California ISO

Business Requirements Specification

Flexible Ramp Product: Requirements Enhancements

Document Version: ~~1.1~~1.2

Current Version Date: ~~7/29/2022~~8/19/2022

Disclaimer

Disclaimer

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Revision History

Date	Version	Description
3/10/2022	1.0	Initial Document release
07/29/2022	1.1	Updated Document Release • Minor formatting changes throughout the document. • Section 5.1 (Manage BAA Ramp Requirements) o Deleted FRPRE-BRQ069, FRPRE-BRQ070, FRPRE-BRQ083, FRPRE-BRQ084, FRPRE-BRQ085, FRPRE-BRQ095. o Edited the following BRQs: FRPRE-BRQ015, FRPRE-BRQ080, FRPRE-BRQ081. • Section 5.2 (Manage OASIS) o Deleted FRPRE-BRQ096. • Appendix A o Added.
08/19/2022	1.2	• FRPRE-BRQ055, FRPRE-BRQ056, FRPRE-BRQ063, FRPRE-BRQ064, FRPRE-BRQ086, FRPRE-BRQ087, FRPRE-BRQ088, FRPRE-BRQ089, FRPRE-BRQ090, FRPRE-BRQ091, FRPRE-BRQ092, FRPRE-BRQ093, FRPRE-BRQ094 o Updated the formulation to reverse the sign of S and W terms. • FRPRE-BRQ095C, FRPRE-BRQ104 o Added. • Appendix-A, Appendix-B o Deleted.

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1 Introduction

1.1 Purpose

The current implemented approach of calculating Flexible ramping product (FRP) requirements utilizes a histogram approach to set the FRP requirements. This histogram approach yields uncertainty for the Flex Ramp up and down requirements that vary seasonally and by the time of the day. The main limitation of this approach is that it only takes into consideration the historical data and not taking into consideration that variability that is forecasted to exist in a given point on time due to differing weather conditions.

This initiative is directly dependent on the FRP Deliverability project as it provides a high-level overview of how the ISO plans to evolve the current methodology for setting the real-time flexible ramping product requirements to incorporate forecasts for Solar, Wind and Load into formulation.

The updated flex requirement and demand curve based on the enhanced approach feed into the FRP Deliverability project. User of this document is advised to also reference the FRP Deliverability External BRS to have the full understanding of this policy initiative.

The scope of the FRP Requirements Enhancements includes-

1. To enhance the current approach by adopting a quantile regression method to adjust the current flexible ramping product up and down requirement.
2. Calculation of the demand curve.

1.2 References

Information related to this Flexible Ramping Product: Deliverability can be found on the following CAISO web page at:

http://www.caiso.com/InitiativeDocuments/DraftFinalProposal-FlexibleRampingProductRefinements.pdf

2 Details of Business Need/Problem

2.1 Description

Business Opportunity/Problem Statement:	
What:	The uncertainty requirement are hourly values calculated every day. As per the Final proposal, the CAISO intended to enhance the current logic of calculating flex ramp requirements and uncertainty by adopting a quantile regression method to adjust the current system up and down requirement.
When:	Fall 2022
Why do we have this opportunity/problem:	The flexible ramping product secures additional ramping capability that can be dispatched in the subsequent market runs to cover uncertainty in forecasted net load. The Balancing Area Ramp ~~Requirements~~Calculator Tool is currently calculating the FRP requirements for the real time markets and its enhancements is needed to improve the efficiency.

3 Business Impacts

3.1 Business Practice Manual (BPM)

BPM	Description of Impact(s)
Market Operations	Yes
Market Instruments	Yes

3.2 Other

Impact:	Description:
Market Simulation	Yes • Market sim needed for calculation of FRP requirements & demand curve
Market Participant Impact	Yes • To improve the FRP requirements to be more accurate based on historical information
External Training	Yes
Policy Initiative	Yes

4 Acronyms and Terms Definition

Acronym	Definition
FRP	Flexible Ramping Product
BAA	Balancing Authority Area
LMP	Locational Marginal Pricing
LMCP	Locational Marginal Corrective Capacity
LAP	Load Aggregation Point Group
VER	Variable Energy Resource
FRU	Flex Ramp up
FRD	Flex Ramp Down
ETSR	Energy Transfer System resource
GHG	Green House Gas
SMEC	System marginal Energy Cost
ITC/ISL	Intertie Transmission Constraint / Interchange Scheduling Limit

5 Business Requirements

The sections below describe the Business processes and the associated business requirements involved in the project. These may represent high-level functional, non-functional, reporting, and/or infrastructure requirements. These business requirements directly relate to the high-level scope items determined for the project.

