EIM Offer Rules Workshop
Resource Sufficiency Test and EIM Mitigation

Stakeholder Workshop

July 19, 2018

Megan Poage & Brittany Dean

Market Design Policy

Agenda

Time	Topic	Presenter
10:00 – 10:15 am	Welcome	Kristina Osborne
10:15 – 11:00 am	Resource Sufficiency Test: Training & Enhancements	Craig Williams, Rahul Kalaskar
11:00 am – Noon	Resource Sufficiency Test: Policy	Megan Poage Don Tretheway
Noon – 1:00 pm	Lunch	
1:00 – 1:15 pm	EIM Mitigation background	Brittany Dean
1:15 – 1:35 pm	Department of Market Monitoring	Eric Hildebrandt
1:35 – 2:05 pm	Powerex	Mark Holman
2:05 – 3:15 pm	Mitigation issues Review CCDEBE policy ISO DEB analysis	Gabe Murtaugh Brittany Dean Gabe Murtaugh
3:15 – 3:55 pm	Discussion of issues	Brittany Dean Gabe Murtaugh
3:55 – 4:00 pm	Next steps	Brittany Dean

The ISO has responded to stakeholder comments and questions from the April 30th workshop.

- Questions and comments have been categorized:
  - Training
  - Data/Enhancements
  - Policy

- Responses to questions and comments were included in the *Real-Time Resource Sufficiency Test: Stakeholder Comments Matrix* posted to the ISO website.

  http://www.caiso.com/Documents/StakeholderQuestions-ISOResponses-Apr30-2018-EIMOfferRulesTechnicalWorkshop-Real-TimeSufficiencyTest.pdf

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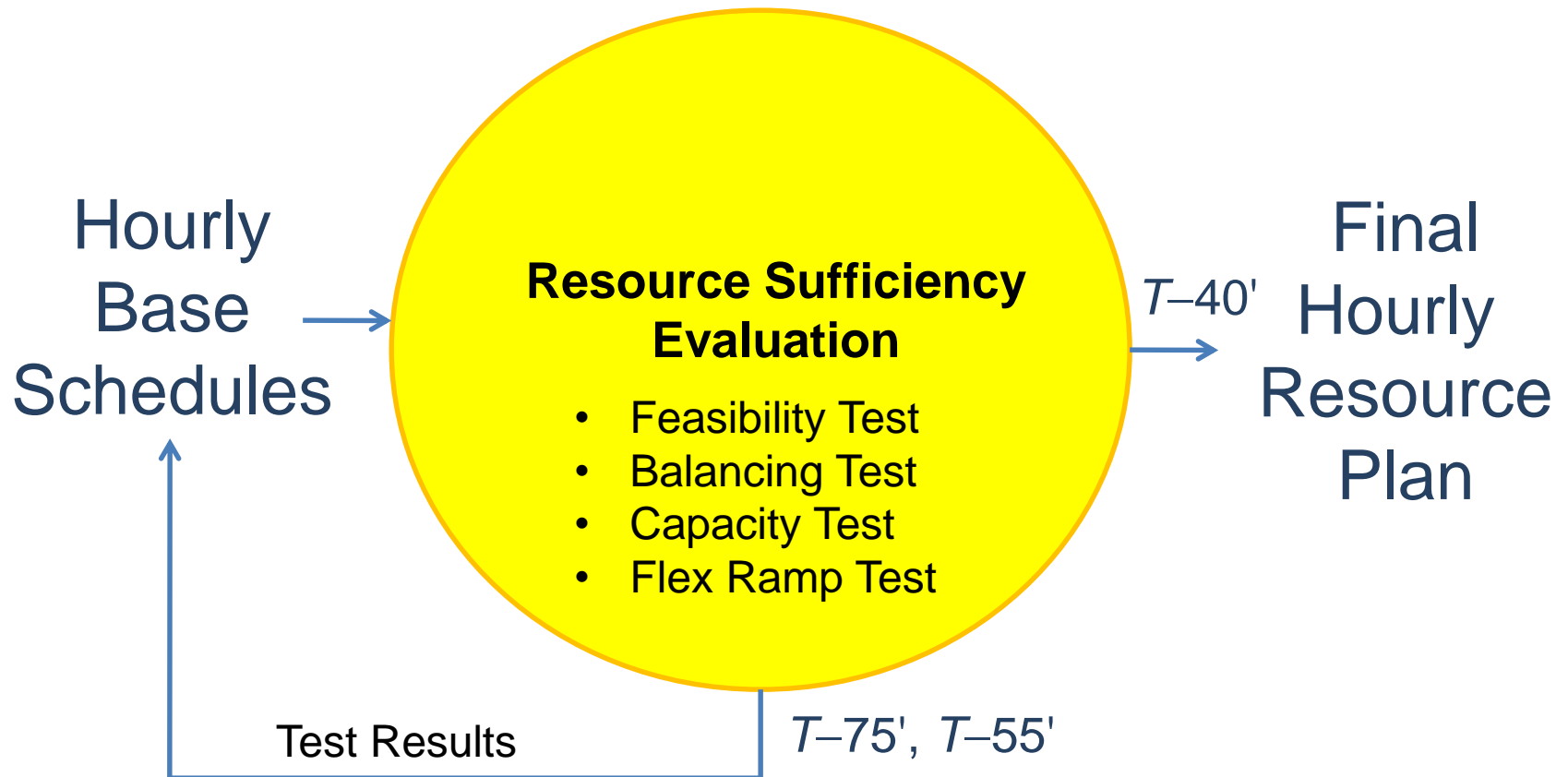
RESOURCE SUFFICIENCY TEST: TRAINING

