ESR Settlements

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MIWG

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Agenda

- Balancing Energy Payments
  - Balancing Energy Payments for ESRs
  - Examples
- Regulation Revenue Adjustment Charge/Payment (RRAC/RRAP)
  - RRAC/RRAP for ESRs
  - Examples
- Day-Ahead Margin Assurance Payments (DAMAP)
  - Existing DAMAP Construct
  - DAMAP for ESRs
    - Energy Level Monitoring modes
- Next Steps

Previous Discussions

Date	Working Group	Discussion points and links to materials
08-04-16	MIWG	Initial discussion on alternatives for Energy Storage in the NYISO markets
09-29-16	MIWG	Market Design ideas discussion
11-29-16	MIWG	Presentation providing more detail on the Market Design that the NYISO will pursue
05-05-17	MIWG	Proposed modeling enhancements as the cornerstone of the Energy Storage Integration
07-19-17	MIWG	Eligibility criteria and RT scheduling logic for Energy Storage Resources (“ESRs”).
08-25-17	MIWG	Discussion on the Settlements logic for ESRs.
10-03-17	MIWG	Day-Ahead scheduling logic and Mitigation framework
11-02-17	MIWG	Aggregations in the ESR model
12-20-17	MIWG	Market Design Concept Proposal Summary
02-21-18	MIWG	Ancillary Services Treatment in the ESR Participation Model
04-26-18	MIWG	ESR Energy Level Monitoring
05-23-18	MIWG	ESR Participation Model: Settlements
06-19-18	MIWG	ESR Metering
06-25-18	MIWG	ESR Settlements: Charges for deviating from NYISO Base Points
07-10-18	MIWG	Energy Mitigation Measures for ESRs

Balancing Energy Payments

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Balancing Market Supplier Settlements

- If a Supplier's actual energy supplied in RT is different from its DAM schedule, the Supplier is required to either pay a charge or be compensated for the Energy Imbalance.
- With exceptions, Suppliers are generally compensated based on:(1)
  - Calculation for Generators not providing Regulation Service:

$$[Lower\ of\ (Actual, (RT\ schedule\ +\ Compensable\ Overgeneration)) - DAM\ schedule\ ] * RT\ LBMP$$

    - Compensable Overgeneration limited to 3% of the supplier's Normal Upper Operating Limit (UOL_N).
  - Calculation for Generators providing Regulation Service:

$$[Lower\ of\ (Actual, RTD\ Avg\ AGC\ basepoint) - DAM\ schedule\ ] * RT\ LBMP$$

1. Refer to Appendix B of Accounting and Billing Manual for exceptions

Balancing Market Settlements for ESRs

- **ESRs will be subject to balancing market settlements in both the injecting and withdrawing states.**
- **The current calculation works for ESRs in both injecting and withdrawing states.**
  - Calculation for ESR not providing Regulation Service:

$$[Lower\ of\ (Actual, (RT\ schedule\ + Tolerance) - DAM\ schedule\ )] * RT\ LBMP$$

Where,

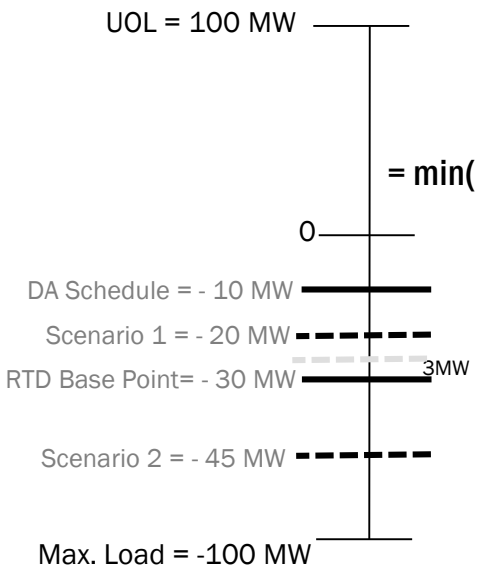
- If an ESRs RT schedule is to inject
  - Tolerance is 3% of the supplier's UOL_N.
- If an ESRs RT schedule is to withdraw
  - Tolerance is 3% of the supplier's $Max\ Load_N$.
    - » Note: For withdrawing- tolerance is 3% of the supplier's absolute value of Max Load.

