Joint Market Seams Workshop

Western Electricity Coordinating Council (WECC), Salt Lake City, UT
Workshop #4

October 22, 2026

Housekeeping

This call is being recorded for informational and convenience purposes only. Any related transcriptions should not be reprinted without ISO's permission.

The meeting is structured to stimulate dialogue and engage different perspectives.

Please engage in a respectful and professional manner. Introduce yourself and your organization when speaking. Follow the facilitator's guidance for speaking or asking questions.

Please keep comments brief and avoid repeating points already made to ensure everyone has an opportunity to participate in a robust discussion.

You can access Closed Captioning and the Transparency Viewer using the controls located at the bottom of the Webex screen.

Instructions for Raising Your Hand to Ask a Question

Please remember to state your name and affiliation before making your comment.

If you are connected to audio through your computer or used the ‘call me’ option, select the raise hand icon located on the bottom of your screen. Start speaking a couple of seconds after you’re unmuted.

If you are connected on the phone line only and not the Webex dial *3 to be added to the queue.

You may also send questions via chat to all panelists.

If you need technical assistance during the meeting, please send a chat to the event producer, Intellor Events.

Welcome and Opening Remarks

Joanne Serina
Vice President
Stakeholder Engagement and Customer Experience, CAISO

California ISO

SPP
Powering Progress

WECC

Welcome and Opening Remarks

Carrie Simpson
Vice President
Markets, SPP

Meeting Objectives

Paul Dockery
Market Strategy & Governance Manager, CAISO

Casey Cadle
Director Seams Strategy, SPP

Agenda

Time (MDT)	Topic	Presenters	
8:30 a.m.	*Breakfast provided*		
9:00 a.m. – 9:10 a.m.	**Welcome and Meeting Objectives**	Joanne Serina, CAISO Carrie Simpson, SPP	
9:10 a.m. – 9:20 a.m.	**Meeting Objectives**	Paul Dockery, CAISO Casey Cadle, SPP	
9:20 a.m. – 10:30 a.m.	**Educational presentation on the Western Loading Relief process**	Raja Thappetaobula, CAISO Yasser Bahbaz, SPP	
10:30 a.m. – 10:45 a.m.	*Break*		
10:45 a.m. – 12:30 p.m.	**Western Loading Relief process now, next, and future processes with examples**	**Moderator:** Casey Cadle, SPP	Raja Thappetaobula, CAISO Yasser Bahbaz, SPP Jamil Daouk, CAISO Paul Dockery, CAISO Alex Watkins, SPP
12:30 p.m. – 1:30 p.m.	*Break (lunch provided)*		
1:30 p.m. – 2:15 p.m.	**Joint report overview, next steps, and moderated Q&A**	**Moderator:** Jeff Droubay, WECC	Casey Cadle, SPP Paul Dockery, CAISO
2:15 p.m. – 2:30 p.m.	**Closing Remarks**	Carrie Simpson, SPP Anna McKenna, CAISO	

Seams workshop series & Joint report

- July 31st, Seattle, WA: Seams stages, expert panel, and panel of state regulators
- August 18th, Salt Lake City, UT: Reliability: Transmission constraints and congestion management
- September 16th, Denver, CO: Imports and Exports: Transactions across market boundaries
- September 30th: Joint Report on Western Seams Coordination due to FERC
- October 22nd, Salt Lake City, UT: Western Loading Relief process, joint report on western seams coordination overview, and next steps

Comments and next meeting

- Comments: Please submit stakeholder comments on the October 22 workshop by visiting Meetings | Market Seams | California ISO and completing the comment template Word document. Upon completion of this template, please submit it to isostakeholderaffairs@caiso.com. Written comments are due by end of day Nov. 5, 2026.

- Next meeting: The California ISO and Southwest Power Pool are planning to continue the Joint Market Seams Workshops in 2027. The plan is to continue hybrid in-person and remote attendance with quarterly cadence. Submit comments with preferred topics or additional feedback on the meeting series.

- Seams Webpage: More information is at Seams | Western Energy Markets

Clarifying terms

- **Seams** refer to the interfaces between adjacent wholesale electric systems on a shared network.
- **Seams issues** are impediments to carrying out responsibilities efficiently and effectively.
- **Market seams** refer to the interfaces between centrally cleared, structured electricity markets.
- **Market seams issues** include barriers to trade, inefficient congestion management, and suboptimal dispatch.

More info: [Seams | Western Energy Markets]

EDUCATIONAL PRESENTATION ON THE WESTERN LOADING RELIEF PROCESS

- **Raja Thappetaobula** — CAISO
- **Yasser Bahbaz** — SPP

Western Interconnect Loading Relief (WLR)

Unscheduled Flow Mitigation Plan (UFMP)

- Mitigate high flows on qualified paths to reliable levels in real-time operations
  - SOL exceedance or 95% SOL observed
  - Limited to 5 qualified paths
  - Difficult process to add qualified paths
  - Limited effectiveness because UFMP only utilizes phase shifter movement and tag curtailment
    - Excludes untagged flows (Gen to Load impacts)
    - Dynamic schedules MW are not real time
  - Inefficient to use 5 paths to control SOL across Western Interconnection

What Is WLR?

Western Interconnection Loading Relief (WLR) is the RC-directed procedure for curtailing transactions and assigning GTL relief obligations to relieve System Operating Limit (SOL) or Interconnection Reliability Operating Limit (IROL) exceedances in the Western Interconnection

1

Who Calls It

The Reliability Coordinator (RC) experiencing the Constraint, using the Enhanced Curtailment Calculator (ECC)

2

What It Coordinates

Interchange Transactions, tagged Intra-BA Transactions, and GTL relief obligations across Balancing Authorities

3

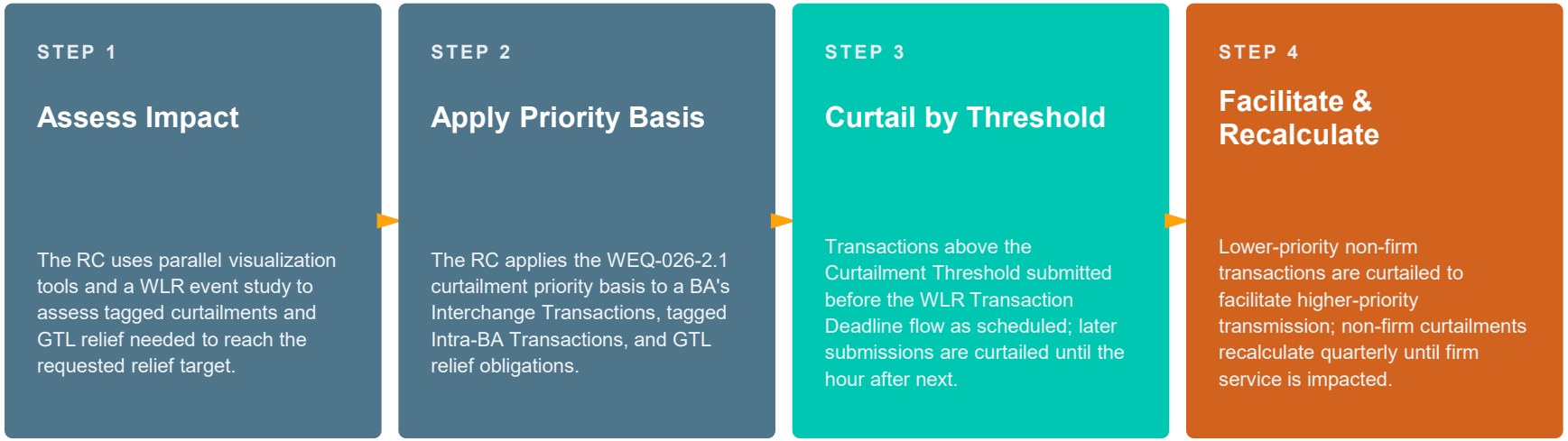
Curtailment Threshold

+0.05 (5%) or greater on the Constrained Facility or Constrained Flowgate triggers the WLR procedure

Western Interconnect Loading Relief

- Flow based curtailment tool on SOLs/IROL's in real-time
- RC led process that can be utilized along with other existing congestion management process (Market Optimization ,UFMP ,Local Op procedures)
- Standardized curtailment methodology
  - Tag Curtailments
    - Very similar to tag curtailments currently being done in UFMP Step 4 but with TDF calculated to the SOL not a proxy path
  - Balancing area Generation to Load relief obligations (GTL)
  - Real time MW acquisition for dynamic schedules
  - Standard approved through NAESB process
  - Ongoing implementation project to include curtailment methodology into ECC (Q4 2027)
  - Utilizes RC West's full network state estimator model of western interconnection. This model is developed in coordination with all 4 RCs

WLR Curtailment Procedure



Only Interchange Transactions, tagged Intra-BA Transactions, and GTL impacts at or above the Curtailment Threshold are included in the WLR procedure (WEQ-026-3.3.2.5).

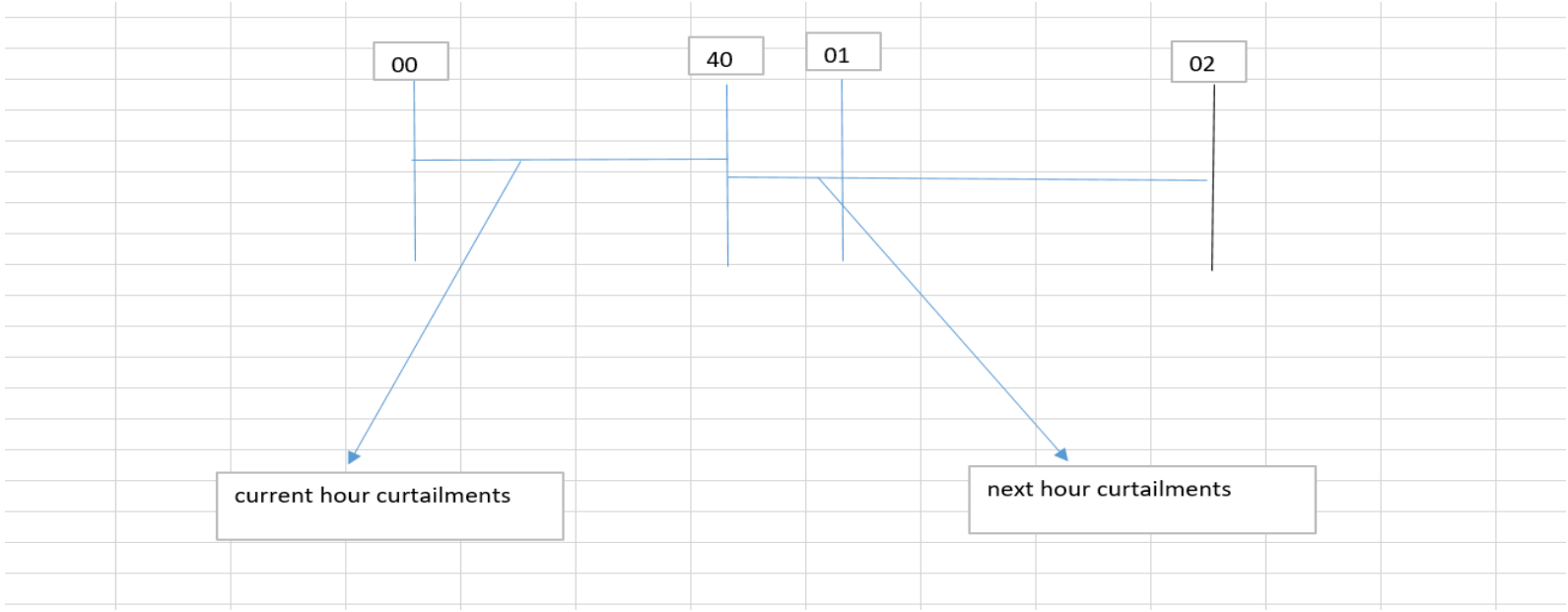
Western Interconnect Loading Relief (WLR)

- WLR process recognizes the Interchange transactions and Intra-BA Transactions priority determined by the Transmission Service reserved as follows

  - Priority 0. non-firm NHM Service – NX (if offered by Transmission Service Provider)
  - Priority 1. non-firm PTP Service over secondary PORs and PODs – NS
  - Priority 2. non-firm PTP Hourly Service – NH
  - Priority 3. non-firm PTP Daily Service – ND
  - Priority 4. non-firm PTP Weekly Service – NW
  - Priority 5. non-firm PTP Monthly Service – NM
  - Priority 6. Secondary Network Transmission Service – NN and long-term firm PTP subject to the Conditional Curtailment Priority Level – CF
  - Priority 7. firm PTP – (F), firm NITS – (FN), and CBM – (CB)
  - Priority for non-tagged GTL impacts within a BA serving its own load calculated by ECC shall be treated as firm.

WLR Effective Timings:

- When RC issue WLR between 00 and 40 minutes in the current hour it will trigger curtailments for current hour and any WLR issuance after 40 minutes will result in next hour curtailments



Western Interconnect Loading Relief

- webECC calculates generation shift factors and load shift factors sourcing the model from RC West State Estimator model every 15 minutes
- Utilizing the load shift factors and generation shift factors webECC calculates the impacts of all e-tags and dynamic transfer tags on any defined constraint
- The tool also calculates each balancing areas generation to load impacts (GTL) on any defined constraint
- Modeling data is provided to webECC every 15 minutes
  - Circuit breaker and switch actual status
  - Generation and pump output
  - Individual load MW
  - PST tap position and status
  - LTC tap positions
  - DC line flows, transmission line and transformer high and low limits, and branch group high and low limits

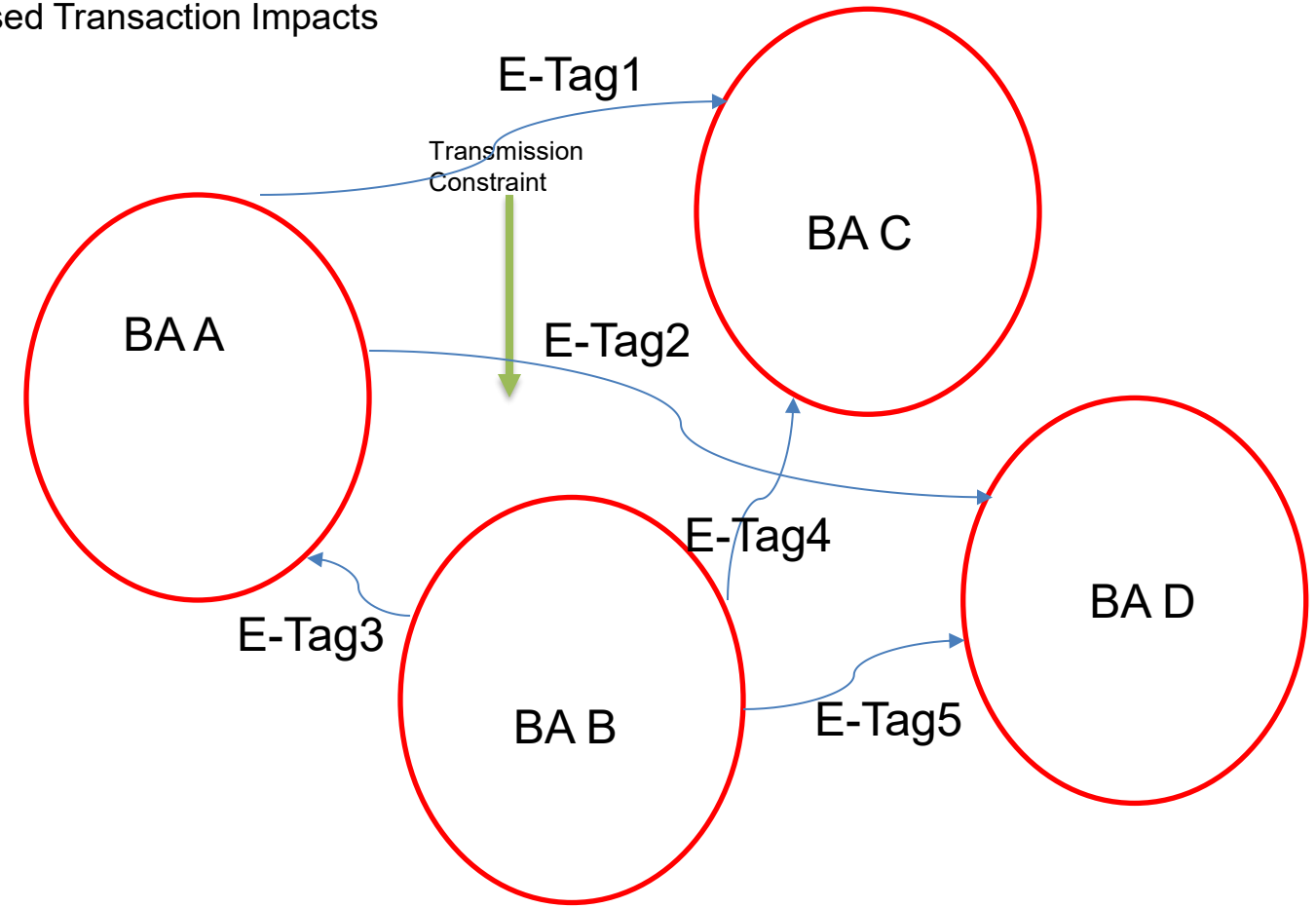
Western Interconnect Loading Relief

- Constraints can be base case constraint/ WECC Paths/ N-1/N-2 constraints

- Impacts on a constraint= e-tag Impacts + Dynamic schedule impacts + BA generation to load impacts + Phase shifter impacts + DC Line impacts + ACE impacts

Western Interconnect Loading Relief

- Flow based Transaction Impacts



Western Interconnect Loading Relief

- 4 balancing areas and there are total 5 import/export transactions
  - E-tag1 is export tag from BA A to BA B- 100 MW
  - E-tag2 is export tag from BA A to BA D – 200 MW
  - E-tag3 is export tag from BA B to BA A – 300 MW
  - E-tag4 is export tag from BA B to BA C – 100 MW
  - E-tag5 is export tag from BA B to BA D – 100 MW

- Flow based impact of each of these transactions on the transmission constraint are calculated to account for total impacts on the constraint

Western Interconnect Loading Relief

- Transfer Distribution factors are calculated for all tags
  - TDF of E-tag1 on constraint 1- 40 %
  - TDF of E-tag2 on constraint 1- 5 %
  - TDF of E-tag3 on constraint 1- 3 %
  - TDF of E-tag4 on constraint 1- (-3%)
  - TDF of E-tag5 on constraint 1- (-5%)

- Impact of all tags on the constraint 1 is calculated as below
  - 100 *0.40+200*0.05+300*0.03 +100 * (-0.03)+100 * (-0.05)=51 MW

Western Interconnect Loading Relief

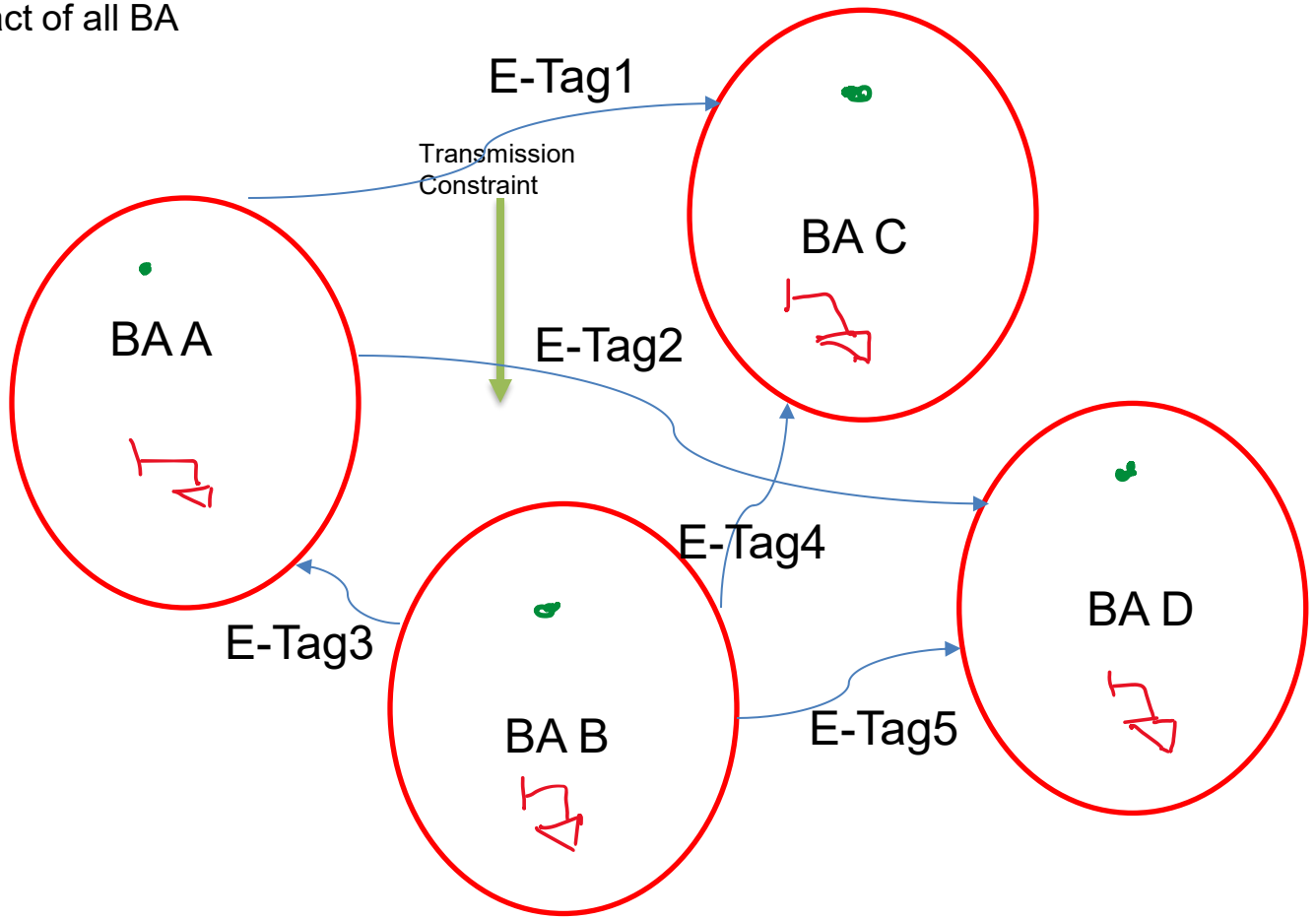
- GTL – Adjustment for Tags

- Any exports tags from a BA result in adjustment of generation.
  - This is basically trying to separate MWs that serve the load within the BA/Zone and those that support the tag
    - MWs supporting a tag don't count as part of GTL. They are accounted for on the tag impact

- Any import tags from a BA result in adjustment of load.
  - This is basically trying to separate MWs served by the generation within the BA/Zone and those served by the tag
    - Tag MWs serving a load don't count as part of GTL. They are accounted for on the tag impact

Western Interconnect Loading Relief

- GTL Impact of all BA

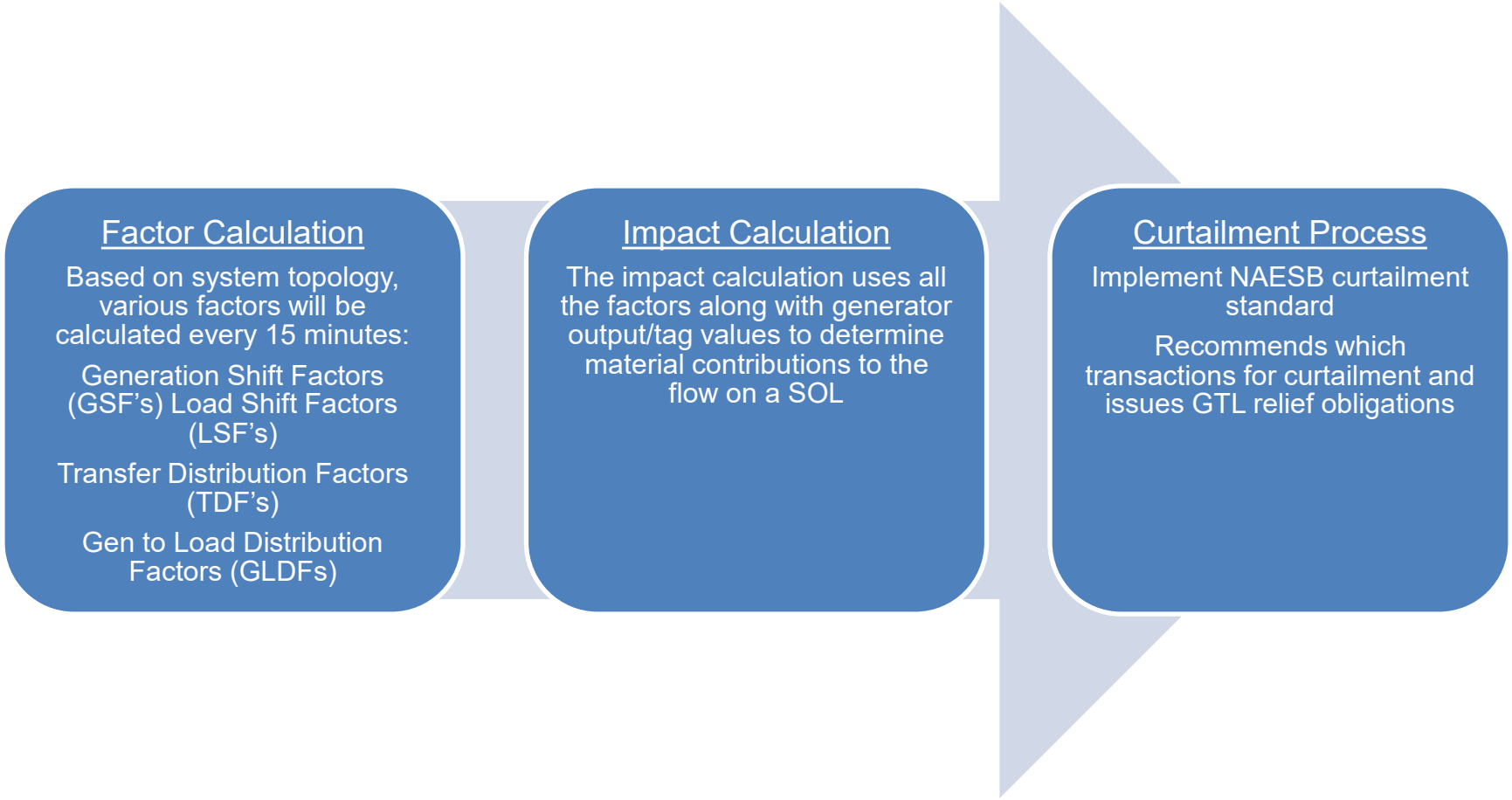


Western Interconnect Loading Relief

- BA A Load MW=100; BA B Load MW=100; BA C Load MW=100; BA D Load MW=100
  - Impact of BA A serving its own load= 30%
  - Impact of BA B serving its own load= -5%
  - Impact of BA C serving its own load= 5%
  - Impact of BA D serving its own load= -5%

- Impact of all GTL on the constraint
  - 100*(0.30)+100*(-0.05)+100*(0.05)+100*(-0.05)= 25 MW

Western Interconnect Loading Relief



Western Interconnect Loading Relief (WLR)

- A BA that receives a GTL relief obligation shall be required to redispatch its resources to meet the assigned obligation
- A tool will be developed with in ECC for BA to identify generation for redispatch
- For a BA participating in an organized market, the BA may delegate to the market operator the redispatch of the required resource(s) to meet the assigned relief obligation
- Pseudo-tied generation and Dynamic Schedules are included in the GTL of the Sink BA for determination of that BA's GTL relief obligation.