5.1 Business Process: Manage BAA Ramp Requirements

5.1.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ001	The system shall have a configurable initialization parameter for the High Percentile, initially set to 97.5% (0.975).	Core	Internal System
FRPRE-BRQ002	The system shall have a configurable initialization parameter for the Low Percentile, initially set to 2.5% (0.025).	Core	Internal System
FRPRE-BRQ003	The system shall have a configurable initialization parameter for the High Percentile Threshold, initially set to 99% (0.99).	Core	Internal System
FRPRE-BRQ004	The system shall have a configurable initialization parameter for the Low Percentile Threshold, initially set to 1% (0.01).	Core	Internal System
FRPRE-BRQ005	The system shall have a configurable initialization parameter for the Percentile Grid Step, initially set to 0.5% (0.005). Implementation Note: The Percentile grid must be symmetric, i.e., it must include all complementary percentiles: p_i and $(1 - p_i)$.	Core	Internal System
FRPRE-BRQ006	The system shall have a configurable initialization parameter for the Price Curve Segment Count, initially set to 10.	Core	Internal System
FRPRE-BRQ007	The system shall have a configurable initialization parameter for the Data Retention Period, initially set to 180 days.	Core	Internal System
FRPRE-BRQ008	The system shall retrieve holidays. Note: Holidays must match the holidays used in Load Forecasting.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ009	The system shall classify each Trading Day in the Data Retention Period by a Day Type of Weekday or Weekend/Holiday.	Core	Internal System
FRPRE-BRQ010	The system shall be capable of identifying BAA groups and their BAAs.	Core	Internal System
FRPRE-BRQ011	The system shall store the maximum capacity of each VER resource by Fuel Type (solar or wind) for each Trading Day in each BAA in the EIM Area.	Existing System Functionality	Master File
FRPRE-BRQ012	The system shall retrieve and aggregate the maximum capacity of VER resources by Fuel Type (solar or wind) at any given Trading Day for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ013	The system shall maintain a list of select BAA(s) that have not joined EIM yet for harvesting historical data.	Core	Internal System
FRPRE-BRQ014	At the end of each Trading Day, the system shall receive the following data for each Trading Hour in that Trading Day for each BAA in the EIM Area and for the entire EIM Area: • RTD binding demand forecast for each 5min interval. • RTD binding solar forecast for each 5min interval. • RTD binding wind forecast for each 5min interval. • RTD first advisory demand forecast for each 5min interval. • RTD first advisory solar forecast for each 5min interval. • RTD first advisory wind forecast for each 5min interval. • FMM first advisory demand forecast for each 15 min interval • FMM first advisory solar forecast for each 15 min interval • FMM first advisory wind forecast for each 15 min interval	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and FMM/RTD Trading Interval.		
FRPRE-BRQ015	At the end of each Trading Day, the system shall receive the following data for each Trading Hour in that Trading Day for the select BAA(s) that have not joined EIM yet: • RTD binding demand forecast for each 5min interval. • RTD binding solar forecast for each 5min interval. • RTD binding wind forecast for each 5min interval. • RTD first advisory demand forecast for each 5min interval. • RTD first advisory solar forecast for each 5min interval. • RTD first advisory wind forecast for each 5min interval. • FMM first advisory demand forecast for each 15 min interval • FMM first advisory solar forecast for each 15 min interval • FMM first advisory wind forecast for each 15 min interval The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and FMM/RTD Trading Interval.	Core	Internal System
FRPRE-BRQ016	After each Trading Day, the system shall calculate the 5min demand forecast uncertainty for each 5min period of each Trading Hour in that Trading Day, for each BAA in the EIM Area, for the entire EIM Area, and for the select BAA(s) that have not joined EIM yet, as the algebraic difference between the demand forecast in the binding RTD interval and the demand forecast in the first advisory RTD interval, for that 5min period. The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and RTD Trading Interval.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ017	After each Trading Day, the system shall calculate the 5min solar forecast uncertainty for each 5min period of each Trading Hour in that Trading Day, for each BAA in the EIM Area, for the entire EIM Area, and for the select BAA(s) that have not joined EIM yet, as the algebraic difference between the solar forecast in the binding RTD interval and the solar forecast in the first advisory RTD interval, for that 5min period. The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and RTD Trading Interval.	Core	Internal System
FRPRE-BRQ018	After each Trading Day, the system shall calculate the 5min wind forecast uncertainty for each 5min period of each Trading Hour in that Trading Day, for each BAA in the EIM Area, for the entire EIM Area, and for the select BAA(s) that have not joined EIM yet, as the algebraic difference between the wind forecast in the binding RTD interval and the wind forecast in the first advisory RTD interval, for that 5min period. The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and RTD Trading Interval.	Core	Internal System
FRPRE-BRQ019	After each Trading Day, the system shall calculate the 15min demand forecast uncertainty for each 15min period of each Trading Hour in that Trading Day, for each BAA in the EIM Area, for the entire EIM Area, and for the select BAA(s) that have not joined EIM yet, as the algebraic difference between the maximum and minimum demand forecast of the three binding RTD intervals in that 15min period and the corresponding demand forecast in the first advisory FMM interval for that 15min period (two samples). The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and FMM Trading Interval.	Core	Internal System
FRPRE-BRQ020	After each Trading Day, the system shall calculate the 15min solar forecast uncertainty for each 15min period of each Trading Hour in that Trading Day, for each BAA in the EIM Area, for the	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	entire EIM Area, and for the select BAA(s) that have not joined EIM yet, as the algebraic difference between the maximum and minimum solar forecast of the three binding RTD intervals in that 15min period and the corresponding solar forecast in the first advisory FMM interval for that 15min period (two samples). The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and FMM Trading Interval.		
FRPRE-BRQ021	After each Trading Day, the system shall calculate the 15min wind forecast uncertainty for each 15min period of each Trading Hour in that Trading Day, for each BAA in the EIM Area, for the entire EIM Area, and for the select BAA(s) that have not joined EIM yet, as the algebraic difference between the maximum and minimum wind forecast of the three binding RTD intervals in that 15min period and the corresponding wind forecast in the first advisory FMM interval for that 15min period (two samples). The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and FMM Trading Interval.	Core	Internal System
FRPRE-BRQ022	After each Trading Day, the system shall calculate the total solar capacity for that Trading Day, for each BAA in the EIM Area, for the entire EIM Area, and for the select BAA(s) that have not joined EIM yet. The system shall store this information for the Data Retention Period by Trading Day and Day Type. Note- Need specify the mapping table from resources to BAAs	Core	Internal System
FRPRE-BRQ023	After each Trading Day, the system shall calculate the total wind capacity for that Trading Day, for each BAA in the EIM Area, for the entire EIM Area, and for the select BAA(s) that have not joined EIM yet. The system shall store this information for the Data Retention Period by Trading Day and Day Type.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ024	The system shall add all the data for the select BAA(s) that have not joined EIM yet to the corresponding EIM Area data in the Data Retention Period after the last Trading Day before this/these BAA(s) join EIM.	Core	Internal System
FRPRE-BRQ025	The system shall roll the Data Retention Period at the end of each Trading Day by one Trading Day, deleting the data for the first Trading Day in the Data Retention Period. Implementation Note: The data deletion only happens after the Data Retention Period is full.	Core	Internal System
FRPRE-BRQ026	After rolling the Data Retention Period, the system shall calculate the solar capacity factor for each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, as the ratio of the total solar capacity in the next Trading Day divided by the total solar capacity in the Trading Day in the Data Retention Period.	Core	Internal System
FRPRE-BRQ027	After rolling the Data Retention Period, the system shall calculate the wind capacity factor for each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, as the ratio of the total wind capacity in the next Trading Day over the total wind capacity in the Trading Day in the Data Retention Period.	Core	Internal System
FRPRE-BRQ028	After rolling the Data Retention Period, the system shall adjust the solar forecast and uncertainty data for each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, by multiplying the data with the solar capacity factor of the Trading Day in the Data Retention Period. Implementation Note: The adjusted solar forecast and uncertainty data can be discarded after the uncertainty histogram and quantile regression calculations are performed.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ029	After rolling the Data Retention Period, the system shall adjust the wind forecast and uncertainty data for each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, by multiplying the data with the wind capacity factor of the Trading Day in the Data Retention Period. Implementation Note: The adjusted wind forecast and uncertainty data can be discarded after the uncertainty histogram and quantile regression calculations are performed.	Core	Internal System
