

Analysis on Market Power Mitigation Price Formation Enhancements

Scott Lehman

Kun Zhao

Market Performance and Advanced Analytics

Working Group

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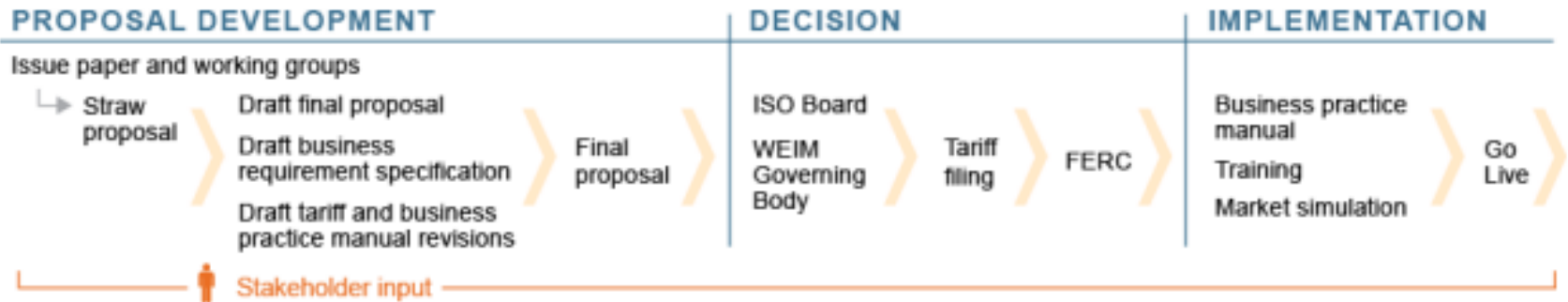
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Working Group in context



This represents the typical process, and often stages of the process run in parallel.



Today's Agenda

Time	Topic	Speaker
1:00 – 1:15 PM	Welcome	Christina Guimera
1:15 – 2:15 PM	CAISO Area Competitiveness	Scott Lehman
2:15 – 3:15 PM	Grouping Approach	Kun Zhao
3:15 – 3:30 PM	Conclusion	Christina Guimera

WEIM DCPA and CAISO competitiveness - Overview

- Review of Dynamic Competitive Path Assessment (DCPA) for WEIM BAAs
- Applying the DCPA to CAISO BAA
- Review of CAISO competitiveness in real time
- Applying the grouping approach to WEIM BAAs

Review of Dynamic Competitive Path Assessment (DCPA) – High Level Overview

- The DCPA is a process to determine if a given constraint is competitive
- The process identifies the top 3 companies with the most potential to impact flow on the constraint. These 3 companies are labeled the Pivotal Suppliers
- It then measures whether there is enough supply from all other resources not owned by Pivotal Suppliers to meet the flow on the constraint
- The result of the DCPA is a Residual Supply Index (RSI) which measures the competitiveness of the constraint

DCPA – Residual Supply Index (RSI)

- The Residual Supply Index (RSI) is the ratio of supply of counter-flow to the demand for counter-flow
- The demand for counter-flow is the cleared MWs on the constraint from participating resources
- The supply of counter-flow is a measure of the supply available on the constraint, discounting withholding from Pivotal Suppliers
- If the RSI is less than 1, the constraint is marked as non-competitive. If the RSI is greater than 1, the constraint is marked as competitive
- RTPD RSI calculation
 - For each constraint (k):

$$RSI_k = (SCF^{PPS}_k + SCF^{FCS}_k) / DCF_k$$

DCEPA – Potential Pivotal Suppliers

- For each constraint, the top 3 companies with the greatest ability to impact flow on the constraint are identified
- The ability to impact flow on the constraint is called Withheld Capacity. It is a measure of the maximum amount of supply each resource could provide minus the minimum, multiplied by the shift factor
- The top 3 companies that own the largest amount of withheld capacity per constraint are labelled as Potential Pivotal Suppliers (PPS). All others are labelled as Fringe Competitive Suppliers (FCS)
- Companies that are net buyers of electricity are excluded from the list of PPS on the basis that they would not have an incentive to raise prices

DCPA – Demand for Counter-flow

- The Demand for Counter-flow (DCF) is the cleared MWs on a constraint from participating resources. For WEIM BAAs, all participating resources within the BAAs are considered
- Resource DCF contribution to a given constraint:

$$-\min(0, SF) * En$$

Where

SF is the shift factor

En is the energy dispatch

- For WEIM BAAs, the SF will be equal to -1 for all resources within the BAA being tested

DCPA – Supply of Counter-flow

- The Supply of Counter-flow (SCF) is a measure of the amount of capacity available on a given constraint
- The SCF is calculated differently for Potential Pivotal Suppliers (PPS) and Fringe Competitive Suppliers (FCS)
- For resources owned by PPS, the SCF is equal to the lowest they could possibly ramp each resource to in the study interval
- For resources owned by FCS, the SCF is equal to the highest they could possibly ramp each resource to in the study interval

DCEPA – Resource Supply of Counter-flow

- Fringe Competitive Supply (FCS)
 - Maximum MW level resource can reach * Shift Factor
 - If resource is offline, only counts if SUT < 15 minutes
- Potential Pivotal Supply (PPS)
 - Minimum MW level resource can reach * Shift Factor
 - Does not consider shutdown
- For more calculation details, see Market Operations BPM appendix B

DCPA – Evaluation of WEIM BAAs

- The DCPA for WEIM BAAs is triggered when there is positive price separation between the BAA and the rest of the system
- This is most often caused by WEIM Transfer constraints or individual EIM Transfer System Resources binding in the import direction
- When a BAA fails the flexible ramping capacity test or the bid range capacity test in the upward direction, the WEIM transfers are limited in the import direction, often triggering the DCPA calculation for that BAA
- The BAA as a whole is then evaluated for competitiveness by applying the logic of the DCPA to the participating resources within that BAA

DCPA – Overview for WEIM BAAs

- WEIM BAA process in DCPA:
 - All participating resources within the BAA are considered
 - The shift factor is equal to -1 for all resources within the BAA

$$RSI_{BAA} = (SCF^{PPS}_{BAA} + SCF^{FCS}_{BAA}) / DCF_{BAA}$$

- Where:
 - SCF^{PPS}_{BAA} is the sum of SCF from resources in the BAA belonging to PPS (minimum MW levels)
 - SCF^{FCS}_{BAA} is the sum of SCF from resources in the BAA belonging to FCS (maximum MW levels)
 - DCF_{BAA} is sum of cleared energy for all participating resources in the BAA

WEIM DCPA and CAISO

- The CAISO BAA is not currently evaluated for competitiveness using the DCPA
- The DCPA is used to test constraints within CAISO for competitiveness (Local market power mitigation)
- This is due to an underlying assumption that CAISO is competitive based on the market structure and competitiveness metrics compiled by DMM based on the DA results
 - Note: The DCPA calculations in DA are slightly different than those in FMM due to the different time horizons

Applying the DCPA to CAISO in Real Time

- For the purpose of this analysis, the DCPA logic was replicated for an offline assessment
- The logic was applied to CAISO in the fifteen-minute market (FMM) using the same calculations that are currently applied to WEIM BAAs
- The test was performed for the intervals in which the CAISO area was import constrained, mimicking the existing logic applicable to other BAAs
- There were no intervals in 2024 when the CAISO would fail the DCPA test based on the existing logic

Applying the DCPA to CAISO BAA in FMM

- The CAISO WEIM Transfer constraint was binding in only 3 FMM intervals in 2024, all due to a system issue:

