PJM Order 2222 Use Case Update
Clarifications and Capacity, Energy, AS Walkthrough

Madalyn Beban

Market Design & Economics

DIRS

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- This Use Case review may reflect proposal items that have been revised or updated since the most recent PJM Draft Proposal presented at the **October 2021 DIRS**

  - Proposal items with updated requirements will be noted verbally or visually

  - There will be examples outlined in PJM Proposal slides not captured in this presentation

  - PJM still welcomes comments and questions on updated proposal items during this presentation for consideration

- This presentation covers the following updates
  - Extend October DIRS walkthrough of Use Cases 3 to energy and ancillary services market participation
  - Evaluate realism of examples: use numbers that would be available based on proposed registration, metering, telemetry
  - Explore heterogeneity vs. homogeneity distinctions by level
  - Comment on which market participation options are impacted by site resource types (BTMG, DR, FTM, continuous DER)

	Composition	Configuration	Sites	Use Case Goal
1	Homogeneous	Front of the meter	One	• Demonstrate size requirements and their implications.
2	Heterogeneous	Front of the meter	Multiple	• Demonstrate information exchange on an aggregate basis. • Walkthrough utility review with multiple distribution feeders.
3	Homogeneous	Behind the meter	One	• Demonstrate participation for sites co-located with retail load. • Illustrate rules where aggregates contain both potential for transmission injection and load reduction.
4	Heterogeneous	Behind the meter	One	• Demonstrate participation for sites co-located with retail load. • Illustrate rules where aggregates contain both potential for transmission injection and load reduction. • Highlight rules for multiple technology types where necessary.
5	Homogeneous	Behind the meter	Multiple	• Illustrate an aggregation of **many customer sites with BTM generation** wanting to participate in one or multiple markets.
6	Heterogeneous	Behind the meter	Multiple	• Illustrate an aggregation of **many customer sites, each with mixed technology types**, wanting to participate in one or multiple markets.
7	Homogeneous	Behind the meter	Multiple	• Illustrate an aggregation of **many distinct customer sites with load reduction** wanting to participate in one or multiple markets.

- Feedback: Examples should be based in data actually available via proposed registration and metering, telemetry rules

- Individual sites will have the following submit by aggregators

- Provides information in line with past examples

| Category	Data Requirements
Market Readiness	Max Load (kW) (Max hourly load over prior 12 months)
Market Readiness	Max Injection (kW) (Max injection amount based on interconnection process)
Market Readiness	Max Market Eligibility (Maximum amount that will be offered in the market)
Market Readiness	Load Reduction Method (Indicate load reduction capability (kw) for each load reduction capability (HVAC, Refrigeration, Generation, Lighting, Industrial Process, etc.))
Market Readiness	Generator Details (Nameplate capacity, inverter type, installation date)
Market Readiness	Peak Load Contribution (PLC) (Used to determine capacity nomination for DR related DER)
Market Readiness	Loss Factor (if applicable)