- Calculation for ESR providing Regulation Service:

$$[Lower\ of\ (Actual, RTD\ Avg\ AGC\ basepoint) - DAM\ schedule\ ] * RT\ LBMP$$

Balancing Market Settlements for ESRs Example 1

	Values	Units
UOL	100	MW
Max Load	-100	MW
3 % of UOL	3	MW
3 % of Max Load	-3	MW
RT LBMP	5	$/MWh
DA Schedule	-10	MW
RTD Base Point	-30	MW
Regulation Schedule	0	MW
Scenario 1: Unit Actual Output	-20	MW
Scenario 2: Unit Actual Output	-45	MW



Settlements calc:

= min(Actual, (RTD BP+3% Abs Max Load)- DA Sch)* RT LBMP

Scenario 1:

=[min(-20,(-30+3))-(-10)]*5

=[-27+10]*5 = -$85

Scenario 2:

=[min(-45,(-30+3))-(-10)]*5

=[-45+10]*5 = -$175

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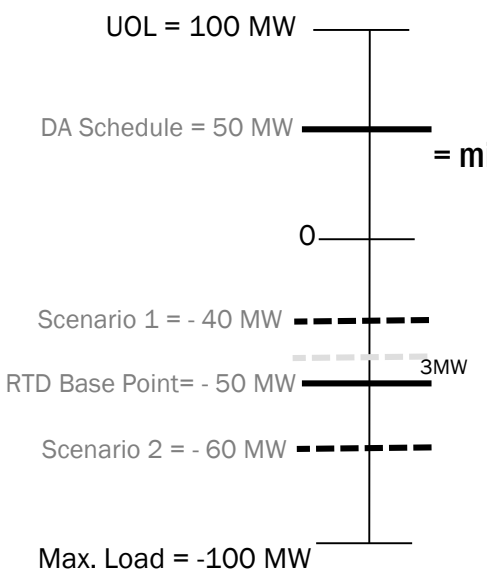
Balancing Market Settlements for ESRs- Example 2

	Values	Units
UOL	100	MW
Max Load	-100	MW
3 % of UOL	3	MW
3 % of Max Load	-3	MW
RT LBMP	5	$/MWh
DA Schedule	50	MW
RTD Base Point	-50	MW
Regulation Schedule	0	MW
Scenario 1: Unit Actual Output	-40	MW
Scenario 2: Unit Actual Output	-60	MW



Settlements calc:

= min(Actual, (RTD BP+3% Abs Max Load)- DA Sch)* RT LBMP

Scenario 1:

=[min(-40,(-50+3))-50]*5

=[-47-50]*5 = -$485

Scenario 2:

=[min(-60,(-50+3))-50]*5

=[-60-50]*5 = -$550

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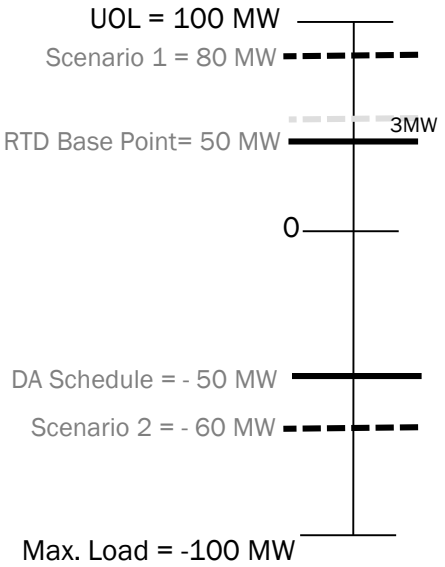
Balancing Market Settlements for ESRs- Example 3

	Values	Units
UOL	100	MW
Max Load	-100	MW
3 % of UOL	3	MW
3 % of Max Load	-3	MW
RT LBMP	20	$/MWh
DA Schedule	-50	MW
RTD Base Point	50	MW
Regulation Schedule	0	MW
Scenario 1: Unit Actual Output	80	MW
Scenario 2: Unit Actual Output	-60	MW



