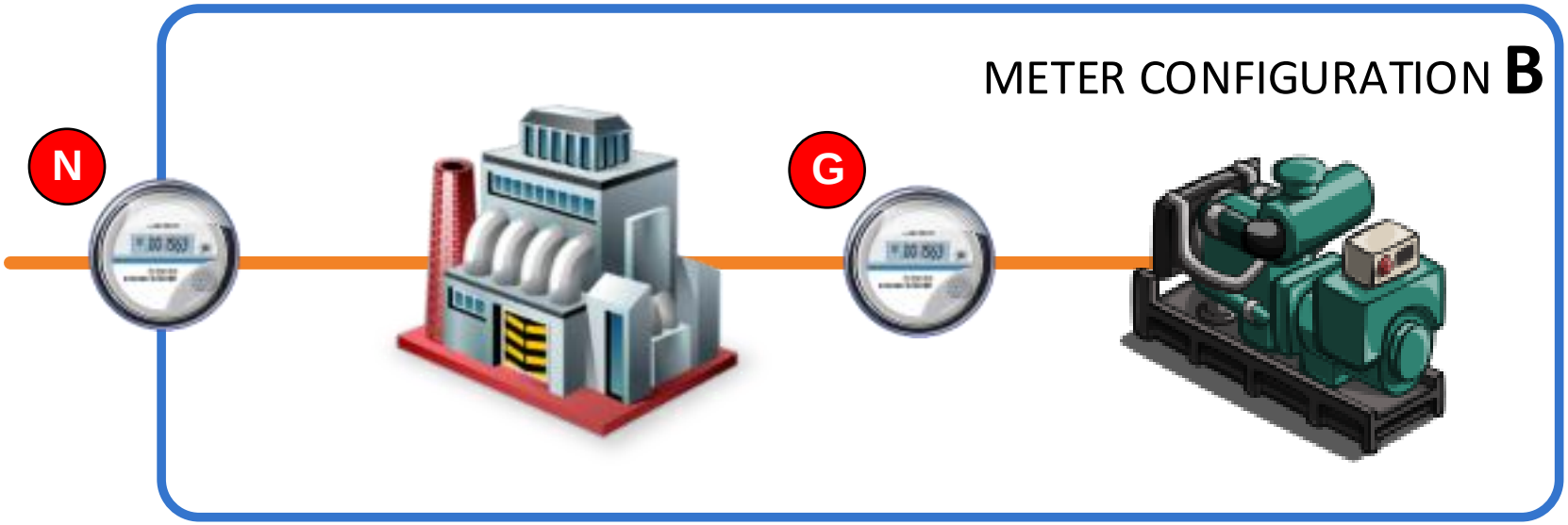
Metering configuration B adds a generation meter G enabling pure load to be derived



- Enables pure load to be derived as difference between the net meter (N) and the generation/device meter (G) = (N-G)
- For example, if N = 8MWh, G = -2MWh*
  - Virtual load meter quantity = L = N-G = (8)-(-2) = 10 MWh

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

Metering configuration B enables the use of meter generator output MGO performance evaluation method



- Enables load consumption offset by the generator/device to be measured
- Directly measure performance of generator output with MGO using the physical meter (G)

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

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Option B1 – load reduction only

Option B2 – generation offset only

Option B3 – load reduction and generation offset

Metering configuration – Option B1 (load reduction only)

Option B1 – load reduction only

- Only the load would be a registered asset in the PDR/RDRR
- ISO Type 1 baseline (B) developed using (N-G) metered quantities
- For ISO dispatch interval t,

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

Baseline (B) still developed with an ISO approved and tariff provisioned baseline (currently 10 in 10)

Metering configuration – Option B2 (generation offset only)

Option B2 – generation offset only

- Only the generation device would be a registered asset in the PDR/RDRR
- Metered Generator Output MGO
- For ISO dispatch interval t,

  Performance Measurement = Gt

Metering configuration – Option B3 (load and generation)

Option B3 – load reduction and generation offset

- Both the load and generation device would be registered assets in the PDR/RDRR
- Performance measurement would incorporate both load and generation offset
- For ISO dispatch interval t,

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

  Generation Performance Measurement = Gt

Total performance measurement would be the addition of resulting calculated performance measurements expressed as a generation quantity.