Trade Date	Trade Hour	Interval	Calculated RSI	Competitive
8/29/2024	4	3	1.33	Y
8/29/2024	4	4	1.35	Y
8/29/2024	5	1	1.33	Y

- In all 3 cases, CAISO would have been competitive
- CAISO failed the RSE tests in one interval in 2024, on July 23 HE 19 interval 4. The CAISO BAA was not import constrained in this case

Grouping approach

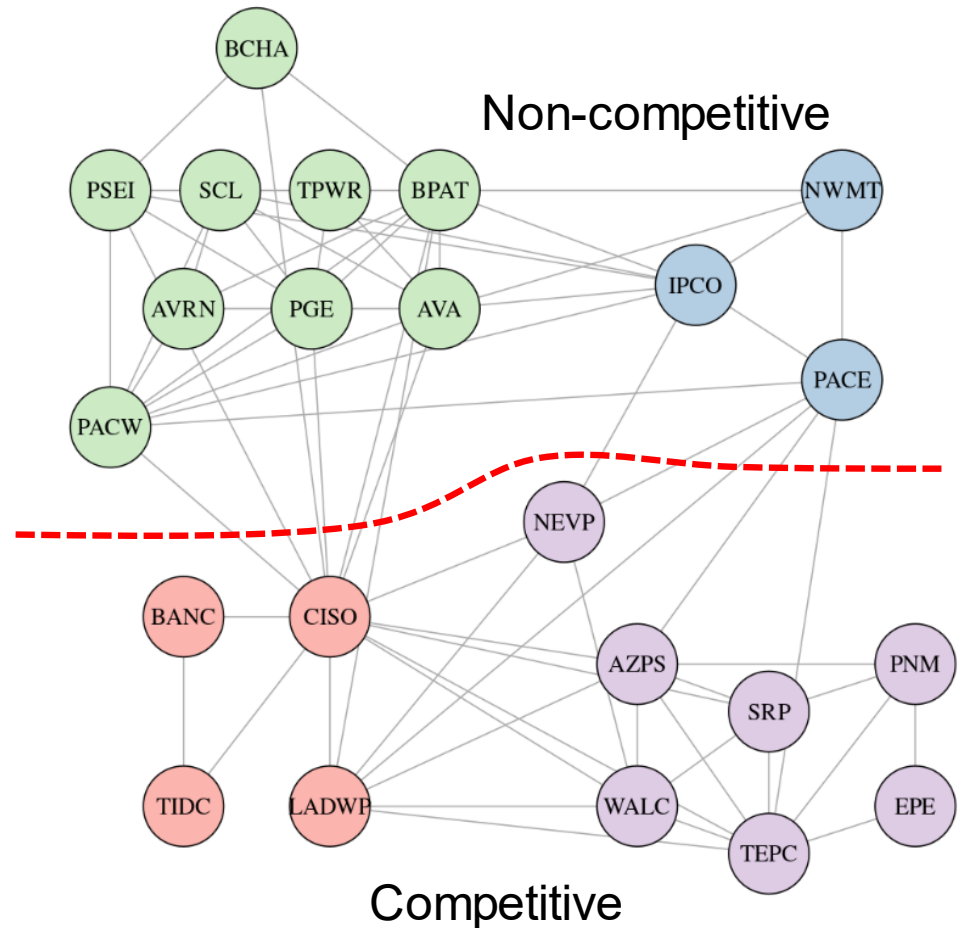
- Current approach:
 - Tests BAAs individually and ignores supply contributions from other BAAs
 - May lead to excess mitigation
- Grouping approach:
 - Potentially reduces unnecessary mitigation by considering available supply in broader areas
 - Potentially better reflects the actual market conditions and competitiveness

Example for grouping approach

Data: 7/24/2024 hour ending 15

Original results:

- Non-competitive BAAs:
AVA, AVRN, BCHA, BPAT, IPCO, NWMT, PACE, PACW, PGE, PSEI, SCL, TPWR
- Competitive BAAs:
AZPS, BANC, CISO, EPE, LADWP, NEVP, PNM, SRP, TEPC, TIDC, WALC

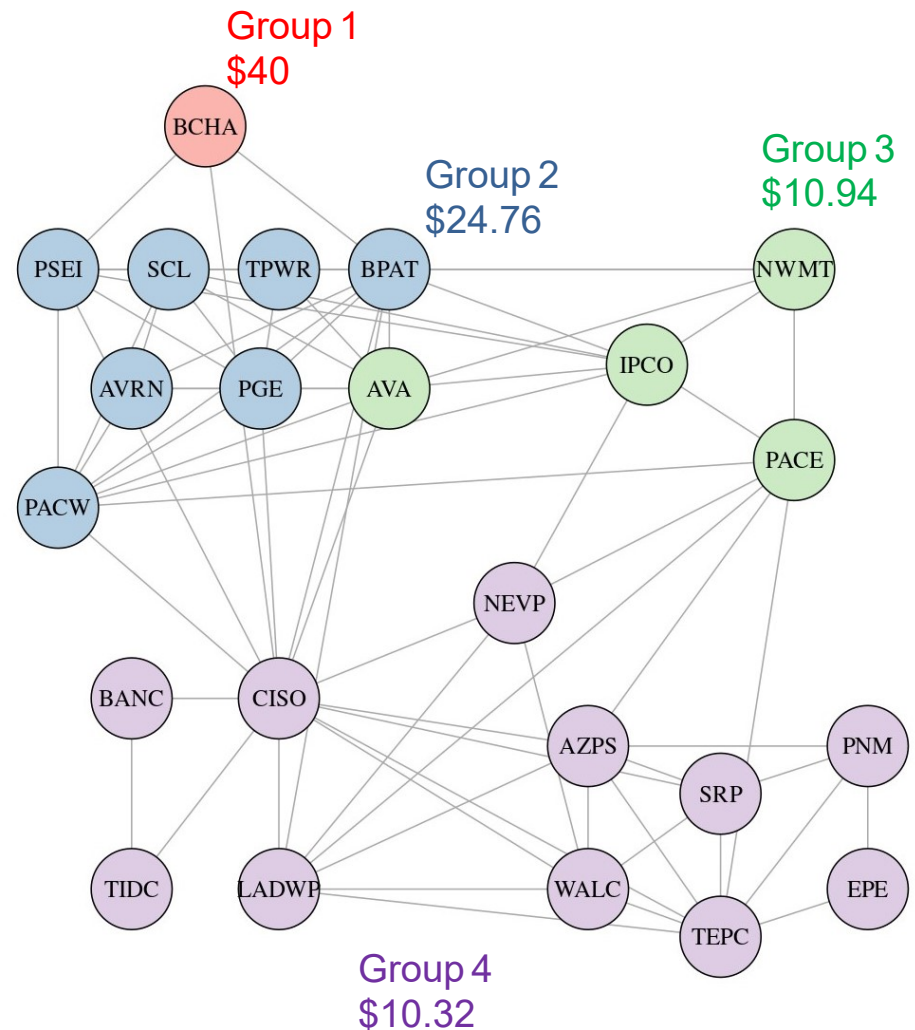


Example for grouping approach

MEC: Marginal Energy component by BAA

BAA MECs can be partitioned into 4 groups:

- Group 1: BCHA @\$40
- Group 2: AVRN, BPAT, PACW, PGE, PSEI, SCL, TPWR @\$24.76
- Group 3: AVA, IPCO, NWMT, PACE @\$10.94
- Group 4: AZPS, BANC, CISO, EPE, LADWP, NEVP, PNM, SRP, TEPC, TIDC, WALC @\$10.32