ECC Impact Calculation Benchmarking Effort

- Benchmark effort will measure the accuracy of the calculations performed by webECC focusing on key constrained transmission paths and monitored element/contingency pairs across a diverse geographical area within the western Interconnect

- Below are some of the primary goals of this effort.
  - Compare Real time flows on the constraint with WebECC calculated impacts.
  - Improve modeling in the existing WebECC tool to make sure all e-tags and dynamic transfer impacts are being calculated/modeled correctly.
  - Impact of phase shifters are accounted correctly.
  - Coordinate with BA's in west to improve the e-tag modeling and Generation to Load impacts in webECC.
  - Compare webECC source/sink Transfer distribution impacts with other tools to benchmark webECC calculations.

What Is webECC?

OATI's web-based Enhanced Curtailment Calculator (webECC) is the tool Reliability Coordinators use to monitor congestion, calculate shift factors, and determine WLR and WIUFMP curtailment and relief obligations across the Western Interconnection.

1

Situational Awareness

Real-time Element Congestion monitoring — flow, congestion %, and monitoring threshold for every watched facility

2

Model & Registry

Elements, Qualified Paths, USF, JOU, Load Share, Model Approval, and Service Point Model configuration

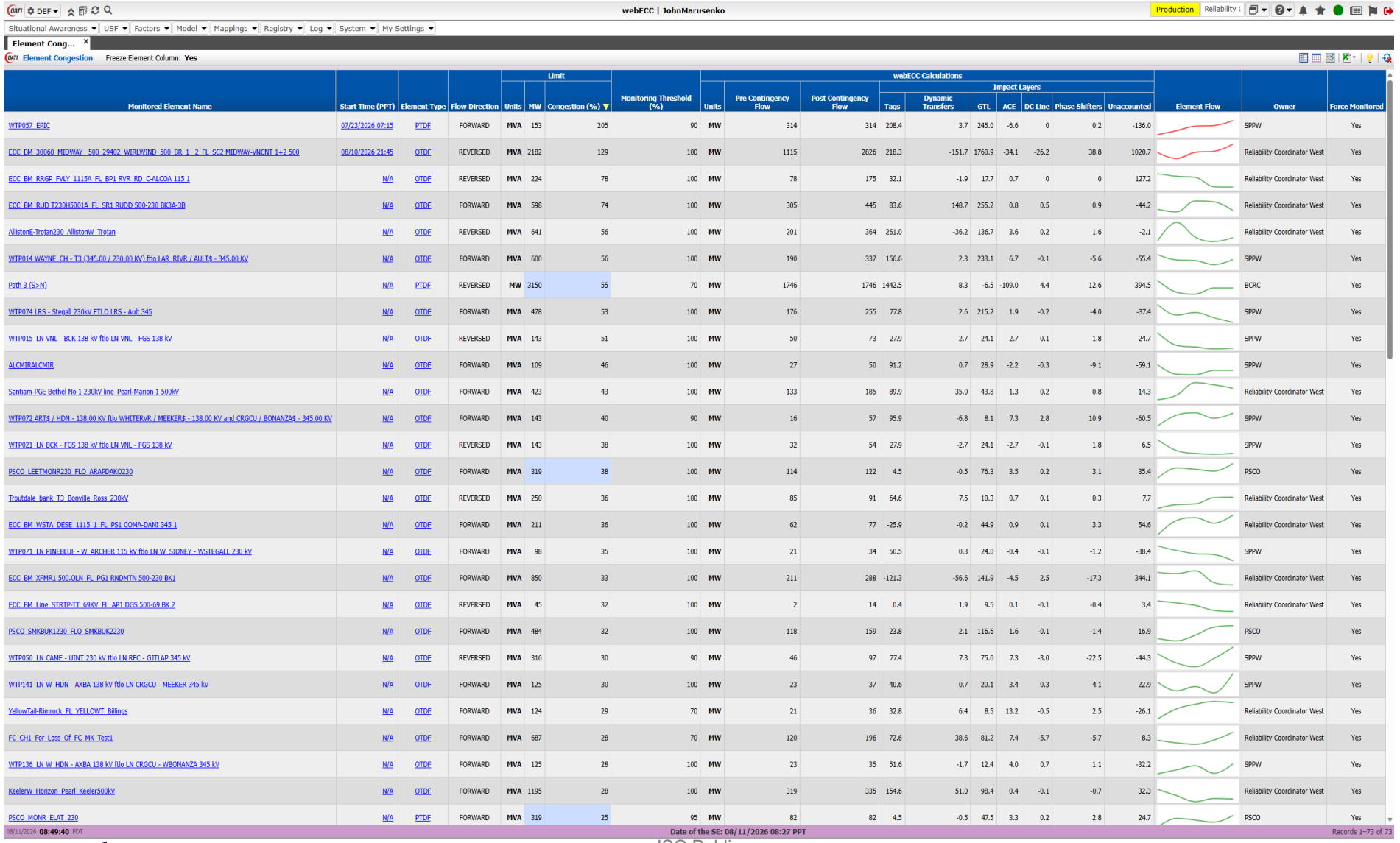
3

WLR Curtailments & UFMP Process Implementation

California ISO SPP Powering Progress

ISO Public

ECC Benchmarking Effort



webECC | JohnMarusenko

Production | Reliability

Situational Awareness | USF | Factors | Model | Mappings | Registry | Log | System | My Settings

Element Cong...

Element Congestion — Freeze Element Column: Yes

Monitored Element Name	Start Time (PPT)	Element Type	Flow Direction	Limit			Monitoring Threshold (%)	webECC Calculations										Element Flow	Owner	Force Monitored
				Units	MW	Congestion (%) ▼		Units	Pre Contingency Flow	Post Contingency Flow	Impact Layers: Tags	Dynamic Transfers	GTL	ACE	DC Line	Phase Shifters	Unaccounted			
WTP057_EPIC	07/23/2026 07:15	PTDF	FORWARD	MVA	153	205	90	MW	314	314	208.4	3.7	245.0	-6.6	0	0.2	-136.0		SPPW	Yes
ECC_BM_30060_MIDWAY_500_29402_WIRLWIND_500_BR_1_2_FL_SC2 MIDWAY-VNCNT 1+2 500	08/10/2026 21:45	OTDF	REVERSED	MVA	2182	129	100	MW	1115	2826	218.3	-151.7	1760.9	-34.1	-26.2	38.8	1020.7		Reliability Coordinator West	Yes
ECC_BM_RRGP_FVLY_1115A_FL_BP1 RVR_RD_C-ALCOA 115 1	N/A	OTDF	REVERSED	MVA	224	78	100	MW	78	175	32.1	-1.9	17.7	0.7	0	0	127.2		Reliability Coordinator West	Yes
ECC_BM_RUD T230H5001A_FL_SR1 RUDD 500-230 BK3A-3B	N/A	OTDF	FORWARD	MVA	598	74	100	MW	305	445	83.6	148.7	255.2	0.8	0.5	0.9	-44.2		Reliability Coordinator West	Yes
AllistonE-Trojan230_AllistonW_Trojan	N/A	OTDF	REVERSED	MVA	641	56	100	MW	201	364	261.0	-36.2	136.7	3.6	0.2	1.6	-2.1		Reliability Coordinator West	Yes
WTP014 WAYNE_CH - T3 (345.00 / 230.00 KV) ftlo LAR_RIVR / AULT$ - 345.00 KV	N/A	OTDF	FORWARD	MVA	600	56	100	MW	190	337	156.6	2.3	233.1	6.7	-0.1	-5.6	-55.4		SPPW	Yes
Path 3 (S>N)	N/A	PTDF	REVERSED	MW	3150	55	70	MW	1746	1746	1442.5	8.3	-6.5	-109.0	4.4	12.6	394.5		BCRC	Yes
WTP074 LRS - Stegall 230kV FTLO LRS - Ault 345	N/A	OTDF	FORWARD	MVA	478	53	100	MW	176	255	77.8	2.6	215.2	1.9	-0.2	-4.0	-37.4		SPPW	Yes
WTP015_LN VNL - BCK 138 kV ftlo LN VNL - FGS 138 kV	N/A	OTDF	REVERSED	MVA	143	51	100	MW	50	73	27.9	-2.7	24.1	-2.7	-0.1	1.8	24.7		SPPW	Yes
ALCMIRALCMIR	N/A	OTDF	FORWARD	MVA	109	46	100	MW	27	50	91.2	0.7	28.9	-2.2	-0.3	-9.1	-59.1		SPPW	Yes
Santiam-PGE Bethel No 1 230kV line_Pearl-Marion 1 500kV	N/A	OTDF	FORWARD	MVA	423	43	100	MW	133	185	89.9	35.0	43.8	1.3	0.2	0.8	14.3		Reliability Coordinator West	Yes
WTP072 ART$ / HDN - 138.00 KV ftlo WHITERVR / MEEKER$ - 138.00 KV and CRGCU / BONANZA$ - 345.00 KV	N/A	OTDF	FORWARD	MVA	143	40	90	MW	16	57	95.9	-6.8	8.1	7.3	2.8	10.9	-60.5		SPPW	Yes
WTP021_LN BCK - FGS 138 kV ftlo LN VNL - FGS 138 kV	N/A	OTDF	REVERSED	MVA	143	38	100	MW	32	54	27.9	-2.7	24.1	-2.7	-0.1	1.8	6.5		SPPW	Yes
PSCO_LEETMONR230_FLO_ARAPDAKO230	N/A	OTDF	FORWARD	MVA	319	38	100	MW	114	122	4.5	-0.5	76.3	3.5	0.2	3.1	35.4		PSCO	Yes
Troutdale_bank_T3_Bonville_Ross_230kV	N/A	OTDF	REVERSED	MVA	250	36	100	MW	85	91	64.6	7.5	10.3	0.7	0.1	0.3	7.7		Reliability Coordinator West	Yes
ECC_BM_WSTA_DESE_1115_1_FL_PS1 COMA-DANI 345 1	N/A	OTDF	FORWARD	MVA	211	36	100	MW	62	77	-25.9	-0.2	44.9	0.9	0.1	3.3	54.6		Reliability Coordinator West	Yes
WTP071_LN PINEBLUF - W_ARCHER 115 kV ftlo LN W_SIDNEY - WSTEGALL 230 kV	N/A	OTDF	FORWARD	MVA	98	35	100	MW	21	34	50.5	0.3	24.0	-0.4	-0.1	-1.2	-38.4		SPPW	Yes
ECC_BM_XFMR1 500.0LN_FL_PG1 RNDMTN 500-230 BK1	N/A	OTDF	FORWARD	MVA	850	33	100	MW	211	288	-121.3	-56.6	141.9	-4.5	2.5	-17.3	344.1		Reliability Coordinator West	Yes
ECC_BM_Line_STRTP-TT_69KV_FL_AP1 DGS 500-69 BK 2	N/A	OTDF	REVERSED	MVA	45	32	100	MW	2	14	0.4	1.9	9.5	0.1	-0.1	-0.4	3.4		Reliability Coordinator West	Yes
PSCO_SMKBUK1230_FLO_SMKBUK2230	N/A	OTDF	FORWARD	MVA	484	32	100	MW	118	159	23.8	2.1	116.6	1.6	-0.1	-1.4	16.9		PSCO	Yes
WTP050_LN CAME - UINT 230 kV ftlo LN RFC - GJTLAP 345 kV	N/A	OTDF	REVERSED	MVA	316	30	90	MW	46	97	77.4	7.3	75.0	7.3	-3.0	-22.5	-44.3		SPPW	Yes
WTP141_LN W_HDN - AXBA 138 kV ftlo LN CRGCU - MEEKER 345 kV	N/A	OTDF	FORWARD	MVA	125	30	100	MW	23	37	40.6	0.7	20.1	3.4	-0.3	-4.1	-22.9		SPPW	Yes
YellowTail-Rimrock_FL_YELLOWT_Billings	N/A	OTDF	FORWARD	MVA	124	29	70	MW	21	36	32.8	6.4	8.5	13.2	-0.5	2.5	-26.1		Reliability Coordinator West	Yes
FC_CH1_For_Loss_Of_FC_MK_Test1	N/A	OTDF	FORWARD	MVA	687	28	70	MW	120	196	72.6	38.6	81.2	7.4	-5.7	-5.7	8.3		Reliability Coordinator West	Yes
WTP136_LN W_HDN - AXBA 138 kV ftlo LN CRGCU - WBONANZA 345 kV	N/A	OTDF	FORWARD	MVA	125	28	100	MW	23	35	51.6	-1.7	12.4	4.0	0.7	1.1	-32.2		SPPW	Yes
KeelerW_Horizon_Pearl_Keeler500kV	N/A	OTDF	FORWARD	MVA	1195	28	100	MW	319	335	154.6	51.0	98.4	0.4	-0.1	-0.7	32.3		Reliability Coordinator West	Yes
PSCO_MONR_ELAT_230	N/A	PTDF	FORWARD	MVA	319	25	95	MW	82	82	4.5	-0.5	47.5	3.3	0.2	2.8	24.7		PSCO	Yes

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ECC Benchmarking Effort

- webECC solves pre contingency flow and post contingency flows on a constraint from the State Estimator model sent to webECC
- WebECC calculates “Tags” impact , Dynamic transfers “impact”, “GTL” impact, “ACE” impact , “DC Line Impact”, “phase shifter” impacts from a DC solution
- Unaccounted is the difference of contingency flow and sum of all impacts
- Goal is to reduce unaccounted flow
- Unaccounted error % can be calculated as = (real time flow – total webECC impacts)/ real time flow in %

Questions?

MARKETS+

Western Loading Relief Framework

Purpose of The Expanded Standard - WLR

- Measure the impact of generation serving load or transfer obligation on any defined transmission constraint to quantify any entity impacts beyond tagged interchange, key for an interconnection-wide congestion management coordination.
  - **Transmission Impact Attribution:**
    - MW Impacts on constrained facilities come from both scheduled transactions and native generation serving load. Both should be quantified to know who is contributing to congestion.
  - **Equitable Curtailment**
    - When relief is required, obligations should be assigned in proportion to each area's real impact. Without the new calculation, Generation-to-Load (GTL), native flow impacts are not captured and included as part of the current interconnection-wide congestion management framework.
  - **Operational Visibility**
    - Reliability Coordinators will benefit from the visibility into any generator output, load, and their combined impact on transmission constraints.

The Scope of the WLR Standards

- **Three Sources for Constraint Management**
  - **Scheduling Constraints / TSP Paths**: Constraints tied to scheduled transactions and path operations. *Internal flow-based management.*
  - **Qualified WECC Paths:** Reliability-based path limitations, internal or external, qualified or not. *UFMP will continue to apply.*
  - **System Operating Limits (SOLs/IROLs):** Real-time reliability constraints that require coordinated, interconnection-wide management.
- **Purpose of the Expanded Design**
  - The expanded scope is built specifically to support **SOL/IROL congestion management**, enabling consistent, coordinated relief actions across the interconnection.

Process Overview

MARKETS+

Purpose	How it works	The Goal
• **Visibility:** real-time flowgate impact for any boundary (BA, zone, etc.) • **Relief:** obligations based on tags and GTL impact • **Priority:** tags and GTL under one framework	• **Calculate:** each BA's GTL impact on every flowgate • **Prioritize:** tags and GTL by transmission service • **Allocate:** relief targets, lowest priority first • **Re-dispatch:** each entity meets its target its own way	• One consistent framework for GTL impacts and tags. • Better equity, transparency, and effectiveness across the interconnection.

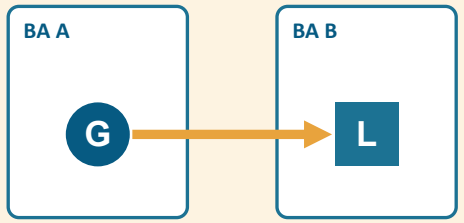
Key Components: Tags and GTL

Every MW on a constraint falls into one of two components. Each has two flavors, and each carries the priority of the transmission service behind it.

Total flow impact on a constraint

TAGS

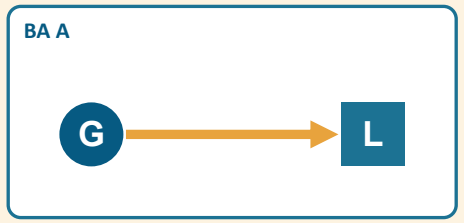
INTER-BA TAG



Scheduled transaction from a source in one BA to a sink in another.

Priority: transmission service on the tag

INTRA-BA TAG

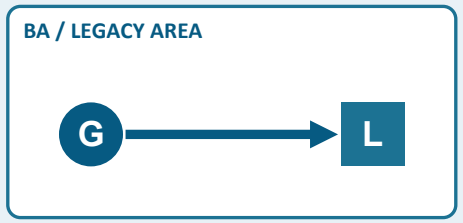


Scheduled transaction with source and sink inside the same BA.

Priority: transmission service on the tag

GENERATION-TO-LOAD (GTL) IMPACT

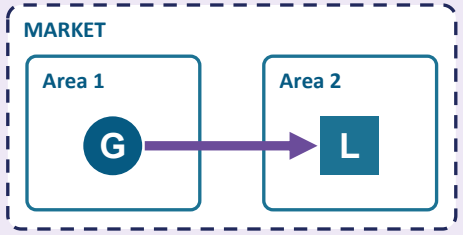
NATIVE GTL



Native generation serving native load in the same BA or legacy area. No tag.

Priority: service serving that load per the Transmission Service Provider (TSP)

TRANSFER GTL



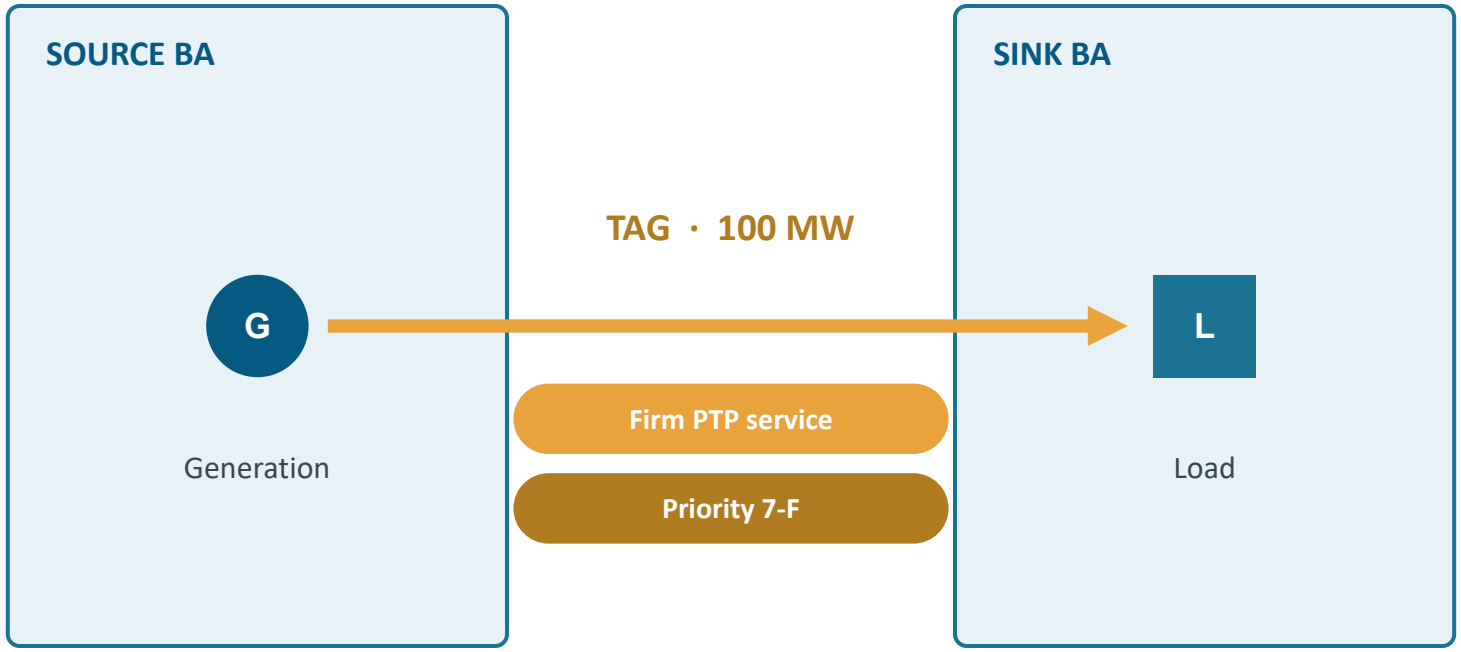
Market dispatch serving load in another legacy area or BA

Priority: TSP's service backing the market transfer

Key point: Every component, tag or GTL, keeps the priority of the transmission service behind it

Component 1: Tags

A tag represents a scheduled transaction: energy moving from a source in one BA to a sink in another



What a tag carries

1 **Source → sink** — who is moving energy, and between which BAs

2 **MW schedule** — how much, and when

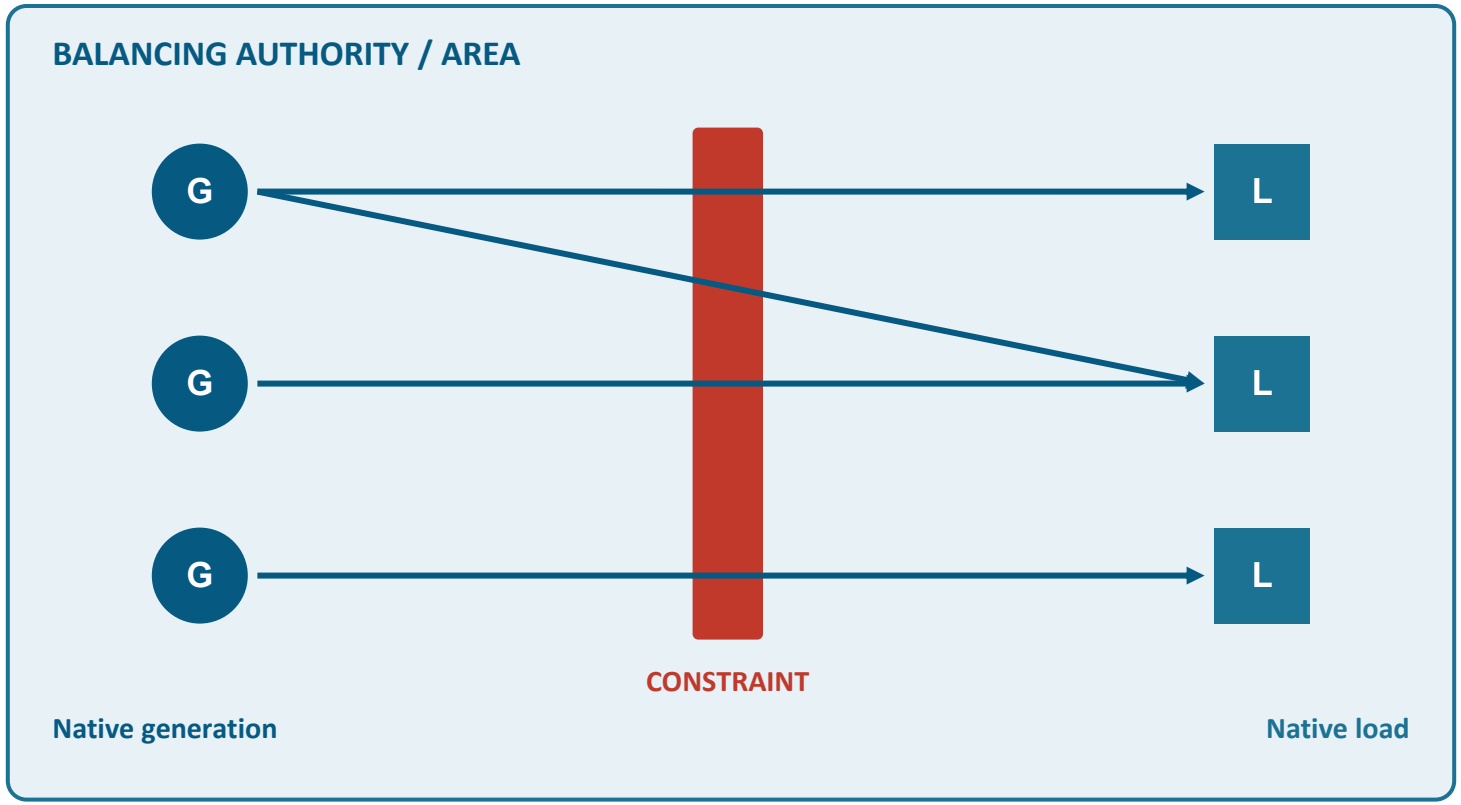
3 **Transmission service** — the reservation it rides on

4 **Priority** — Based its transmission service (0-NX through 7-F)

Key point: A tag's priority carries the priority of the transmission service it was scheduled on.

Component 2: Generation-to-Load (GTL)

GTL represents native generation serving native load: real flow on the constraint that never shows up on a tag.



What GTL captures

1 **Native generation** — the area's own resources at submitted real-time output

2 **Native load** — the load those resources serve

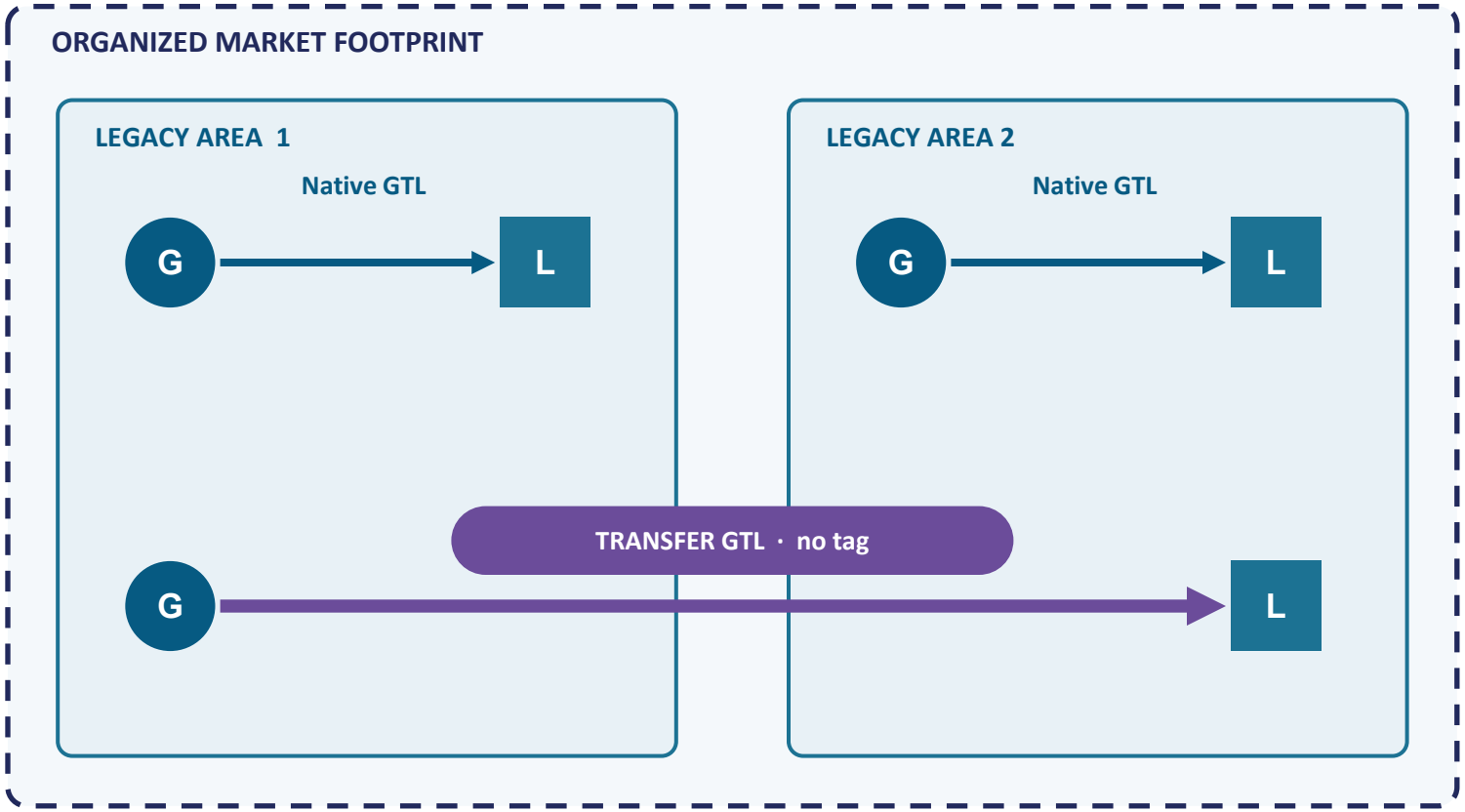
3 **Impact** — each generator's flow to its own load, from the west-wide model

4 **Priority** — the transmission service serving that load, submitted by the RC/BA

Key point: No schedule and no tag, but it still loads the constraint. GTL measures it the same way for every area.

