Load Bias and the Flexible Ramping Sufficiency Test
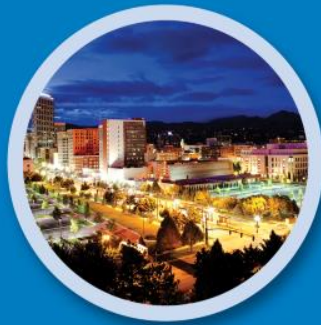
April 30, 2018
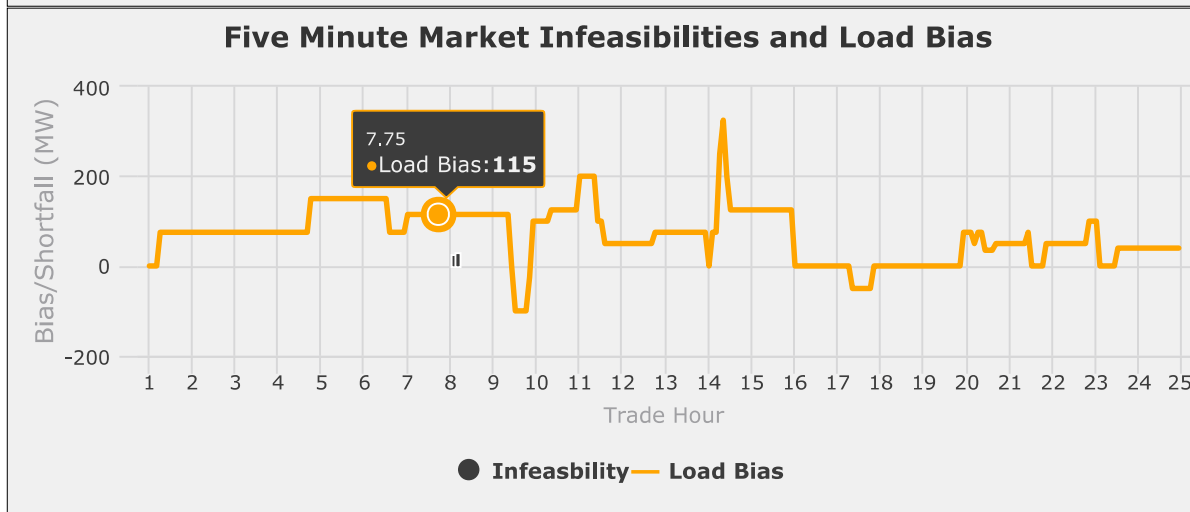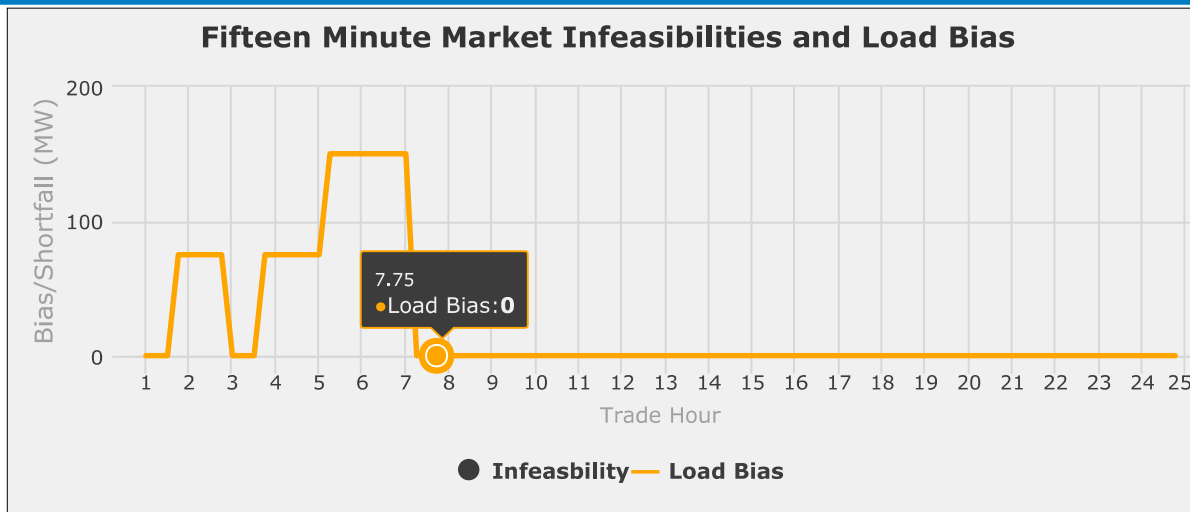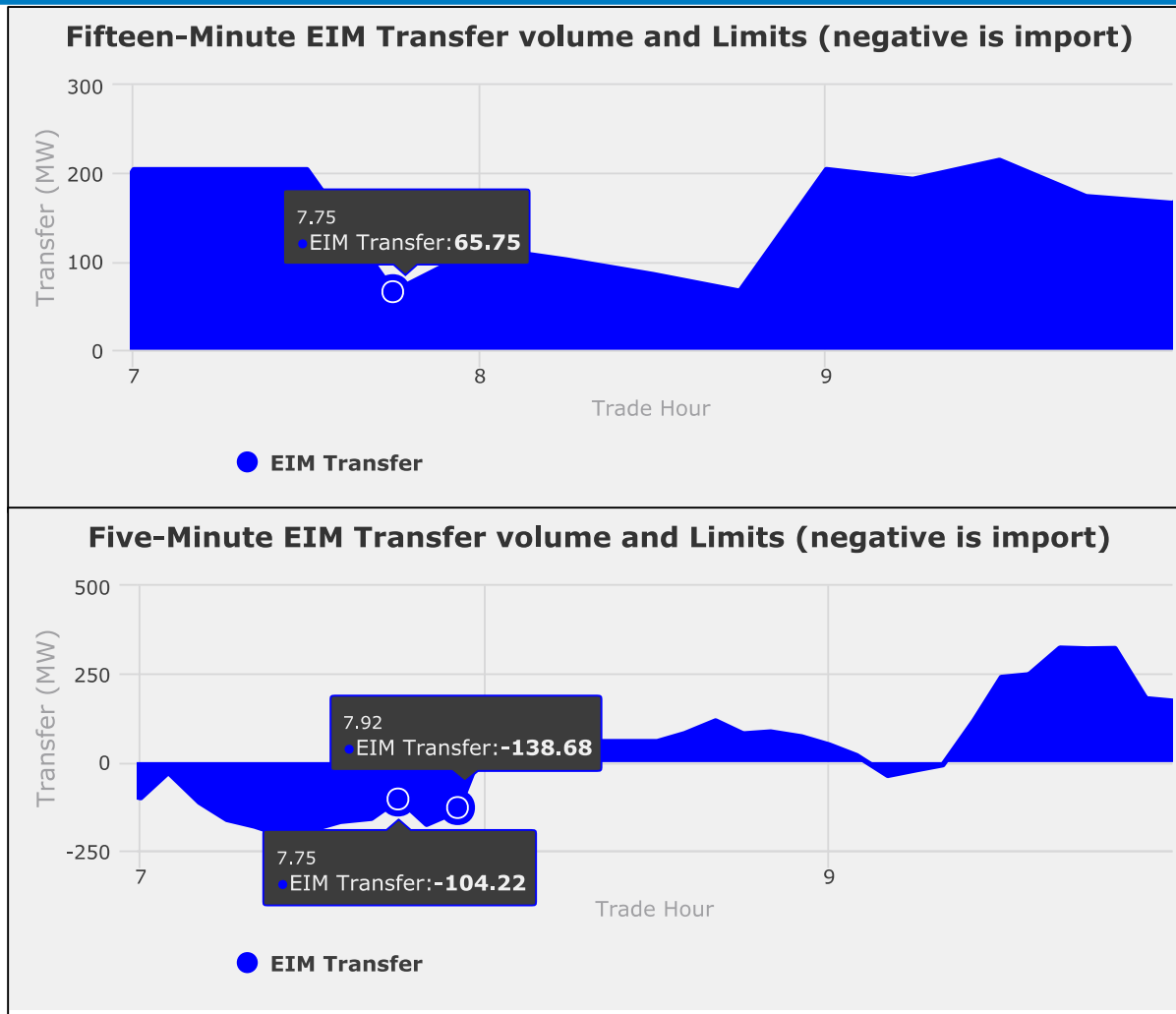
PACIFICORP