Example for grouping approach

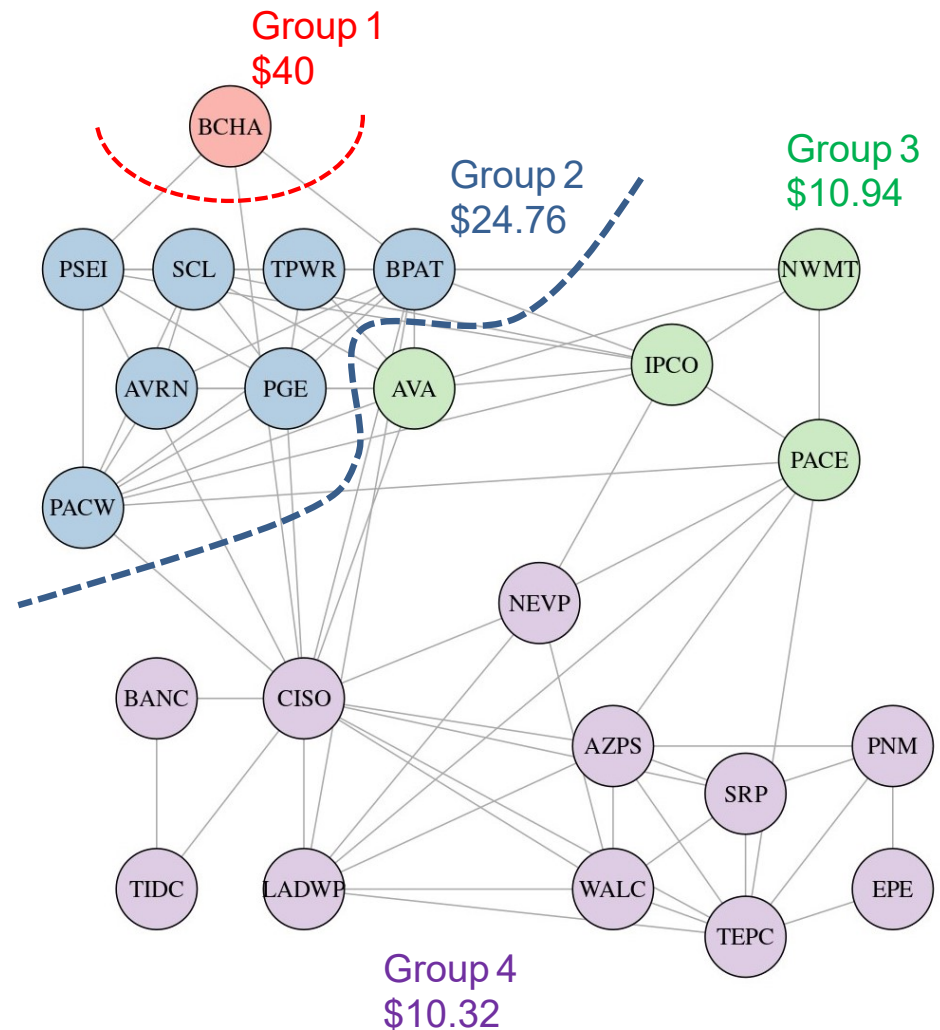
Grouping algorithm:

1) Test group {1}:

- Fail
- Non-competitive: BCHA

2) Test group {1, 2}:

- Fail
- Non-competitive: AVRN, BPAT, PACW, PGE, PSEI, SCL, TPWR



Example for grouping approach

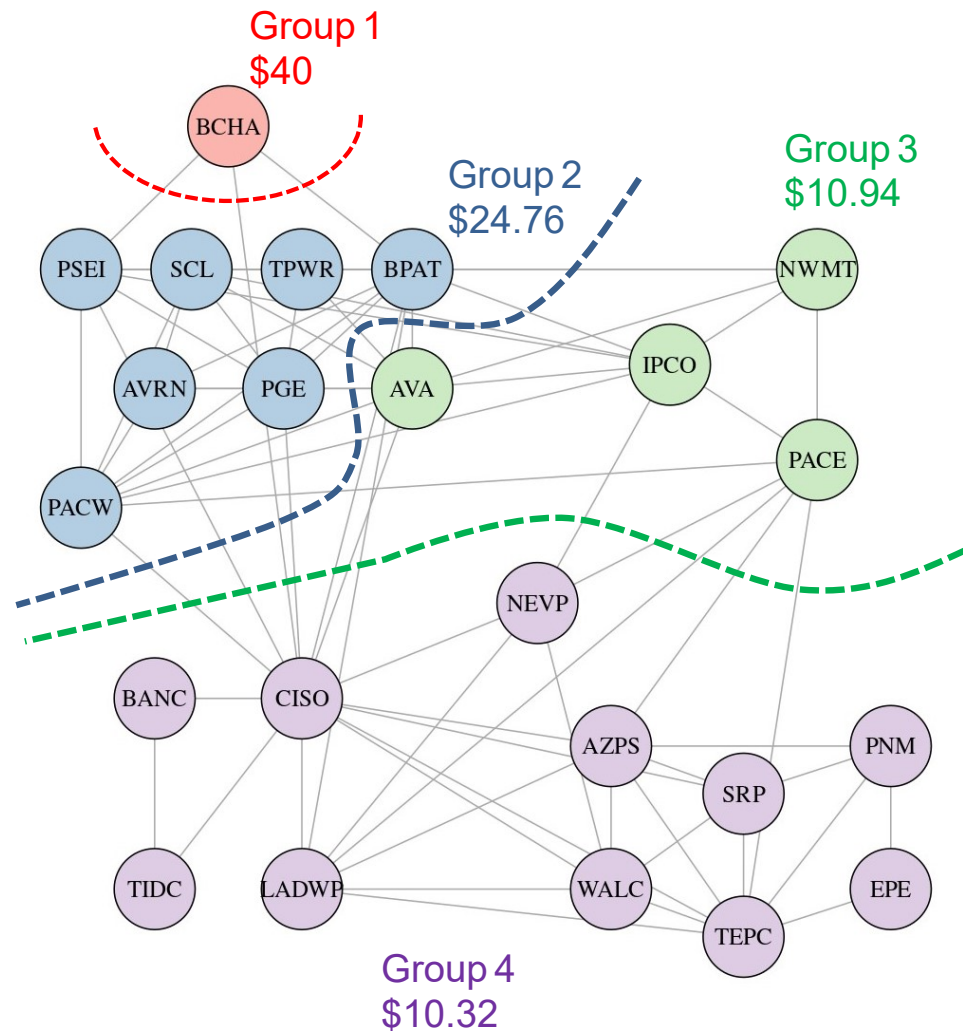
Grouping algorithm:

3) Test group {1, 2, & 3}:

- Pass
- Competitive: AVA, IPCO, NWMT, PACE
- Competitive LMP \$10.94: BCHA, AVRN, BPAT, PACW, PGE, PSEI, SCL, TPWR

4) Test all BAAs together:

- Pass
- Competitive: AZPS, BANC, CISO, EPE, LADWP, NEVP, PNM, SRP, TEPC, TIDC, WALC