Settlements calc:

= min(Actual, (RTD BP+3% of UOL)- DA Sch)* RT LBMP

Scenario 1:

=[min(80,(50+3))-(-50)]*20

=[53+50]*20 = $2060

Scenario 2:

=[min(-60,(50+3))-(-50)]*20

=[-60+50]*20 = -$200

Regulation Revenue Adjustment Charges/ Payments

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Regulation Revenue Adjustments

- **Regulation Revenue Adjustments are designed to balance the Energy payments that Generators receive and the costs that Generators incur when providing Regulation Service.**
  - For any interval in which a Generator that is providing Regulation Service receives an AGC Base Point Signal that is different from its RTD Base Point Signal, it may be eligible to receive a Regulation Revenue Adjustment Payment (RRAP) or be required to pay a Regulation Revenue Adjustment Charge (RRAC).

- **The RRAC and RRAP are designed to ensure that a unit is economically indifferent to following an AGC basepoint that differs from its RTD basepoint.**

- **Generators are eligible for RRAC/RRAP when:**
  - Scheduled by RTD to provide Regulation service and;
  - Regulating up or down from their RTD basepoint.

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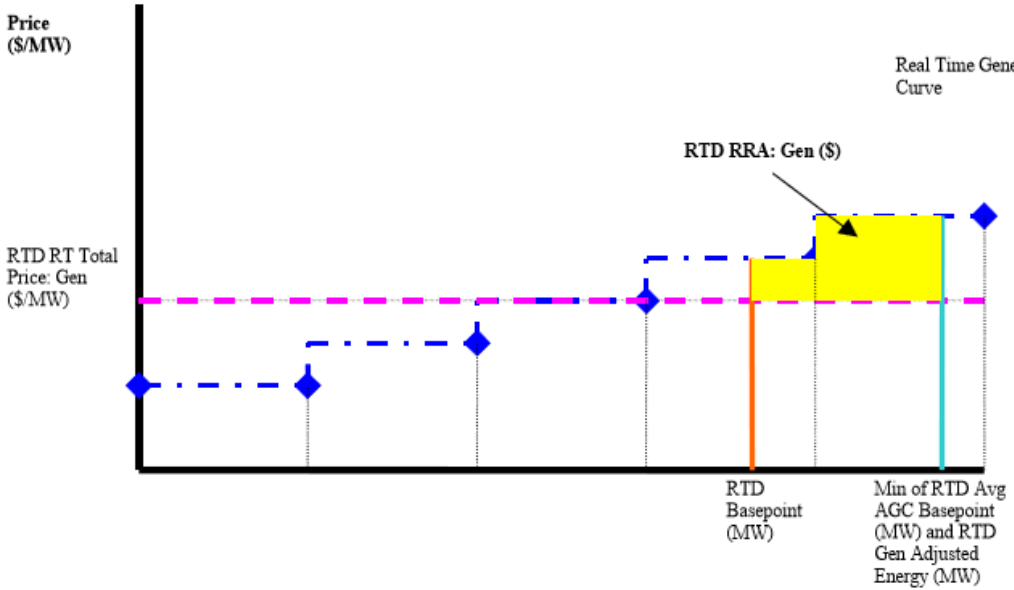
Regulation Revenue Adjustments for ESRs

- The NYISO proposes that ESRs be eligible for similar charges/payments when providing Regulation in either withdrawing or injecting states.
- The current formulas for RRAP/RRAC work for ESRs in both injecting and withdrawing states.

Regulation Revenue Adjustments

- **When the AGC Basepoint is greater than RTD Basepoint (i.e. Regulating Up)**
  - Calculation over a RTD interval:

$$[\{Bid\ Cost\ from\ RTD\ to\ lower\ of\ (Actual, AGC)\} - \{Gen\ LBMP * (lower\ of\ [Actual, AGC] - RTD)\}]$$