- Feedback: Explore heterogeneity vs. homogeneity distinctions
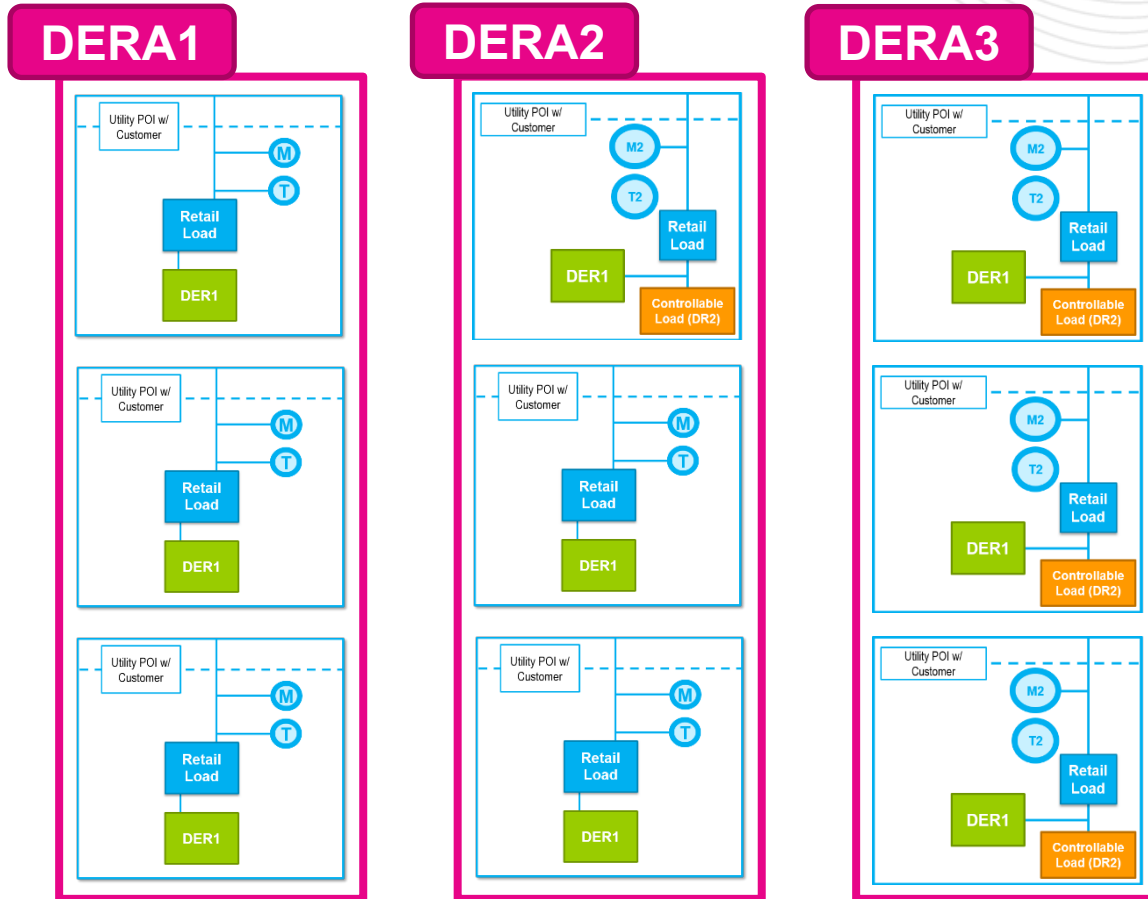
DERA1

DERA2

DERA3

- DERA1 = Homogeneous
- DERA2 = Heterogeneous within a site, Heterogeneous across sites = Heterogeneous
- DERA3 = Heterogeneous within a site, Homogeneous across sites = **Heterogeneous? Homogeneous?**

Is the distinction significant?