Overview

o The California ISO Energy Imbalance Market's (EIM) transfer freezes may occur as a result of the flex ramp sufficiency test

  o "If the EIM Entity BAA fails the flexible ramp up sufficiency test ... **the EIM Transfer during the next hour will be bounded from below** at the lower of the base transfer for [the] current hour or the optimal transfer **at the last fifteen-minute interval of the current hour**." -*Business Practice Manual For The Energy Imbalance Market*

o The ISO load bias, or load conformance, is currently utilized by grid operators in the fifteen-minute (FMM) and five-minute market (RTD), but the fifteen-minute market bias is more challenging to utilize due to an inability to forecast a need for the bias within the necessary time frame

  o The ISO uses the term "conforming" to refer to the process of updating the load forecast to account for observed system conditions... **The grid operator may conform the load forecast independently for each market run**: ... Typically, RTD conformance is used for minor corrections including VER deviation and unit testing." - *Imbalance Conformance Enhancements, Issue Paper & Straw Proposal*

o For PacifiCorp, due to its slower ramping units, the transfer freeze can be problematic due to the difference between the FMM and RTD bias

- o The following slides illustrate PacifiCorp's operational experience with unintended consequences of transfer freezes due to load bias
- o *Setting the stage (transfers and bias)*
- o *Flex sufficiency test failure*
- o *Transfer freeze*
- o *Balancing area insufficiency due to ramp limitations*

EXAMPLES

Fifteen Minute Market Infeasibilities and Load Bias

Five Minute Market Infeasibilities and Load Bias

- This example occurred on December 16, 2017, HE 7
- A positive RTD bias of 115 MW was in place due to wind and load forecast error
- No FMM bias was in place at the time of the RTD bias in this example

Fifteen-Minute EIM Transfer volume and Limits (negative is import)

7.75
●EIM Transfer:**65.75**

Five-Minute EIM Transfer volume and Limits (negative is import)

7.92
●EIM Transfer:**-138.68**

7.75
●EIM Transfer:**-104.22**

- o Due to the 115 MW RTD bias, the last FMM interval of HE 7 is a net export of 66 MW while the last RTD interval of HE 7 is a net import of 139 MW
- o *Of note, both transfers include a base schedule of 57 MW*

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

BAA [ALL] ▿ End Time [ALL] ▿ Test [ALL] ▿ Apply Reset ☑ Enable Automation Toggle Compact

▾ Flexible Ramping Capacity Sufficient Test

T-55

BAA	Start Time	End Time	Test Type	Test Status	Ramp Type	Capacity	Requirement	Credit	Export Capacity	Import Capacity	Insufficiency MW	Insufficiency Percentage	Diversity Benefit
PACE	12/16/2017 07:00	12/16/2017 08:00	1	PASS	UP	217.59	182.53	123.45	224.55	1,831.45	-35.06	0.00	25.14

+57   -114

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

BAA [ALL] ▿ End Time [ALL] ▿ Test [ALL] ▿ Apply Reset ☑ Enable Automation Toggle Compact