Craig Williams
Lead Client Trainer

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ISO EXTERNAL

Why Perform Resource Sufficiency Evaluation

- Resource sufficiency evaluation addresses <u>real-time</u> leaning prior to the start of each EIM trade hour

- Over and Under-scheduling penalties provide incentives to <u>balance</u> base schedules

- Flexibility sufficiency tests ensure that EIM entities have sufficient ramping capability to meet forecasted uncertainties and variability in load and resource performance.

  This calculation includes EIM Diversity Benefit and is calculated <u>independently</u> before the start of the market optimization across the EIM footprint.

Energy Imbalance Market Overview

Hourly Base Schedules

Resource Sufficiency Evaluation

- Feasibility Test
- Balancing Test
- Capacity Test
- Flex Ramp Test

$T-40'$ Final Hourly Resource Plan

Test Results $T-75',\ T-55'$

Feasibility Test

CAISO performs a Day-Ahead and Base Schedule power flow feasibility test on the day before the Operating Day.

- If the Day-Ahead Market or the Base Schedules submitted for the Real-Time Market result in no transmission violations in the EIM Entity Balancing Authority Area, then the feasibility test passes.

- Transmission constraint violations result in a failed feasibility test.

Balancing Test

If an EIM Entity elects to use the ISO demand forecast:

- BAA base schedules (for EIM generating and intertie resources) are compared to the ISO's demand forecast to determine the BAA imbalance.

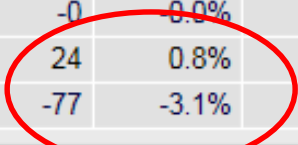 If the BAA imbalance is within 1% = PASS

  If the BAA imbalance is greater than 1%

  Then the EIM balancing authority will be subject to over-scheduling or under-scheduling penalties if its actual load is five percent more or less than its load Base Schedule for that hour.