Markets & BA Consolidation Split GTL

When a market dispatches across legacy areas and legacy BAs. Energy crosses those lines without an updated tag, so market GTL splits into what stays home and what transfers.



NATIVE GTL

A legacy area's generation serving its own legacy load. Looks like any non-market area's GTL.

TRANSFER GTL

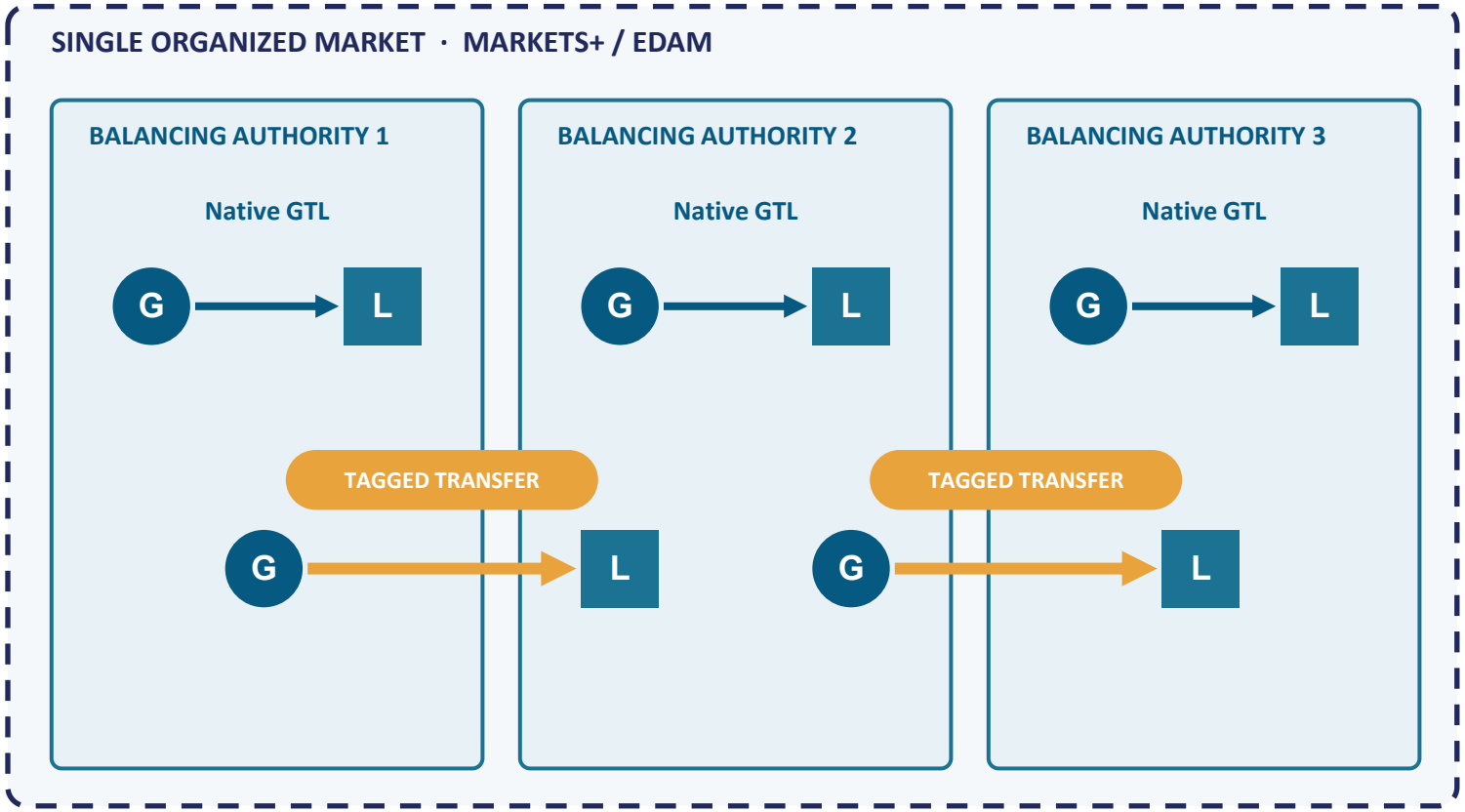
Market dispatch moving energy from one legacy area to load in another. Acts like interchange, without a tag.

Native + **Transfer** = total market GTL

Key point: Splitting the two keeps markets on equal footing: native looks like anyone's GTL, transfer looks like interchange.

In Practice: Markets+ and EDAM

BAs continue to exist inside a single organized market. Each BA's own generation serving its own load is native GTL, and market transfers between BAs are tagged.



How it maps

1 **Native GTL** — each BA's own generation serving its own load

2 **Transfers** — market transfers between BAs are tagged

3 **Priority** — the tag carries the transfer's transmission service priority

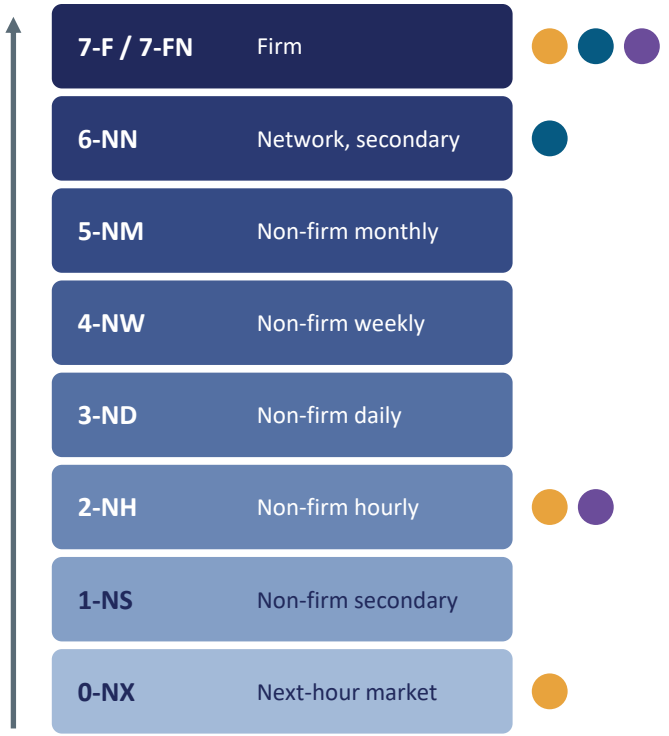
4 **No double counting** — tagged transfers come out before GTL is calculated

Key point: In Markets+ and EDAM, the transfer component shows up as tags because the BAs are still intact. Native GTL plus tag impacts cover all the flow.

Every component keeps its service priority

	REPRESENTS	PRIORITY COMES FROM
TAGS	Scheduled interchange between BAs	The transmission service on the tag (from E-Tag)
NATIVE GTL	Native generation serving native load	The transmission service serving that load, submitted by the RC/BA
TRANSFER GTL	Market transfer across legacy areas and BAs	The transmission service backing the transfer: firm stays firm, non-firm stays non-firm

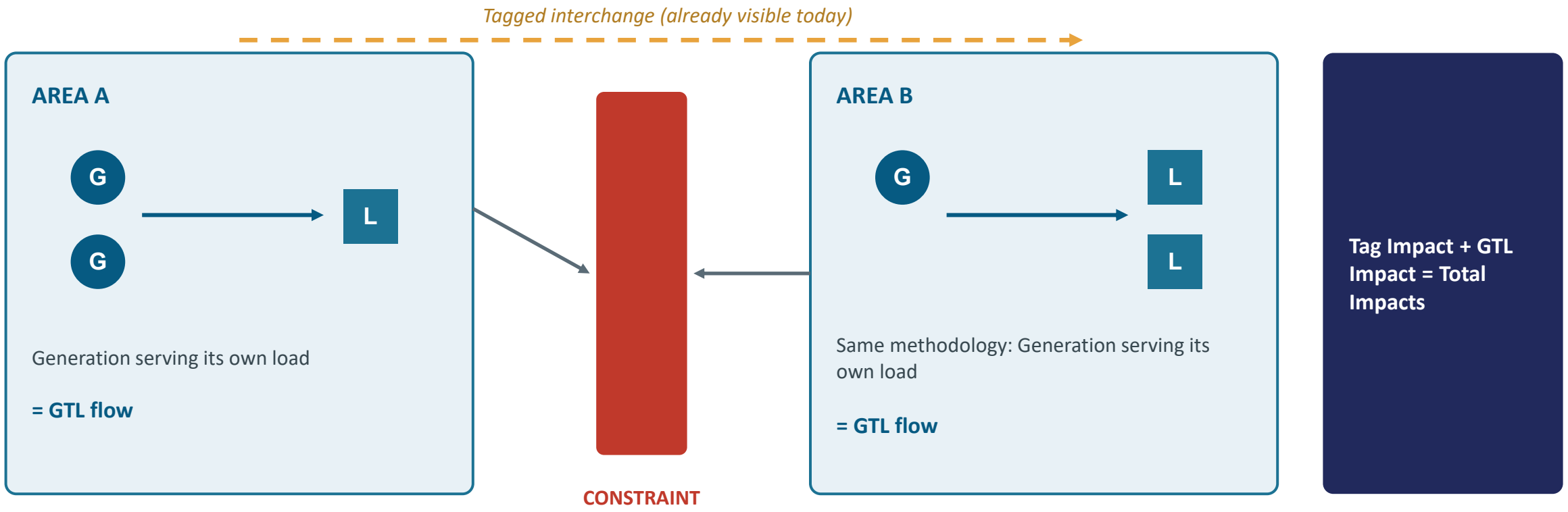
One shared priority stack



Key point: Relief comes off the stack from lowest priority first to highest across Tags and GTL together

Calculate Contributions to Allocate Relief

Flow on a constraint is made of two primary components: tagged interchange, and each area's own generation serving its own load. GTL measures the second, consistently for everyone, markets and non-market alike.

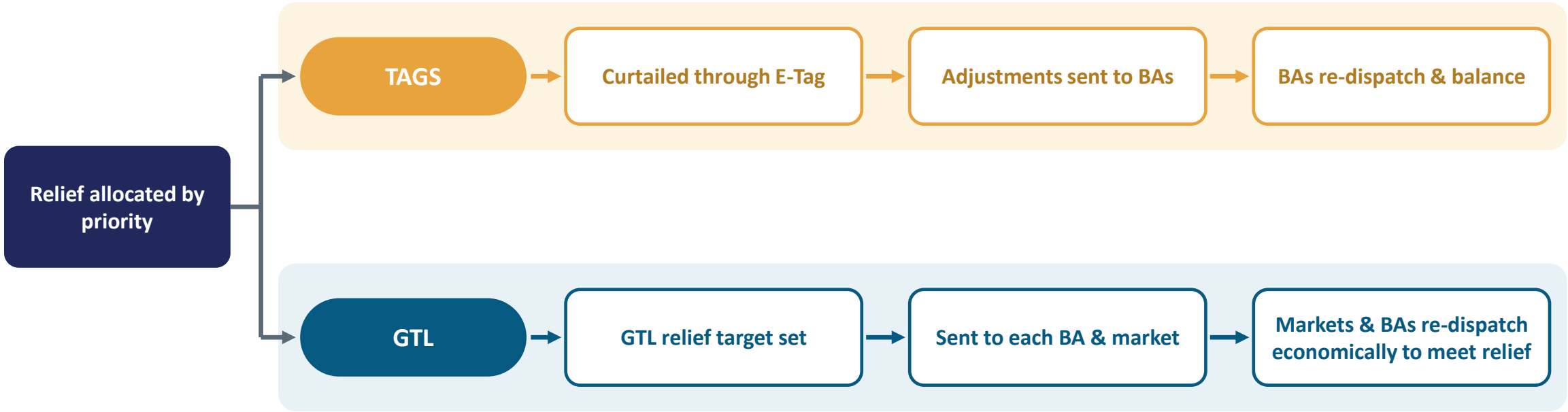


Attribution is based on actual power flow impact; topology and MW quantities as submitted in the west-wide model.

Equal Footing: Everyone Curtails by Priority

Equitable Relief Allocation: Relief is shared across tags and every area's GTL, in proportion to impact and in order of priority.

Putting It Together: How Relief Is Achieved



Key point: Tags settle through E-Tag; GTL relief is sent as a target for BAs and Markets to economically re-dispatch and meet requested relief

BREAK

LUNCH BREAK

WESTERN LOADING RELIEF PROCESS NOW, NEXT, AND FUTURE PROCESSES WITH EXAMPLES

Moderator:

Casey Cadle
SPP

Panelists:

- **Raja Thappetaobula** — CAISO
- **Yasser Bahbaz** — SPP
- **Jamil Daouk** — CAISO
- **Paul Dockery** — CAISO
- **Alex Watkins** — SPP

Seams Workshop – Western Loading Relief process examples

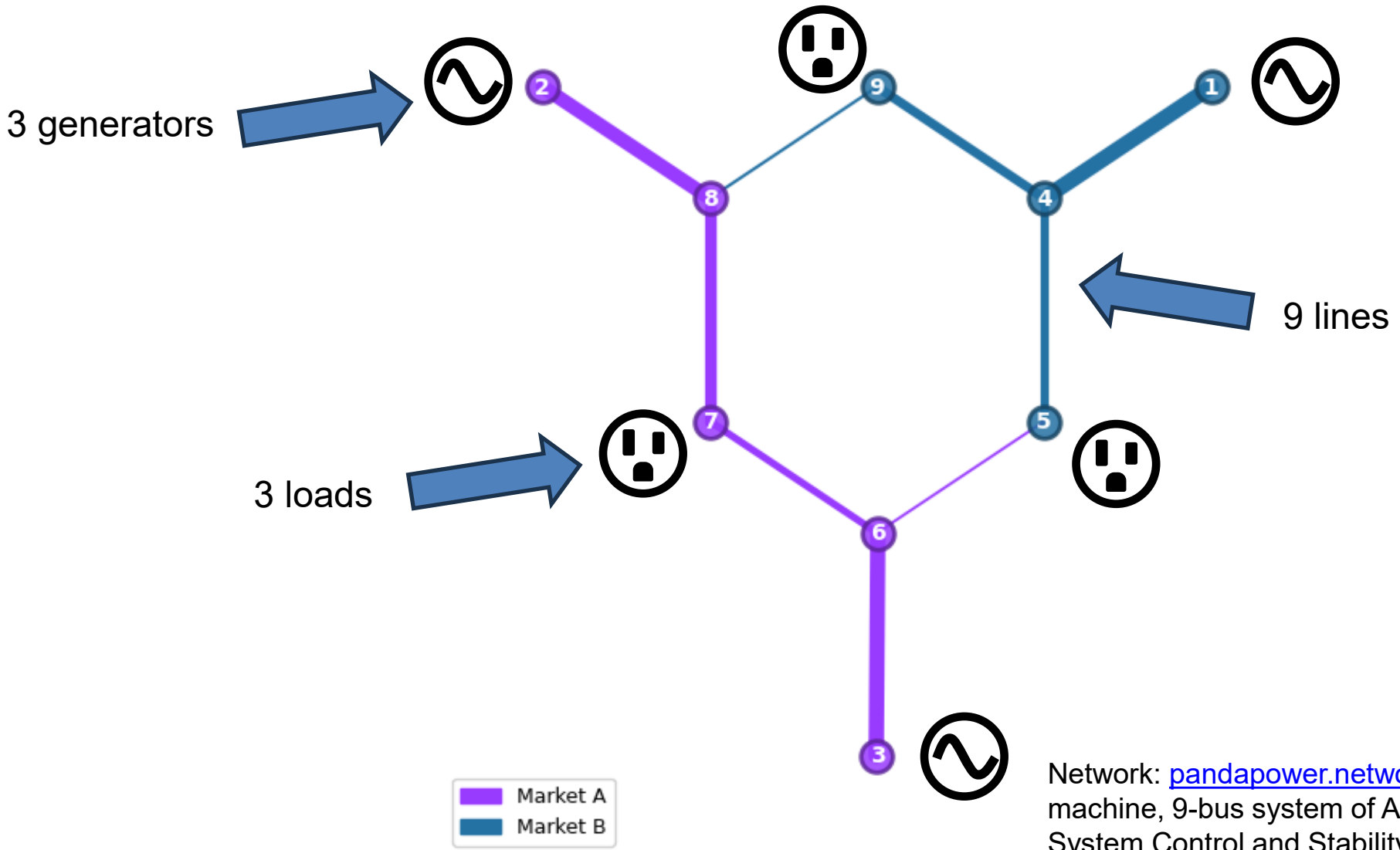
Paul Dockery
Market Strategy & Governance Manager

October 22, 2026

Western Loading Relief process example using an illustrative model

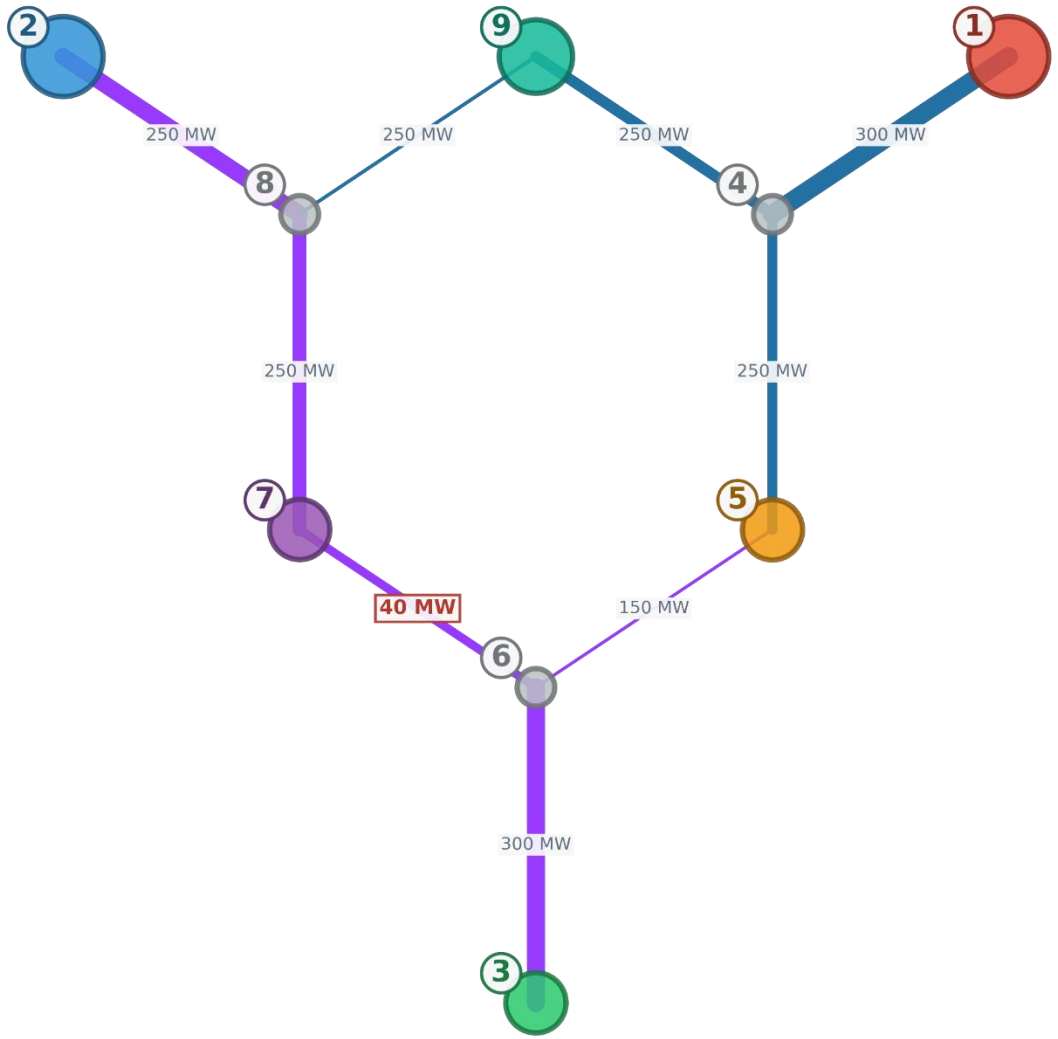
1. Example from August with two markets on a shared network that ignores neighbor's flow contribution on a binding element
2. Extension of the example where Western Loading Relief process is used to allocate relief obligation among tagged schedules
3. WLR process is used to allocate relief obligations for an example with both tagged schedules and gen-to-load
4. WLR process allocates relief obligations and markets are used to provide the relief

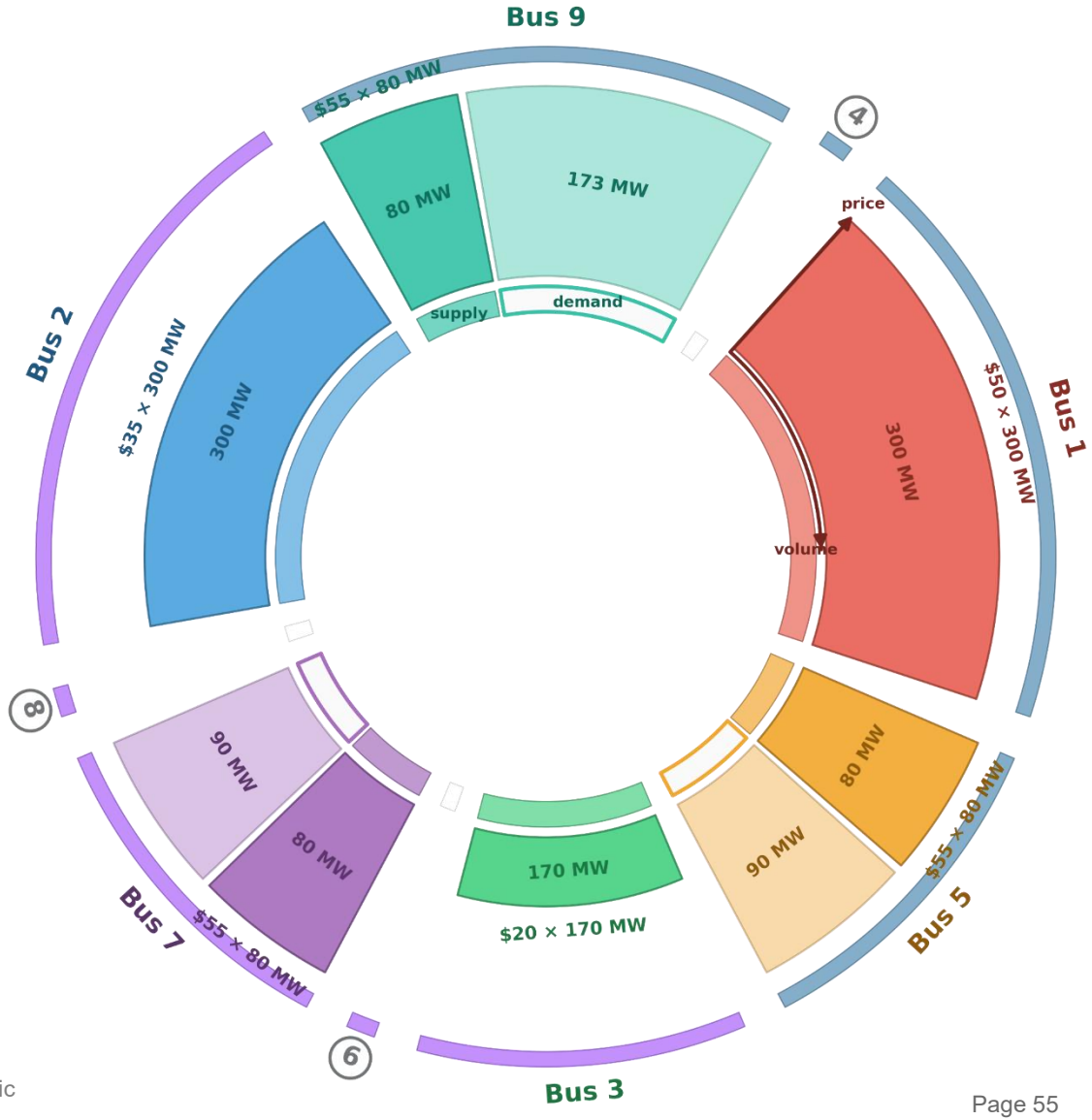
WSCC 9 Bus Test Case – Seams Example



Network: pandapower.networks.case9 after the WSCC 3-machine, 9-bus system of Anderson & Fouad, Power System Control and Stability (1977).