▾ Flexible Ramping Capacity Sufficient Test

T-40

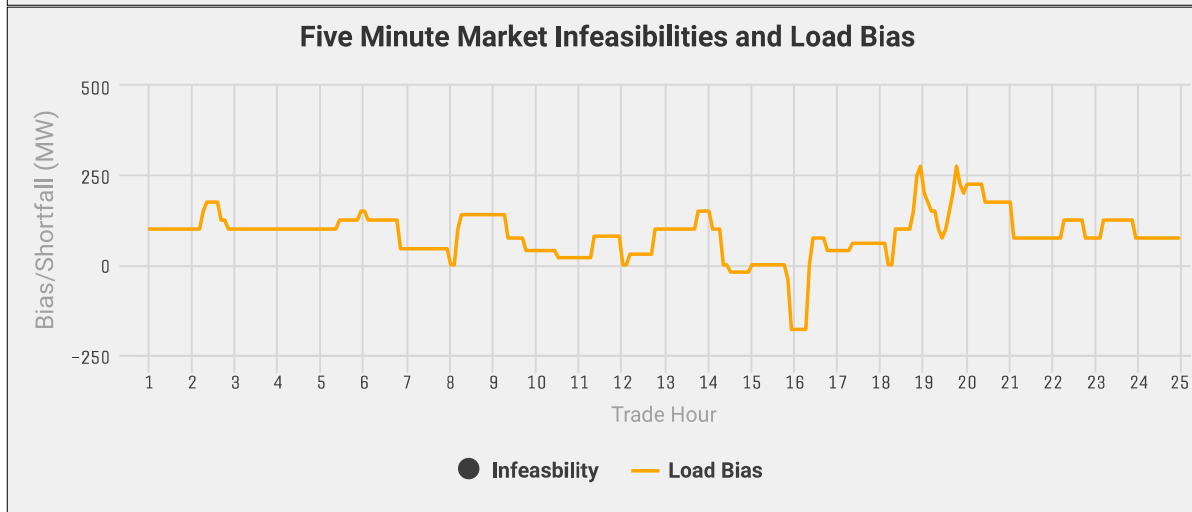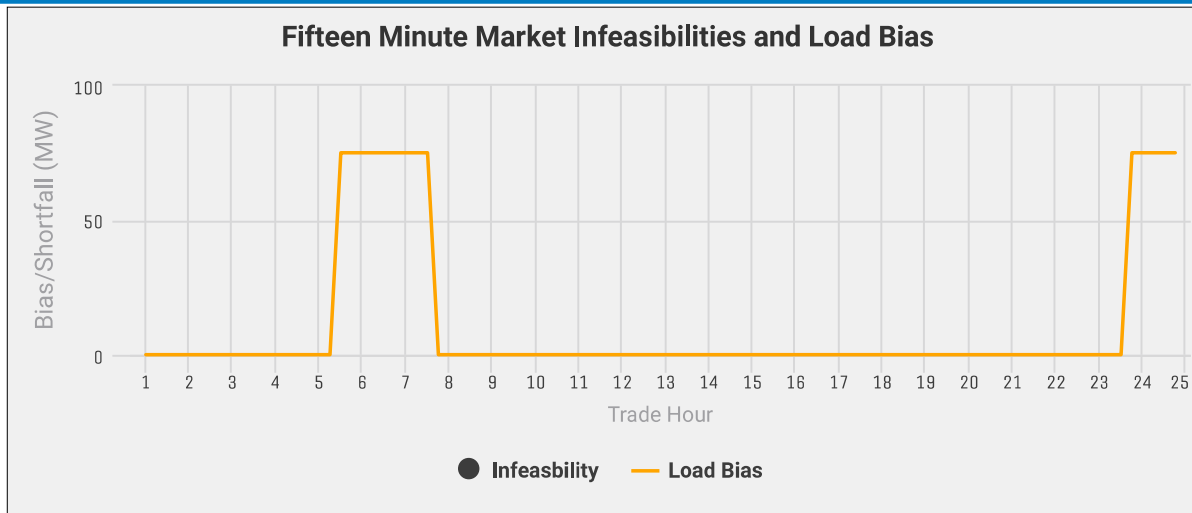| BAA	Start Time	End Time	Test Type	Test Status	Ramp Type	Capacity	Requirement	Credit	Export Capacity	Import Capacity	Insufficiency MW	Insufficiency Percentage	Diversity Benefit
PACE	12/16/2017 07:00	12/16/2017 08:00	1	FAIL	UP	274.98	296.23	9.75	338.25	1,717.75	21.25	7.17	25.14

o Between T55 and T40, export credit decreases by 114 MW (requirement increase)
o Ramp capability (capacity) increases by 57 MW
o PacifiCorp East fails the Flex Ramp Sufficiency Test for HE 8