- A single distributed generator or ESR (single fuel type) at a…
- Single geographic site
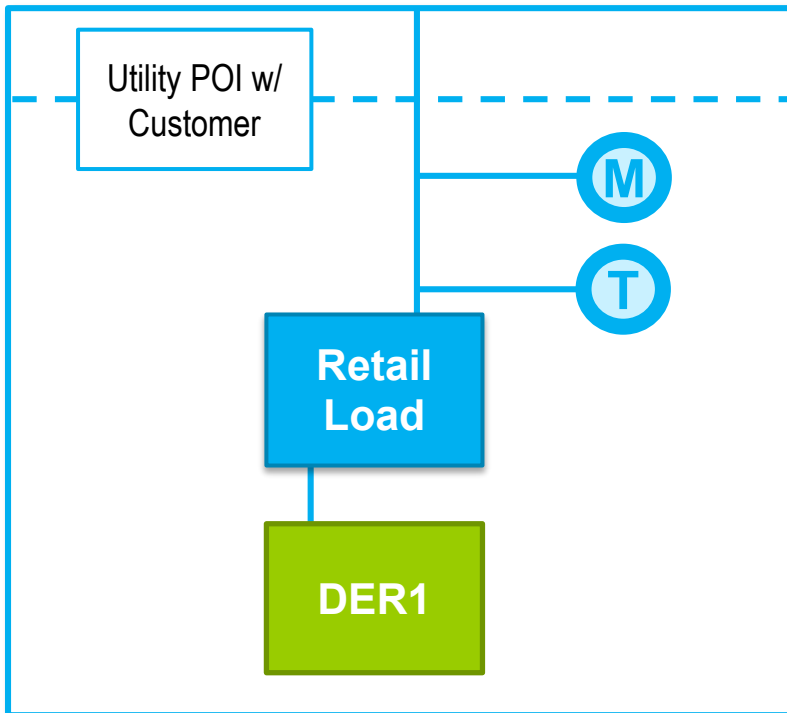- Participating as a single DERA
- Not co-located with retail load
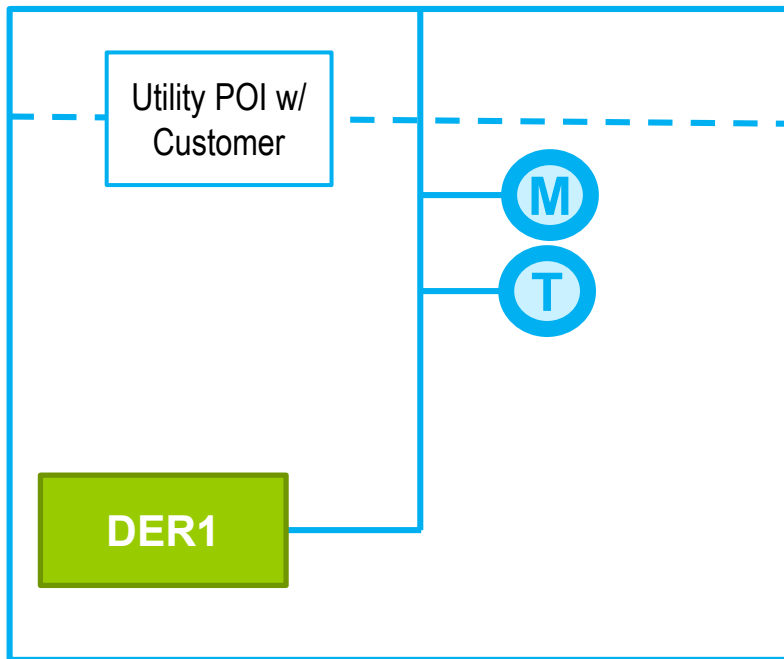
Area	Proposal
Energy Market Participation Model	DERA Model, Gen Model or ESR Model** depending on tech. ** DERA can schedule charging energy through the ESR Model.
Capacity Capability	Calculated Status Quo based on technology - Generator: ICAP * eFORd (either unit-specific, or class average—see M-22, or RAA Sch. 5 Sec. B respectively) - Solar, Wind, or Battery: ELCC
M&V / Testing	Leverage existing business rules: - Generator: 1 hour test for ICAP - Solar, Wind, or Battery: relevant data per M-21 and M-21a
PAI	Expected: Capacity Commitment * BR Actual: PowerMeter data + Ancillary adjustments
Locational Requirements	(Energy, Ancillary) Maps to 1 primary location in PJM (DERA of 1 DER will always meet locational requirements) (Capacity) Can aggregate with other DER for a DER CP Resource within defined LDAs
Metering (Settlements)	Hourly MW values at M meter are submitted to PowerMeter
Telemetry	RT telemetry required for applicable markets