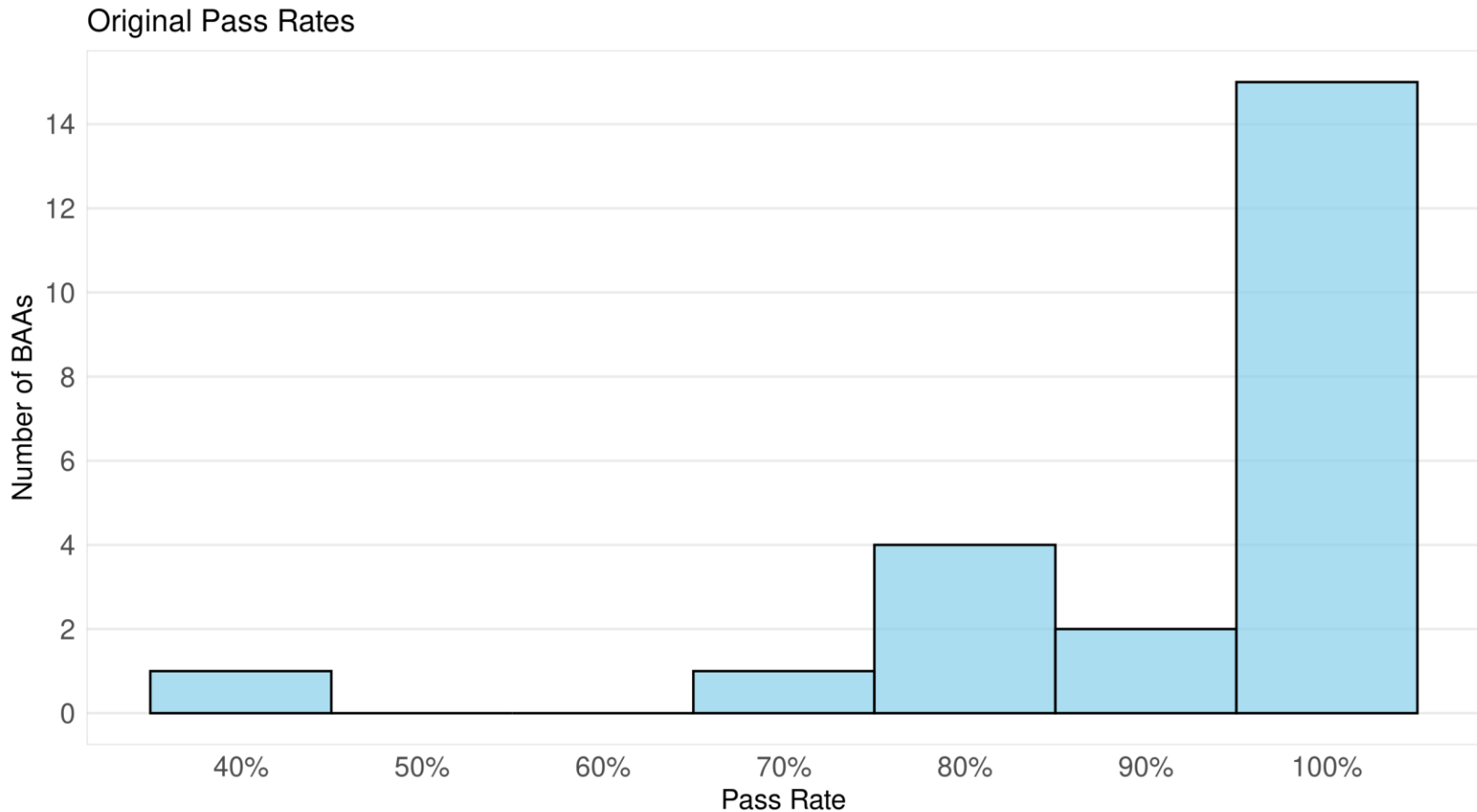


Counterfactual study: evaluating the impact of the grouping approach

Factors considered in the analysis:

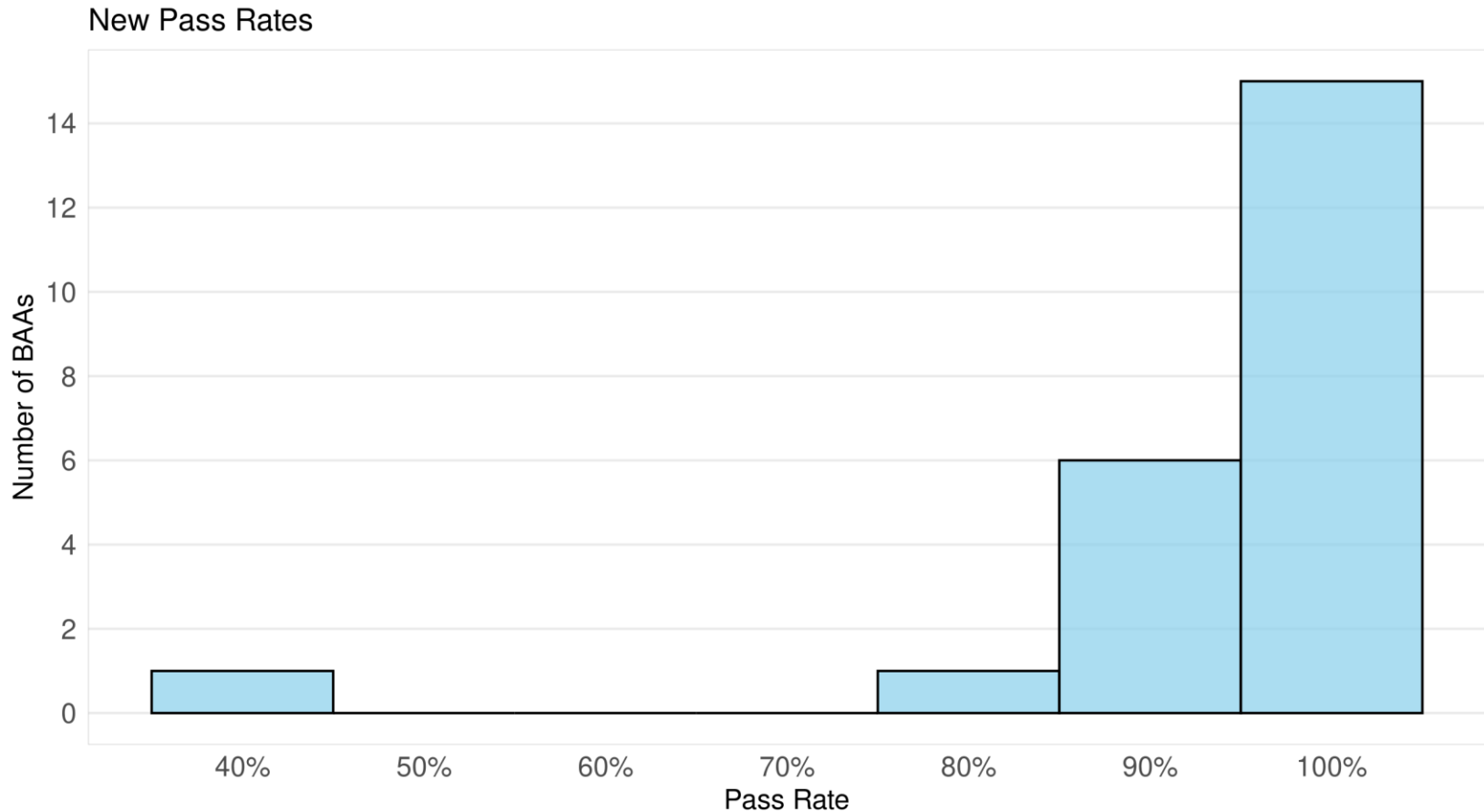
- Range: 2024 Q3 (July 1st – September 30th)
- FMM LMPM results
- Master file registered ETSR mapping is used as the reference for connectivity among BAAs
- Competitive LMP of a passing group is set by the lowest MEC in the group

A BAA is considered as Pass in BAA-level MPM if it is not import-transfer constrained, or passed the RSI test



In the study period, 15 WEIM BAAs had pass rates of 95% or higher, and 17 BAAs had pass rates 85% or higher

With the grouping approach, 15 WEIM BAAs maintained pass rates of 95% or higher, and 21 BAAs had pass rates 85% or higher