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Base Balance Viewer

HR	BAA	Aggregate BS	Aggregate BS Deviation	Available 60' Flexibility		Demand Forecast (DF)	Base - DF		Gen
				Up	Down		MW	%	
01		2,168				2,173	-4	-0.2%	
02		2,021				2,021	0	0.0%	
03		1,925				1,925	-0	-0.0%	
04		1,895				1,895	-0	-0.0%	
05		1,934				1,934	-0	-0.0%	
06		2,056				2,056	-0	-0.0%	
07		2,230				2,230	-0	-0.0%	
08		2,450				2,450	0	0.0%	
09		2,606				2,606	0	0.0%	
10		2,756				2,757	-0	-0.0%	
11		2,843				2,843	-0	-0.0%	
12		2,943				2,943	-0	-0.0%	
13		3,009				3,011	-2	-0.1%	
14		3,089				3,093	-4	-0.1%	
15		3,178				3,180	-2	-0.1%	
16		3,222				3,222	0	0.0%	
17		3,272				3,272	0	0.0%	
18		3,311				3,311	-0	-0.0%	
19		3,262				3,261	0	0.0%	
20		3,200				3,200	-0	-0.0%	
21		3,124				3,125	-0	-0.0%	
22		3,098				3,099	-0	-0.0%	
23		2,905				2,881	24	0.8%	
24		2,454				2,531	-77	-3.1%	

Balancing Test

If the EIM Entity elects their own demand forecast:

- Then the EIM balancing authority will always be subject to over-scheduling or under-scheduling penalties if its actual load is five percent more or less than its load Base Schedule for that hour.

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Capacity Test

Prior to each hour, the ISO administers a capacity test if an EIM balancing authority uses the ISO forecast and does not balance that forecast exactly with submitted Base Schedules.

There must be a sufficient EIM Participating Resource capacity bid range in the EIM through incremental or decremental energy bids above or below the Base Schedules to meet the imbalance, positive or negative.

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Capacity Test

Sufficient Capacity = Pass

If the EIM balancing authority fails the capacity test, it will automatically fail the flexible ramp sufficiency test. The capacity test is also applicable to the CAISO BAA.

Insufficient capacity also results in the EIM transfers being limited to the value from the last 15-minute interval of the previous hour's dispatch.

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Flexible Ramping Sufficiency Test (FRST)

Data used:

- Initial schedules at $T-7.5'$
- EIMPR energy bids and ramp rates
- Intertie Transactions
- 15' Flexible ramping up/down requirements
  - Change in demand forecast
  - reduced by any prorated EIM diversity benefit
  - reduced by any credit for net outgoing/incoming EIM transfer at $T-7.5'$
  - reductions limited by the available net import/export capability

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Flexible Ramping Sufficiency Test

Cumulative test for meeting flexible ramping requirements for each 15' interval of the hour
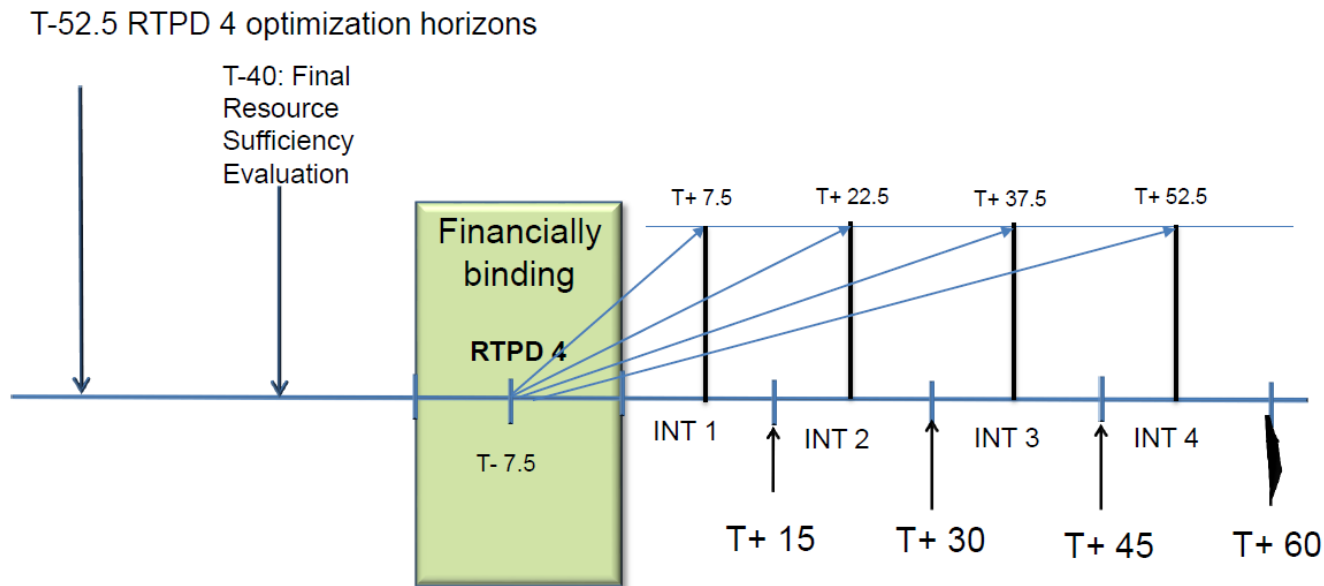
Test passes if <u>all</u> four cumulative tests pass