WSCC 9 Bus Test Case – Seams Example

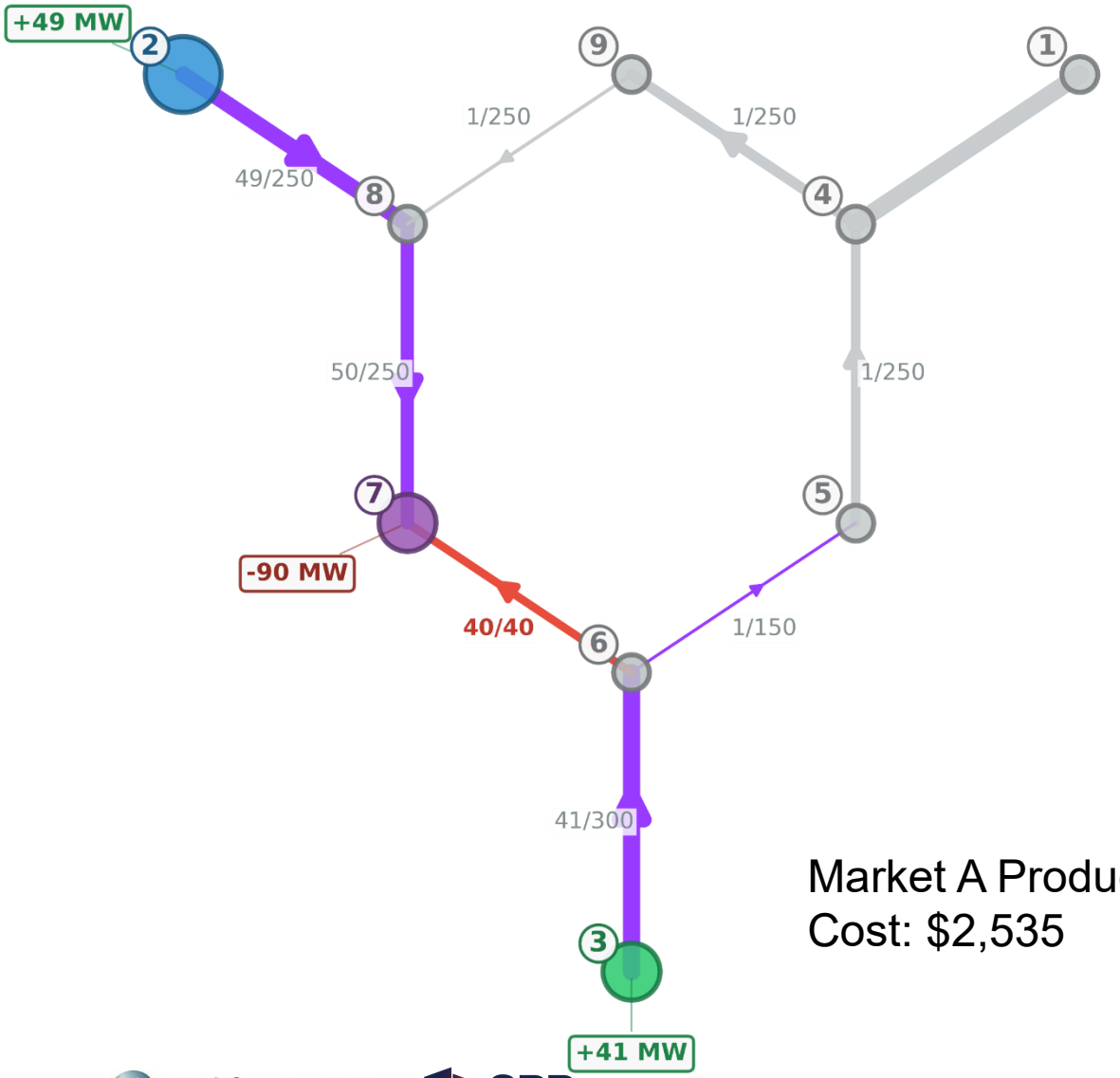




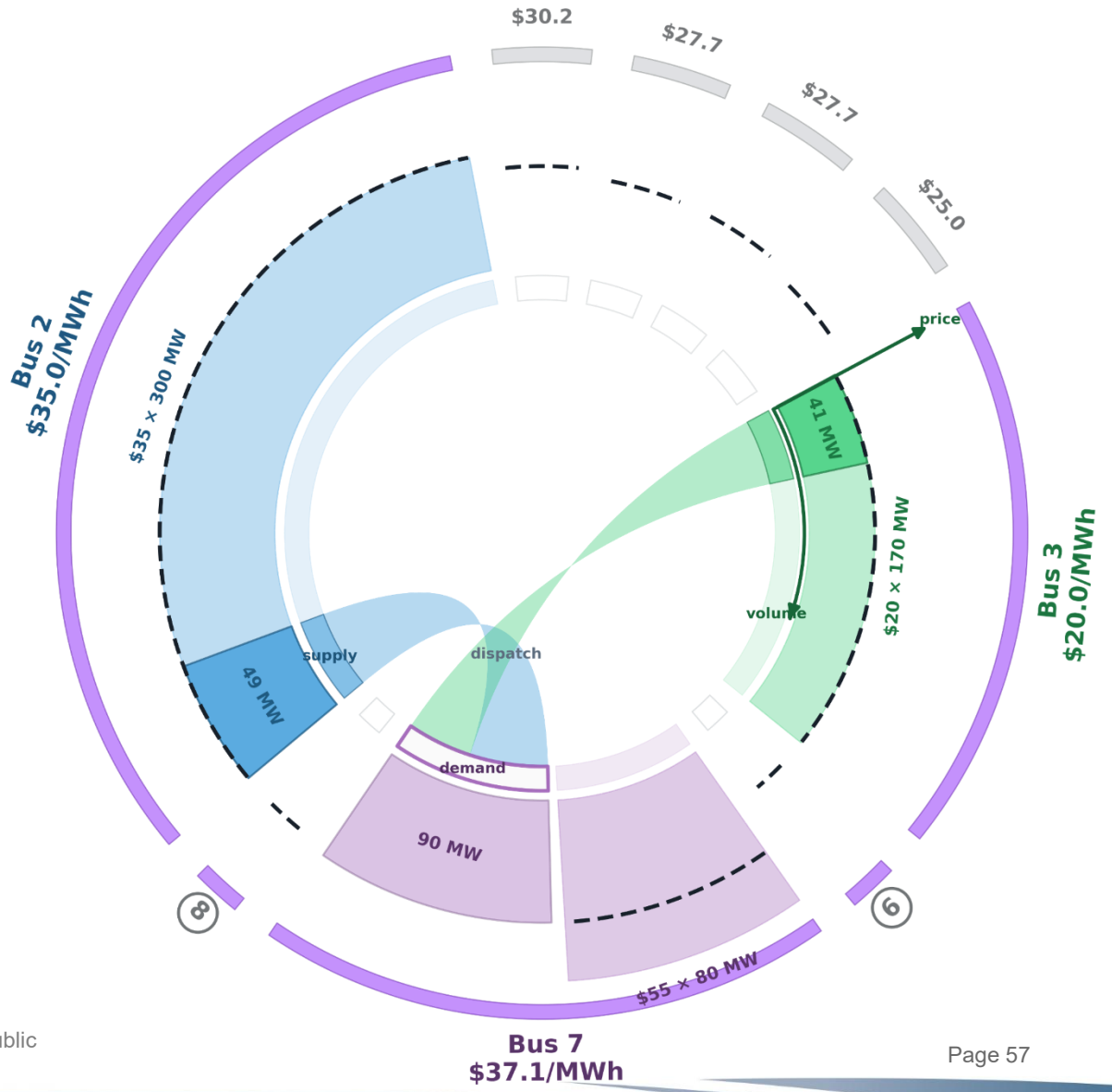
August Joint Workshop – Example #1 – no forecast of neighbor's flow contribution

- Each market clears independently without accounting for each other's use of the transmission network
- Market A has a binding constraint and finds the least cost dispatch of its system resources while respecting the limit
- Market B has no binding constraints and does not monitor binding constraint in Market A
- Power flow on the network based on combined dispatch overloads a line
- ***Market A redispatches to bring the line back into its limits***

Example #1 – no forecast of neighbor's flow contribution – Market A



Market A Production
Cost: $2,535



Example #1 – no forecast of neighbor's flow contribution – Market A

Marginal cost of serving load at bus 7

+ Bus 2 Gen

↑ 1.14 MW @ $35/MWh

= $39.90

- Bus 3 Gen

↓ 0.14 MW @ $20/MWh

= $2.80

△ Bus 7: $39.90 - $2.80 = $37.10

Example #1 – no forecast of neighbor's flow contribution – Market A

Marginal cost of flowing on the line from 6 to 7

+ Bus 2 Gen

↑ 1.34 MW @ $35/MWh

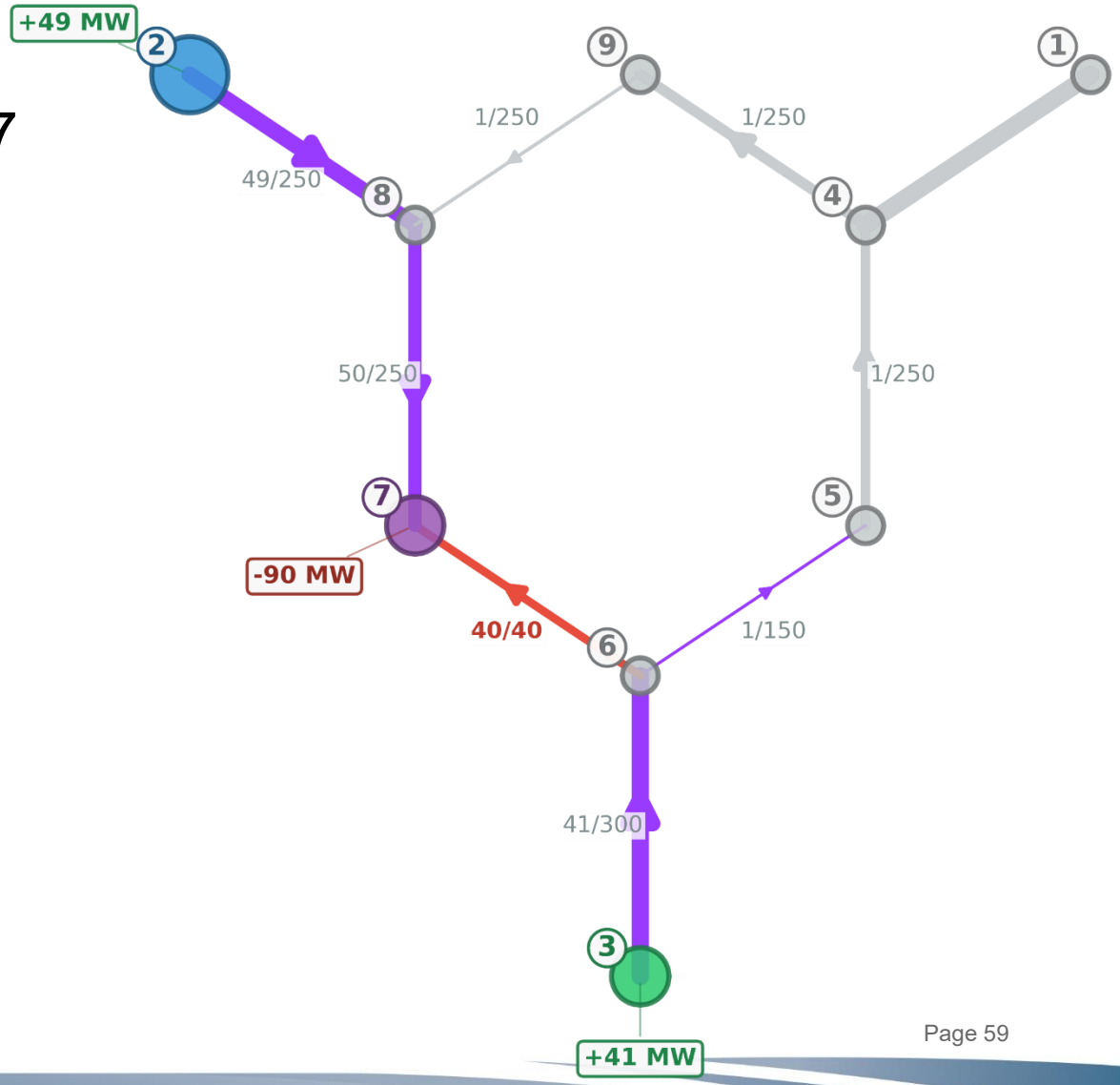
= $46.90

- Bus 3 Gen

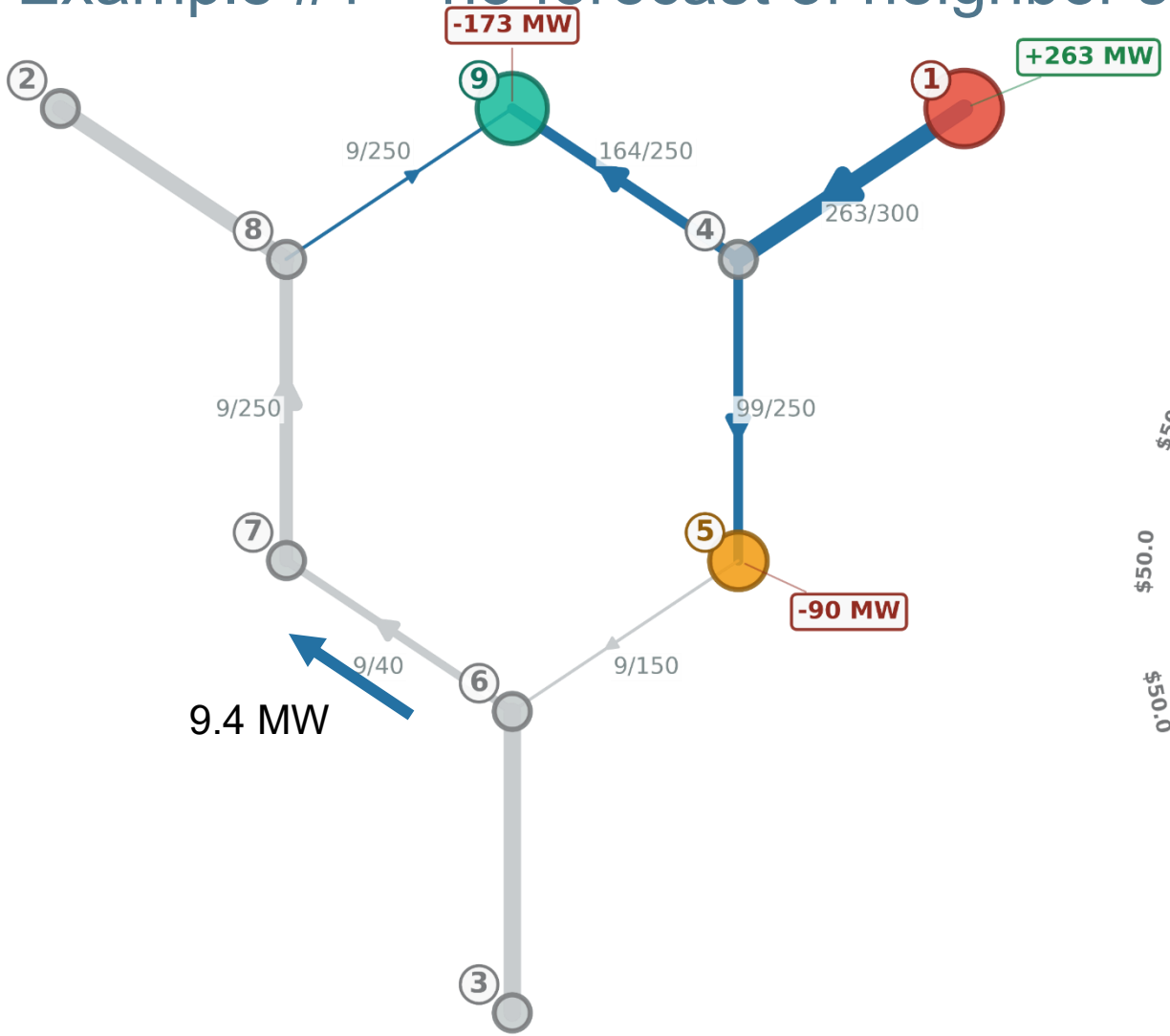
↓ 1.34 MW @ $20/MWh

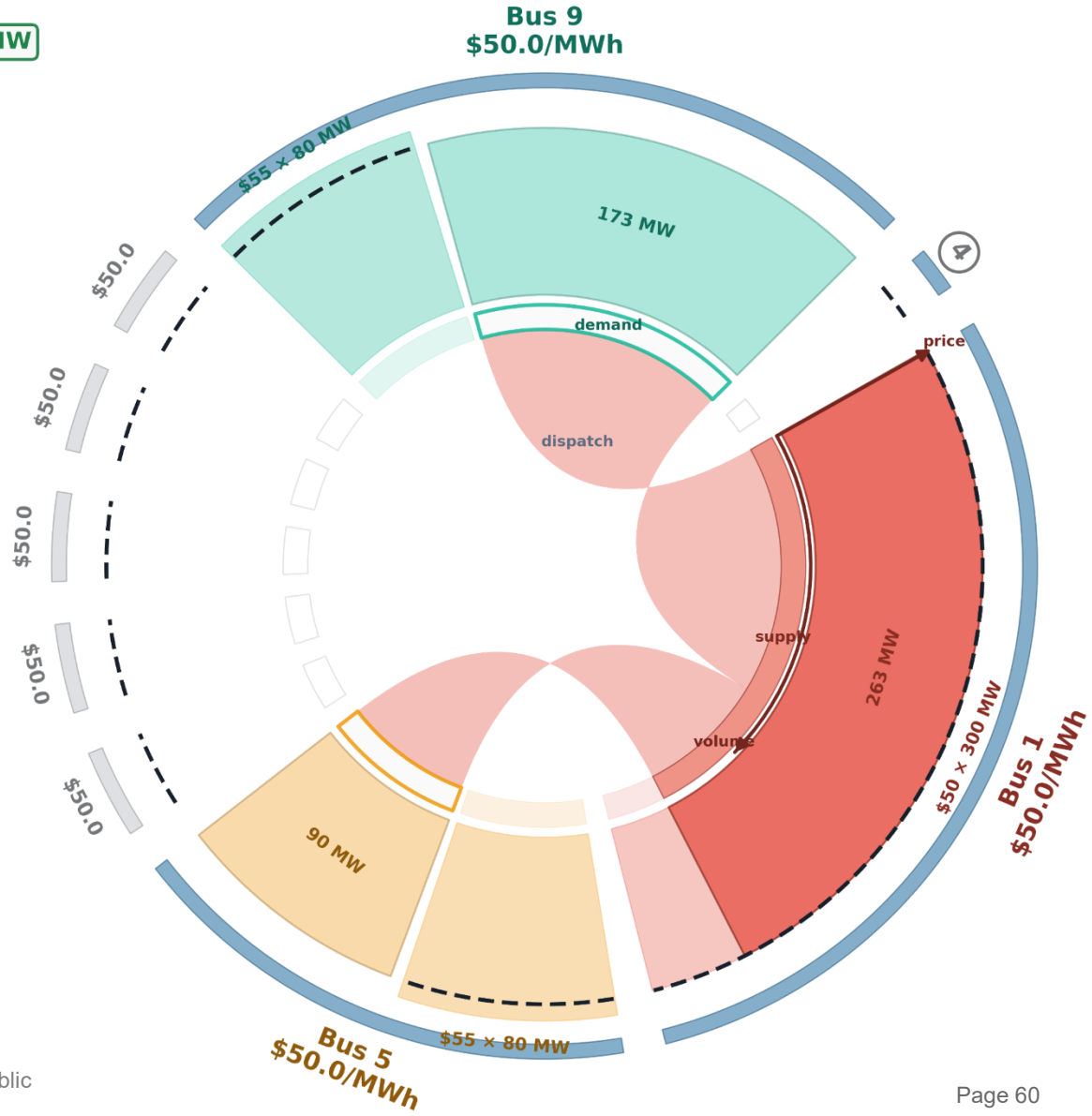
= $26.80

△ Line 6-7: $46.90 - $26.80 = $20.10

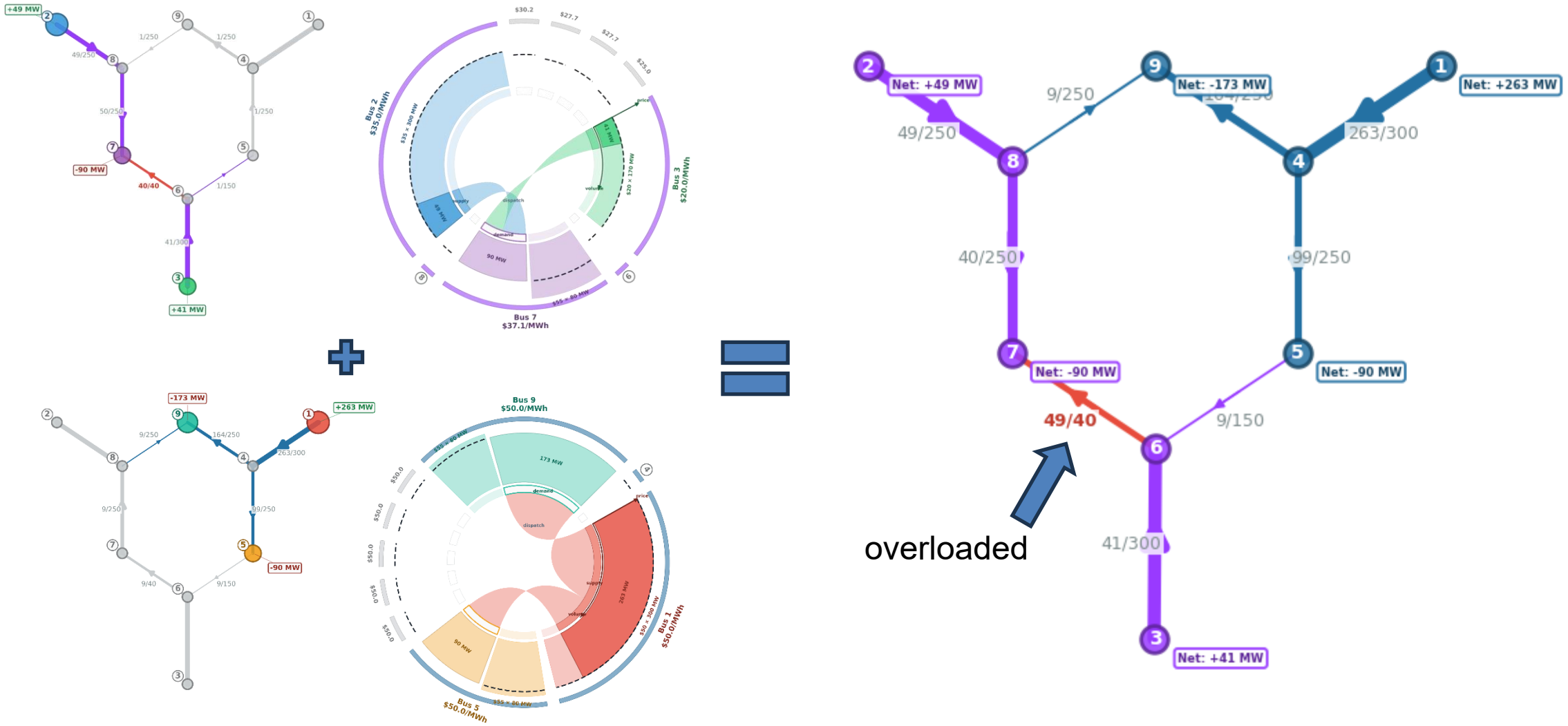


Example #1 – no forecast of neighbor's flow contribution – Market B





Example #1 – no forecast of neighbor's flow contribution - combined



Example #1 – no forecast of neighbor's flow contribution – redispatch

Market A Production Cost: $2,725

Independent run: $2,535

+ Bus 2 Gen

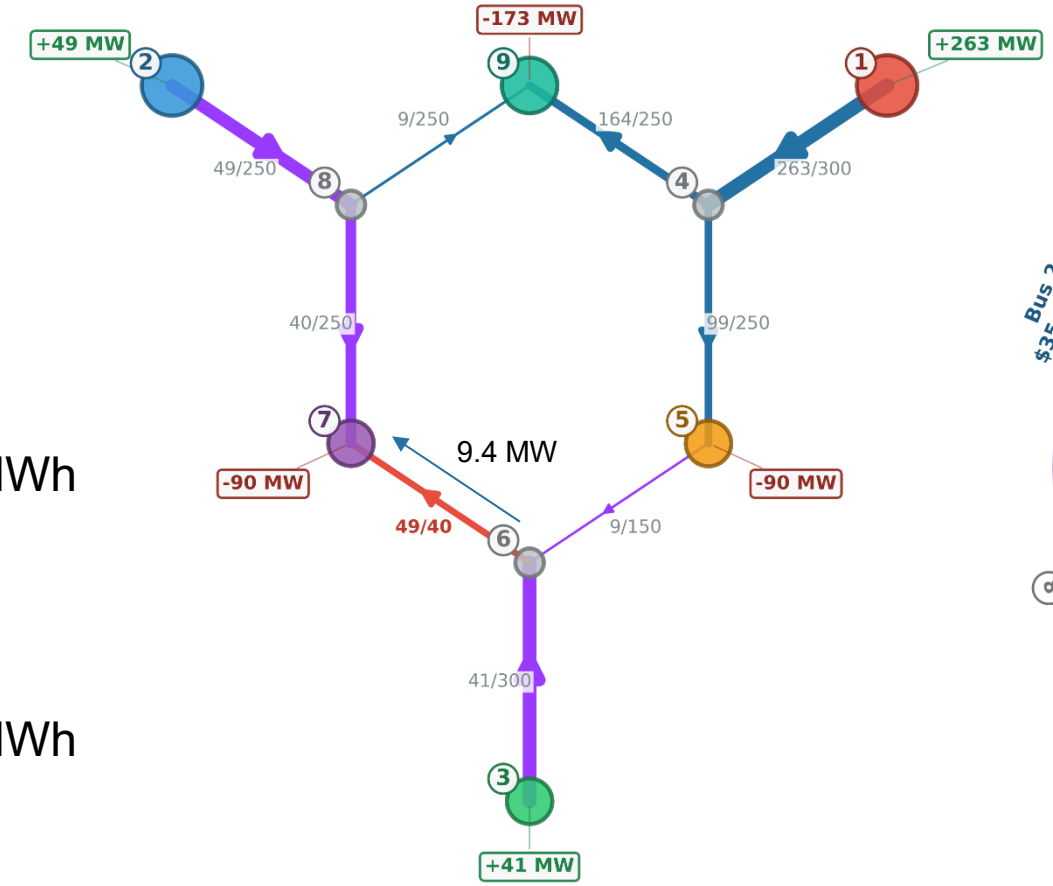
↑ 12.66 MW @ $35/MWh

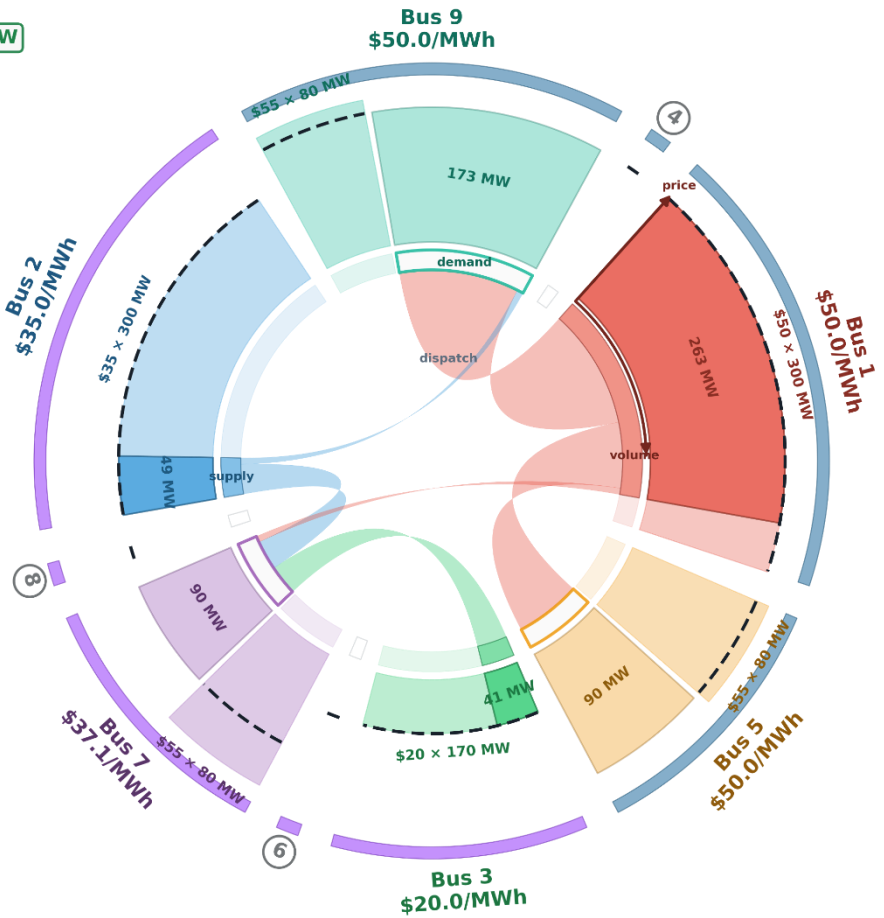
= $443

- Bus 3 Gen

↓ 12.66 MW @ $20/MWh

= $253



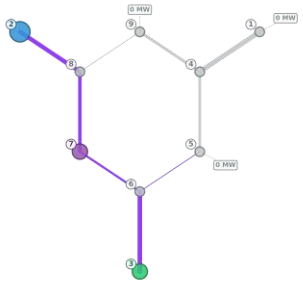


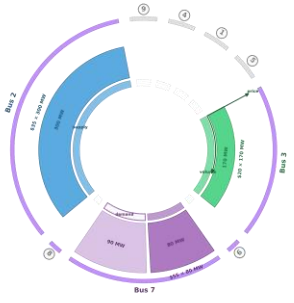
△ Market A production cost: $443 - $253 = $190