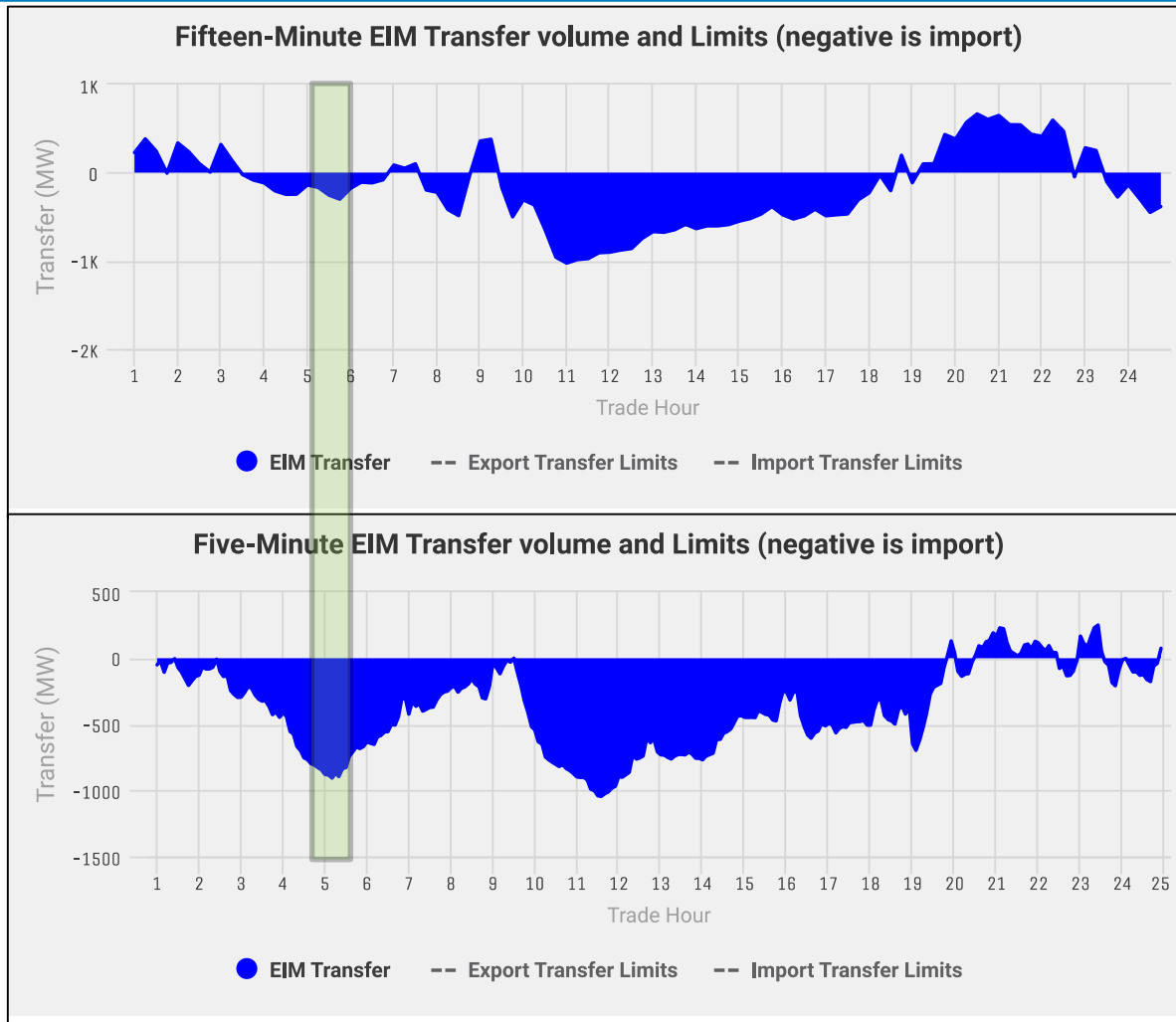Five-Minute EIM Transfer volume and Limits (negative is import)
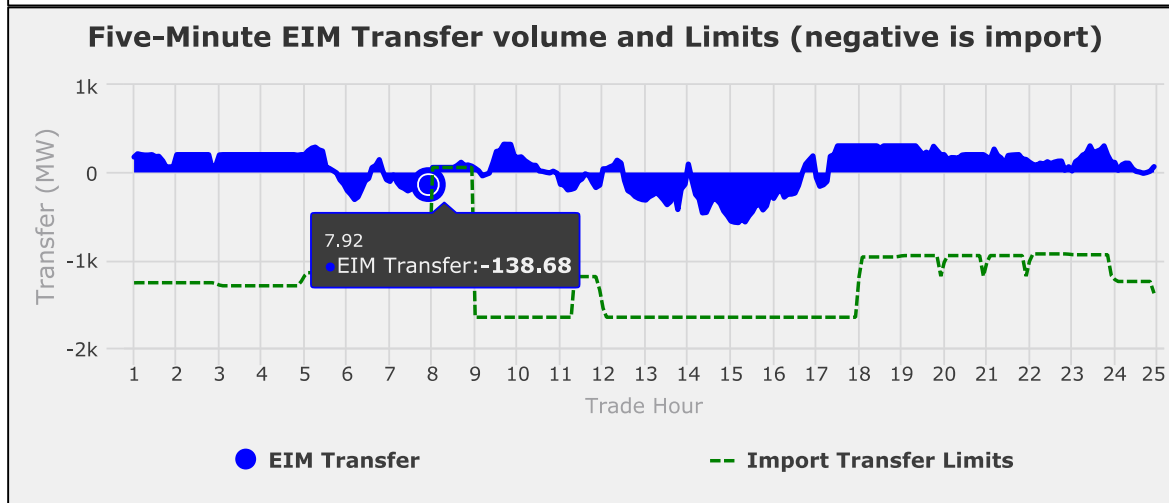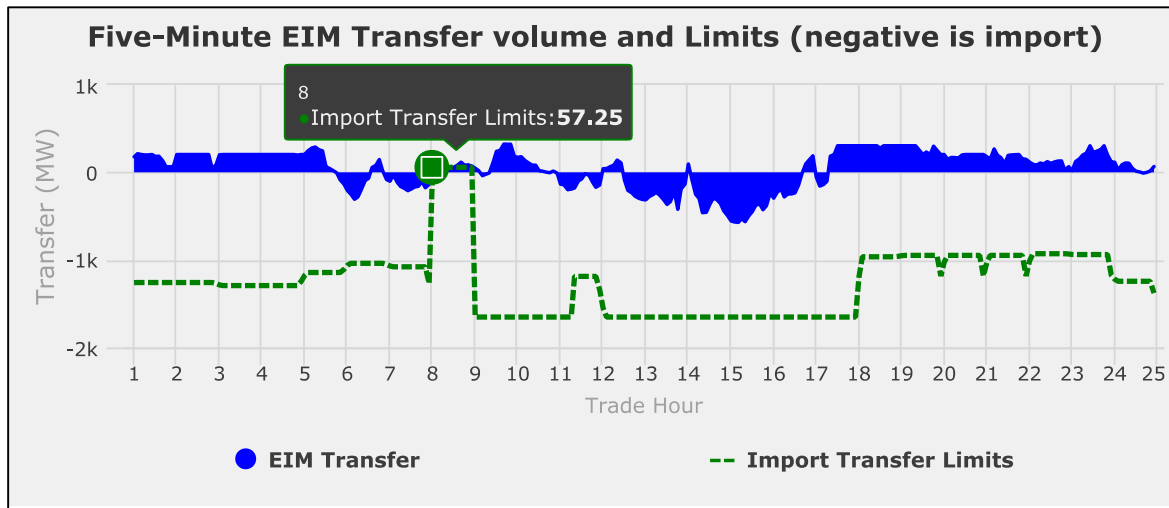
- o Transfer bounded from below at the base transfer in the 4th 15min interval of HE 7
- o RTD schedule forced to "snap" upwards by 196 MW to the lower bound
- o Market needs to find 196 MWs in 5 minutes, relying only on the PAC East system