- A single distributed generator or ESR (single fuel type) at…
- Multiple geographically distinct sites
- No sites in DERA co-located with retail load
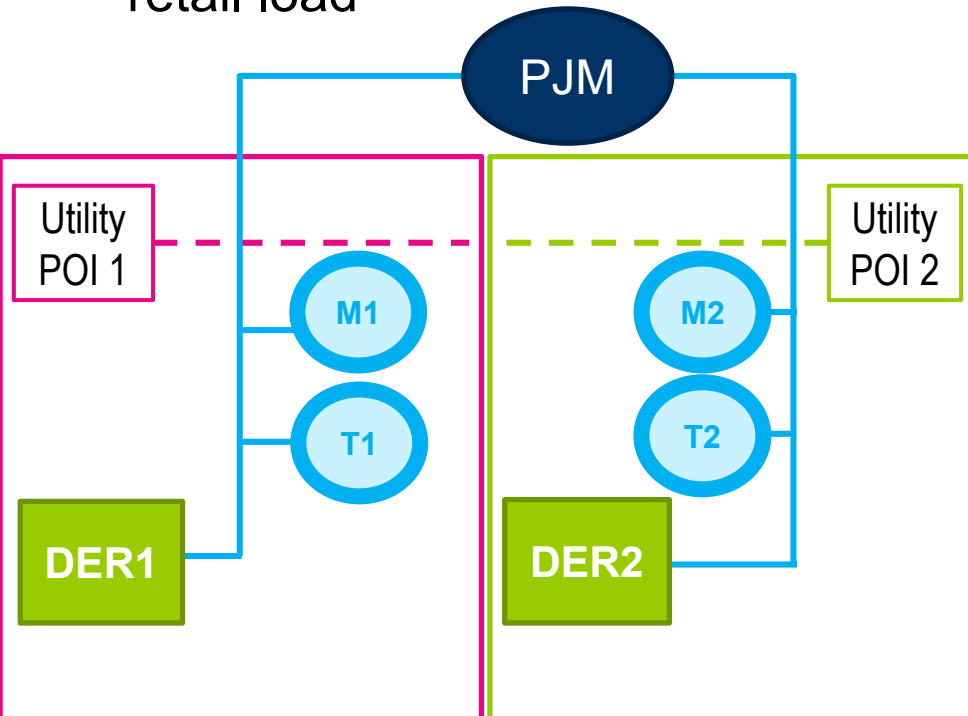
Area	Proposal
Energy Market Participation Model	Homogenous: DERA Model, Gen Model, or ESR Model, depending on technology present Heterogeneous: DERA Model
Capacity Capability	DERA Capability = DER1 + DER2 (prev. slide) Commitments allocated to DERA CP Resource level
M&V / Testing	M&V and testing at DER level. Leverage existing rules: - Generator: 1 hour test for ICAP - Solar, Wind, or Battery: relevant data per M-21, 21a
PAI	Expected: Capacity Commitment * BR at DER level, aggregated up to DERA and CP resource Actual: PowerMeter data for DERA + Ancillary adjustments
Locational Requirements	(Energy, Ancillary) Maps to 1 primary location in PJM (Ancillary Only) Can map across EDC footprint (Capacity) Can aggregate with other DER for a DER CP Resource within defined LDAs
Metering (Settlements)	Hourly MW values from each DER (M1 and M2) meter submitted to PowerMeter
Telemetry	RT telemetry required for DERA for applicable markets

Settlements

- A single distributed generator or ESR (single fuel type) at a…
- Single geographic site participating as a single DERA
- Site co-located with retail load

Area	Proposal
Energy Market Participation Model	DERA Model, or ESR model if energy storage
Capacity Capability **Details provided on the following slides.**	Option 1: Participate as BTMG Option 2: Participate as DR Option 3: FTM Option 4: Participate as Continuous DER
M&V / Testing	Based on technology type, see previous case
PAI	Expected: Capacity Commitment * BR Actual: PowerMeter data + Ancillary adjustments
Locational Requirements	(Energy, Ancillary) Maps to 1 primary location in PJM (DERA of 1 DER will always meet locational requirements) (Capacity) Can aggregate with other DER for a DER CP Resource within defined LDAs
Metering (Settlements)	Hourly MW values at M meter submitted to PowerMeter or DR Hub if relevant
Telemetry	RT telemetry required for DERA for applicable markets Individual resources do not need telemetry **(Ancillary Only) can submeter DER1 for regulation**

- **Retail Load = 4 MW max**

- **FPR = 1.1, PLC = 2 MW**
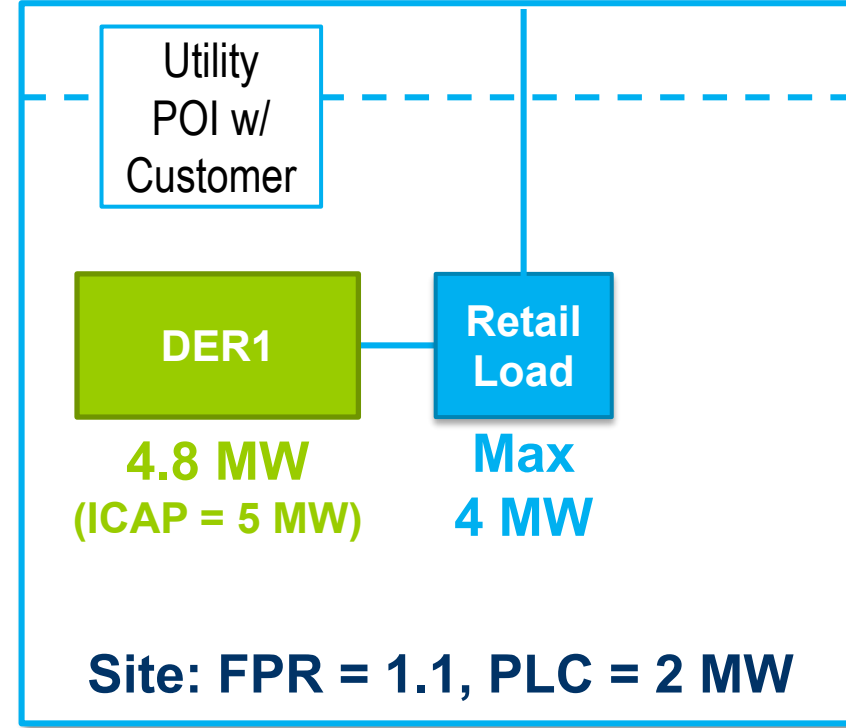
- **DER1 = 5 MW ICAP, 4.8 MW UCAP**