Test fails if <u>any</u> of the four cumulative tests fail

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Flex Ramp Sufficiency Test – Requirement has six components (1 of 2)

➢ **Net Demand Uncertainty** – Stays same for all Tests

➢ Forecasted Change in Demand

➢ Diversity Benefit Factor

➢ Net Import Capability

➢ Net Export Capability

➢ Flexible Ramp Credit

🟥	Increase requirement
🟦	Either increase or reduce requirements
🟩	Reduce requirement

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Flex Ramp Sufficiency Test – Requirement has six components (2 of 2)

$$Flex\ Ramp\ Up\ Requirement\ (T) = \Delta Demand(T)$$
$$+\max[(Flex\ Up\ Uncertainty - Net\ Import\ Capability),$$
$$((Diversity\ Benefit\ Factor * Flex\ Up\ Uncertainty)$$
$$- Flex\ Ramp\ Up\ Credit)]$$

$$Flex\ Ramp\ Down\ Requirement\ (T) = \Delta Demand(T)$$
$$+\max[(Flex\ Dn\ Uncertainty - Net\ Export\ Capability),$$
$$((Diversity\ Benefit\ Factor * Flex\ Dn\ Uncertainty)$$
$$- Flex\ Ramp\ Dn\ Credit)]$$

🟥	Increase requirement
🟦	Either increase or reduce requirements
🟩	Reduce requirement

Flex Ramp Sufficiency Test – Checking test results

EIM > System > Base Schedule Test Results > Flex Ramp Sufficiency Test

BAA [ALL] ▾ End Time [ALL] ▾ Test [ALL] ▾ **Apply** **Reset**

▼ **Flexible Ramping Capacity Sufficient Test**

BAA	Start Time	End Time	Test Type	Test Status	Ramp Type	Capacity	Requirement	Credit	Export Capacity	Import Capacity	Insufficiency MW	Insufficiency Percentage	Diversity Benefit
	07/18/2018 09:00	07/18/2018 10:00	1	PASS	UP			63.33			0.00	0.00	38.00
	07/18/2018 09:00	07/18/2018 10:00	1	PASS	DN			0.00			0.00	0.00	53.54
	07/18/2018 09:00	07/18/2018 10:00	2	PASS	UP			63.33			0.00	0.00	38.00
	07/18/2018 09:00	07/18/2018 10:00	2	PASS	DN			0.00			0.00	0.00	53.54
	07/18/2018 09:00	07/18/2018 10:00	3	PASS	UP			63.33			0.00	0.00	38.00
	07/18/2018 09:00	07/18/2018 10:00	3	PASS	DN			0.00			0.00	0.00	53.54
	07/18/2018 09:00	07/18/2018 10:00	4	PASS	UP			63.33			0.00	0.00	38.00
	07/18/2018 09:00	07/18/2018 10:00	4	PASS	DN			0.00			0.00	0.00	53.54

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Question/Comment	ISO Response
Is the resource sufficiency test equitably tested and enforced upon all EIM BAAs?	Yes. The test is applied equally to all BAAs that are participating in the EIM. There are no specific rules for individual BAAs.
What is the purpose of the RST? Is it to prevent leaning on other BAAs and/or ensure adequate ramping capacity?	The RST ensures EIM entities do not lean on others' generation capacity, generation flexibility, and transmission. Besides ensuring entities offer their own generation into the EIM, the RST ensures entities enter into forward bilateral contracts to make up for any shortfalls (including purchasing any needed transmission).