Current rules in place for PDR/RDRR 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 as an aggregate or individual asset cannot “export” energy to the grid
4. While not a currently addressed rule,
   - The ISO is proposing that the location and all performance methodologies utilized by assets within the location be within a single resource associated to a single demand response provider (DRP)

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

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

- Assuming ISO dispatch on Day 7
- Two scenarios: No Prior ISO Event Days and 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

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

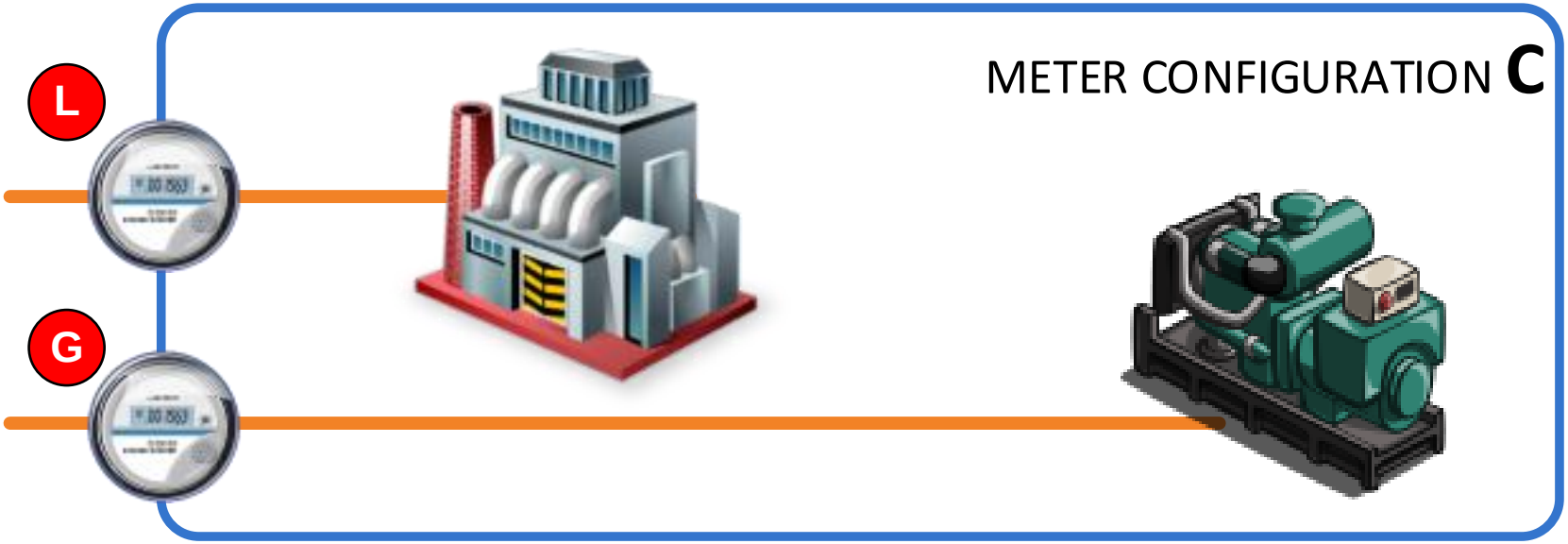
- Resulting performance evaluations based on the two scenarios for prior events days and the meter registration type used “N vs L”

		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**

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)	Baseline (N-G)	MGO (G)
Export Check	All Intervals N ≥ 0	All Intervals N ≥ 0	All Intervals N ≥ 0	All Intervals N ≥ 0

Metering configuration C is identical to meter configuration B (N-G replaced by L)



- Required if separate participants are independently managing the load and generation
- 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.

MGO intended for use of “infrequent loads”, such as backup generators

NAESB business practices for wholesale demand response were not written with “frequent” generation to offset load

- “rule-of-thumb” is generation subject to RICE-NESHAP* rules
- issues must be considered for “frequent” behind the meter generation use

** “The National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (“RICE NESHAP”) limits emissions of toxic air pollutants from stationary reciprocating internal combustion engines…The RICE NESHAP applies to stationary reciprocating internal combustion engines. Stationary engines are commonly used to generate electricity and to power pumps and compressors, and also in emergencies to produce electricity and pump water for flood and fire control. All sizes of stationary engines are covered by the rule.”*

--http://www.epa.gov/ttn/atw/icengines/docs/EPARegionalRICEcontacts.pdf

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 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?