Powerex BAA fails the test about 60% of the time due to its import transfers binding frequently

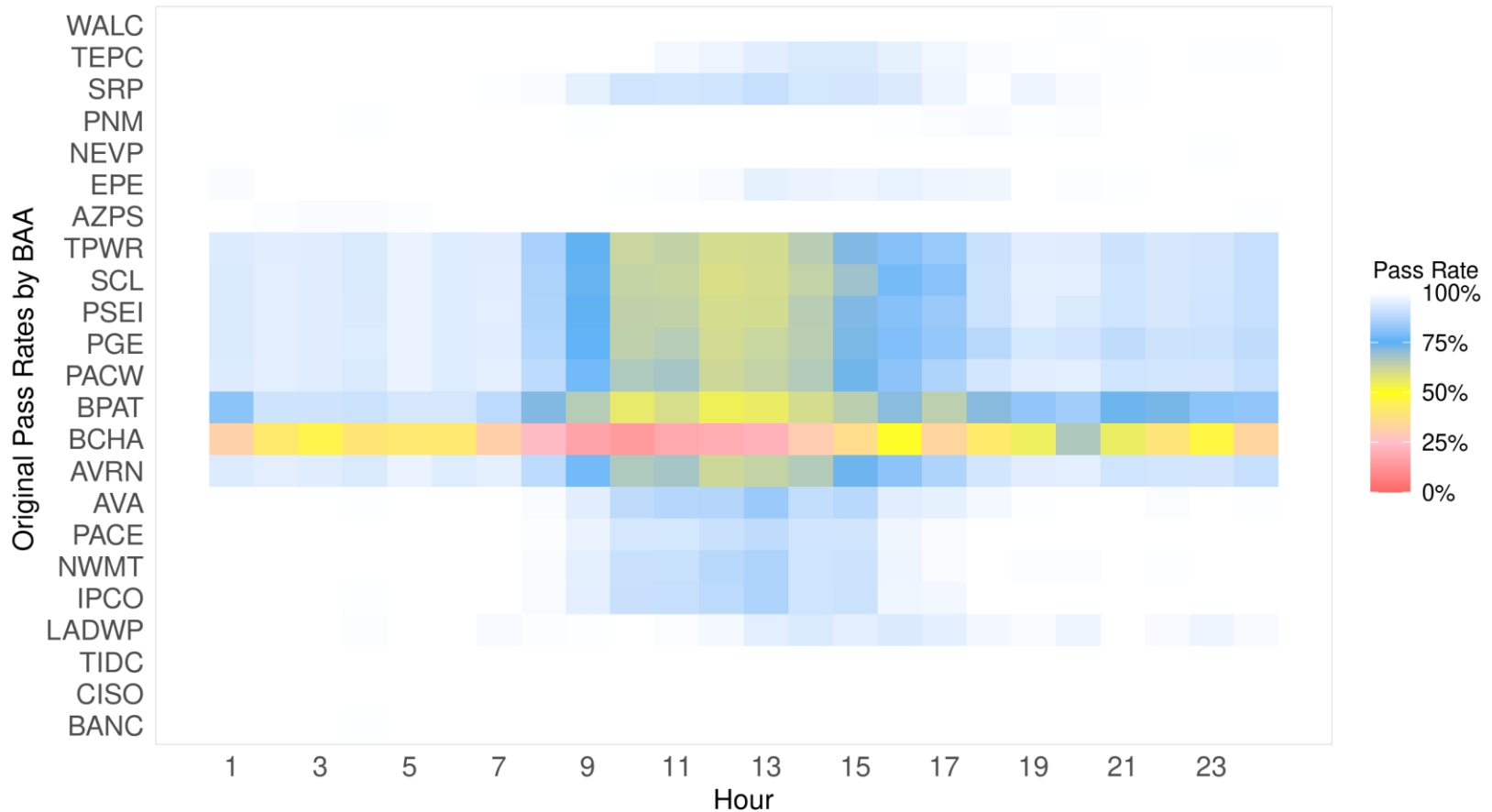
Overall pass rates maintained or increased on the BAA level under the grouping approach. In some cases, previously failed BAA tests showed significant increase in pass rate

BAA	Pass Rate Original	Pass Rate New	Pass Rate Delta	Pass Rate Given Fail *
AVA	96.0%	98.2%	2.2%	56.3%
AVRN	85.1%	88.7%	3.6%	25.6%
AZPS	99.9%	99.9%	0.0%	0.0%
BANC	100.0%	100.0%	0.0%	0.0%
BCHA	36.3%	37.6%	1.4%	2.6%
BPAT	75.0%	78.3%	3.3%	14.1%
CISO	100.0%	100.0%	0.0%	
EPE	99.0%	99.1%	0.1%	17.6%
IPCO	96.9%	98.8%	1.9%	61.1%
LADWP	98.1%	98.1%	0.0%	0.6%
NEVP	100.0%	100.0%	0.0%	0.00%
NWMT	96.9%	98.8%	1.8%	60.7%
PACE	97.5%	98.9%	1.4%	56.0%
PACW	85.1%	88.7%	3.6%	25.6%
PGE	83.7%	87.2%	3.6%	22.9%
PNM	99.8%	99.8%	0.0%	0.0%
PSEI	84.0%	87.7%	3.6%	23.9%
SCL	83.5%	87.1%	3.6%	22.8%
SRP	97.1%	97.2%	0.1%	3.9%
TEPC	98.6%	98.9%	0.3%	23.5%
TIDC	100.0%	100.0%	0.0%	
TPWR	83.9%	87.5%	3.7%	23.8%
WALC	100.0%	100.0%	0.0%	0.0%