Results in:
RRAP: if Bid cost > Gen LBMP
RRAC: if Bid Cost < Gen LBMP

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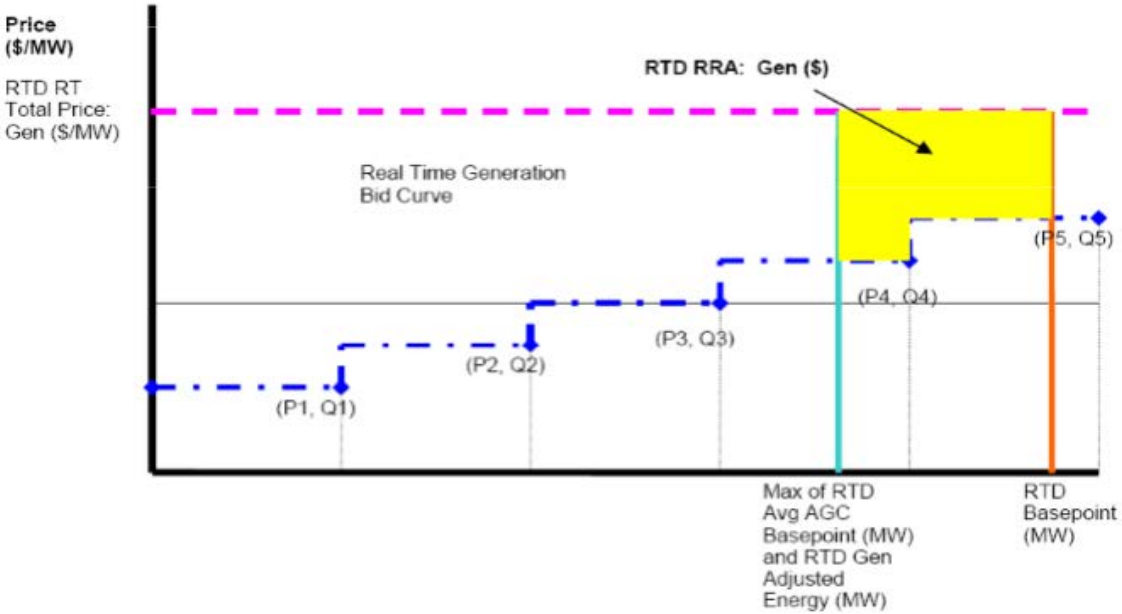
Regulation Revenue Adjustments

- **When the AGC Basepoint is less than RTD Basepoint (i.e. Regulating Down)**
  - Calculation over a RTD interval:

$$[\{Bid\ Cost\ from\ higher\ of(Actual, AGC)\ to\ RTD\} - \{Gen\ LBMP * (RTD - higher\ of[Actual, AGC])\} * -1]$$



Results in:
RRAP: if Bid cost < Gen LBMP
RRAC: if Bid Cost > Gen LBMP

Example 1- ESR Regulating Up

- Consider an ESR with the following parameters:

ESR Bid Cost:
-100 to -80 MW = $40
-79 to -40 MW = $50
-39 to 0 MW = $60
1 to 40 MW = $75
41 to 80 MW = $100
81 to 100 MW = $150

	Values	Units
RT LBMP at ESR	100	$
RTD Basepoint	30	MW
AGC Basepoint	40	MW
ESR Actual output	45	MW
RTD interval length	300	sec

- RTD Revenue Adjustment Calculation : Gen ($)

= (Bid Cost –LBMP Revenue Received) * Time weighting

= $\{Bid\ Cost\ from\ RTD\ to\ lower\ of (Actual, AGC)\} - \{Gen\ LBMP * (lower\ of [Actual, AGC] - RTD)\}$

= [{Bid cost from 30 to min(45,40)} –{$100*(min(45,40) – 30)}] * 300/3600

= [{10*$75} – {$100*(40-30)}] *300/3600

= [750 – 1000]*(0.0833) = **-$20.83** (RRAC)

- In this example, the ESR would pay a Regulation Revenue Adjustment Charge (RRAC) of $20.83.