FRPRE-BRQ030	After rolling the Data Retention Period, the system shall calculate the following data for each Trading Hour in each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: • RTD binding net demand forecast for each 5min interval. • RTD first advisory net demand forecast for each 5min interval. • FMM first advisory net demand forecast for each 15min interval. Where the net demand forecast is the demand forecast minus the adjusted solar forecast minus the adjusted wind forecast. Implementation Note: The net demand forecast data can be discarded after the uncertainty histogram and quantile regression calculations are performed.	Core	Internal System
FRPRE-BRQ031	After rolling the Data Retention Period, the system shall calculate the 5min net demand forecast uncertainty for each 5min period of each Trading Hour in each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, as the algebraic difference between the net demand forecast in the binding RTD interval and the net demand forecast in the first advisory RTD interval, for that 5min period. Implementation Note: The net demand forecast uncertainty data can be discarded after the uncertainty histogram and quantile regression calculations are performed.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ032	After rolling the Data Retention Period, the system shall calculate the 15min net demand forecast uncertainty for each 15min period of each Trading Hour in each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, as the algebraic difference between the maximum and minimum net demand forecast of the three binding RTD intervals in that 15min period and the corresponding net demand forecast in the first advisory FMM interval for that 15min period (two samples). Implementation Note: The net demand forecast uncertainty data can be discarded after the uncertainty histogram and quantile regression calculations are performed.	Core	Internal System
FRPRE-BRQ033	After rolling the Data Retention Period, the system shall calculate and store the 5min High Percentile net demand forecast uncertainty histogram ($ND_5^{H97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ034	After rolling the Data Retention Period, the system shall calculate and store the 5min High Percentile demand forecast uncertainty histogram ($D_5^{H97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ035	After rolling the Data Retention Period, the system shall calculate and store the 5min High Percentile adjusted solar forecast uncertainty histogram ($S_5^{H97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ036	After rolling the Data Retention Period, the system shall calculate and store the 5min High Percentile adjusted wind forecast uncertainty histogram ($W_5^{H97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ037	After rolling the Data Retention Period, the system shall calculate and store the 5min Low Percentile net demand forecast uncertainty histogram ($ND_5^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ038	After rolling the Data Retention Period, the system shall calculate and store the 5min Low Percentile demand forecast uncertainty histogram ($D_5^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ039	After rolling the Data Retention Period, the system shall calculate and store the 5min Low Percentile adjusted solar forecast uncertainty histogram ($S_5^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ040	After rolling the Data Retention Period, the system shall calculate and store the 5min Low Percentile adjusted wind forecast uncertainty histogram ($W_5^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ041	After rolling the Data Retention Period, the system shall calculate and store the 15min High Percentile net demand forecast uncertainty histogram ($ND_{15}^{H97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ042	After rolling the Data Retention Period, the system shall calculate and store the 15min High Percentile demand forecast uncertainty histogram ($D_{15}^{H97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ043	After rolling the Data Retention Period, the system shall calculate and store the 15min High Percentile adjusted solar forecast uncertainty histogram ($S_{15}^{H97.5}$) for each Trading Hour in the Data	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.		
FRPRE-BRQ044	After rolling the Data Retention Period, the system shall calculate and store the 15min High Percentile adjusted wind forecast uncertainty histogram ($W_{15}^{H97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ045	After rolling the Data Retention Period, the system shall calculate and store the 15min Low Percentile net demand forecast uncertainty histogram ($ND_{15}^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ046	After rolling the Data Retention Period, the system shall calculate and store the 15min Low Percentile demand forecast uncertainty histogram ($D_{15}^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ047	After rolling the Data Retention Period, the system shall calculate and store the 15min Low Percentile adjusted solar forecast uncertainty histogram ($S_{15}^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ048	After rolling the Data Retention Period, the system shall calculate and store the 15min Low Percentile adjusted wind forecast uncertainty histogram ($W_{15}^{H2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ049	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients ($A_5^{D97.5}, B_5^{D97.5}, C_5^{D97.5}$) of the High Percentile quadratic quantile regression of 5min demand forecast (d) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $D_5^{P97.5}(d) \equiv A_{D5}^{P97.5}\, d^2 + B_{D5}^{P97.5}\, d + C_{D5}^{P97.5}$.		
FRPRE-BRQ050	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_5^{S97.5}, B_5^{S97.5}, C_5^{S97.5})$ of the High Percentile quadratic quantile regression of 5min adjusted solar forecast (s) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $S_5^{P97.5}(s) \equiv A_5^{S97.5}\, s^2 + B_5^{S97.5}\, s + C_5^{S97.5}$.	Core	Internal System
FRPRE-BRQ051	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_5^{W97.5}, B_5^{W97.5}, C_5^{W97.5})$ of the High Percentile quadratic quantile regression of 5min adjusted wind forecast (w) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $W_5^{P97.5}(w) \equiv A_5^{W97.5}\, w^2 + B_5^{W97.5}\, w + C_5^{W97.5}$.	Core	Internal System
FRPRE-BRQ052	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_5^{D2.5}, B_5^{D2.5}, C_5^{D2.5})$ of the Low Percentile quadratic quantile regression of 5min demand forecast (d) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $D_5^{P2.5}(d) \equiv A_5^{D2.5}\, d^2 + B_5^{D2.5}\, d + C_5^{D2.5}$.	Core	Internal System
FRPRE-BRQ053	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_5^{S2.5}, B_5^{S2.5}, C_5^{S2.5})$ of the Low Percentile quadratic quantile regression of 5min adjusted solar forecast (s) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $S_5^{P2.5}(s) \equiv A_5^{S2.5}\, s^2 + B_5^{S2.5}\, s + C_5^{S2.5}$.	Core	Internal System
FRPRE-BRQ054	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_5^{W2.5}, B_5^{W2.5}, C_5^{W2.5})$ of the Low Percentile quadratic quantile regression of 5min adjusted wind forecast (w) uncertainty for	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $W_5^{P2.5}(w) \equiv A_5^{W2.5}\, w^2 + B_5^{W2.5}\, w + C_5^{W2.5}$.		
FRPRE-BRQ055	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_5^{M97.5}, B_5^{M97.5}, C_5^{M97.5})$ of the High Percentile quadratic quantile regression of 5min MOSAIC forecast uncertainty $(M_5^{P97.5})$ for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, where: $M_5^{P97.5}(nd, d, s, w) \equiv ND_5^{H97.5} - ~~D_5^{H97.5} - S_5^{H2.5} - W_5^{H2.5} + D_5^{P97.5}(d) + S_5^{P2.5}(s) + W_5^{P2.5}(w).~~\left(D_5^{H97.5} - S_5^{H2.5} - W_5^{H2.5}\right) + \left(D_5^{P97.5}(d) - S_5^{P2.5}(s) - W_5^{P2.5}(w)\right)$.	Core	Internal System
FRPRE-BRQ056	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_5^{M2.5}, B_5^{M2.5}, C_5^{M2.5})$ of the Low Percentile quadratic quantile regression of 5min MOSAIC forecast uncertainty $(M_5^{P2.5})$ for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, where: $M_5^{P2.5}(nd, d, s, w) \equiv ND_5^{H2.5} - ~~D_5^{H2.5} - S_5^{H97.5} - W_5^{H97.5} + D_5^{P2.5}(d) + S_5^{P97.5}(s) + W_5^{P97.5}(w).~~\left(D_5^{H2.5} - S_5^{H97.5} - W_5^{H97.5}\right) + \left(D_5^{P2.5}(d) - S_5^{P97.5}(s) - W_5^{P97.5}(w)\right)$.	Core	Internal System
FRPRE-BRQ057	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_{15}^{D97.5}, B_{15}^{D97.5}, C_{15}^{D97.5})$ of the High Percentile quadratic quantile regression of 15min demand forecast (d) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $D_{15}^{P97.5}(d) \equiv A_{15}^{D97.5}\, d^2 + B_{15}^{D97.5}\, d + C_{15}^{D97.5}$.	Core	Internal System
FRPRE-BRQ058	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients $(A_{15}^{S97.5}, B_{15}^{S97.5}, C_{15}^{S97.5})$ of the High Percentile quadratic quantile regression of 15min adjusted solar forecast (s) uncertainty for	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $S_{15}^{P97.5}(s) \equiv A_{15}^{S97.5}\, s^2 + B_{15}^{S97.5}\, s + C_{15}^{S97.5}$.		
FRPRE-BRQ059	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients ($A_{15}^{W97.5}, B_{15}^{W97.5}, C_{15}^{W97.5}$) of the High Percentile quadratic quantile regression of 15min adjusted wind forecast (w) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $W_{15}^{P97.5}(w) \equiv A_{15}^{W97.5}\, w^2 + B_{15}^{W97.5}\, w + C_{15}^{W97.5}$.	Core	Internal System
FRPRE-BRQ060	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients ($A_{15}^{D2.5}, B_{15}^{D2.5}, C_{15}^{D2.5}$) of the Low Percentile quadratic quantile regression of 15min demand forecast (d) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $D_{15}^{P2.5}(d) \equiv A_{15}^{D2.5}\, d^2 + B_{15}^{D2.5}\, d + C_{15}^{D2.5}$.	Core	Internal System
FRPRE-BRQ061	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients ($A_{15}^{S2.5}, B_{15}^{S2.5}, C_{15}^{S2.5}$) of the Low Percentile quadratic quantile regression of 15min adjusted solar forecast (s) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $S_{15}^{P2.5}(s) \equiv A_{15}^{S2.5}\, s^2 + B_{15}^{S2.5}\, s + C_{15}^{S2.5}$.	Core	Internal System
FRPRE-BRQ062	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients ($A_{15}^{W2.5}, B_{15}^{W2.5}, C_{15}^{W2.5}$) of the Low Percentile quadratic quantile regression of 15min adjusted wind forecast (w) uncertainty for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area: $W_{15}^{P2.5}(w) \equiv A_{15}^{W2.5}\, w^2 + B_{15}^{W2.5}\, w + C_{15}^{W2.5}$.	Core	Internal System