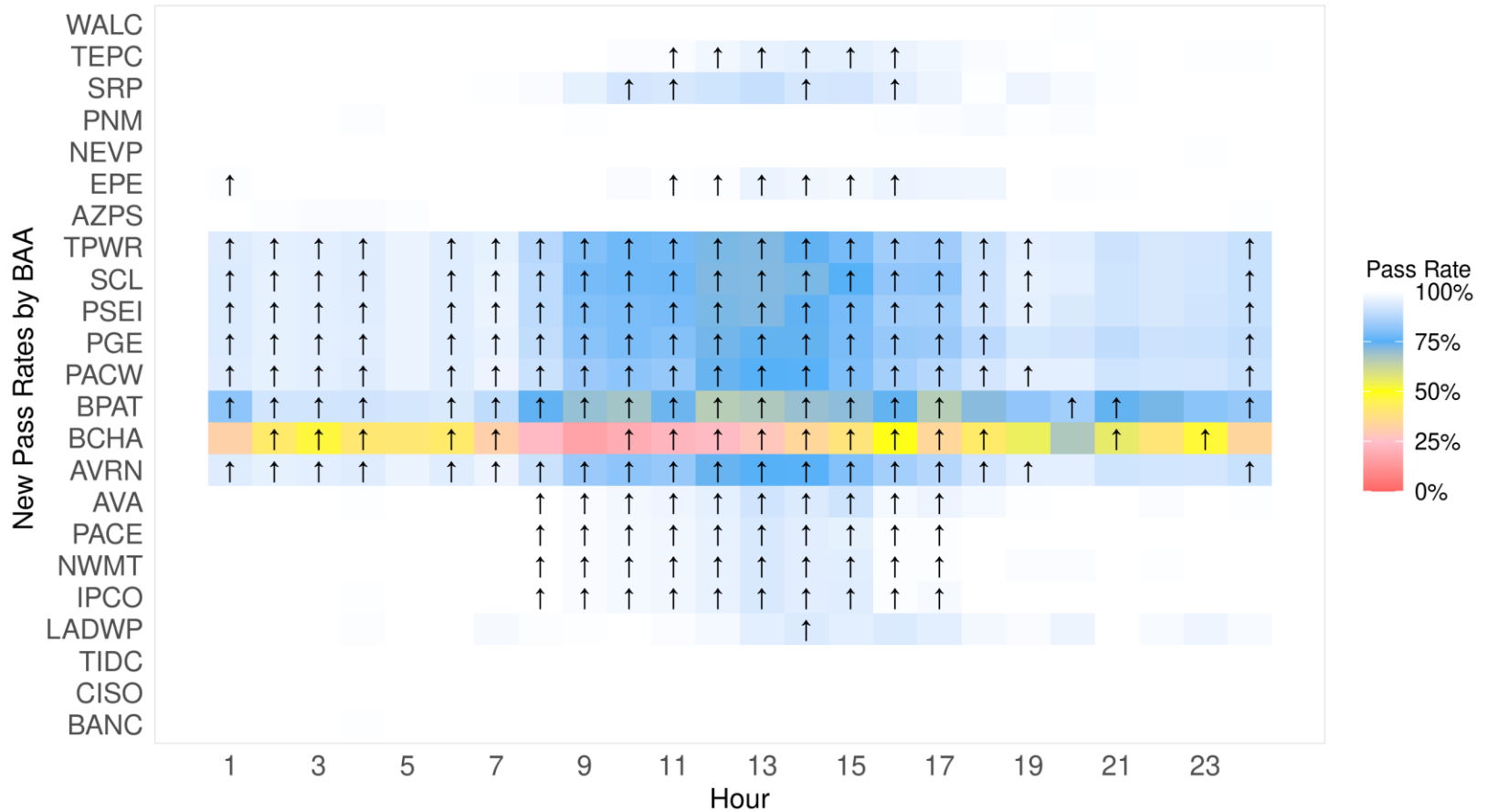
		After	
Bef → Aft		Pass	Fail
Before	Pass	91.059%	0.076%
	Fail	1.566%	7.299%

* The percentage of previously failed BAA tests that passed under the grouping approach.

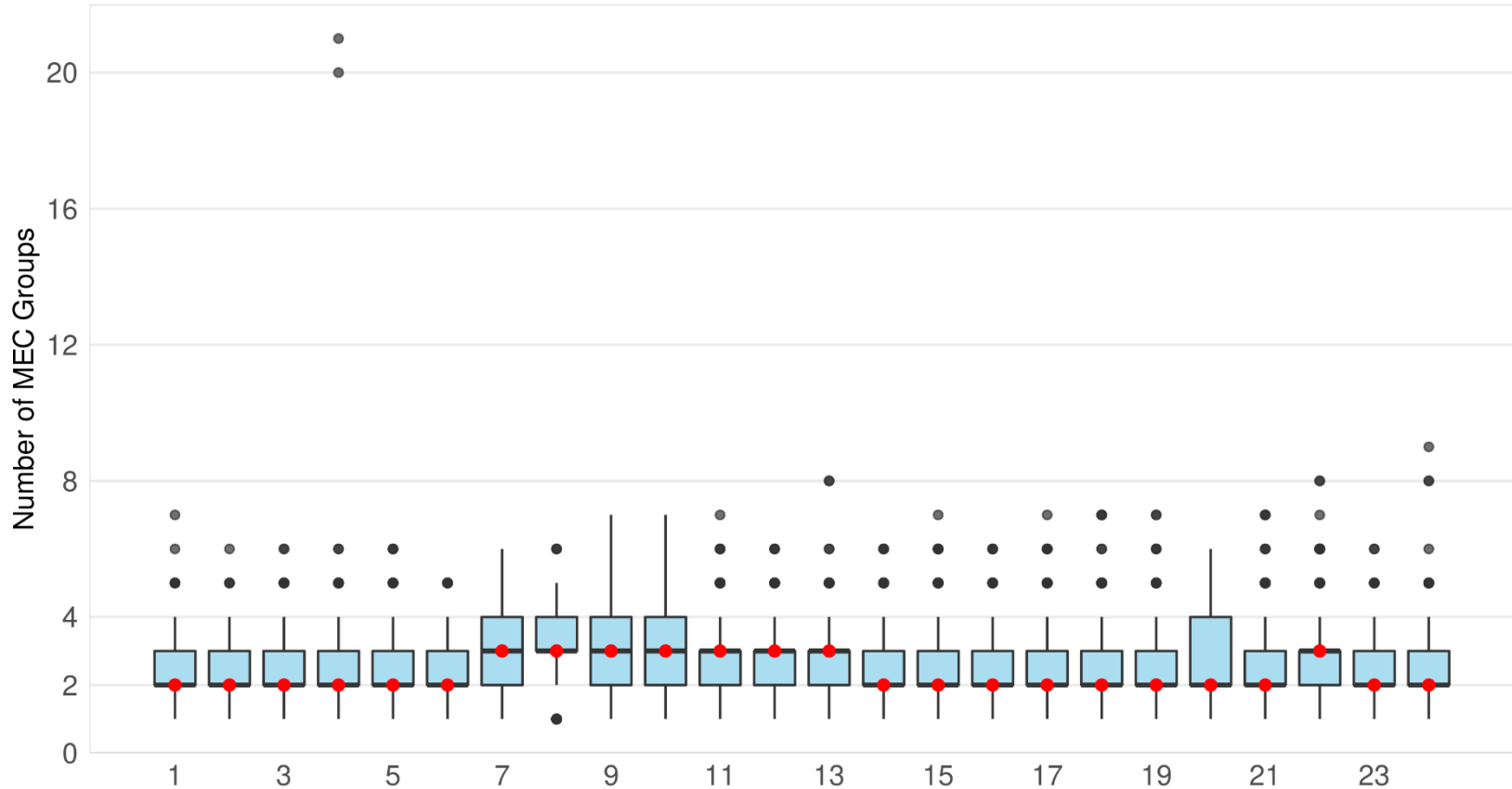
Original pass rates by BAA mainly concentrated in midday hours when BAAs are import constrained



With the grouping approach, pass rates went up for majority of the midday hours for central/mountain and pacific northwest regions