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Example 2- ESR Regulating Down

- Consider an ESR with the following parameters:

ESR Bid Cost:
-100 to -80 MW = $40
-79 to -40 MW = $50
-39 to 0 MW = $60
1 to 40 MW = $75
41 to 80 MW = $100
81 to 100 MW = $150

	Values	Units
RT LBMP at ESR	100	$
RTD Basepoint	40	MW
AGC Basepoint	-40	MW
ESR Actual output	-10	MW
RTD interval length	300	sec

- **RTD Revenue Adjustment Calculation : Gen ($)**
  = (Bid Cost Saved–LBMP Revenue Not Received) * Time weighting
  = $[\{Bid\ Cost\ from\ higher\ of(Actual, AGC)\ to\ RTD\} - \{Gen\ LBMP * (RTD - higher\ of[Actual, AGC])\} * -1]$
  = [{Bid cost from max (-10,-40) to 40} –{$100*(40 - max(-10,-40))}] * 300/3600 *-1
  = [{10*$60 + 40*$75} – {$100*(40- (-10))}] *300/3600 *-1
  = [600 +3000 - 5000]*(0.0833)*-1 = **$116.66** (RRAP).

- In this example, the ESR would get paid a Regulation Revenue Adjustment Payment (RRAP) of $116.66

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Existing DAMAP Construct

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Day-Ahead Margin Assurance Payment(DAMAP)

- **If an eligible Supplier[1] buys out of a Day-Ahead Energy, Regulation Service or Operating Reserve schedule in a manner that reduces its Day-Ahead Margin, the NYISO provides that Supplier with a Day-Ahead Margin Assurance Payment, with limited exceptions[2].**
  - If an eligible Generator receives RT dispatch instructions that force it to buy-out off its DA position, the NYISO protects the Generator's DA margin.
  - DAMAP is calculated on an RTD interval level across products with payment (loss) netted across the hour.
- **By protecting Suppliers' Day-Ahead Margins, the NYISO incentivizes Suppliers to follow their Base Point instructions in real-time.**
  - This helps to ensure that Suppliers will respond flexibly to meet system demand in real-time.

1. Eligibility is determined pursuant to MST Attachment J, Section 25.2
2. Exceptions are noted in MST Attachment J, Sections 25.4 and 25.5

Day-Ahead Margin Assurance Payment(DAMAP)

- **The following Resources are eligible under current Tariff provisions[1]:**
  - (i) Self-Committed Flexible and ISO-Committed Flexible Generators that are either online and dispatched by RTD or available for commitment by RTC;
  - (ii) Demand Side Resources committed to provide Operating Reserves or Regulation Service;
  - (iii) Any Resource that is scheduled out of economic merit order by the ISO in response to an ISO or Transmission Owner system security need or to permit the ISO to procure additional Operating Reserves;
  - (iv) Any Resource internal to the NYCA that is derated or decommitted by the ISO in response to an ISO or Transmission Owner system security need or to permit the ISO to procure additional Operating Reserves; and
  - (v) Energy Limited Resources with an ISO-approved real-time reduction in scheduled output from its Day-Ahead schedule.

1. MST Attachment J, Section 25.2

Day-Ahead Margin Assurance Payment(DAMAP)

- **The following exceptions apply under current Tariff provisions, among other exceptions:**
  - Generators lagging behind RTD base point signals are not eligible for DAMAP for the interval in which they are lagging[1].
    - The penalty limit for under-generation is the tolerance described in Section 15.3A.1 of Rate Schedule 3-A of the MST, used in the calculation of persistent under-generation charges applicable to Generators that are not providing Regulation Service.
  - Supplier Derates:
    - When a Supplier requests and is granted a derate of its real-time Operating Capacity, but is otherwise eligible to receive DAMAP, the Supplier may receive a DAMAP up to a Capacity level consistent with its revised Emergency Upper Operating Limit or Normal Upper Operating Limit, whichever is applicable[2].
  - LESR's are only eligible for DAMAP for RT intervals during which the NYISO is not managing their energy levels[3].
    - During an out-of-merit situation or during regulation shortage intervals, NYISO does not utilize energy management for LESRs. Therefore, these resources are eligible for DAMAP during such intervals.