FRPRE-BRQ063	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients ($A_{15}^{M97.5}, B_{15}^{M97.5}, C_{15}^{M97.5}$) of the High Percentile quadratic quantile	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	regression of 15min MOSAIC forecast uncertainty ($M_{15}^{P97.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, where: $M_{15}^{P97.5}(nd,d,s,w) \equiv ND_{15}^{H97.5} - ~~D_{15}^{H97.5} - S_{15}^{H2.5} - W_{15}^{H2.5} + D_{15}^{P97.5}(d) + S_{15}^{P2.5}(s) + W_{15}^{P2.5}(w).~~\left(D_{15}^{H97.5} - S_{15}^{H2.5} - W_{15}^{H2.5}\right) + \left(D_{15}^{P97.5}(d) - S_{15}^{P2.5}(s) - W_{15}^{P2.5}(w)\right)$.		
FRPRE-BRQ064	After rolling the Data Retention Period, the system shall calculate and store the second-order polynomial coefficients ($A_{15}^{M2.5}, B_{15}^{M2.5}, C_{15}^{M2.5}$) of the Low Percentile quadratic quantile regression of 15min MOSAIC forecast uncertainty ($M_{15}^{P2.5}$) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area, where: $M_{15}^{P2.5}(nd,d,s,w) \equiv ND_{15}^{H2.5} - ~~D_{15}^{H2.5} - S_{15}^{H97.5} - W_{15}^{H97.5} + D_{15}^{P2.5}(d) + S_{15}^{P97.5}(s) + W_{15}^{P97.5}(w).~~\left(D_{15}^{H2.5} - S_{15}^{H97.5} - W_{15}^{H97.5}\right) + \left(D_{15}^{P2.5}(d) - S_{15}^{P97.5}(s) - W_{15}^{P97.5}(w)\right)$.	Core	Internal System
FRPRE-BRQ065	After rolling the Data Retention Period, the system shall calculate and store the 5min High Percentile Threshold net demand forecast uncertainty histogram (ND_5^{H99}) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ066	After rolling the Data Retention Period, the system shall calculate and store the 5min Low Percentile Threshold net demand forecast uncertainty histogram (ND_5^{H1}) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ067	After rolling the Data Retention Period, the system shall calculate and store the 15min High Percentile Threshold net demand forecast uncertainty histogram (ND_{15}^{H99}) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ068	After rolling the Data Retention Period, the system shall calculate and store the 15min Low Percentile Threshold net demand forecast uncertainty histogram (ND_{15}^{H1}) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA in the EIM Area and for the entire EIM Area.	Core	Internal System
FRPRE-BRQ071	After rolling the Data Retention Period, the system shall calculate and store for each percentile (p_i) in a grid moving from the Low Percentile to the High Percentile by the Percentile Grid Step the following 5min data for each Trading Hour in the next Trading Day for the Day Type of that Trading Day, for each BAA in the EIM Area: • the 5min net demand forecast uncertainty histogram ($ND_5^{Hp_i}$) • the 5min demand forecast uncertainty histogram ($D_5^{Hp_i}$) • the 5min adjusted solar forecast uncertainty histogram ($S_5^{Hp_i}$) • the 5min adjusted wind forecast uncertainty histogram ($W_5^{Hp_i}$) • the second-order polynomial coefficients ($A_5^{Dp_i}, B_5^{Dp_i}, C_5^{Dp_i}$) of the quadratic quantile regression of 5min demand forecast uncertainty • the second-order polynomial coefficients ($A_5^{Sp_i}, B_5^{Sp_i}, C_5^{Sp_i}$) of the quadratic quantile regression of 5min adjusted solar forecast uncertainty • the second-order polynomial coefficients ($A_5^{Wp_i}, B_5^{Wp_i}, C_5^{Wp_i}$) of the quadratic quantile regression of 5min adjusted wind forecast uncertainty • the second-order polynomial coefficients ($A_5^{Mp_i}, B_5^{Mp_i}, C_5^{Mp_i}$) of the quadratic quantile regression of 5min MOSAIC forecast uncertainty	Core	Internal System
FRPRE-BRQ072	After rolling the Data Retention Period, the system shall calculate and store for each percentile (p_i) in a grid moving from the Low Percentile to the High Percentile by the Percentile Grid Step the following 15min data for each Trading Hour in the next Trading	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Day for the Day Type of that Trading Day, for each BAA in the EIM Area: • the 15min net demand forecast uncertainty histogram ($ND_{15}^{Hp_i}$) • the 15min demand forecast uncertainty histogram ($D_{15}^{Hp_i}$) • the 15min adjusted solar forecast uncertainty histogram ($S_{15}^{Hp_i}$) • the 15min adjusted wind forecast uncertainty histogram ($W_{15}^{HP_i}$) • the second-order polynomial coefficients ($A_{15}^{Dp_i}, B_{15}^{Dp_i}, C_{15}^{Dp_i}$) of the quadratic quantile regression of 15min demand forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{Sp_i}, B_{15}^{Sp_i}, C_{15}^{Sp_i}$) of the quadratic quantile regression of 15min adjusted solar forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{Wp_i}, B_{15}^{Wp_i}, C_{15}^{Wp_i}$) of the quadratic quantile regression of 15min adjusted wind forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{Mp_i}, B_{15}^{Mp_i}, C_{15}^{Mp_i}$) of the quadratic quantile regression of 15min MOSAIC forecast uncertainty		
FRPRE-BRQ073	The system shall receive the group of BAAs that have passed the latest FRU sufficiency test after *T*–75', *T*–55', and *T*–40' for each 15min interval of the Active Hour starting at *T*. Implementation Note: Implicit BAA group name and membership based on character string convention.	Core	Internal System
FRPRE-BRQ074	The system shall receive the group of BAAs that have passed the latest FRD sufficiency test after T–75', T–55', and T–40' for each 15min interval of the Active Hour starting at T.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Implementation Note: Implicit BAA group name and membership based on character string convention.		
FRPRE-BRQ075	For each 15min interval of the Active Hour, the system shall merge the following 5min data for the Active Hour in the Data Retention Period for the Day Type of the Trading Day of the Active Hour, for all BAAs in the group of BAAs that have passed the FRU sufficiency test in that 15min interval: • the 5min net demand forecast uncertainty • the 5min demand forecast uncertainty • the 5min adjusted solar forecast uncertainty • the 5min adjusted wind forecast uncertainty Implementation Note: Four sets of merged data, one for each 15min interval of the Active Hour; the entire 5min data (all 5min intervals) for the Active Hour is included in each set. The data sets can be deleted after the Active Hour becomes the current hour.	Core	Internal System
FRPRE-BRQ076	For each 15min interval of the Active Hour, the system shall merge the following 15min data for the Active Hour in the Data Retention Period for the Day Type of the Trading Day of the Active Hour, for all BAAs in the group of BAAs that have passed the FRU sufficiency test in that 15min interval: • the 15min net demand forecast uncertainty • the 15min demand forecast uncertainty • the 15min adjusted solar forecast uncertainty • the 15min adjusted wind forecast uncertainty Implementation Note: Four sets of merged data, one for each 15min interval of the Active Hour; the entire 15min data (all 15min intervals) for the Active Hour is included in each set. The data sets can be deleted after the Active Hour becomes the current hour.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ077	For each 15min interval of the Active Hour, the system shall merge the following 5min data for the Active Hour in the Data Retention Period for the Day Type of the Trading Day of the Active Hour, for all BAAs in the group of BAAs that have passed the FRD sufficiency test in that 15min interval: • the 5min net demand forecast uncertainty • the 5min demand forecast uncertainty • the 5min adjusted solar forecast uncertainty • the 5min adjusted wind forecast uncertainty Implementation Note: Four sets of merged data, one for each 15min interval of the Active Hour; the entire 5min data (all 5min intervals) for the Active Hour is included in each set. The data sets can be deleted after the Active Hour becomes the current hour.	Core	Internal System
FRPRE-BRQ078	For each 15min interval of the Active Hour, the system shall merge the following 15min data for the Active Hour in the Data Retention Period for the Day Type of the Trading Day of the Active Hour, for all BAAs in the group of BAAs that have passed the FRD sufficiency test in that 15min interval: • the 15min net demand forecast uncertainty • the 15min demand forecast uncertainty • the 15min adjusted solar forecast uncertainty • the 15min adjusted wind forecast uncertainty Implementation Note: Four sets of merged data, one for each 15min interval of the Active Hour; the entire 15min data (all 15min intervals) for the Active Hour is included in each set. The data sets can be deleted after the Active Hour becomes the current hour.	Core	Internal System
FRPRE-BRQ079	For each 15min interval of the Active Hour, the system shall calculate and broadcast the following 5min data for the Active Hour in the Data Retention Period for the Day Type of the	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Trading Day of the Active Hour, for the group of BAAs that have passed the FRU sufficiency test in that 15min interval: • the 5min High Percentile net demand forecast uncertainty histogram ($ND_5^{H97.5}$) • the 5min High Percentile demand forecast uncertainty histogram ($D_5^{H97.5}$) • the 5min Low Percentile adjusted solar forecast uncertainty histogram ($S_5^{H2.5}$) • the 5min Low Percentile adjusted wind forecast uncertainty histogram ($W_5^{H2.5}$) • the second-order polynomial coefficients ($A_5^{D97.5}, B_5^{D97.5}, C_5^{D97.5}$) of the High Percentile quadratic quantile regression of 5min demand forecast uncertainty • the second-order polynomial coefficients ($A_5^{S2.5}, B_5^{S2.5}, C_5^{S2.5}$) of the Low Percentile quadratic quantile regression of 5min adjusted solar forecast uncertainty • the second-order polynomial coefficients ($A_5^{W2.5}, B_5^{W2.5}, C_5^{W2.5}$) of the Low Percentile quadratic quantile regression of 5min adjusted wind forecast uncertainty • the second-order polynomial coefficients ($A_5^{M97.5}, B_5^{M97.5}, C_5^{M97.5}$) of the High Percentile quadratic quantile regression of 5min MOSAIC forecast uncertainty • the 5min High Percentile Threshold net demand forecast uncertainty histogram (ND_5^{H99}) • the 5min Low Percentile Threshold net demand forecast uncertainty histogram (ND_5^{H1}) Implementation Notes: Four sets of data, one for each 15min interval of the Active Hour. The data sets can be deleted after the Active Hour becomes the current hour.		