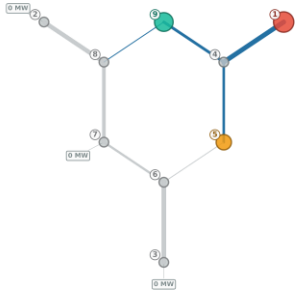
= 9.4 MW @ $20.10/MWh = $190

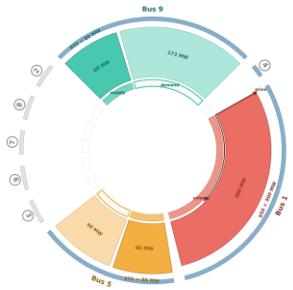
Parallel process considerations

Inputs

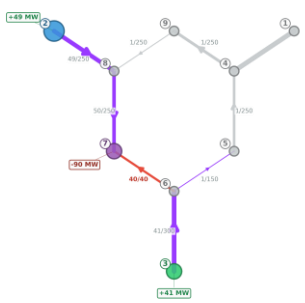


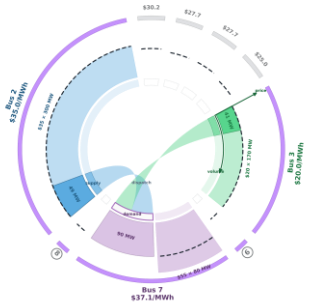


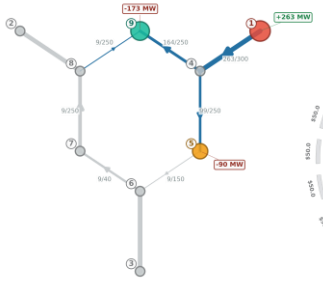


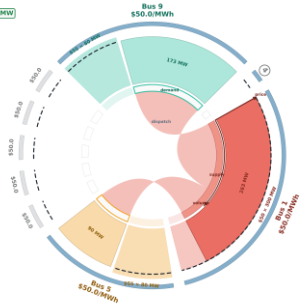


Optimization

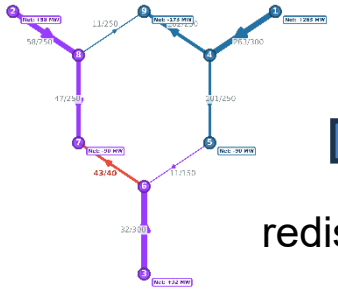




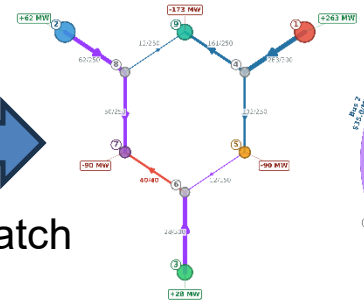


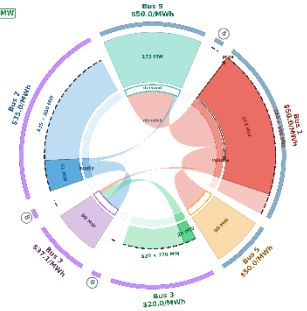


Reconciliation



redispatch

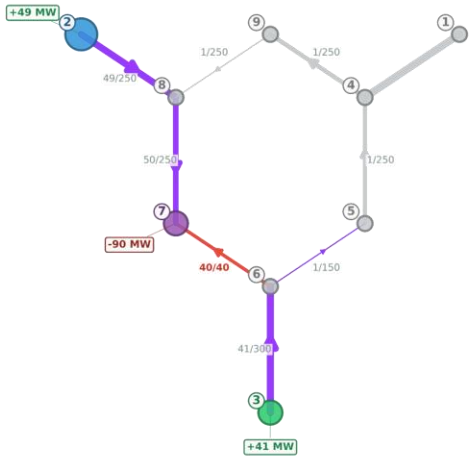


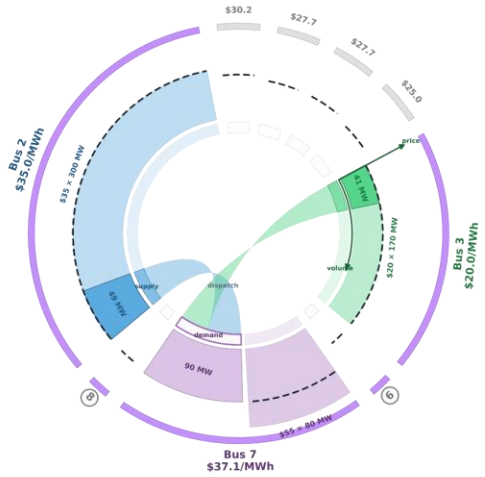


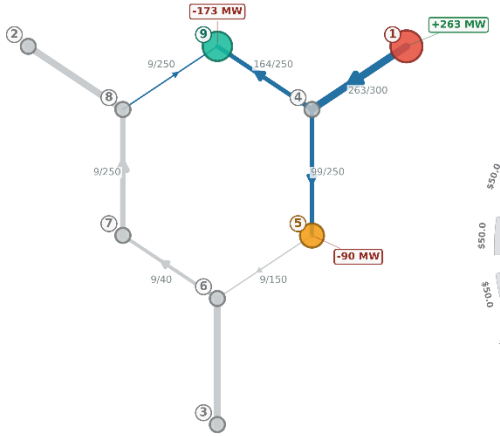
Example #2 – Reconciliation with WLR process – everything tagged

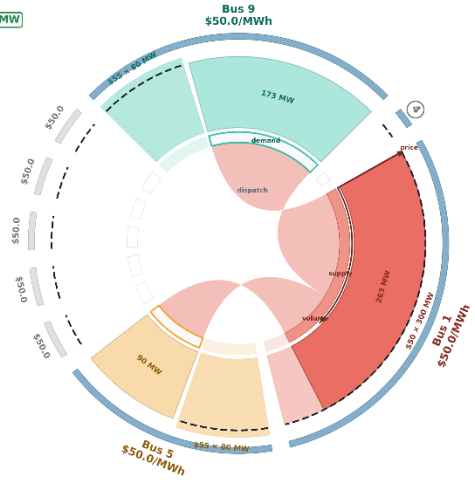
- Start with Example #1 market dispatch
- Illustrative tagged schedules based on example #1 market dispatch
- Power flow on the network based on combined dispatch overloads a line
- ***WLR process assigns a relief obligation*** to bring the line under its limits by reducing tagged schedules

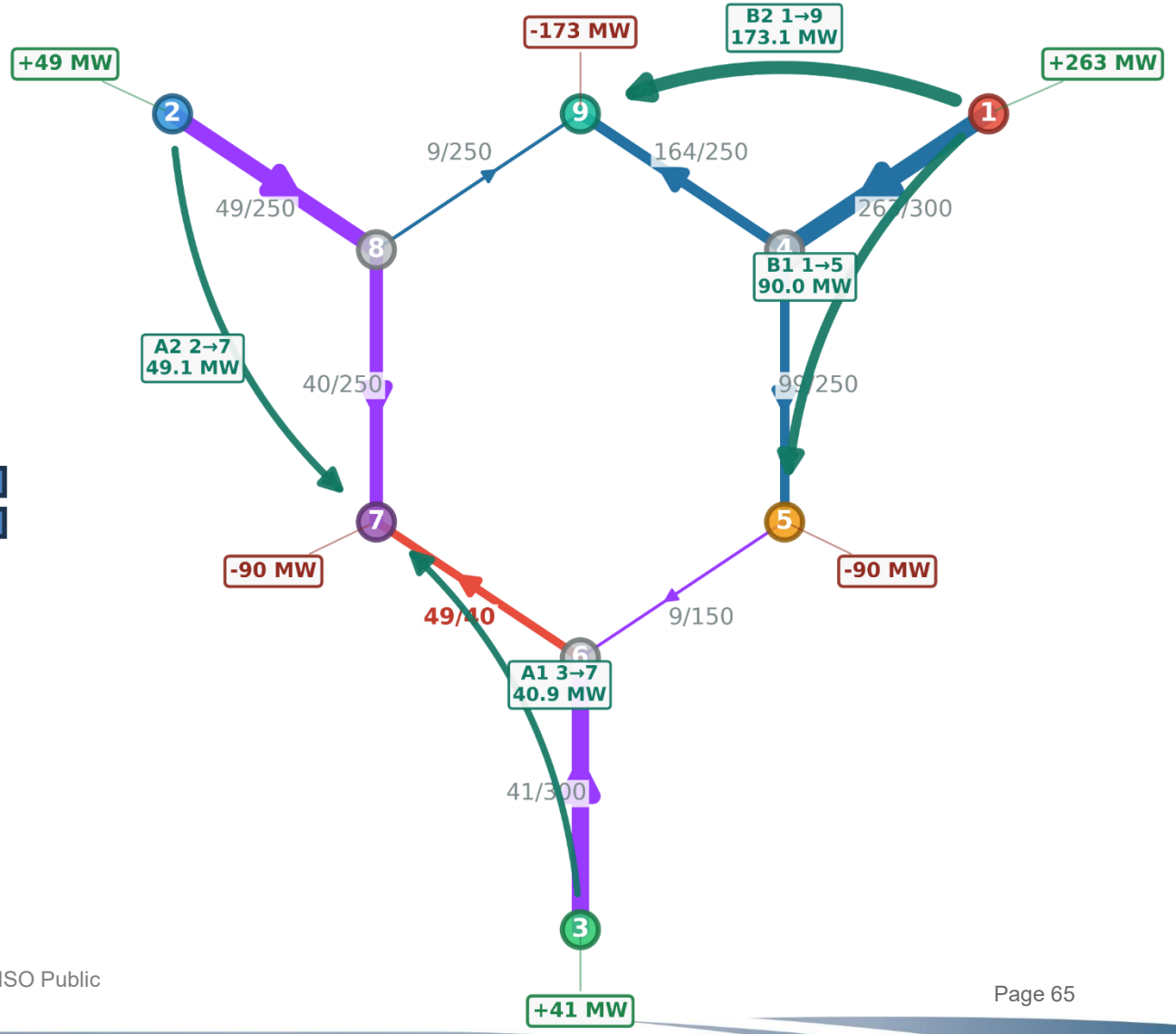
Example #1 – Reconcile dispatch with WLR process



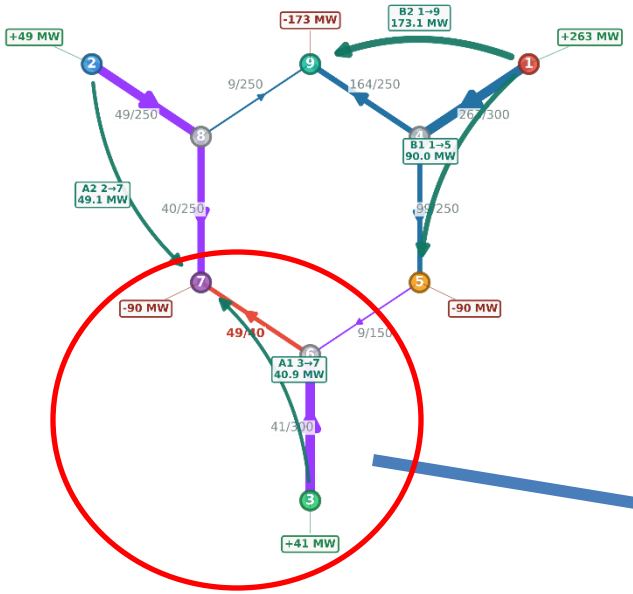


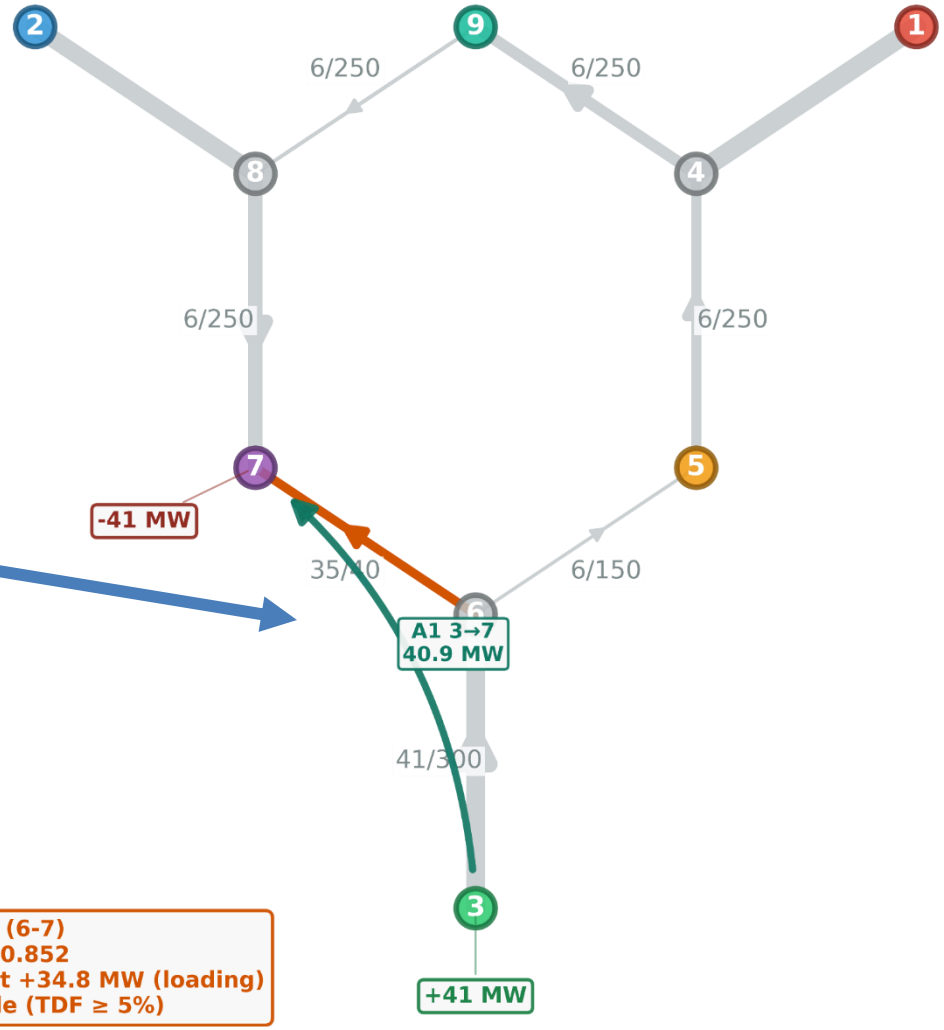






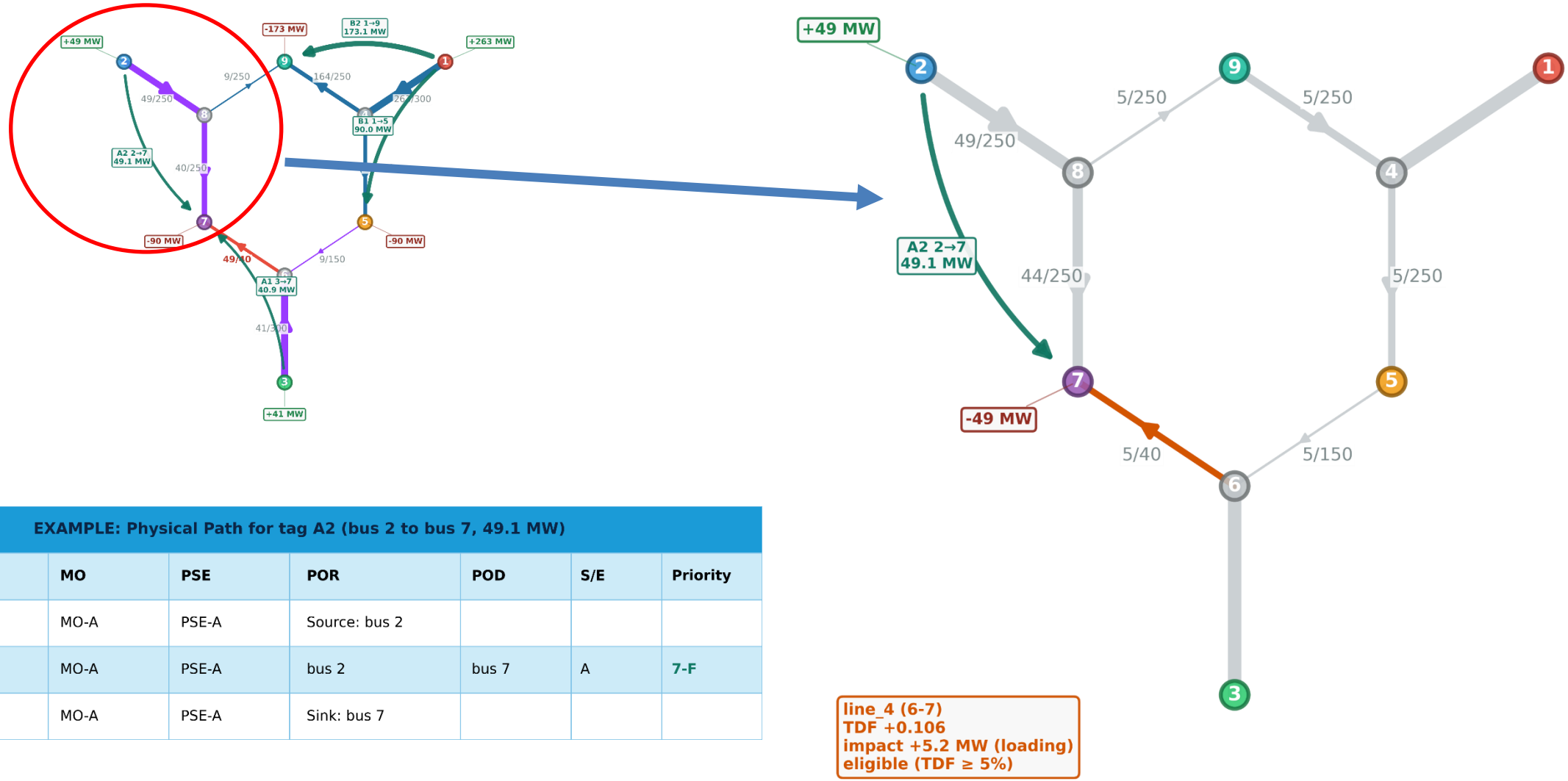
Example #1 – Enhanced Curtailment Calculator – Tag 3->7





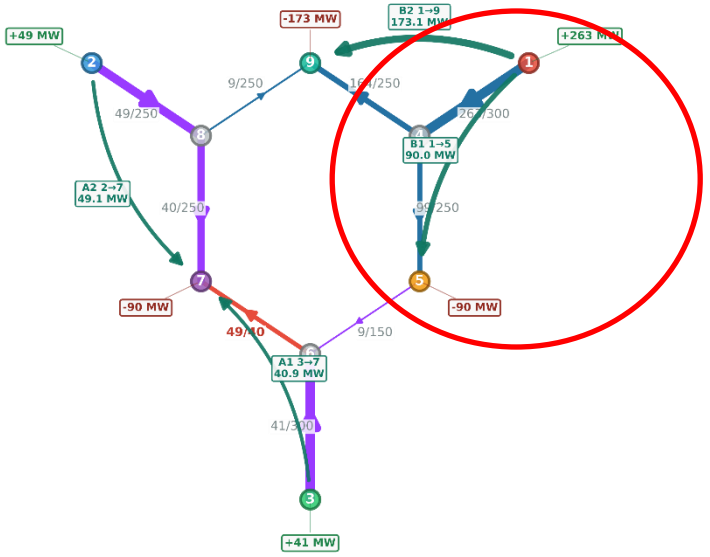
EXAMPLE: Physical Path for tag A1 (bus 3 to bus 7, 40.9 MW)							
BA	**TSP**	**MO**	**PSE**	**POR**	**POD**	**S/E**	**Priority**
A		MO-A	PSE-A	Source: bus 3			
	A	MO-A	PSE-A	bus 3	bus 7	A	**7-F**
A		MO-A	PSE-A	Sink: bus 7			

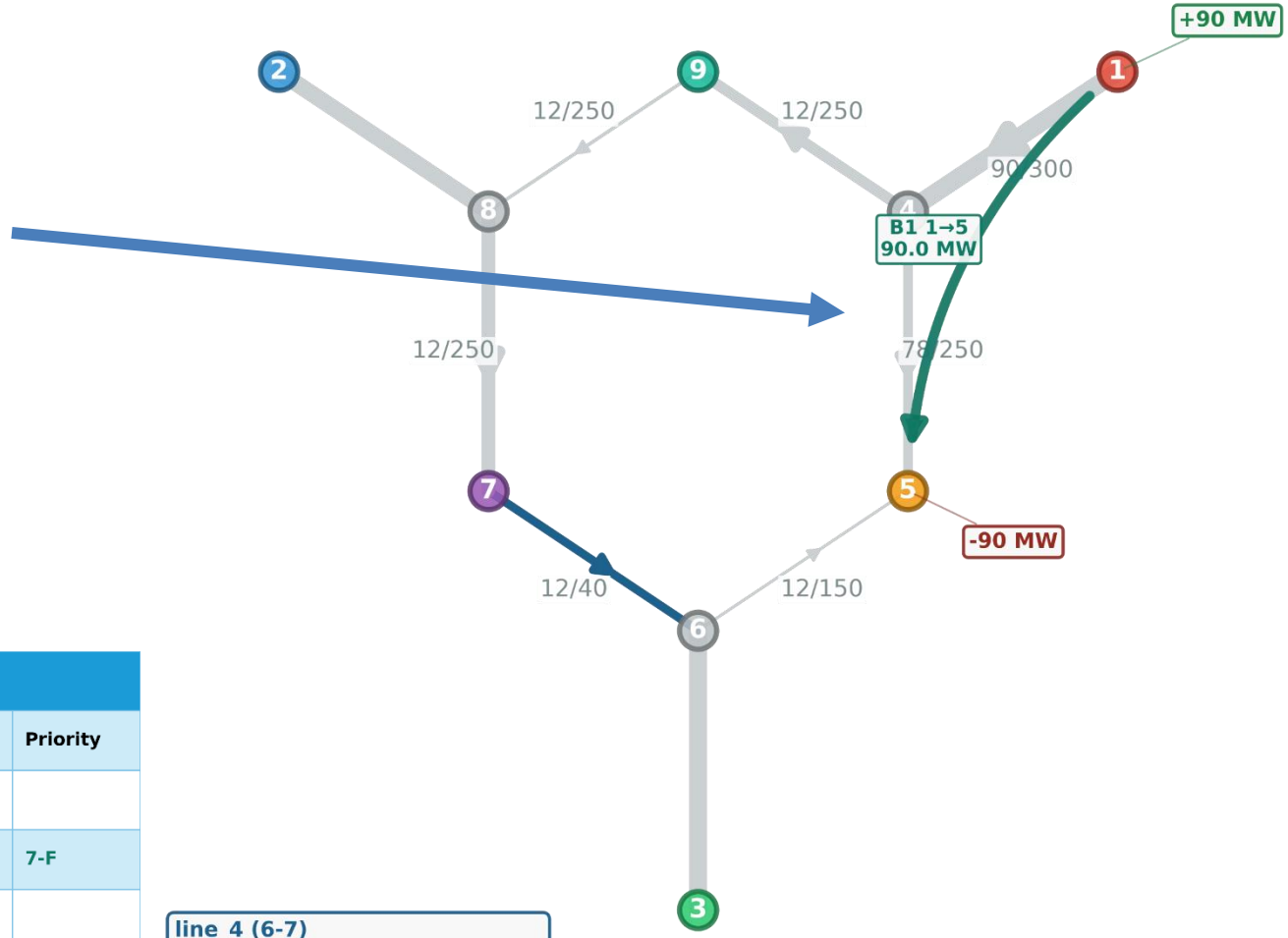
Example #1 – Enhanced Curtailment Calculator – Tag 2->7



EXAMPLE: Physical Path for tag A2 (bus 2 to bus 7, 49.1 MW)							
BA	**TSP**	**MO**	**PSE**	**POR**	**POD**	**S/E**	**Priority**
A		MO-A	PSE-A	Source: bus 2			
	A	MO-A	PSE-A	bus 2	bus 7	A	**7-F**
A		MO-A	PSE-A	Sink: bus 7			

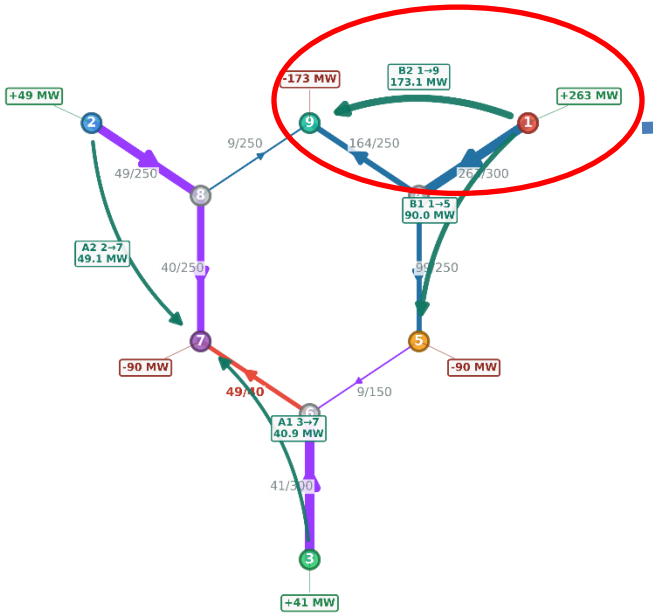
Example #1 – Enhanced Curtailment Calculator – Tag 1->5