Option 1: BTMG net injections = 4.8 MW – 4 MW = **0.8 MW**

Option 2: DR load reduction = PLC * FPR = **2.2 MW**

Option 3: Bring resource front-of-meter = FTM = **4.8 MW**

Option 4: Continuous DER = **3.0 MW**

- Acknowledges all load reduction (PJM), net load (retail) and injections (PJM) in valuation

- Two part calculation
  - DR: 2 MW PLC * FPR factor = 2.2 MW capability
  - Injection: 4 MW max load, 4.8 MW UCAP = 0.8 MW capability

- Total Capacity Capability= 3.0 MW

- Add back to PLC for PJM dispatch

PJM

Utility POI w/ Customer

DER1

Retail Load

4.8 MW
(ICAP = 5 MW)

Max
4 MW

Site: FPR = 1.1, PLC = 2 MW

PAI

Expected: Capacity Commitment * BR
Actual: PowerMeter data + Ancillary adjustments

- **Retail Load = 4 MW max, not controllable**

- **FPR = 1.1, CBL = 4 MW**

- **DER1 = 5 MW ICAP, 4.8 MW UCAP**

DERA Model Participation

Option 1: BTMG net injections = Metered injections

Option 2: DR load reduction only = Metered reduction with CBL

Option 3: Bring resource front-of-meter = Generator submetered value (Load addback required)