1. MST Attachment J, Section 25.4
2. MST Attachment J, Section 25.5
3. MST Attachment J, Section 25.3.3

ESR Participation and DAMAP Eligibility

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Energy Level Monitoring - Review

- **The NYISO proposes that ESRs be allowed to participate in one of two modes[1]:**

  1) NYISO-monitored energy level:

  - ESRs will be able to request that the NYISO monitor their energy level (SoC) constraints by awarding schedules that respect their Beginning Energy Level, Roundtrip Efficiency, Upper Storage Limit and Lower Storage Limit parameters.
  - ESRs participating in this mode will be preserved from receiving physically infeasible schedules throughout the dispatch day.
  - ESRs participating in NYISO Energy level monitoring will be required to offer as ISO-Committed Flexible.

  2) Self-monitored energy level:

  - ESRs will be responsible for managing their energy level (SoC) constraints through their offers.
  - It will be possible for ESRs participating in this mode to receive physically infeasible schedules during the dispatch day.

1. See 4/26/18 MIWG Presentation: ESR Participation Model: Energy Level Monitoring for additional information.

Energy Level Monitoring - Review

- **ESRs will be able to toggle between Self and NYISO-monitored modes between markets.**
  - ESRs can offer as Self-Monitored in the DAM and NYISO-monitored in RTM.
  - ESRs can offer as NYISO-Monitored in the DAM and Self-monitored in RTM.
- **ESRs will not be able to change modes between hours of the DAM.**
  - Because the DA optimization window is 24 hours and only one evaluation per day, the State of Charge (SoC) constraint will be optimized over a 24 hour horizon. Therefore, an ESR will not be able to toggle between modes in the DAM.
- **ESRs will be able to change modes between hours in the RTM.**

Self-Monitored ESRs: DAMAP Eligibility

- **The NYISO proposes that ESR's participating as Self-monitored be eligible to receive DAMAP when offering as Self-Committed Flexible or ISO-committed Flexible Generators that are either online and dispatched by RTD or available for commitment by RTC.**
  - Consistent with current treatment of Generators.
  - Because the NYISO's market optimization software will not consider State of Charge (SoC) for Self-monitored ESR's, existing eligibility criteria will require few changes.
  - Existing incentives to offer flexibly in RT will remain unchanged.
  - Calculation must be revised to calculate DAMAP during withdrawal periods.

Self-Monitored ESRs: DAMAP Eligibility

- If an ESR offers as Self-Monitored in DAM, it will be ineligible for DAMAP for any hours in which it offers as NYISO-Monitored in RT, as well as, two hours preceding and two hours following that hour.
- This is consistent with the eligibility rules for Generators that offer less flexibly in the RTM than in the DAM.
  - For example, when a generator's incremental energy bid in RT exceeds the bids it submitted in the DAM, it becomes ineligible for DAMAP during the hour in which it increased its incremental energy bid, and the two hours before and after those hours.

NYISO-Monitored ESRs: DAMAP Eligibility

- **The NYISO proposes that ESR's participating as NYISO-monitored not be eligible to receive DAMAP.**
  - However, if the unit is committed OOM for reliability reasons- it will be eligible for DAMAP during that time period.
    - SoC optimization might result in the ISO dispatching an ESR at a lower level in RT than its DA schedule.
- **Consistent with treatment of LESR's, which also receive NYISO energy-level management[1].**

1. MST Attachment J, Section 25.3.3

DAMAP Eligibility for ESRs

Day-Ahead Mode	Real Time Market Mode	Eligible for DAMAP
NYISO-monitored	Self-monitored	No
	NYISO-monitored	No
Self- monitored	Self-monitored	Yes
	NYISO-monitored	No(for that hour, previous two hours and next two hours)

Next Steps

- July – August 2018:
  - Continue Discussions at MIWG on key topics:
    - Settlements- DAMAP and BPCG examples
    - Review of ESR scheduling parameters and bid modes
    - Capacity Market Participation
    - DA and RT market prototyping efforts
    - Mitigation rules
    - Credit implications
    - Consumer impact analysis

- July - September 2018:
  - Draft tariff language and discuss with stakeholders.

- September-November 2018:
  - Prepare and finalize FERC Order No. 841 compliance filing.

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Questions?

We are here to help. Let us know if we can add anything.

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- Planning the power system for the future
- Providing factual information to policy makers, stakeholders and investors in the power system

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