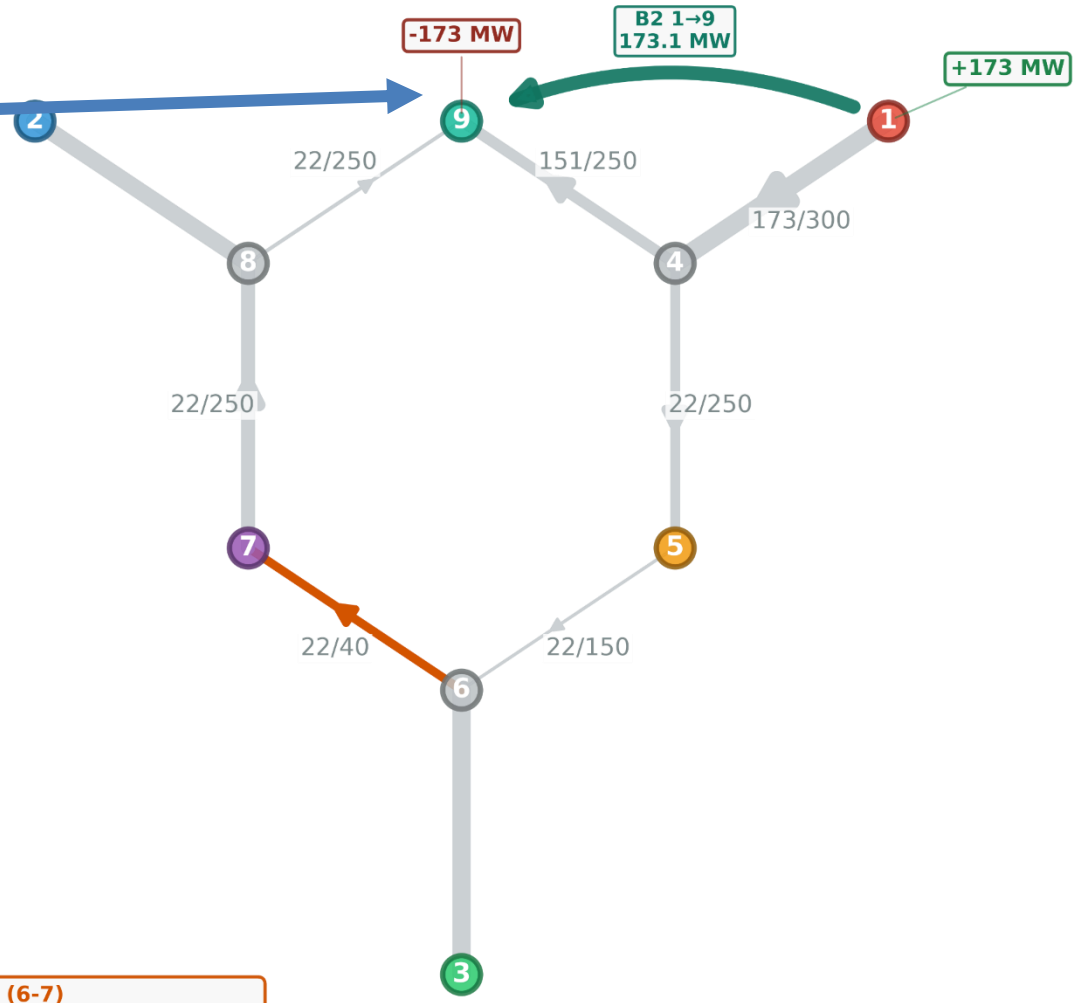




EXAMPLE: Physical Path for tag B1 (bus 1 to bus 5, 90.0 MW)							
BA	**TSP**	**MO**	**PSE**	**POR**	**POD**	**S/E**	**Priority**
B		MO-B	PSE-B	Source: bus 1			
	B	MO-B	PSE-B	bus 1	bus 5	B	**7-F**
B		MO-B	PSE-B	Sink: bus 5			

Example #1 – Enhanced Curtailment Calculator – Tag 1->9

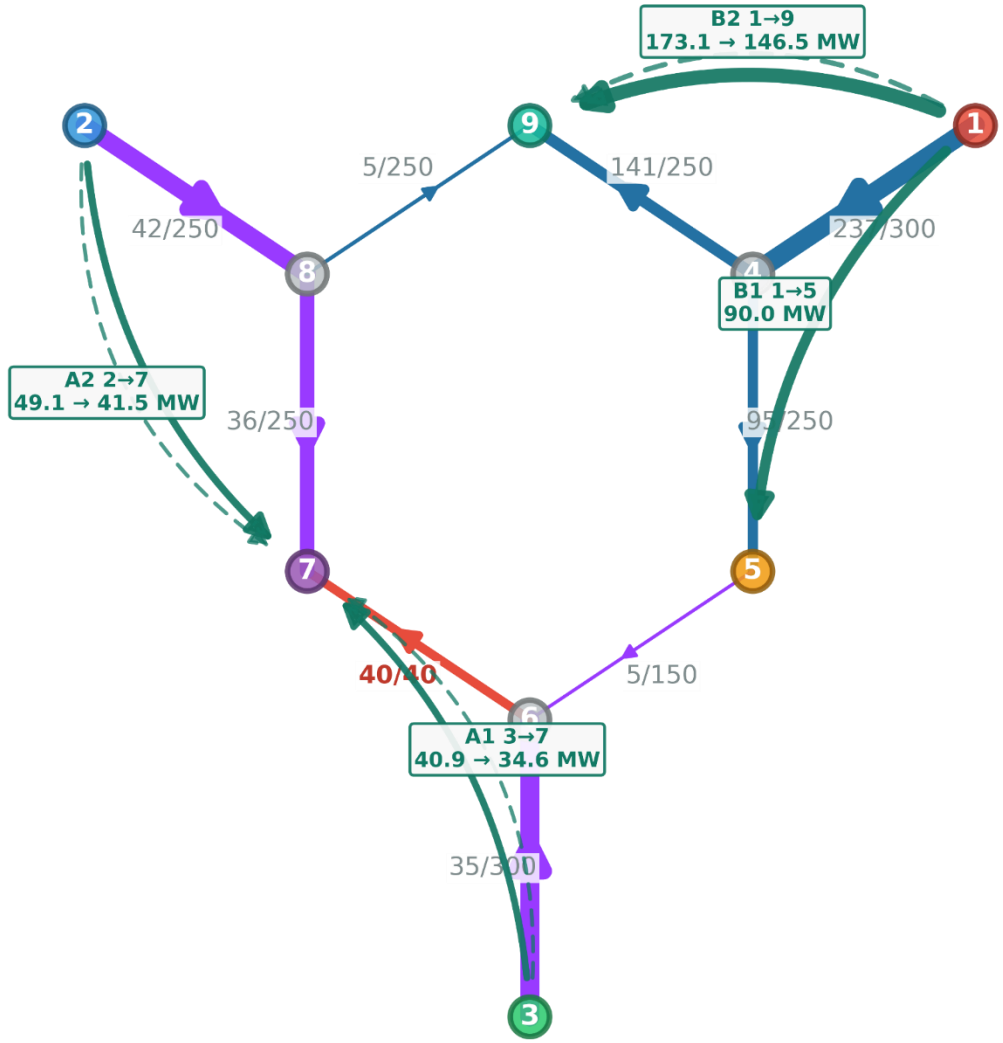




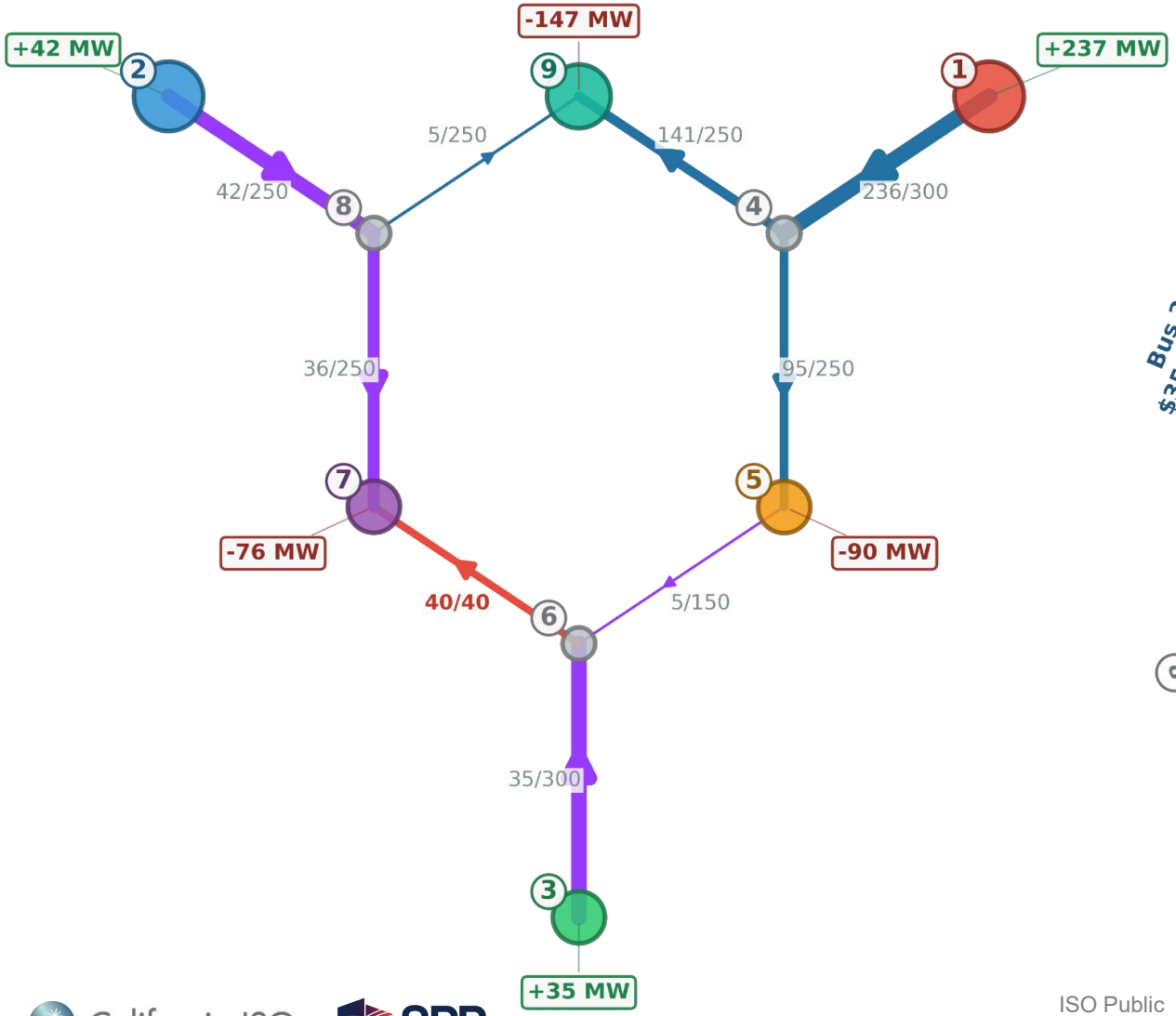
EXAMPLE: Physical Path for tag B2 (bus 1 to bus 9, 173.1 MW)							
BA	**TSP**	**MO**	**PSE**	**POR**	**POD**	**S/E**	**Priority**
B		MO-B	PSE-B	Source: bus 1			
	B	MO-B	PSE-B	bus 1	bus 9	B	**7-F**
B		MO-B	PSE-B	Sink: bus 9			

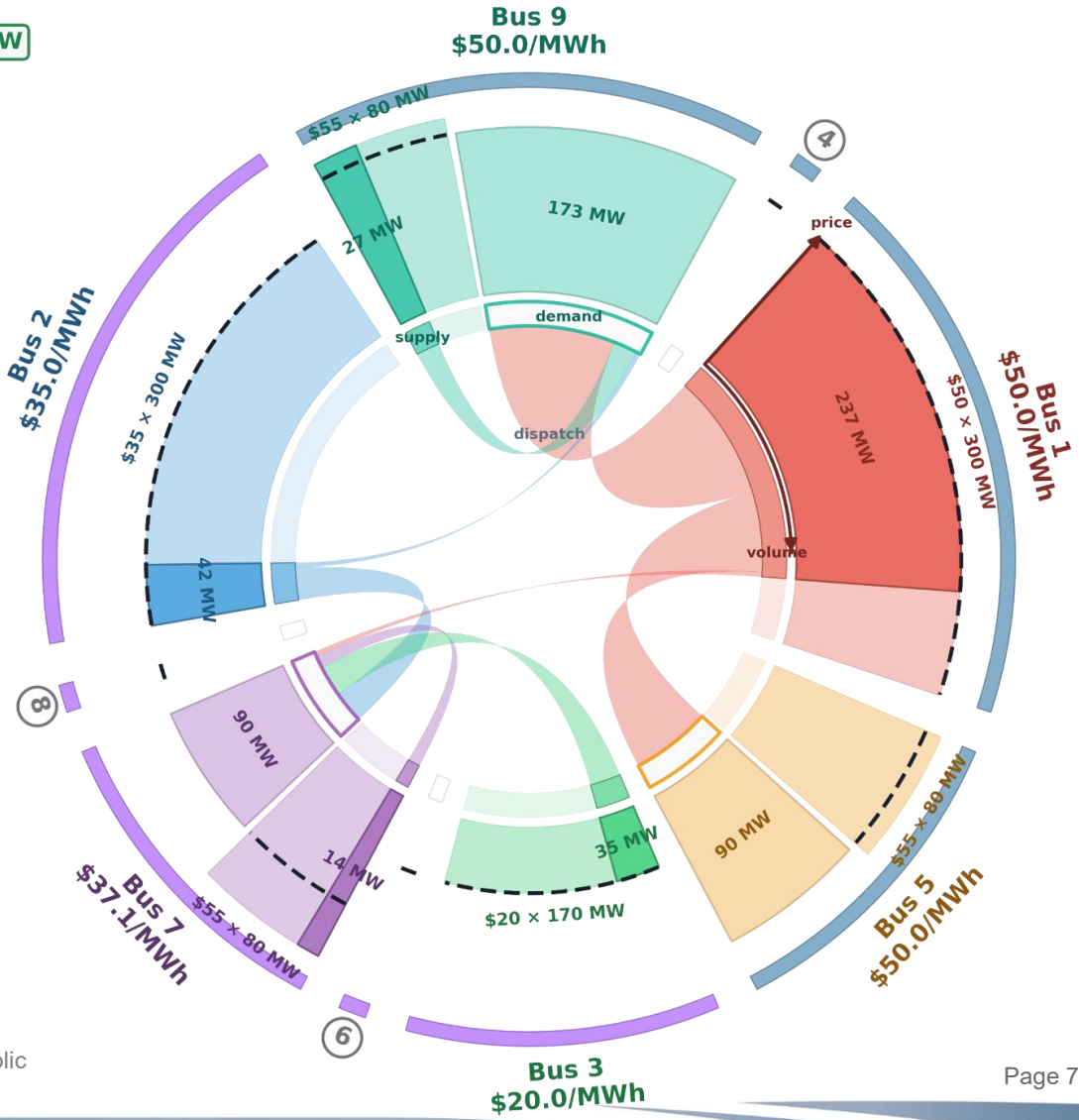
Calculation of relief

Tag	Priority	Scheduled (MW)	Impact (MW)	Share of relief	Relief (MW)	Curtailment or redispatch (MW)	Curtailed to (MW)
A1 (3→7)	7-F	40.9	34.8	56.5%	5.34	6.3	34.6
A2 (2→7)	7-F	49.1	5.2	8.4%	0.80	7.5	41.5
B2 (1→9)	7-F	173.1	21.6	35.1%	3.31	26.5	146.5
B1 (1→5, counterflow)	7-F	90.0	-12.2	not eligible	0.00	0.0	90.0
Total		**353.0**	**49.4**	**100.0%**	**9.45**	**40.3**	**312.7**



Resulting dispatch

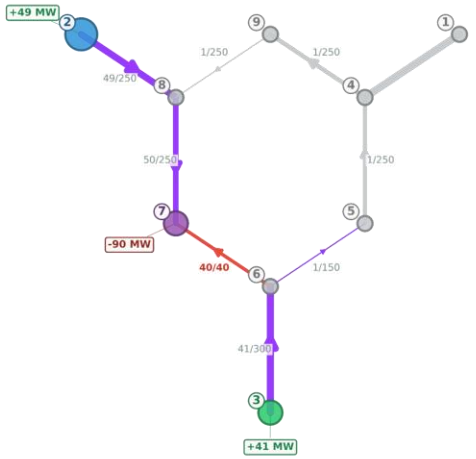


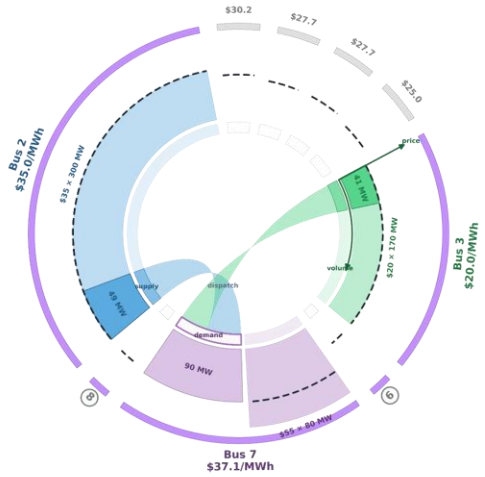


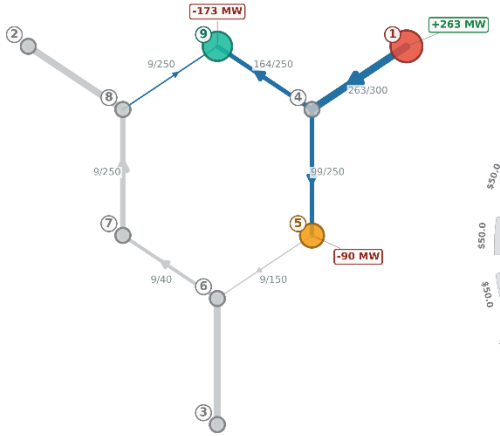
Example #3 – Reconciliation with WLR process – Gen-to-Load example

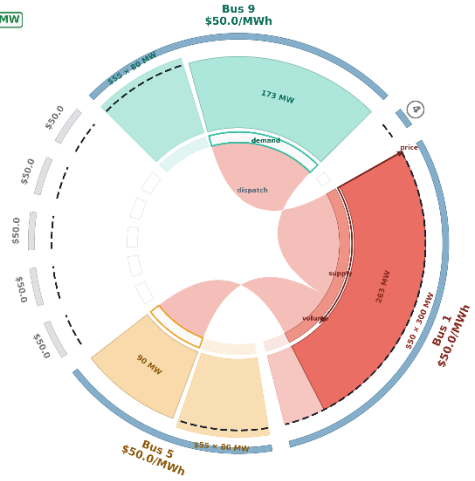
- Start with Example #1 market dispatch
- Illustrative combination of tagged schedules and untagged gen-to-load based on example #1 market dispatch
- Power flow on the network based on combined dispatch overloads a line
- ***WLR process assigns a relief obligation*** to bring the line under its limits by reducing tagged schedules and gen-to-load

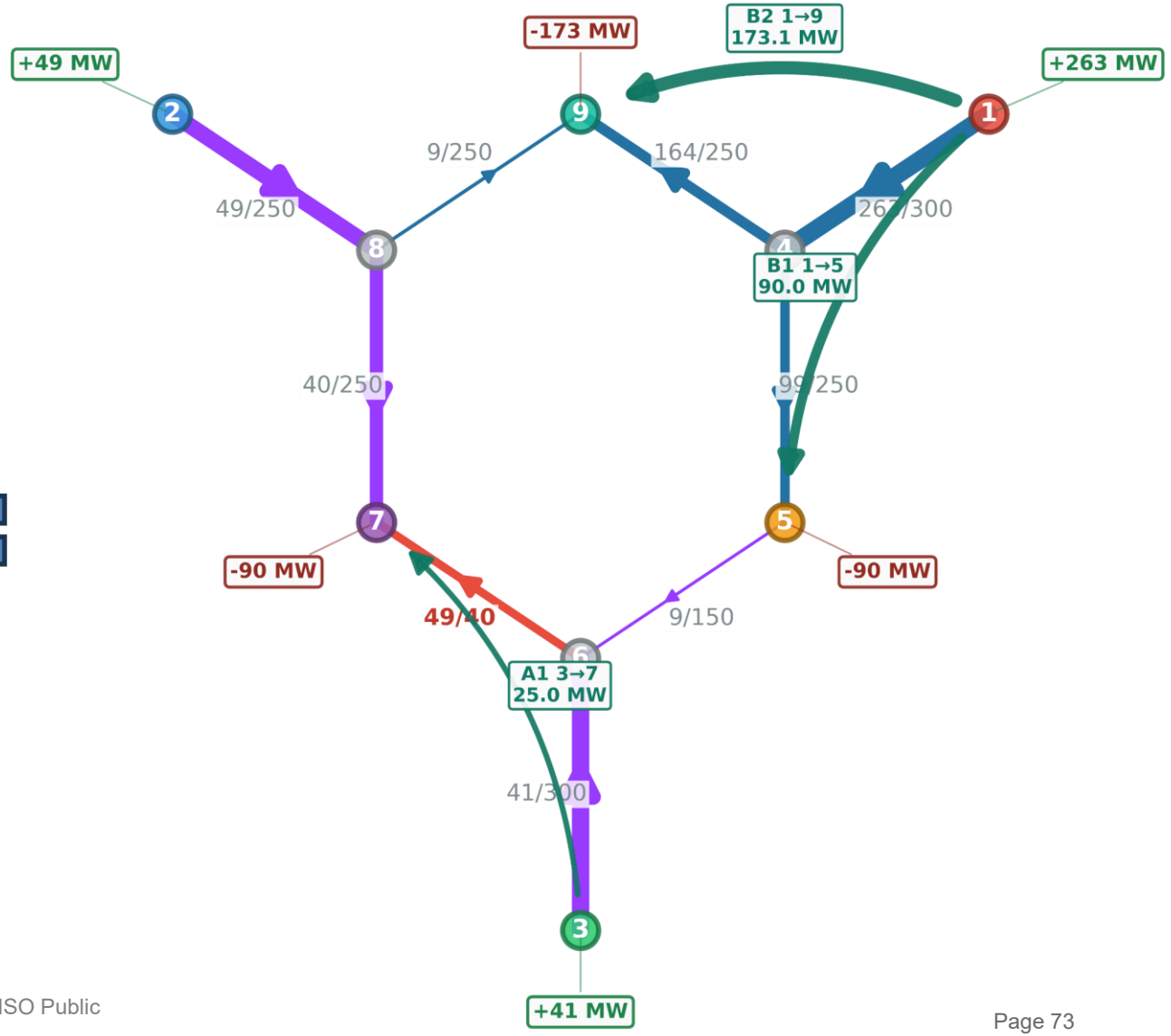
Example #3 – Reconcile dispatch with WLR process