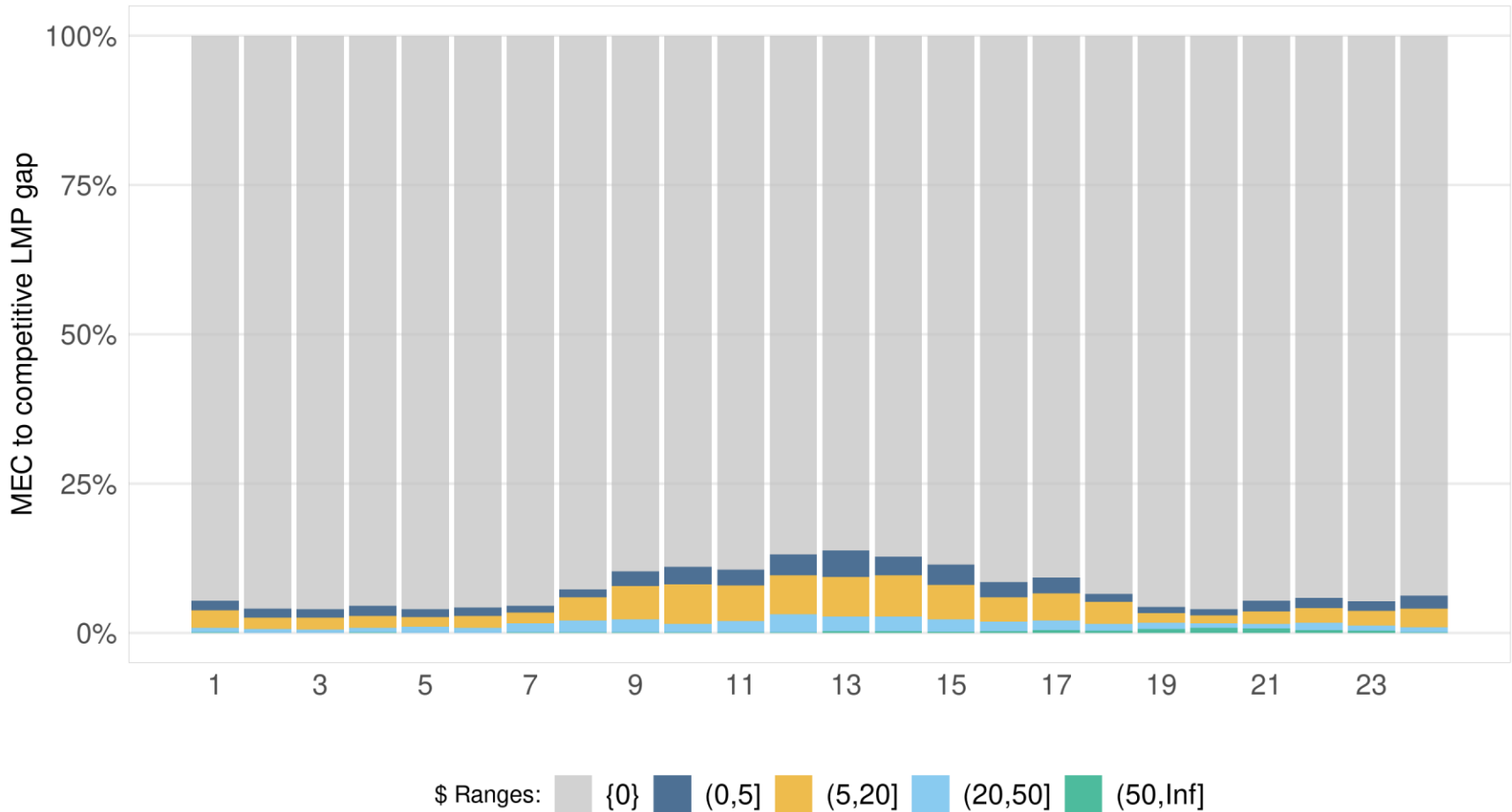


Majority of the time, all BAA MECs fall into either 2 or 3 groups.