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ080	For each 15min interval of the Active Hour, the system shall calculate and broadcast the following 5min data for the Active Hour in the Data Retention Period for the Day Type of the Trading Day of the Active Hour, for the group of BAAs that have passed the FRD sufficiency test in that 15min interval: • the 5min Low Percentile net demand forecast uncertainty histogram ($ND_5^{H2.5}$) • the 5min Low Percentile demand forecast uncertainty histogram ($D_5^{H2.5}$) • the 5min High Percentile adjusted solar forecast uncertainty histogram ($S_5^{H97.5}$) • the 5min High Percentile adjusted wind forecast uncertainty histogram ($W_5^{H97.5}$) • the second-order polynomial coefficients ($A_5^{D2.5}, B_5^{D2.5}, C_5^{D2.5}$) of the Low Percentile quadratic quantile regression of 5min demand forecast uncertainty • the second-order polynomial coefficients ($A_5^{S97.5}, B_5^{S97.5}, C_5^{S97.5}$) of the High Percentile quadratic quantile regression of 5min adjusted solar forecast uncertainty • the second-order polynomial coefficients ($A_5^{W97.5}, B_5^{W97.5}, C_5^{W97.5}$) of the High Percentile quadratic quantile regression of 5min adjusted wind forecast uncertainty • the second-order polynomial coefficients ($A_5^{M2.5}, B_5^{M2.5}, C_5^{M2.5}$) of the Low Percentile quadratic quantile regression of 5min MOSAIC forecast uncertainty • the 5min High Percentile Threshold net demand forecast uncertainty histogram (ND_5^{H99})	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• the 5min Low Percentile Threshold net demand forecast uncertainty histogram (ND_5^{H1})		
FRPRE-BRQ081	For each 15min interval of the Active Hour, the system shall calculate and broadcast the following 15min data for the Active Hour in the Data Retention Period for the Day Type of the Trading Day of the Active Hour, for the group of BAAs that have passed the FRU sufficiency test in that 15min interval: • the 15min High Percentile net demand forecast uncertainty histogram ($ND_{15}^{H97.5}$) • the 15min High Percentile demand forecast uncertainty histogram ($D_{15}^{H97.5}$) • the 15min Low Percentile adjusted solar forecast uncertainty histogram ($S_{15}^{H2.5}$) • the 15min Low Percentile adjusted wind forecast uncertainty histogram ($W_{15}^{H2.5}$) • the second-order polynomial coefficients ($A_{15}^{D97.5}, B_{15}^{D97.5}, C_{15}^{D97.5}$) of the High Percentile quadratic quantile regression of 15min demand forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{S2.5}, B_{15}^{S2.5}, C_{15}^{S2.5}$) of the Low Percentile quadratic quantile regression of 15min solar adjusted forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{W2.5}, B_{15}^{W2.5}, C_{15}^{W2.5}$) of the Low Percentile quadratic quantile regression of 15min adjusted wind forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{M97.5}, B_{15}^{M97.5}, C_{15}^{M97.5}$) of the High Percentile quadratic quantile regression of 15min MOSAIC forecast uncertainty • the 15min High Percentile Threshold net demand forecast uncertainty histogram (ND_{15}^{H99}) • the 15min Low Percentile Threshold net demand forecast uncertainty histogram (ND_{15}^{H1})	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ082	For each 15min interval of the Active Hour, the system shall calculate and broadcast the following 15min data for the Active Hour in the Data Retention Period for the Day Type of the Trading Day of the Active Hour, for the group of BAAs that have passed the FRD sufficiency test in that 15min interval: • the 15min Low Percentile net demand forecast uncertainty histogram ($ND_{15}^{H2.5}$) • the 15min Low Percentile demand forecast uncertainty histogram ($D_{15}^{H2.5}$) • the 15min High Percentile adjusted solar forecast uncertainty histogram ($S_{15}^{H97.5}$) • the 15min High Percentile adjusted wind forecast uncertainty histogram ($W_{15}^{H97.5}$) • the second-order polynomial coefficients ($A_{15}^{D2.5}, B_{15}^{D2.5}, C_{15}^{D2.5}$) of the Low Percentile quadratic quantile regression of 15min demand forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{S97.5}, B_{15}^{S97.5}, C_{15}^{S97.5}$) of the High Percentile quadratic quantile regression of 15min adjusted solar forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{W97.5}, B_{15}^{W97.5}, C_{15}^{W97.5}$) of the High Percentile quadratic quantile regression of 15min adjusted wind forecast uncertainty • the second-order polynomial coefficients ($A_{15}^{M2.5}, B_{15}^{M2.5}, C_{15}^{M2.5}$) of the Low Percentile quadratic quantile regression of 15min MOSAIC forecast uncertainty • the 15min High Percentile Threshold net demand forecast uncertainty histogram (ND_{15}^{H99}) • the 15min Low Percentile Threshold net demand forecast uncertainty histogram (ND_{15}^{H1}) Implementation Notes:	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Four sets of data, one for each 15min interval of the Active Hour. The data sets can be deleted after the Active Hour becomes the current hour. This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ086	For each RTD interval, the system shall calculate the percentile with zero quantile (p_0) by evaluating the 5min MOSAIC forecast uncertainty polynomials over the percentile grid for the corresponding Trading Hour and BAA to find the consecutive percentiles where the quantile changes sign. Then, p_0 shall be derived by linear interpolation between these percentiles. If all quantiles over the percentile grid are positive, p_0 shall be set to the Percentile with minimum quantile. If all quantiles over the percentile grid are negative, p_0 shall be set to thePercentile with the Maximum Quantile. . The quantile q for a given percentile p is calculated as follows: $q = A_5^{Mp}\left(M_5^{Pp}\right)^2 + B_5^{Mp} M_5^{Pp} + C_5^{Mp}$ Where: $M_5^{Pp} \equiv ND_5^{Hp} - \sout{D_5^{Hp} - S_5^{H(1-p)} - W_5^{H(1-p)} + D_5^{Pp}(d) + S_5^{P(1-p)}(s) + W_5^{P(1-p)}(w).}\left(D_5^{Hp} - S_5^{H(1-p)} - W_5^{H(1-p)}\right) + \left(D_5^{Pp}(d) - S_5^{P(1-p)}(s) - W_5^{P(1-p)}(w)\right).$ Implementation Notes: p_0 can be found by a search starting at P50 moving up (if the quantile is positive) or down (if the quantile is negative) on the percentile grid until the quantile changes sign. This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.	Core	Internal System
FRPRE-BRQ087	For each RTPD interval, the system shall calculate the percentile with zero quantile (p_0) by evaluating the 15min MOSAIC forecast uncertainty polynomials over the percentile grid for the corresponding Trading Hour and BAA to find the consecutive	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	percentiles where the quantile changes sign. Then, p_0 shall be derived by linear interpolation between these percentiles. If all quantiles over the percentile grid are positive, p_0 shall be set to the Percentile with Minimum Quantile. If all quantiles over the percentile grid are negative, p_0 shall be set to the Percentile with Maximum Quantile. The quantile q for a given percentile p is calculated as follows: $q = A_{15}^{Mp}\left(M_{15}^{Pp}\right)^2 + B_{15}^{Mp}\,M_{15}^{Pp} + C_{15}^{Mp}$ Where: $M_{15}^{Pp} \equiv ND_{15}^{Hp} - \sout{D_{15}^{Hp} - S_{15}^{H(1-p)} - W_{15}^{H(1-p)} + D_{15}^{Pp}(d) + S_{15}^{P(1-p)}(s) + W_{15}^{P(1-p)}(w).