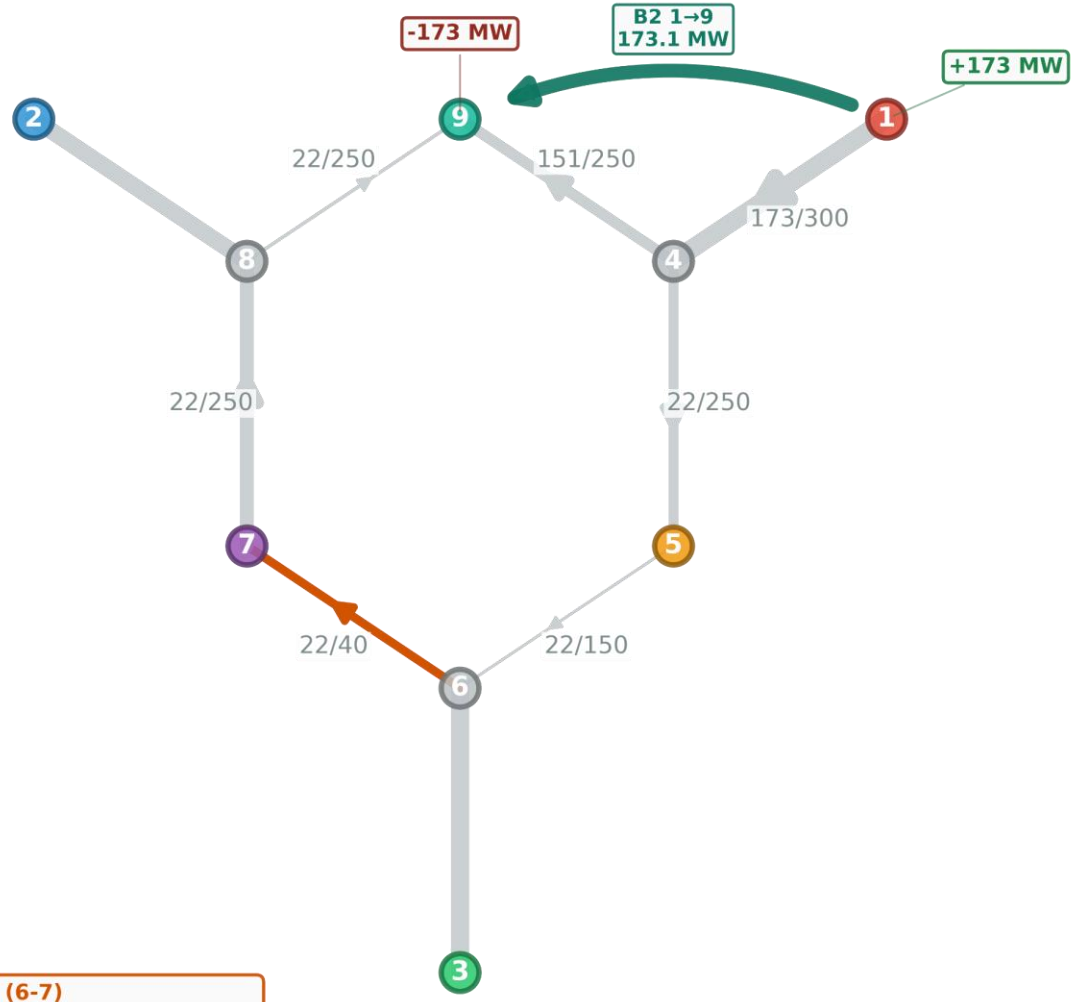


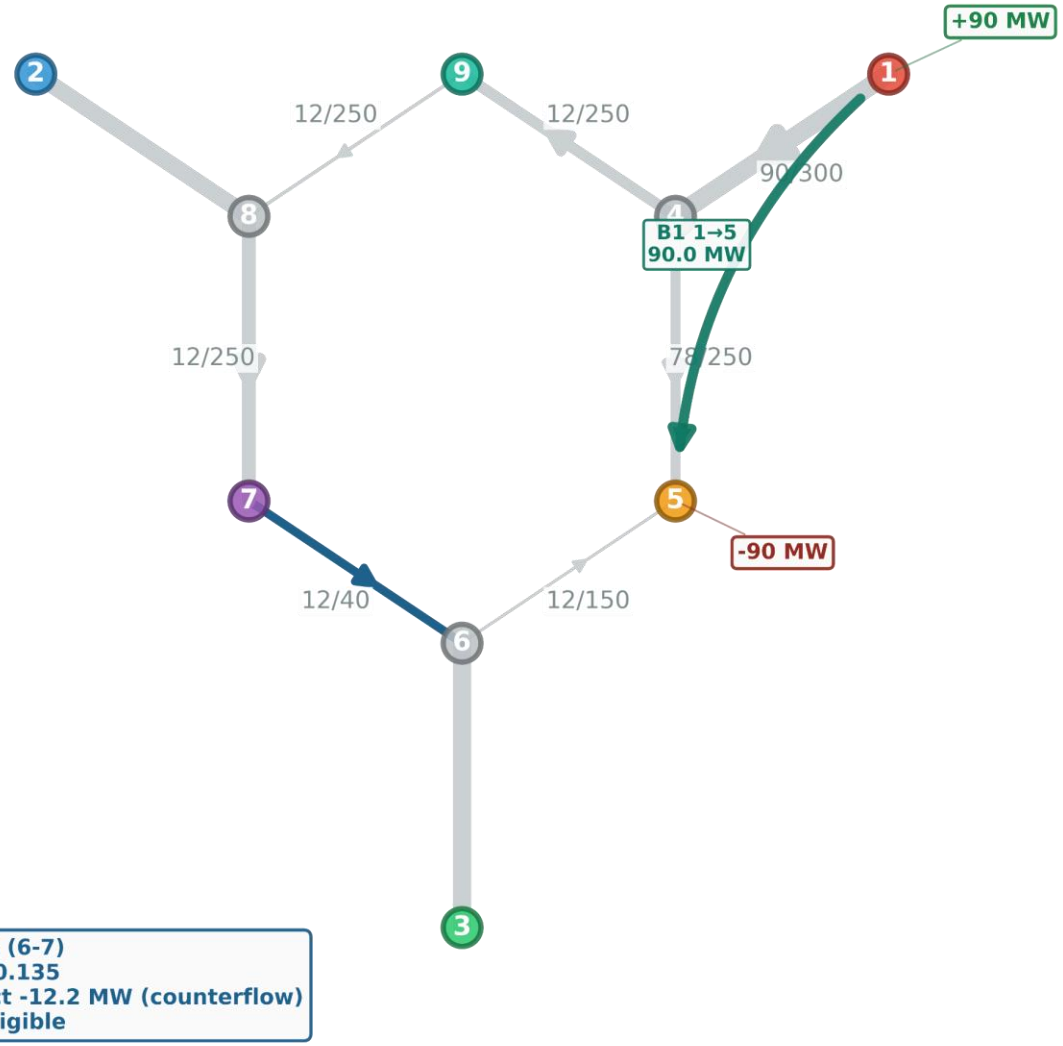




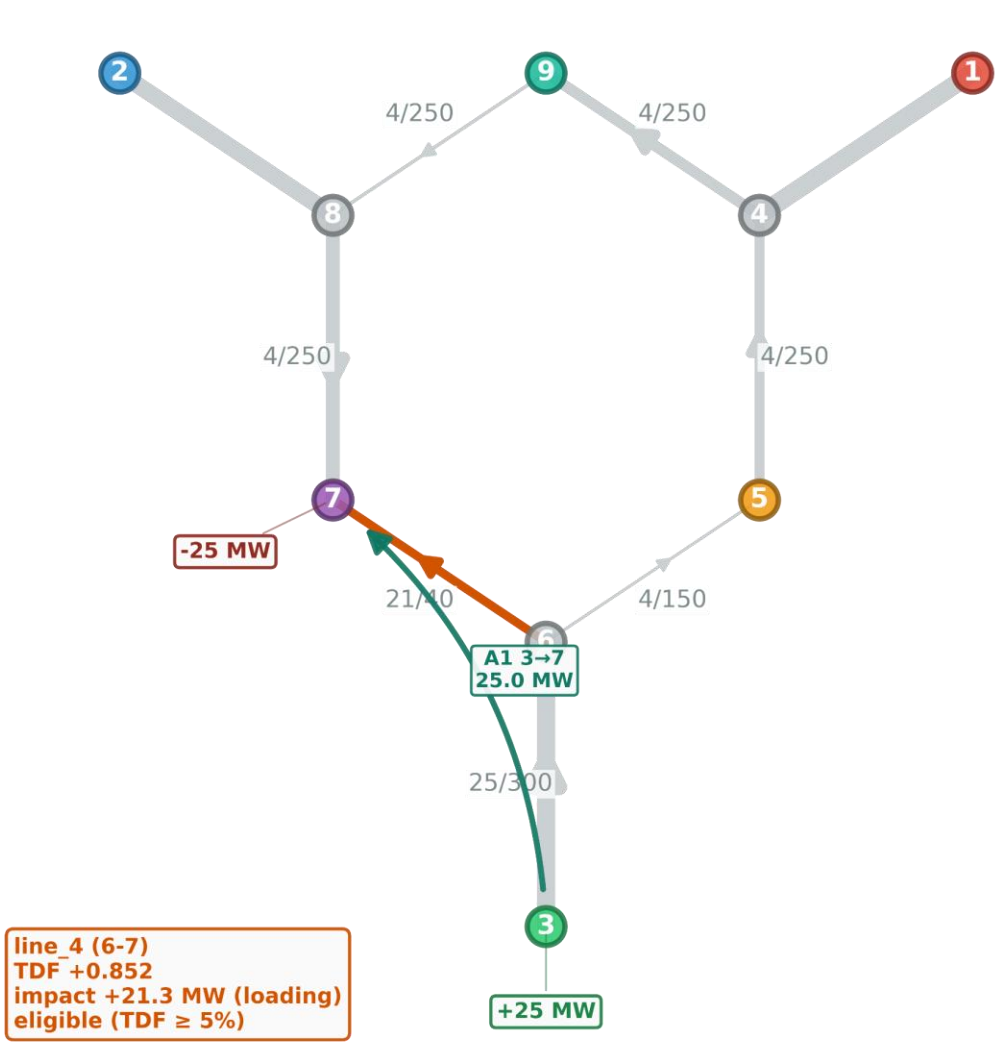


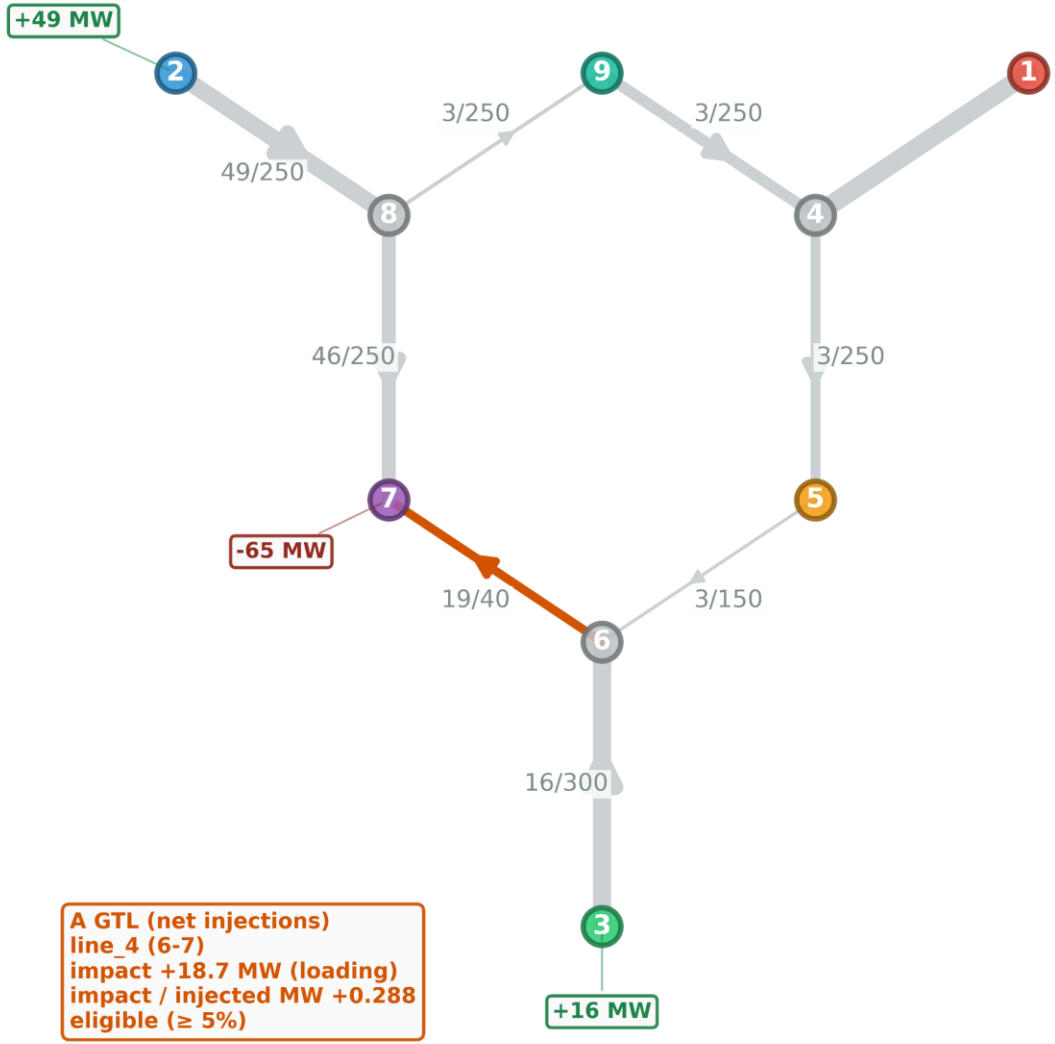
Example #3 – Market B tagged schedules





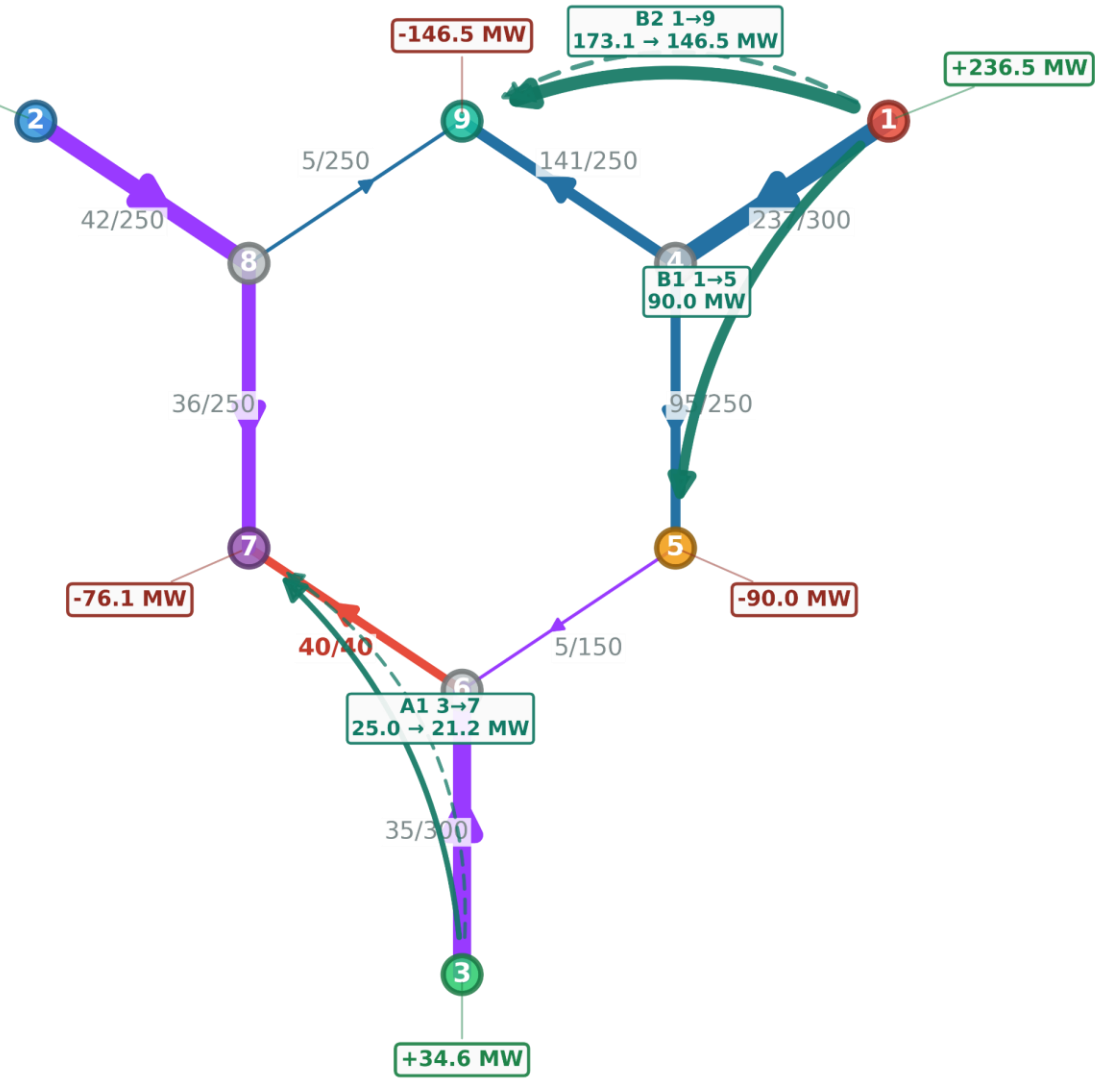
Example #3 – Market A tagged schedules & gen-to-load



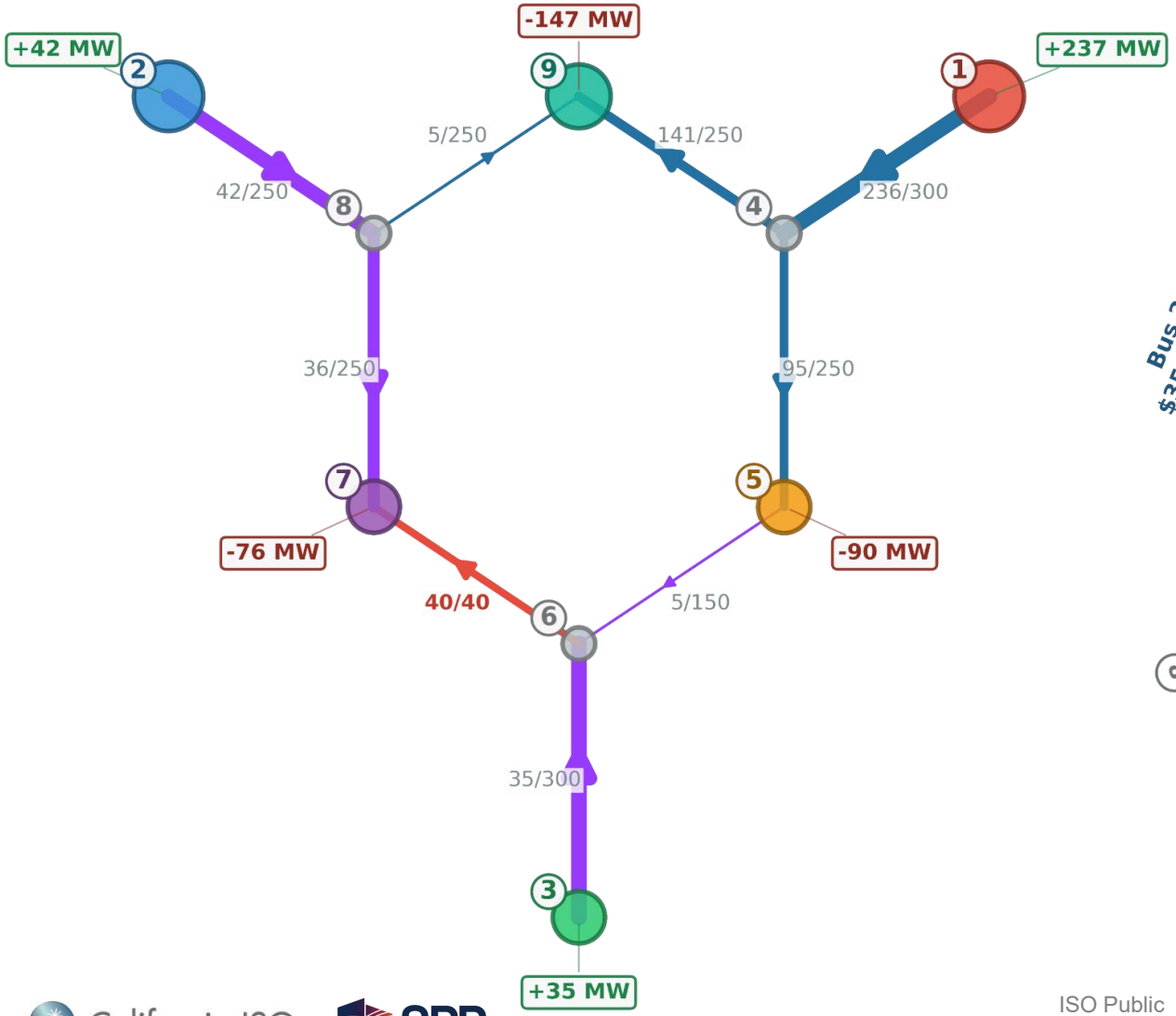


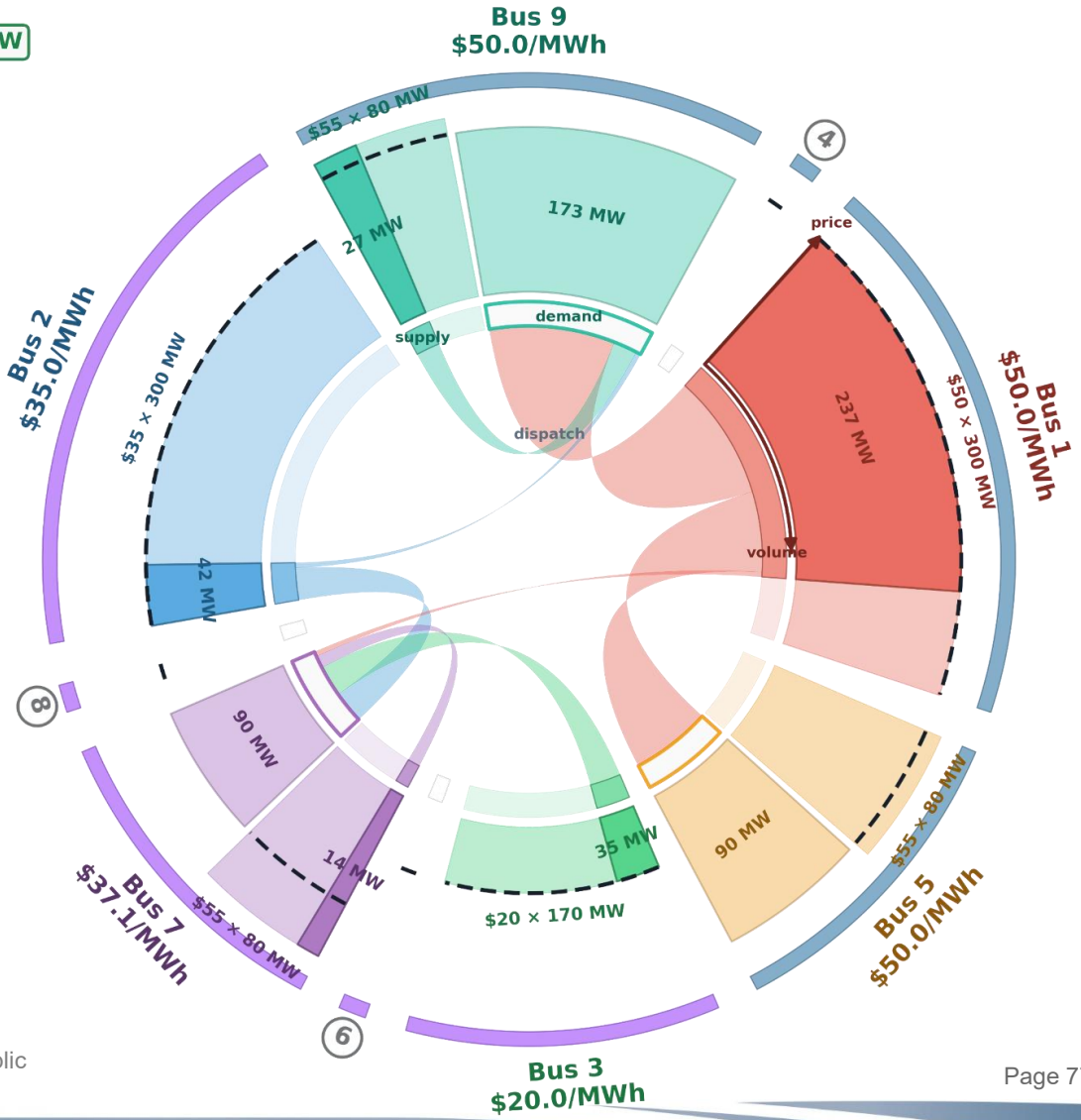
Example #3 - Calculation of relief

Tag	Priority	Scheduled (MW)	Impact (MW)	Share of relief	Relief (MW)	Curtailment or redispatch (MW)	Curtailed to (MW)
A1 (3→7)	7-F	25.0	21.3	34.6%	3.27	3.8	21.2
A GTL (net injections), untagged	7-F	64.9	18.7	30.4%	2.87	10.0	55.0
	gen at bus 2	49.1	5.2	8.4%	0.80	7.5	41.5
	gen at bus 3	15.9	13.5	21.9%	2.07	2.4	13.4
B2 (1→9)	7-F	173.1	21.6	35.1%	3.31	26.5	146.5
B1 (1→5, counterflow)	7-F	90.0	-12.2	not eligible	0.00	0.0	90.0
Total		**353.0**	**49.4**	**100.0%**	**9.45**	**40.3**	**312.7**



Example #3 - Resulting dispatch





Example #4 – Relief through adjustment of transmission constraint in the market

- Start with Example #3 relief obligations
- Incorporate relief obligation as market flow constraint on the element
- ***Both markets dispatch to market flow constraints that reflect relief obligations***

Starting with calculation of relief from example #3

Tag	Priority	Scheduled (MW)	Impact (MW)	Share of relief	Relief (MW)	Curtailment or redispatch (MW)	Curtailed to (MW)
A1 (3→7)	7-F	25.0	21.3	34.6%	3.27	3.8	21.2
A GTL (net injections), untagged	7-F	64.9	18.7	30.4%	2.87	10.0	55.0
	gen at bus 2	49.1	5.2	8.4%	0.80	7.5	41.5
	gen at bus 3	15.9	13.5	21.9%	2.07	2.4	13.4
B2 (1→9)	7-F	173.1	21.6	35.1%	3.31	26.5	146.5
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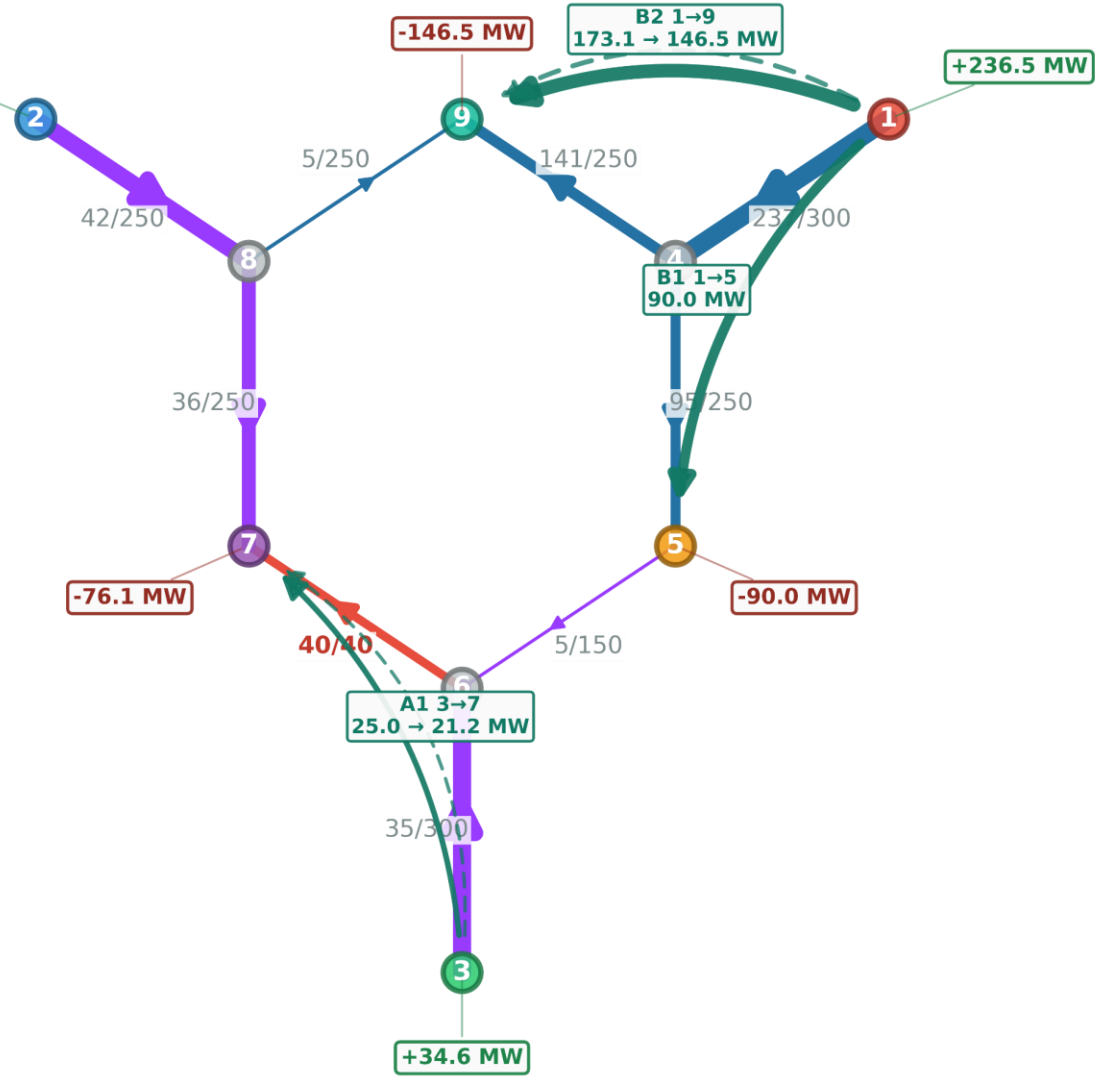
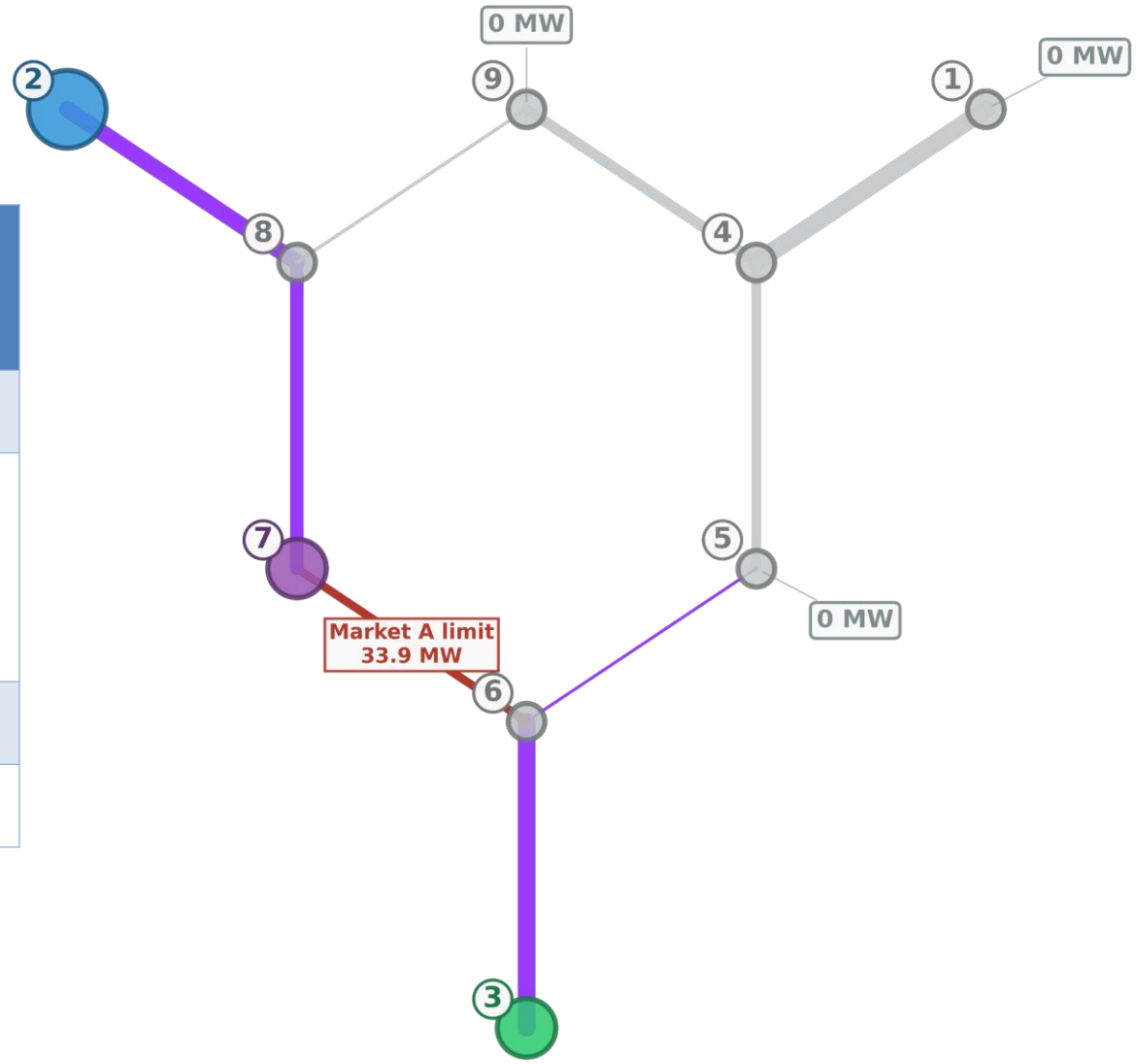
Total		**353.0**	**49.4**	**100.0%**	**9.45**	**40.3**	**312.7**