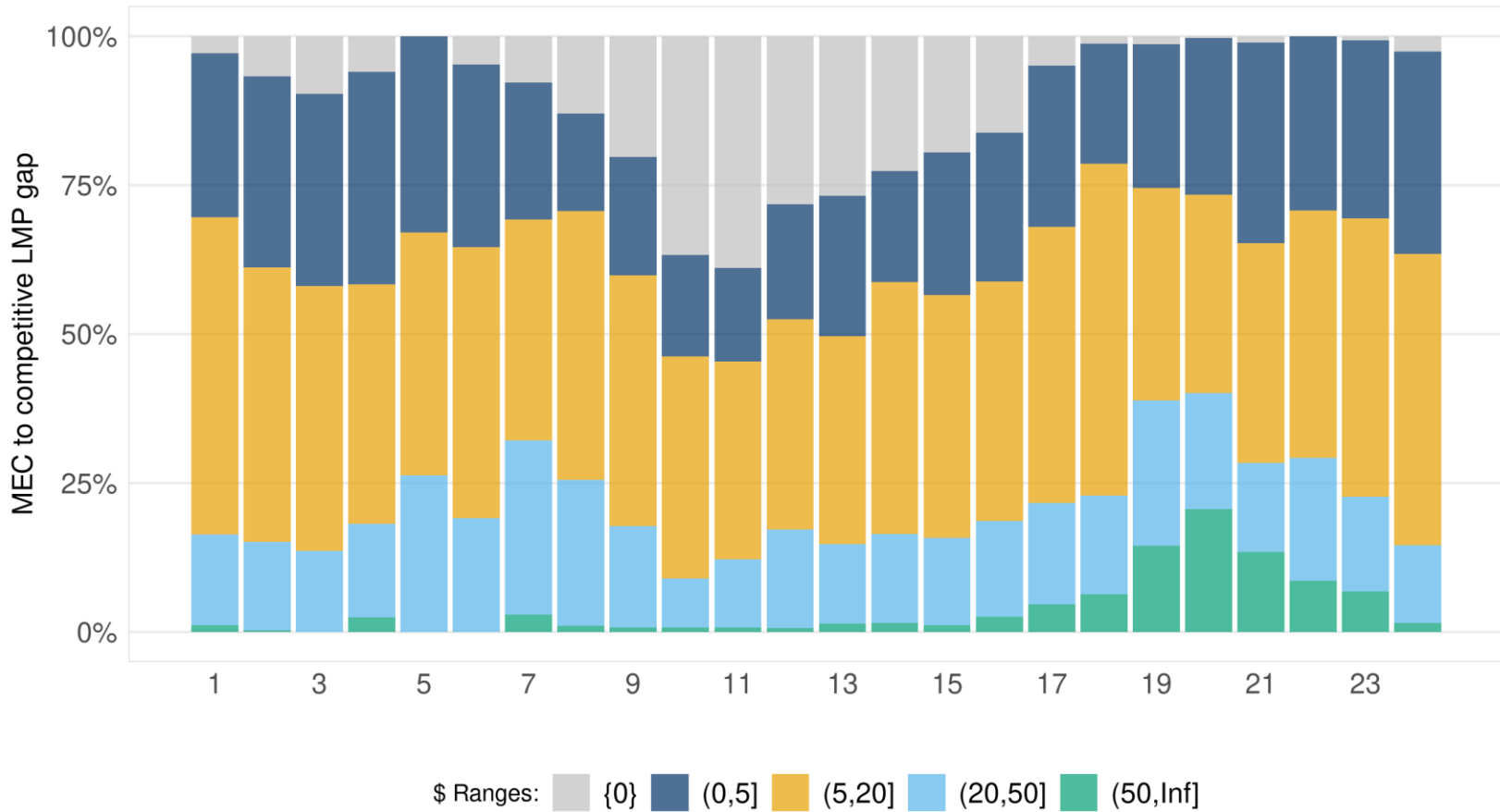


Number of groups tend to be higher in morning peak and hour ending 20

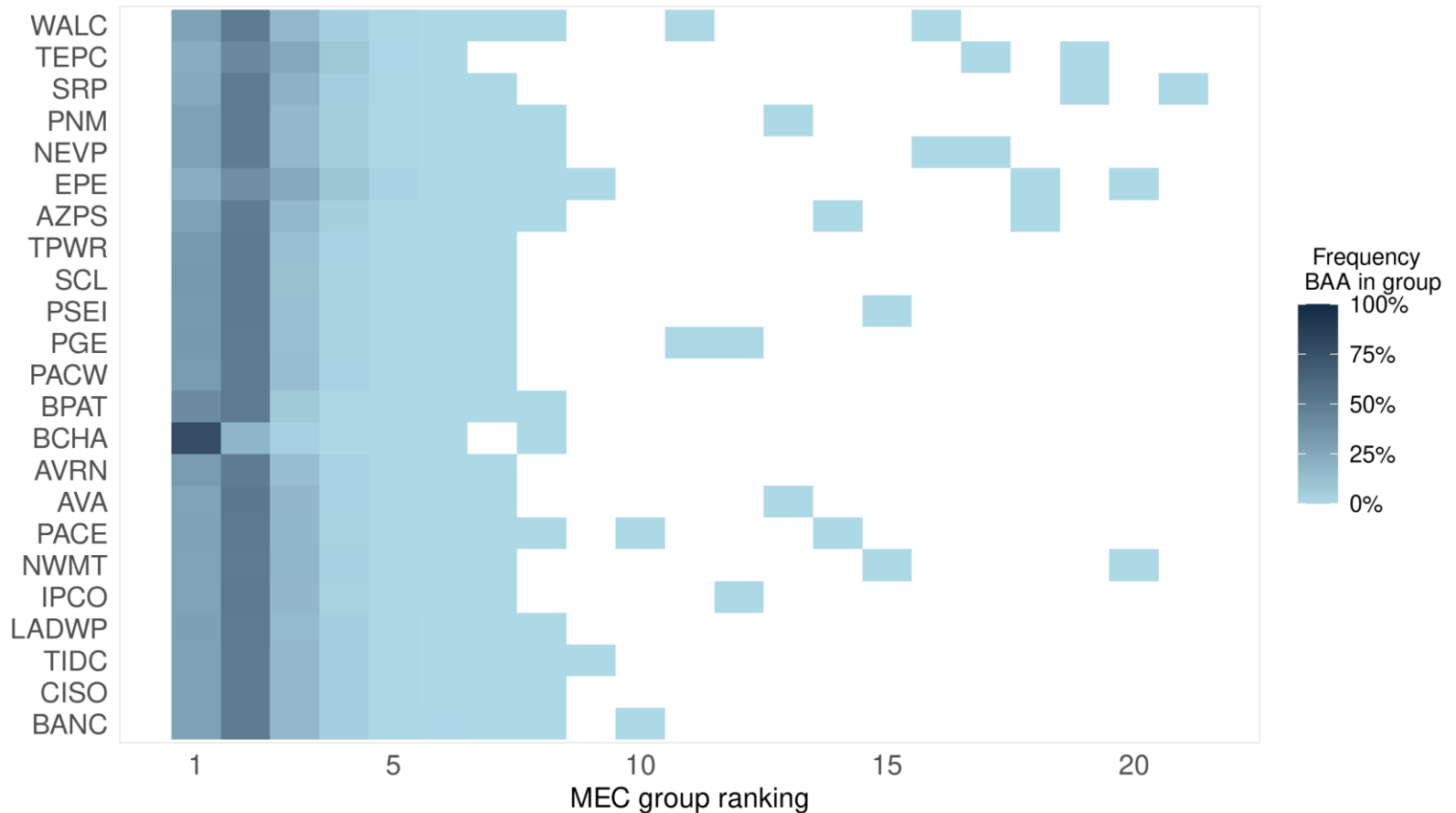
When a group passes, the competitive LMP is set to the lowest MEC in the group. Majority of the time, competitive LMPs are the original MECs



Price buckets for MEC to competitive LMP deltas for originally failed tests: If a BAA failed in the original results, the difference between MEC and competitive LMP tend to be smaller in midday hours and larger during afternoon peak hours

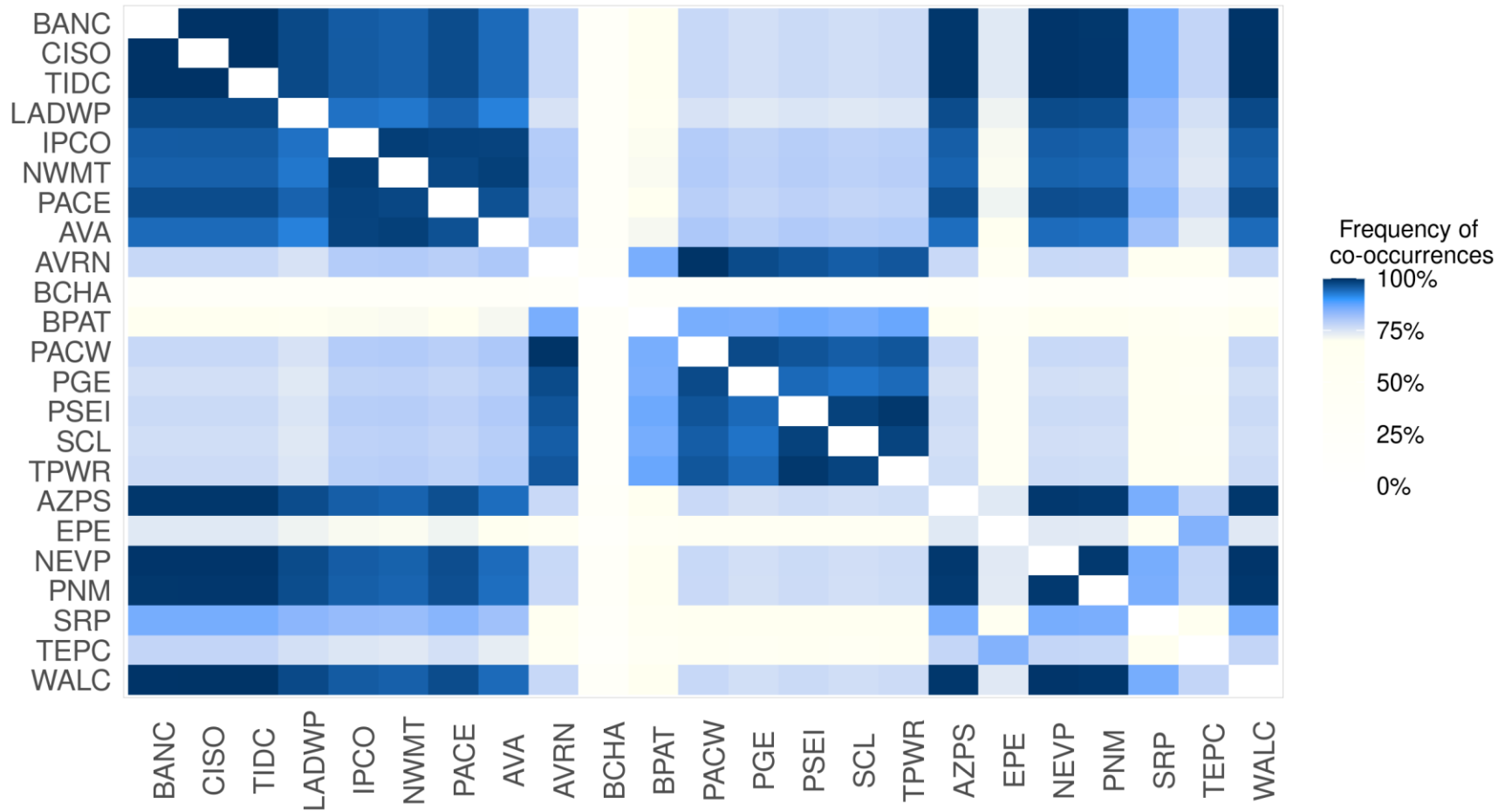


BCHA was consistently assigned to group 1, while the rest BAAs were primarily in group 2 and 3. The pattern suggests a fairly consistent group formation, with modest variability



Grouping MECs in descending order, group 1 represents the highest MEC group, and group 2 being the second highest MEC group, etc. The frequency of a BAA being part of a group shows the statistics on its MEC's relative position in the WEIM fleet

Frequency of co-occurrences for pairwise BAAs in the same MEC groups



For Reference

- All meeting material and notices are available on the Price Formation Enhancements Initiative webpage: <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Price-formationenhancements>
- If you have any questions, please contact ISOStakeholderAffairs@caiso.com



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