}\left(D_{15}^{Hp} - S_{15}^{H(1-p)} - W_{15}^{H(1-p)}\right) + \left(D_{15}^{Pp}(d) - S_{15}^{P(1-p)}(s) - W_{15}^{P(1-p)}(w)\right)$. Implementation Notes: p_0 can be found by a search starting at P50 moving up (if the quantile is positive) or down (if the quantile is negative) on the percentile grid until the quantile changes sign. This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ088	For each STUC interval, the system shall calculate the percentile with zero quantile (p_0) by evaluating the 15min MOSAIC forecast uncertainty polynomials over the percentile grid for the corresponding Trading Hour and BAA to find the consecutive percentiles where the quantile changes sign. Then, p_0 shall be derived by linear interpolation between these percentiles. If all quantiles over the percentile grid are positive, p_0 shall be set to the Percentile with Minimum Quantile. If all quantiles over the percentile grid are negative, p_0 shall be set to the Percentile with Maximum Quantile. The quantile q for a given percentile p is calculated as follows: $q = A_{15}^{Mp}\left(M_{15}^{Pp}\right)^2 + B_{15}^{Mp}\,M_{15}^{Pp} + C_{15}^{Mp}$	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Where: $M_{15}^{Pp} \equiv ND_{15}^{Hp} - \sout{D_{15}^{Hp} - S_{15}^{H(1-p)} - W_{15}^{H(1-p)} + D_{15}^{Pp}(d) + S_{15}^{P(1-p)}(s) + W_{15}^{P(1-p)}(w).}\left(D_{15}^{Hp} - S_{15}^{H(1-p)} - W_{15}^{H(1-p)}\right) + \left(D_{15}^{Pp}(d) - S_{15}^{P(1-p)}(s) - W_{15}^{P(1-p)}(w)\right)$. Implementation Notes: p_0 can be found by a search starting at P50 moving up (if the quantile is positive) or down (if the quantile is negative) on the percentile grid until the quantile changes sign. This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ089	The system shall calculate and broadcast the FRU demand price curve for each RTD interval for each BAA in the EIM Area as follows: $\{q_k, (p_k - p_{k-1})\ ENPC,\}$ $\{k = 1,2,\dots,n\}$ Where: n is the Price Curve Segment Count $ENPC$ is the energy price ceiling p_0 is the percentile with zero quantile p_n is the High Percentile $p_k = p_{k-1} + (n - k + 1)\ \Delta p,$ $k = 1,2,\dots,n-1$ The closest percentile from the grid shall be selected for each p_k. $\Delta p = \frac{2\ (p_n - p_0)}{n\ (n+1)}$ $q_k = A_5^{Mp_k}\left(M_5^{Pp_k}\right)^2 + B_5^{Mp_k}\ M_5^{Pp_k} + C_5^{Mp_k}$	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Where: $M_5^{Pp_k} \equiv ND_5^{Hp_k} - \sout{D_5^{Hp_k} - S_5^{H(1-p_k)} - W_5^{H(1-p_k)} + D_5^{Pp_k}(d) + S_5^{P(1-p_k)}(s) + W_5^{P(1-p_k)}(w)}\left(D_5^{Hp_k} - S_5^{H(1-p_k)} - W_5^{H(1-p_k)}\right) + \left(D_5^{Pp_k}(d) - S_5^{P(1-p_k)}(s) - W_5^{P(1-p_k)}(w)\right)$ Implementation Note: This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ090	The system shall calculate and broadcast the FRD demand price curve for each RTD interval for each BAA in the EIM Area as follows: $\{q_k, (p_k - p_{k-1})\ ENPF, \}$ $\{\quad k = 1,2,\dots,n \quad\}$ Where: n is the Price Curve Segment Count $ENPF$ is the energy price floor p_0 is the percentile with zero quantile p_n is the Low Percentile $p_k = p_{k-1} + (n - k + 1)\ \Delta p,$ $k = 1,2,\dots,n-1$ The closest percentile from the grid shall be selected for each p_k. $\Delta p = \frac{2\ (p_n - p_0)}{n\ (n+1)}$ $q_k = A_5^{Mp_k}\ \left(M_5^{Pp_k}\right)^2 + B_5^{Mp_k}\ M_5^{Pp_k} + C_5^{Mp_k}$ Where: $M_5^{Pp_k} \equiv ND_5^{Hp_k} - \sout{D_5^{Hp_k} - S_5^{H(1-p_k)} - W_5^{H(1-p_k)} + D_5^{Pp_k}(d) + S_5^{P(1-p_k)}(s) + W_5^{P(1-p_k)}(w)}\left(D_5^{Hp_k} - S_5^{H(1-p_k)} - W_5^{H(1-p_k)}\right) + \left(D_5^{Pp_k}(d) - S_5^{P(1-p_k)}(s) - W_5^{P(1-p_k)}(w)\right)$ Implementation Note: This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ091	The system shall calculate and broadcast the FRU demand price curve for each RTPD interval for each BAA in the EIM Area as follows: $\{q_k, (p_k - p_{k-1})\ ENPC,\}$ $\{k = 1,2,\dots,n\}$ Where: n is the Price Curve Segment Count $ENPC$ is the energy price ceiling p_0 is the percentile with zero quantile p_n is the High Percentile $p_k = p_{k-1} + (n - k + 1)\ \Delta p,$ $k = 1,2,\dots,n-1$ The closest percentile from the grid shall be selected for each p_k. $\Delta p = \frac{2\ (p_n - p_0)}{n\ (n+1)}$ $q_k = A_{15}^{Mp_k}\ \left(M_{15}^{Pp_k}\right)^2 + B_5^{Mp_k}\ M_{15}^{Pp_k} + C_{15}^{Mp_k}$ Where: $M_{15}^{Pp_k} \equiv ND_{15}^{Hp_k} - \sout{D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)} + D_{15}^{Pp_k}(d) + S_{15}^{P(1-p_k)}(s) + W_{15}^{P(1-p_k)}(w)}\left(D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)}\right) + \left(D_{15}^{Pp_k}(d) - S_{15}^{P(1-p_k)}(s) - W_{15}^{P(1-p_k)}(w)\right)$ Implementation Note: This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.	Core	Internal System
FRPRE-BRQ092	The system shall calculate and broadcast the FRD demand price curve for each RTPD interval for each BAA in the EIM Area as follows: $\{q_k, (p_k - p_{k-1})\ ENPF,\}$ $\{k = 1,2,\dots,n\}$ Where:	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	n is the Price Curve Segment Count ENPF is the energy price floor p_0 is the percentile with zero quantile p_n is the Low Percentile $p_k = p_{k-1} + (n-k+1)\,\Delta p,$ $k = 1,2,\ldots,n-1$ The closest percentile from the grid shall be selected for each p_k. $\Delta p = \frac{2\,(p_n - p_0)}{n\,(n+1)}$ $q_k = A_{15}^{Mp_k}\left(M_{15}^{Pp_k}\right)^2 + B_5^{Mp_k}\,M_{15}^{Pp_k} + C_{15}^{Mp_k}$ Where: $M_{15}^{Pp_k} \equiv ND_{15}^{Hp_k} - \sout{D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)} + D_{15}^{Pp_k}(d) + S_{15}^{P(1-p_k)}(s) + W_{15}^{P(1-p_k)}(w)}\left(D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)}\right) + \left(D_{15}^{Pp_k}(d) - S_{15}^{P(1-p_k)}(s) - W_{15}^{P(1-p_k)}(w)\right)$ Implementation Note: This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ093	The system shall calculate and broadcast the FRU demand price curve for each STUC interval for each BAA in the EIM Area as follows: $\{q_k, (p_k - p_{k-1})\,ENPC,\}$ $\{\quad k = 1,2,\ldots,n \quad\}$ Where: n is the Price Curve Segment Count $ENPC$ is the energy price ceiling p_0 is the percentile with zero quantile p_n is the High Percentile	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	$k = 1,2, \dots, n-1$ The closest percentile from the grid shall be selected for each p_k. $\Delta p = \frac{2\,(p_n - p_0)}{n\,(n+1)}$ $q_k = A_{15}^{Mp_k}\left(M_{15}^{Pp_k}\right)^2 + B_5^{Mp_k}\,M_{15}^{Pp_k} + C_{15}^{Mp_k}$ Where: $M_{15}^{Pp_k} \equiv ND_{15}^{Hp_k} - ~~D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)} + D_{15}^{Pp_k}(d) + S_{15}^{P(1-p_k)}(s) + W_{15}^{P(1-p_k)}(w)~~\left(D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)}\right) + \left(D_{15}^{Pp_k}(d) - S_{15}^{P(1-p_k)}(s) - W_{15}^{P(1-p_k)}(w)\right)$ Implementation Note: This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ094	The system shall calculate and broadcast the FRD demand price curve for each STUC interval for each BAA in the EIM Area as follows: $\{q_k, (p_k - p_{k-1})\,ENPF,\}$ $\{\quad k = 1,2, \dots, n \quad\}$ Where: n is the Price Curve Segment Count $ENPF$ is the energy price floor p_0 is the percentile with zero quantile p_n is the Low Percentile $p_k = p_{k-1} + (n-k+1)\,\Delta p,$ $k = 1,2, \dots, n-1$ The closest percentile from the grid shall be selected for each p_k. $\Delta p = \frac{2\,(p_n - p_0)}{n\,(n+1)}$ $q_k = A_{15}^{Mp_k}\left(M_{15}^{Pp_k}\right)^2 + B_5^{Mp_k}\,M_{15}^{Pp_k} + C_{15}^{Mp_k}$	Core	Internal System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Where: $M_{15}^{Pp_k} \equiv ND_{15}^{Hp_k} - \sout{D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)} + D_{15}^{Pp_k}(d) + S_{15}^{P(1-p_k)}(s) + W_{15}^{P(1-p_k)}(w)}\left(D_{15}^{Hp_k} - S_{15}^{H(1-p_k)} - W_{15}^{H(1-p_k)}\right) + \left(D_{15}^{Pp_k}(d) - S_{15}^{P(1-p_k)}(s) - W_{15}^{P(1-p_k)}(w)\right)$ Implementation Note: This calculation, as most calculations in this system, can be parallelized to reduce the time to return data to the market applications.		
FRPRE-BRQ095C	System shall auto broadcast to OASIS the min and max FRU/FRD threshold for the BAAs/EIM_AREA every day.	Core	Internal System