Five Minute Infeasibilities (MW)
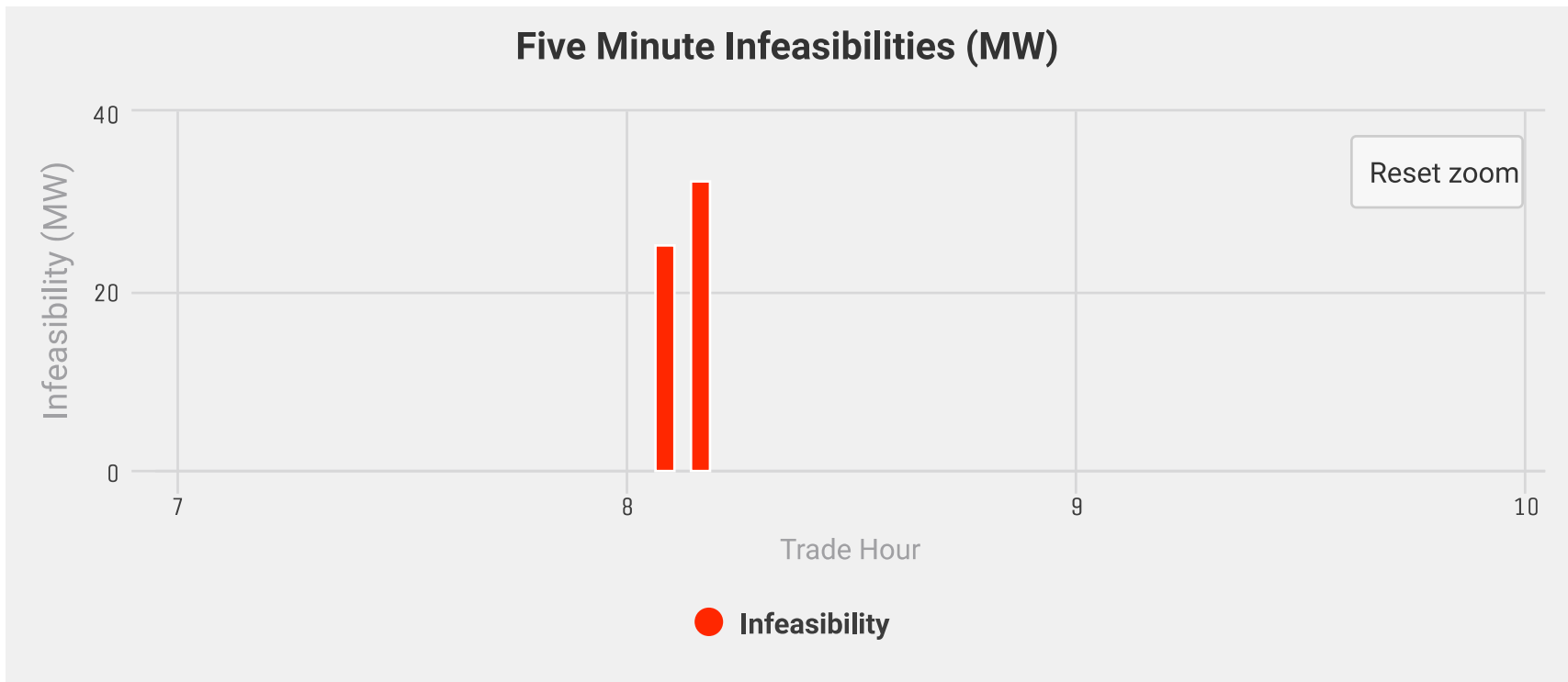
- o Market attempts to ramp PAC East resources up by 196 MW
- o PAC East exhausts ramp capacity by interval ending 8:10
- o BAA violates power balance constraint; i.e. goes infeasible

Fifteen Minute Market Infeasibilities and Load Bias

Five Minute Market Infeasibilities and Load Bias

o PacifiCorp frequently biases in the five minute market

Fifteen-Minute EIM Transfer volume and Limits (negative is import)

Five-Minute EIM Transfer volume and Limits (negative is import)

o RTD biases can drive large deviations between FMM and RTD schedules
o These deviations create the potential for large "snaps" in the event of flex failure
o In such an event, ramp capacity limits may result in infeasibilities

Conclusion

o As a consequence of load biasing in the five minute market, the **FMM schedule may deviate significantly from the RTD schedule**.

o This deviation has the potential to create **operationally infeasible ramp requirements** in the event that transfers are bounded by the FMM schedule.

o **Freezing to the RTD schedule** would resolve these challenging ramp requirements and reduce the potential for infeasibilities.

Thank You