Question/Comment	ISO Response
Improve accuracy of the resource sufficiency requirement to ensure there is no leaning on other EIM entities.	Yes. The intent of the RST is to ensure each EIM BAA carries adequate capacity to maintain the balance between generation and load. This prevents one EIM entity from leaning on another. The accuracy of the requirement will be addressed in the DAME initiative.
Should ABC count towards the requirement?	No. The resource sufficiency test is intended to determine if there are adequate economic bids to enable the market to meet imbalance needs of each Balancing Authority Area (BAA). Available balancing capacity (ABC) can only be dispatched if the BAA is violating its power balance constraint. ABC is used for reliability needs after all effective economic bids in the EIM have been exhausted.

Resource Sufficiency Test training questions (3 of 4):

Question/Comment	ISO Response
When a BAA fails the RST, do the transfer freeze completely or are they locked in one direction?	When a BAA fails the RST, the transfers are capped in the direction in which the entity failed. For example, if an EIM BAA does not have adequate generation to serve load, the imports will be capped at the previous schedule. If an EIM BAA has excess generation in comparison to load, the exports will be capped at the previous schedule.
The capacity test should be applied to all EIM entities in all hours.	The capacity test is applied to all entities for all hours. Failing the capacity test results in the automatic failure of the flexible ramping test.

Question/Comment	ISO Response
The resource sufficiency tests are needlessly challenging for EIM Entities to pass: • Involve compressed timelines • Capacity test comingles concepts that should be evaluated separately	Although the calculation for the requirement is complex, when the tests were originally developed it was assumed that EIM entities would bid all available EIM participating resources. The compressed timeline occurs as a result of the publication of the FMM. To address this, the ISO freezes the load and VER forecast used in the test to ensure the target doesn't move. This was implemented on 12/12/2017. The objective of the balancing test is to determine if the EIM Entity will be subject to the under-over scheduling penalty. The capacity test ensures there are sufficient economic bids to meet the demand forecast and historical intertie declines.

EIM enhancements are presented during the ISO RUG meetings.

- The Release Users Group (RUG) reviews upcoming enhancements
  - Details are documented in Business Requirement Specification (BRS) documents

- Bi-weekly EIM Operations meeting

- The ISO is working on process improvements to ensure all EIM entities are aware of upcoming changes
  - Ensure EIM entities understand impacts and are aware of implementation dates

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RESOURCE SUFFICIENCY TEST: ENHANCEMENTS & DATA

Rahul Kalaskar
Manager, Market Validation & Analysis

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The ISO has implemented the following RST enhancements:

- Flexible Ramping Sufficiency Test Updates:

  - Freeze load and VER forecast between T-55 and T-40 test (implemented on 12/12/17)

  - Flexible Ramp requirements for BAAs are now posted on OASIS (implemented on 12/22/17)

  - Resource Ramp Capacity Information is now posted on CMRI (implemented on 4/4/18)

  - Net import calculation improvement when EIM entity fails flex ramp test for multiple intervals (implemented on 6/12/18)

Resource Sufficiency Test data/enhancement questions (1 of 2):

Question/Comment	ISO Response
When was the net import/export solution implemented and how does it affect the EIM?	This was implemented on 6/12/18. The intent of the fix was to improve the calculation of net import capability when an EIM entity fails the flex ramp test for two consecutive hours. The net import capability is now calculated using the EIM transfer limit which is not impacted by the flex ramp test failures from previous hours.