5.2 Business Process: Manage Open Access Same Time Information System (OASIS)

5.2.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ097	The system shall publicly report on the 5 minute Uncertainty histogram values for both the low and high percentile for wind, solar, net demand, and demand forecast by EIM Entity and by the EIM Area. This report is titled as: "Flex Ramp Requirement Calc Input: Uncertainty Histogram Data"	Core	OASIS
FRPRE-BRQ098	The system shall publicly report on the 15 minute Uncertainty histogram values for both the low and high percentile for wind, solar, net demand, and demand forecast by EIM Entity and by the EIM Area. This report is titled as: "Flex Ramp Requirement Calc Input: Uncertainty Histogram Data"	Core	OASIS
FRPRE-BRQ099	The system shall publicly report on the 5 minute polynomial coefficients for both low and high for wind, solar, and demand forecast by EIM Entity and by EIM Area • Polynomial coefficients are calculated for FRU and FRD This report is titled as: "Flex Ramp Requirement Calculation Input: Polynomials" Note: multiple type of polynomial coefficient	Core	OASIS

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ100	The system shall publicly report on the 15 minute polynomial coefficients for both low and high for wind, solar, and demand forecast by EIM Entity and by EIM Area • Polynomial coefficients are calculated for FRU and FRD This report is titled as: "Flex Ramp Requirement Calc Input: Polynomials" Note: multiple type of polynomial coefficient	Core	OASIS
FRPRE-BRQ101	The system shall publicly report on the 5 minute uncertainty threshold based on histogram for both the low and high by EIM entity and by EIM area • calculated for FRU and FRD This report is titled as: "Flex Ramp Requirement Threshold"	Core	OASIS
FRPRE-BRQ102	The system shall publicly report on the 15 minute uncertainty threshold based on histogram for both the low and high by EIM entity and by EIM area • calculated for FRU and FRD This report is titled as: "Flex Ramp Requirement Threshold"	Core	OASIS

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
FRPRE-BRQ104	System shall report the threshold value for the FRU and FRD requirement for each BAA and EIM_AREA	Core	OASIS

5.3 Business Process: Business Process: Market/Business Simulation

5.3.1 Business Requirements

This section shall provide a basis for the development of the Market/Business Simulation Scenarios. These requirements will provide guidance on the market participant impacts, inputs into the Scenarios, endpoints to the Scenarios and reasons for potential Scenarios. The guidance on market participant impacts shall be gathered from the requirements that impact rules, interfaces, applications/reports, new system processes, new/modified data models and new user roles. The source and sink systems shall be determined through the development of the system context diagram and the web service requirements. The Reason for the Potential Scenario column will be to offer guidance regarding what potential Scenarios, and their context, may be needed for this project. This section applies to all policy development projects, market enhancements, technology enhancements, operation enhancements, Energy Imbalance Market (EIM) implementations and Reliability Coordination (RC) service implementations.