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:

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

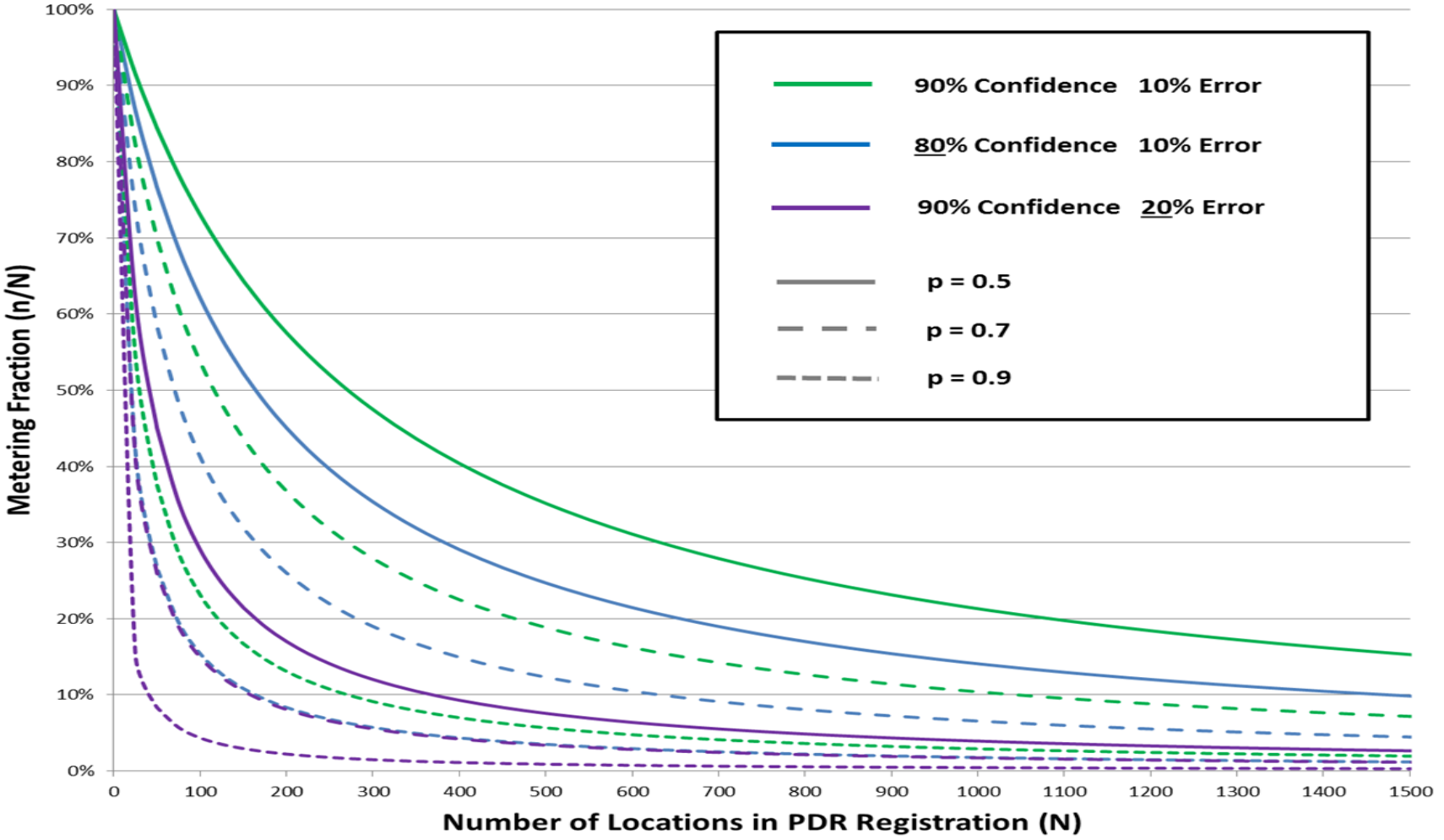
ISO Type 2 suggested formulation is employed by many ISOs and RTOs

The following table summarizes typical values used:

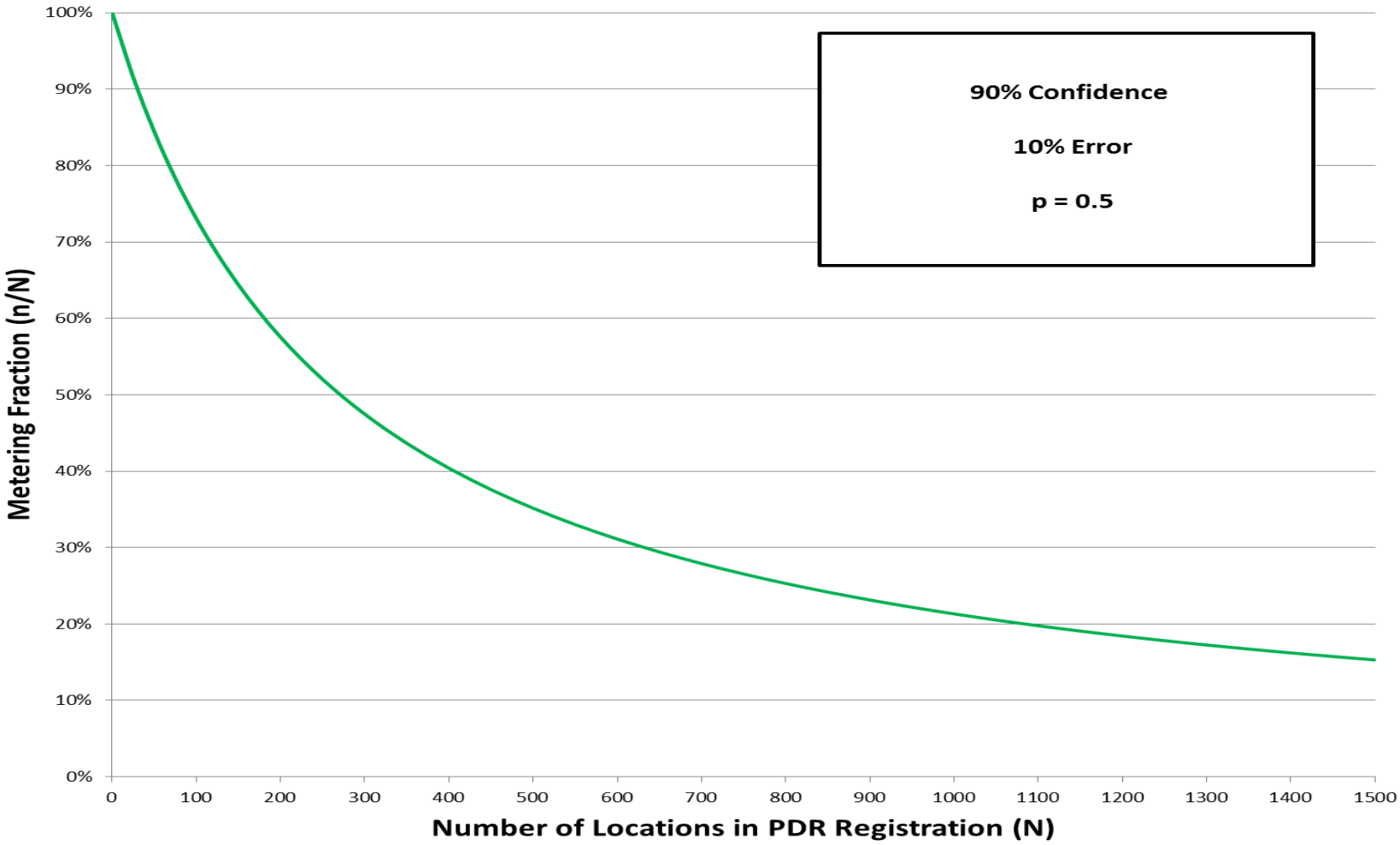
	Relative Precision Level	Level Of Confidence
PJM	10%	90% (z=1.645)
ISO New England	10%	80% (z=1.282)
NYISO	10%	90% (z=1.282)

- 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%

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

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 is considering a modification to 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

Type 1 – Distribution system service provision and wholesale market participation

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

- Proposal: ISO would 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 would not implement provisions at this time to address potential double payment
- May want to revisit 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
- Per assumption, 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

Next Steps

Request for stakeholder comments by October 9, 2015

Comments mailbox initiativecomments@caiso.com

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