Option 4: Continuous DER = Metered injection and/or reduction based on CBL

– e.g. CBL is 4 MW, and DER1 operates to 5 MW

– Meter sees net injection of 1 MW

– Energy credit = 1 MW injection + 4 MW CBL reduction = **5 MW**

PJM

Utility POI w/ Customer

DER1

Retail Load

5 MW

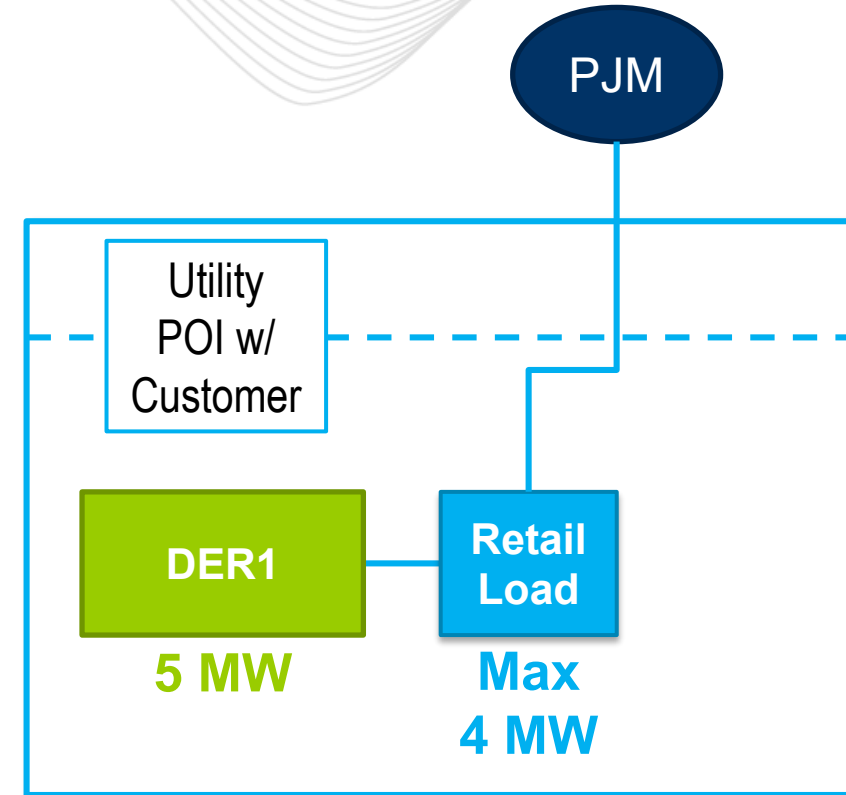Max 4 MW

Site: FPR = 1.1, CBL = 4 MW
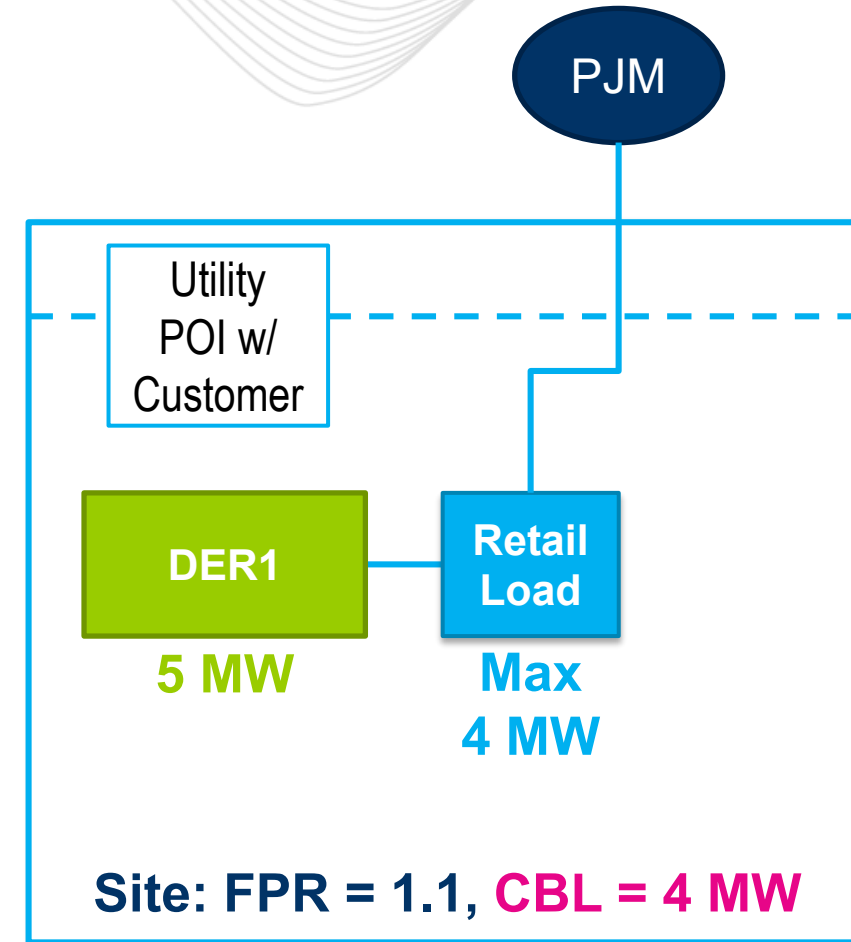
- **Retail Load = 4 MW max, not controllable**

- **DER1 = 5 MW ICAP**

- The full resource is capable of providing AS, but constraints exist based on technical capabilities and bidding parameters

Regulation

- Must provide symmetric capability

- Can be site metered or sub-metered

Reserves

- Provision in response to event

- Site meter determines response

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Market Readiness	Generator Details (Nameplate capacity, inverter type, installation date)

PJM

Utility POI w/ Customer

DER1

Retail Load

5 MW

Max 4 MW

- Next steps for Order 2222 use cases
  - Receive feedback
  - Illustrate walkthroughs of Use Cases 4+
  - Review aggregations of DERA for capacity, ancillary services
  - Discuss ESR Model for energy participation, ESR capacity valuation

Facilitator:
Scott Baker, scott.baker@pjm.com

Secretary:
Hamad Ahmed, hamad.ahmed@pjm.com

Presenter:
Madalyn Beban,
madalyn.beban@pjm.com

DERA Use Case Development

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com