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Resource Sufficiency Test data/enhancement questions (2 of 2):

Question/Comment	ISO Response
The ISO should publish metrics and reporting related to the resource sufficiency test and requirement for all EIM entities (including the ISO).	The ISO will begin publishing these metrics in either the monthly reports or the MPPF slides.
The ISO should complete data analysis to compare the RST requirement to the amount of uncertainty that materialized to evaluate if the FRST is meeting the P95 standard.	The ISO will take this request into consideration and provide a metric in the MPPF slides or one of the EIM discussions.
Ensure EIM entities are correctly passing or failing the RST based on the 95% confidence level.	Additional discussion is needed to determine a methodology that all entities agree to. The ISO will coordinate a meeting for this.

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RESOURCE SUFFICIENCY TEST: POLICY

Megan Poage
Sr Market Design Policy Developer

California ISO

Question/Comment	ISO Response
When an entity fails the RST, freeze transfers for the corresponding interval as opposed to the entire hour.	This will be implemented with the fifteen-minute scheduling granularity in the Day-Ahead Market Enhancements (DAME) initiative.
The RST requirement should be published ahead of time to allow adequate response by BAA.	The requirement considers the final 15-minute schedule of the preceding hour; therefore, the requirement isn't known until after the market run and cannot be published any sooner than it currently is. The intent is to determine if sufficiency resources were economically bid into the EIM. The intent of the RST was not to facilitate "strategic" participation in the EIM.

Resource Sufficiency Test policy questions (2 of 5):

Question/Comment	ISO Response
Are the consequences of failing the RST adequate?	Yes. Freezing transfers for the corresponding interval (as implemented with DAME) prevents BAA from participating in the EIM for that interval. Stakeholders examined a penalty during the EIM Y1 initiative. The penalty would need to be too high and therefore was not a feasible option.
Uncertainty of renewable resources should be taking into consideration when determining the RST requirement.	The flexible ramping requirement currently uses historical net load (load – wind – solar) to account for uncertainty at a net level. The ISO agrees improvements can be made. These are proposed in the DAME initiative and include potential uncertainty based on the amount of load, wind and solar.

Resource Sufficiency Test policy questions (3 of 5):

Question/Comment	ISO Response
Credits should be allocated ahead of time so the BAA can anticipate balance capacity requirement reduction.	Credits (inclusion of imports/exports to reduce the RST requirement) can only be allocated once the market has run; it is impossible to determine the appropriate amount of credits prior to the market run.
Import/export transfer limits that are used to set the requirement should be based on expected future transfer capacity.	Future capacity can change (e.g. forced transmission outages). Therefore, it is not appropriate to forecast future transmission capacity.

Question/Comment	ISO Response
Apply the RST equitably by not counting imports if physical generator and transmission are not identified.	This issue is limited to hourly block schedules. All EIM entities have hourly imports/exports that are used in the determination of the requirement at T-40. 15-min dispatchable imports/exports must be tagged with a transmission profile at T-40. If there is no transmission profile, the schedule is reduced to 0 MW and therefore does not impact the RST.
RST should incorporate imbalance conformances that occur systematically.	Imbalance conformances can change by interval and therefore cannot be guaranteed to be predictable. The ISO is addressing systematic conforming and making improvements to the conforming process.

Resource Sufficiency Test policy questions (5 of 5):

Question/Comment	ISO Response
RST should be measured relative to base schedules instead of last interval of previous hour.	Using base schedules would result in inaccurate ramp capability because the balancing test does not ensure base schedules are ramp feasible between hours.
RST should be performed with 5-minute granularity.	This is not feasible. The RST results occur in the real-time unit commitment (RTUC) which occurs in 15-minute granularity.
Is the CAISO incorrectly receiving credits towards its flexibility capacity requirement?	No. There are no unique credits towards the flexibility capacity requirement. The test recognizes that each BAA needs to individually meet their own requirements absent economic transfers between BAAs.

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The ISO will not pursue a specific policy initiative for the RT Resource Sufficiency Test at this time

- The DAME initiative will address many of the outstanding real-time RST policy questions/concerns

- The extension of the DAM to the EIM (EDAM) will introduce a day-ahead RST

- Successful implementation of the DA RST will require alignment with the RT RST

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EIM Offer Rules next steps

Item	Date
EIM Offer Rules Workshop	July 19, 2018
Stakeholder Comments Due	August 2, 2018