In the Reason for Potential Scenario column, the Business Analyst must select one or more of the following reasons:

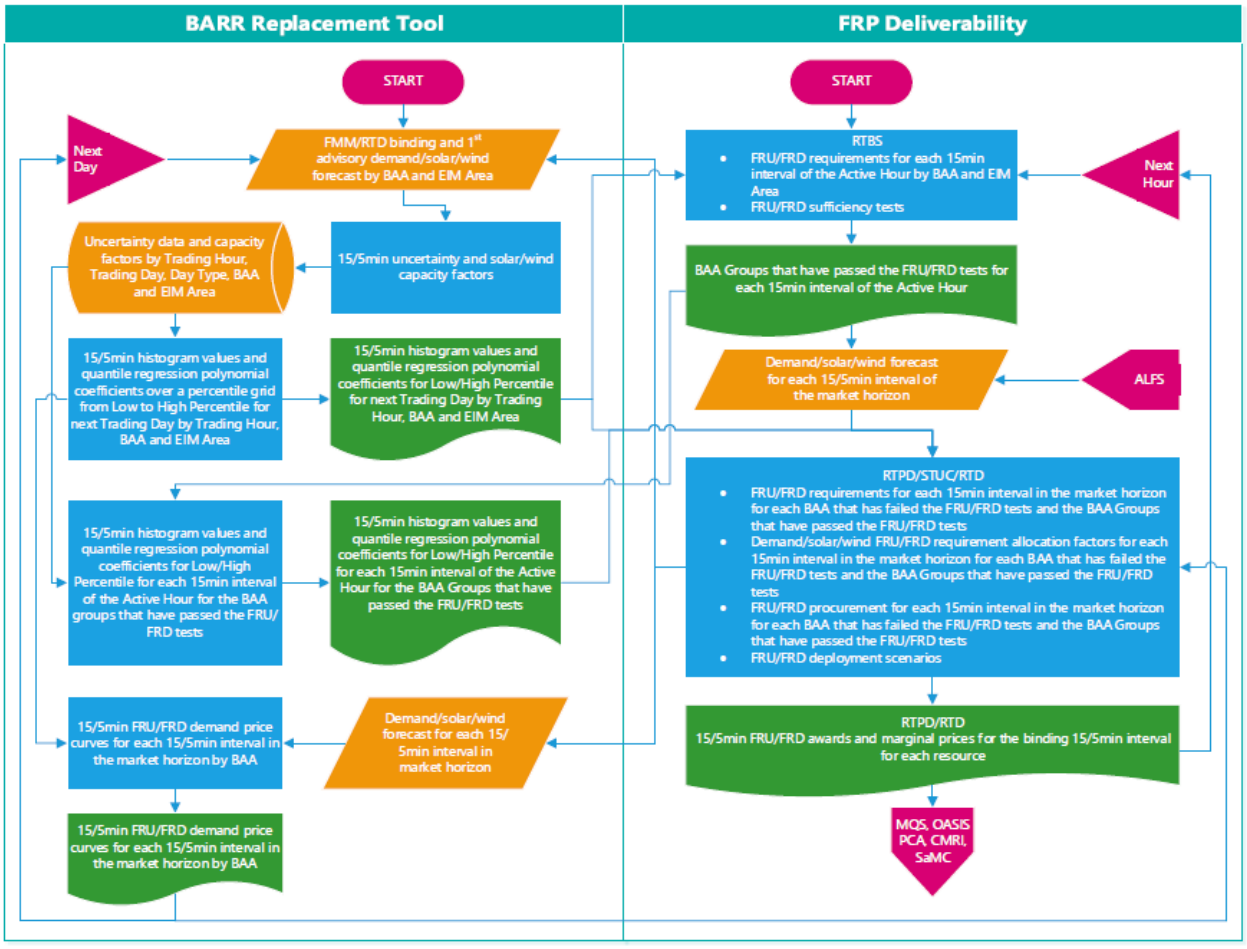
1. **Rule Impacts**: Generalized changes in market rules, bidding rules, settlements rules, market design changes, or other business rules.
2. **Interface changes**: Changes that impact templates (e.g. the Resource Adequacy {RA} supply plan), user interface (UI), and application programming interface (API) (e.g. retrievals of new shadow settlement data).
3. **New application/report**: Changes that cause addition/modification of market software or reports, especially when market data input is required by the market participant.
4. **New system process**: Modification of data flow in systems, especially if the new process requires the market participant to demonstrate proficiency prior to production.
5. **New/Modified model data**: Addition or substantial modification of model data as a market solution provided by the ISO.
6. **New user role**: The addition or modification of access permissions for a user role applied to specific business units within an EIM entity or market participant organization (e.g. Load Serving Entity (LSE) as a Local Regulatory Authority (LRA) role). Scenarios are beneficial for market participants taking on a new function or process within their organization.

5.3.1 Business Requirements

ID#	Guidance on Market Participant Impacts	Source System	Sink System	Reason for Potential Scenario
	The project team deemed that this section has no impacts.			

~~6 Appendix A~~

~~6.1 FRP Flow Chart~~



~~6.1 Symmetrical Settlement for Wheeling through EIMA BAA's (MF Definition)~~

~~Using following Base ETSRs as example:~~

~~RES_ID~~	~~BAA~~	~~FROM_BAA~~	~~TO_BAA~~	~~TIE_ID~~
~~BAA2_TIE25_BAA5_E_EIMBASE~~	~~BAA2~~	~~BAA2~~	~~BAA5~~	~~TIE25_BAA5~~
~~BAA2_TIE25_BAA5_I_EIMBASE~~	~~BAA2~~	~~BAA2~~	~~BAA5~~	~~TIE25_BAA5~~
~~BAA5_TIE25_BAA2_E_EIMBASE~~	~~BAA5~~	~~BAA5~~	~~BAA2~~	~~TIE25_BAA5~~
~~BAA5_TIE25_BAA2_I_EIMBASE~~	~~BAA5~~	~~BAA5~~	~~BAA2~~	~~TIE25_BAA5~~

~~6.1.1 Appendix A.1 – Existing Definition~~

~~Current financial location definition:~~

~~RES_ID~~	~~FIN_LOC_ID~~	~~FIN_LOC_TYPE~~	~~FROM_FIN_LOC~~	~~FROM_FIN_TYPE~~	~~TO_FIN_LOC~~	~~TO_FIN_TYPE~~	~~SPLIT_RATIO~~
~~BAA2_TIE25_BAA5_E_EIMBASE~~	~~BAA2_TIE25_BAA5_E_EIMBASE-APND~~	~~APND~~	~~DGAP_BAA2-APND~~	~~APND~~	~~DGAP_BAA5-APND~~	~~APND~~	~~0.5~~
~~BAA2_TIE25_BAA5_I_EIMBASE~~	~~BAA2_TIE25_BAA5_I_EIMBASE-APND~~	~~APND~~	~~DGAP_BAA2-APND~~	~~APND~~	~~DGAP_BAA5-APND~~	~~APND~~	~~0.5~~
~~BAA5_TIE25_BAA2_E_EIMBASE~~	~~BAA5_TIE25_BAA2_E_EIMBASE-APND~~	~~APND~~	~~DGAP_BAA5-APND~~	~~APND~~	~~DGAP_BAA2-APND~~	~~APND~~	~~0.5~~
~~BAA5_TIE25_BAA2_I_EIMBASE~~	~~BAA5_TIE25_BAA2_I_EIMBASE-APND~~	~~APND~~	~~DGAP_BAA5-APND~~	~~APND~~	~~DGAP_BAA2-APND~~	~~APND~~	~~0.5~~

~~6.1.2 Appendix A.2 – Proposed Enhanced Definition:~~

~~Proposed new financial location definition:~~

~~RES_ID~~	~~FIN_LOC_ID~~	~~FIN_LOC_TYPE~~	~~FIN_LOC_BAA~~	~~FIN_LOC_TIE~~
~~BAA2_TIE25_BAA5_E_EIMBASE~~	~~BAA2_TIE25_BAA5-APND~~	~~APND~~	~~BAA2~~	~~TIE25_BAA5~~
~~BAA2_TIE25_BAA5_I_EIMBASE~~	~~BAA2_TIE25_BAA5-APND~~	~~APND~~	~~BAA2~~	~~TIE25_BAA5~~
~~BAA5_TIE25_BAA2_E_EIMBASE~~	~~BAA5_TIE25_BAA2-APND~~	~~APND~~	~~BAA5~~	~~TIE25_BAA5~~
~~BAA5_TIE25_BAA2_I_EIMBASE~~	~~BAA5_TIE25_BAA2-APND~~	~~APND~~	~~BAA5~~	~~TIE25_BAA5~~