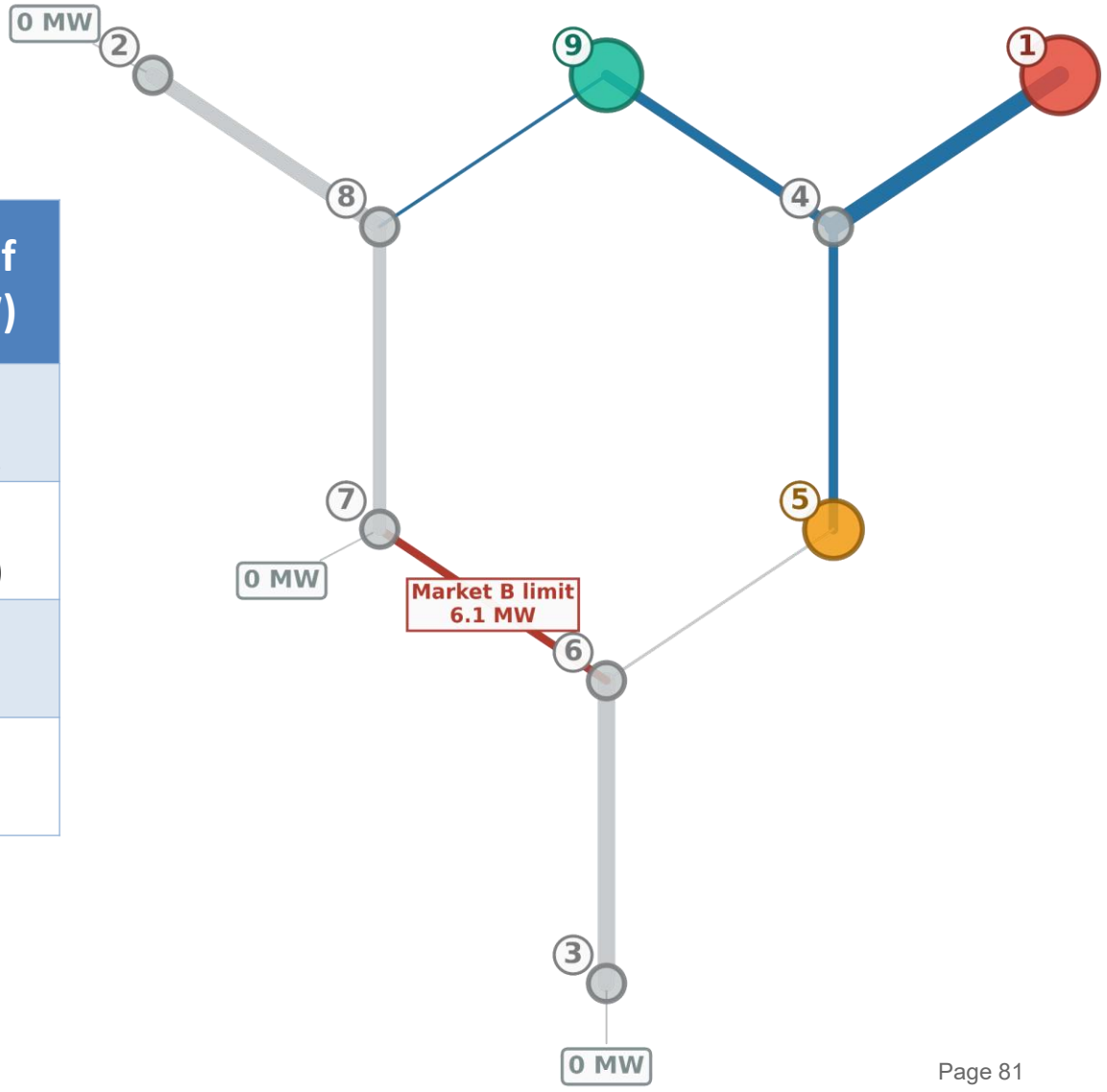
Market A - Calculation of market flow constraint based on relief obligation

Tag	Priority	Scheduled (MW)	Impact (MW)	Relief (MW)
A1 (3→7)	7-F	25.0	21.3	3.27
A GTL (net injections), untagged	7-F	64.9	18.7	2.87
Total		**89.9**	**40.0**	**6.1**
		Market Flow Limit	33.9	

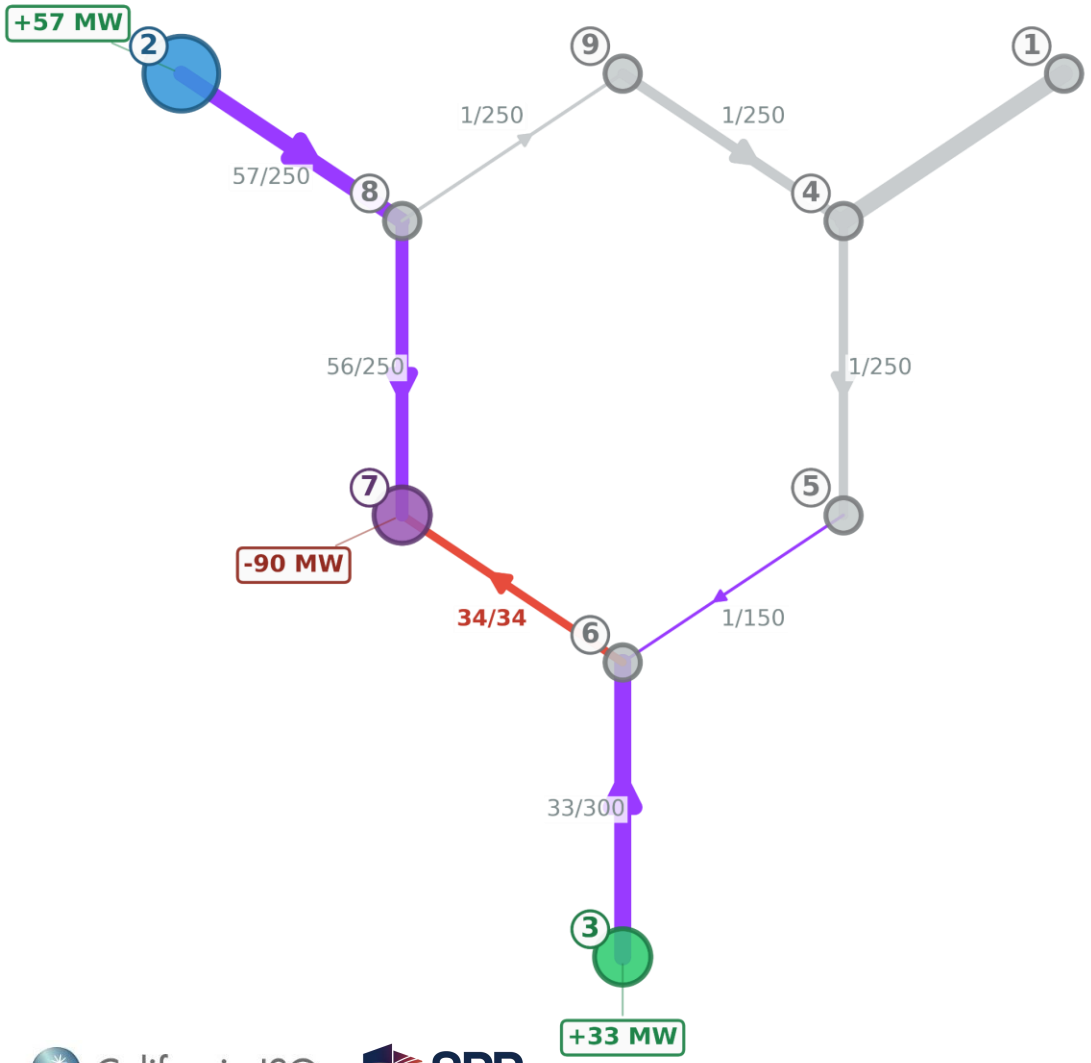


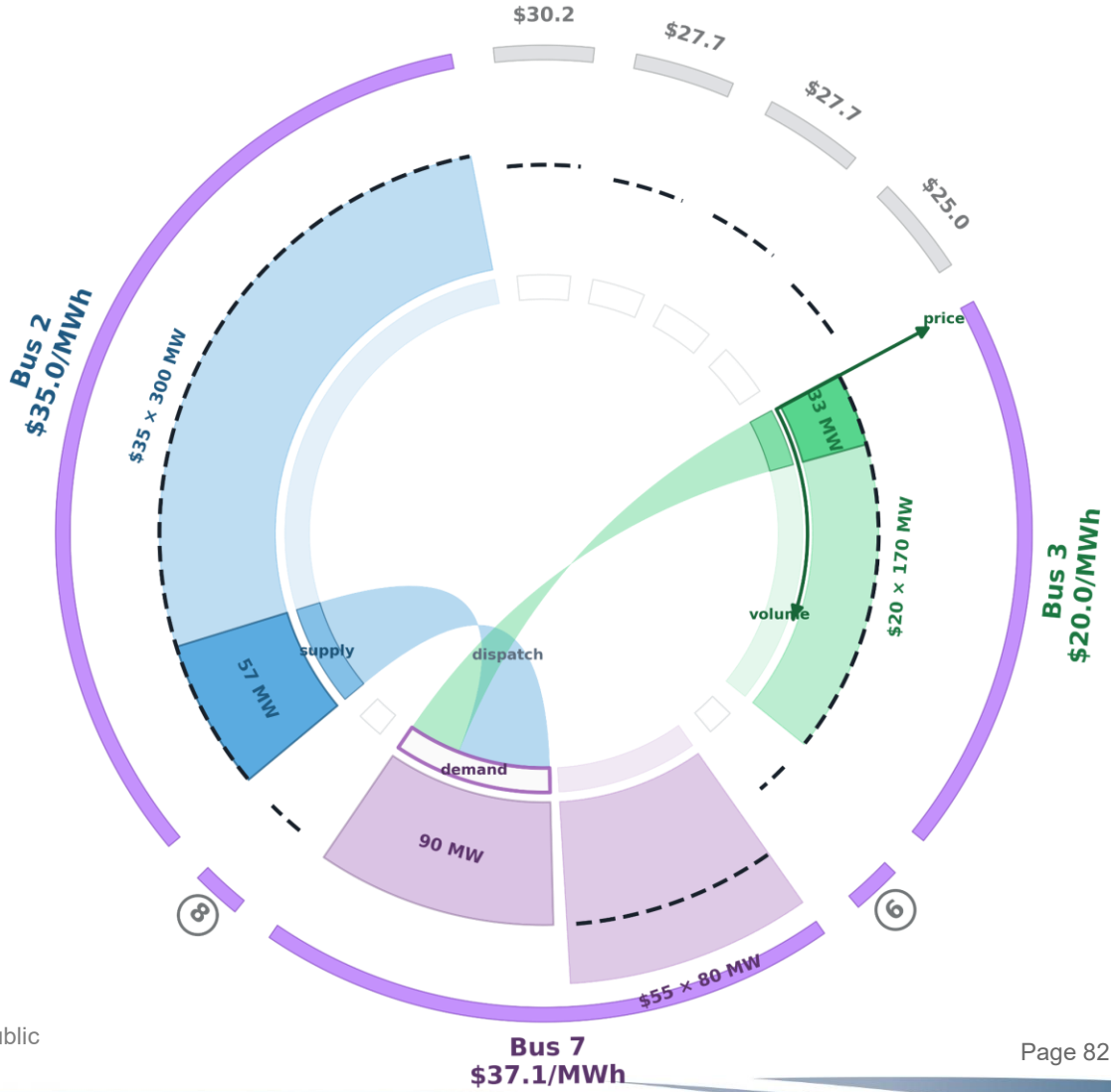
Market B - Calculation of market flow constraint based on relief obligation

Tag	Priority	Scheduled (MW)	Impact (MW)	Relief (MW)
B2 (1→9)	7-F	173.1	21.6	3.31
B1 (1→5, counterflow)	7-F	90.0	-12.2	0.00
Total		**263.1**	**9.4**	**3.3**
		Market Flow Limit	6.1	

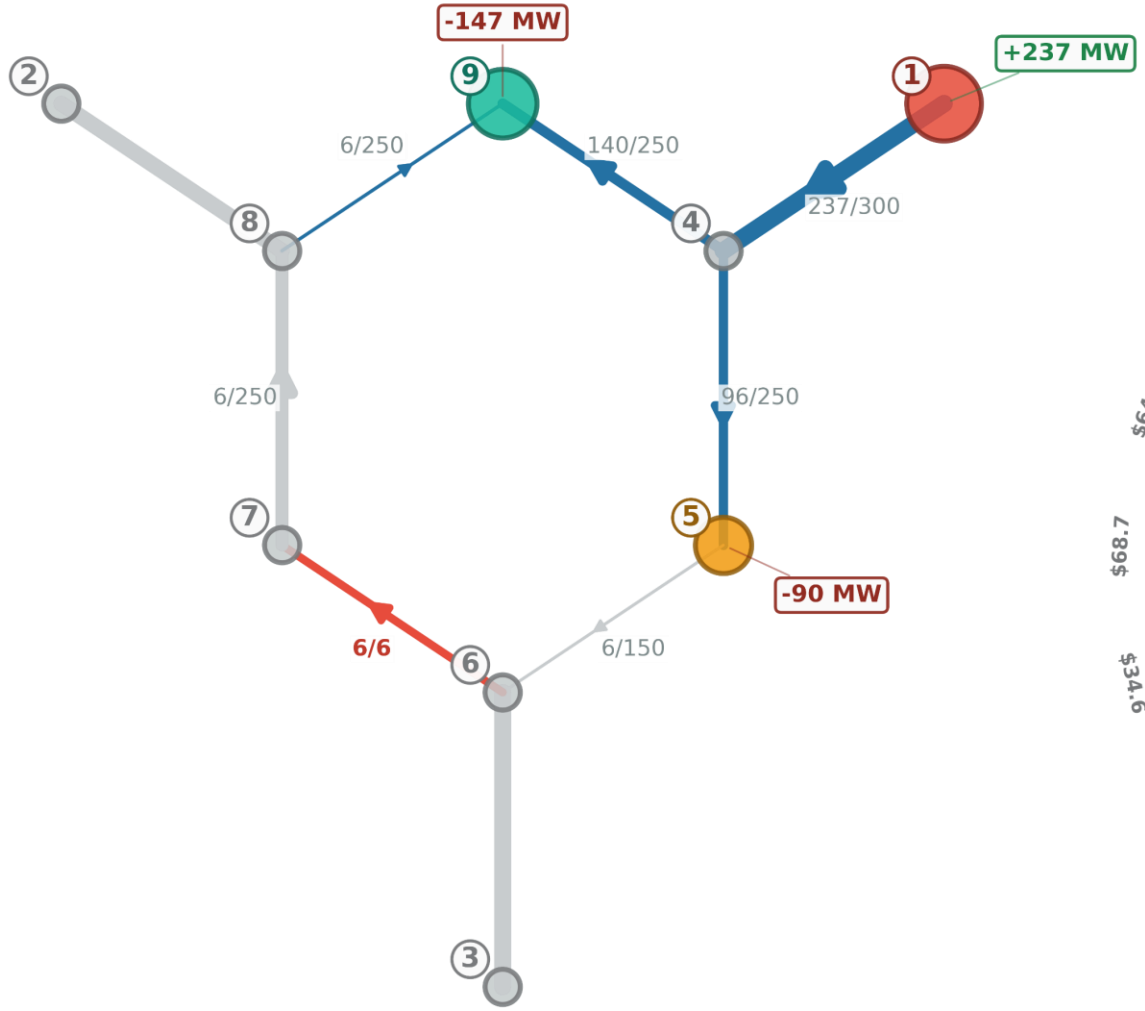


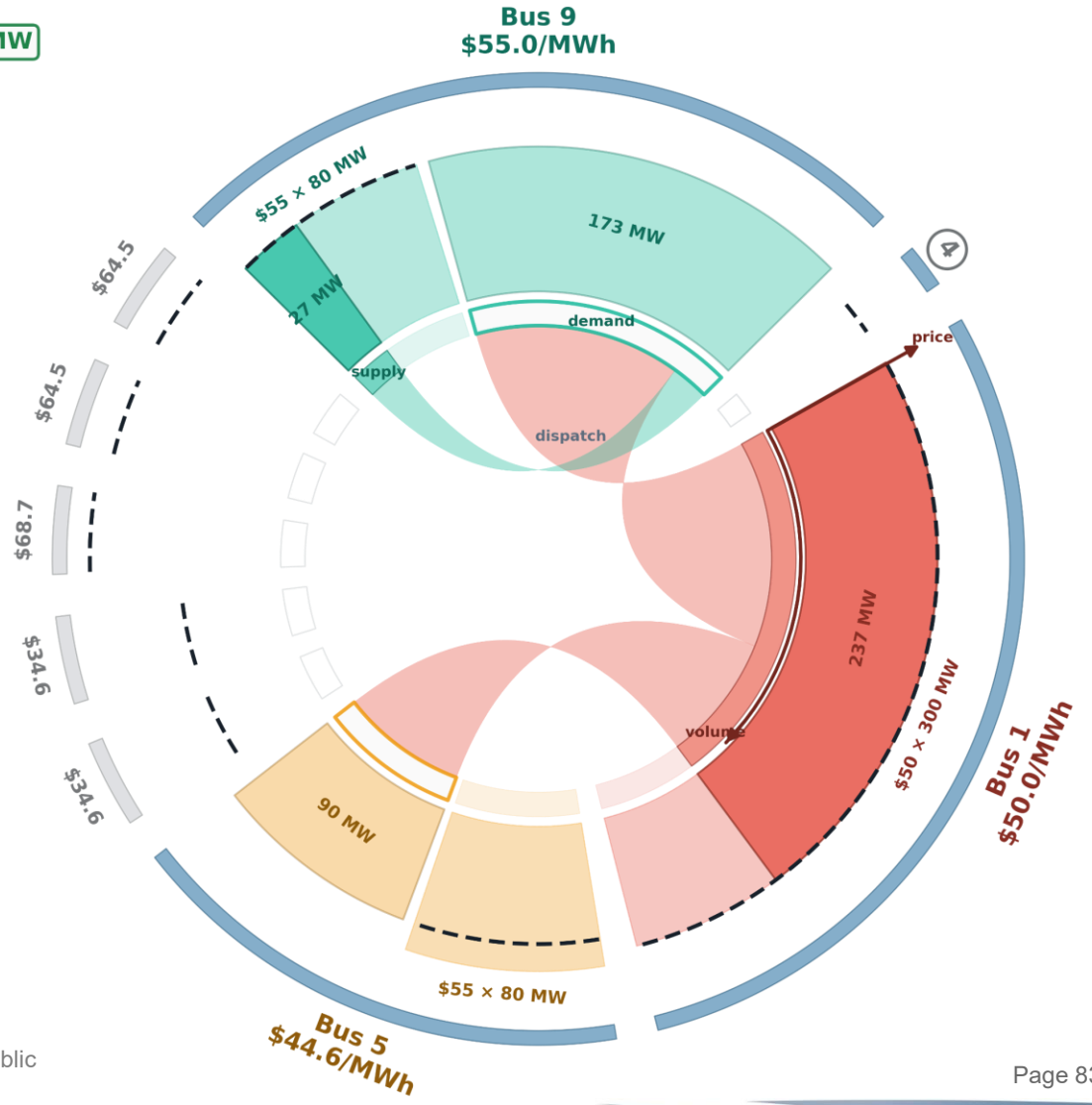
Example #4 – Market A dispatch with market flow limit



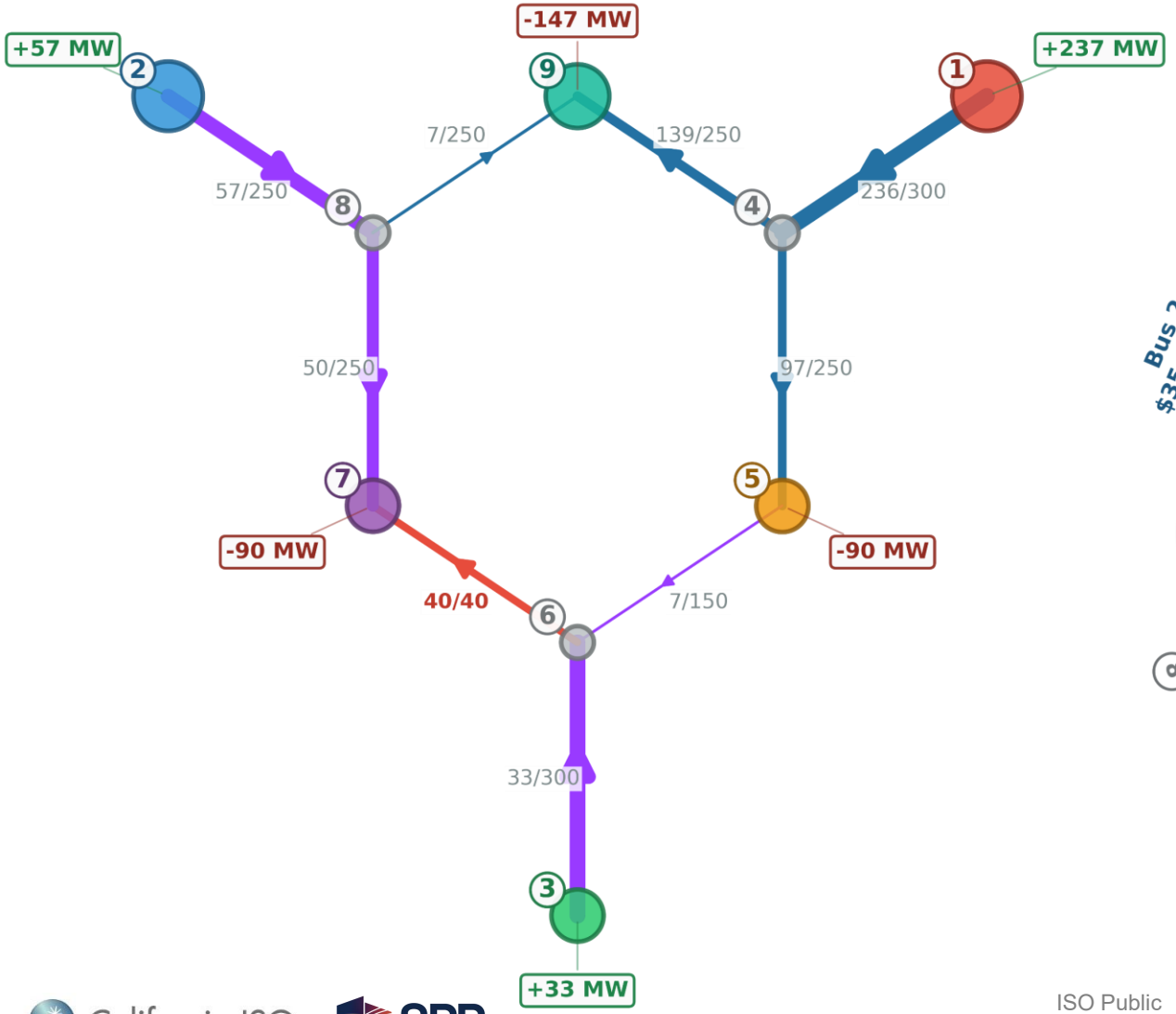


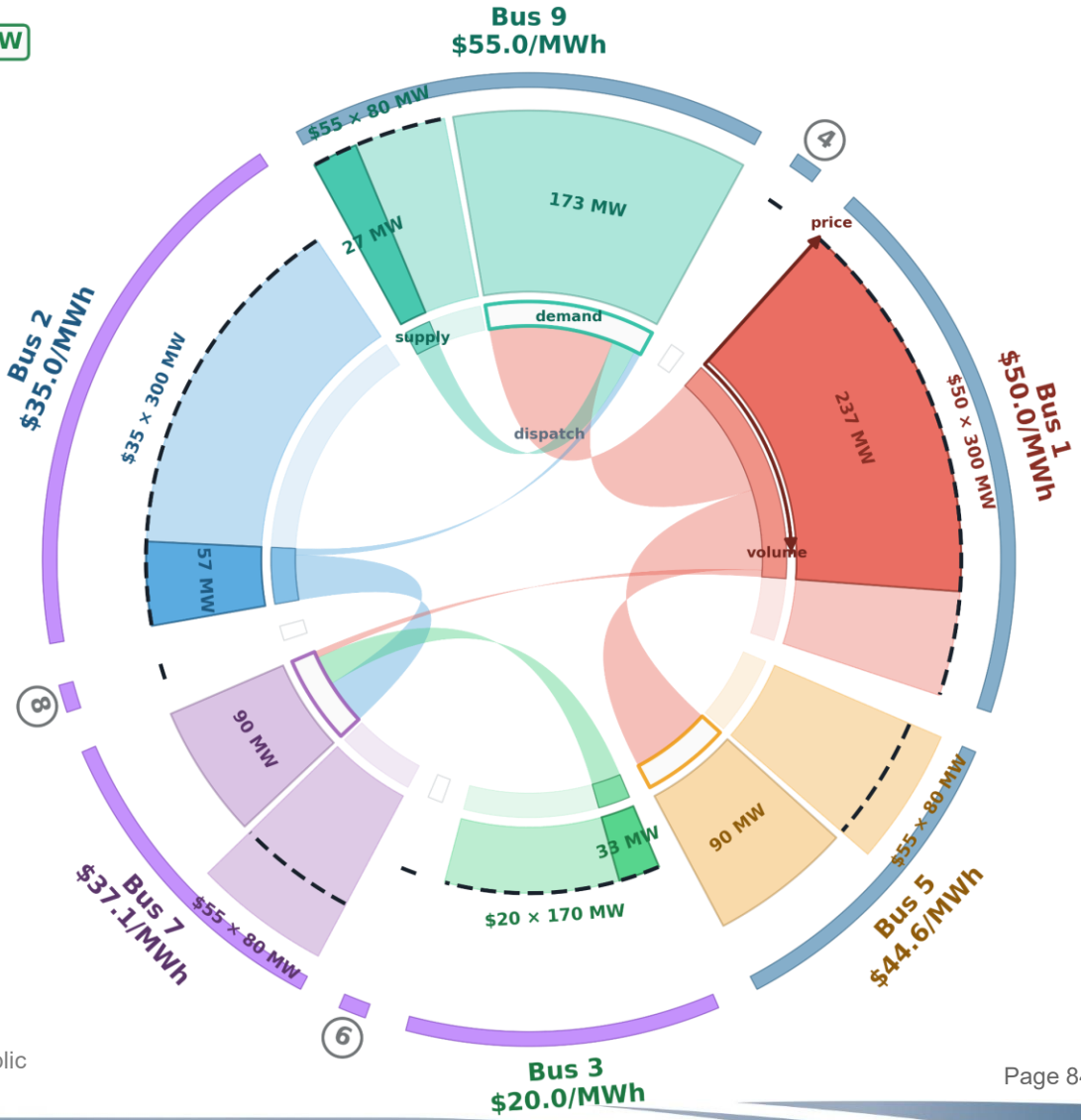
Example #4 – Market B dispatch with market flow limit





Example #4 – Network dispatch using market flow constraint



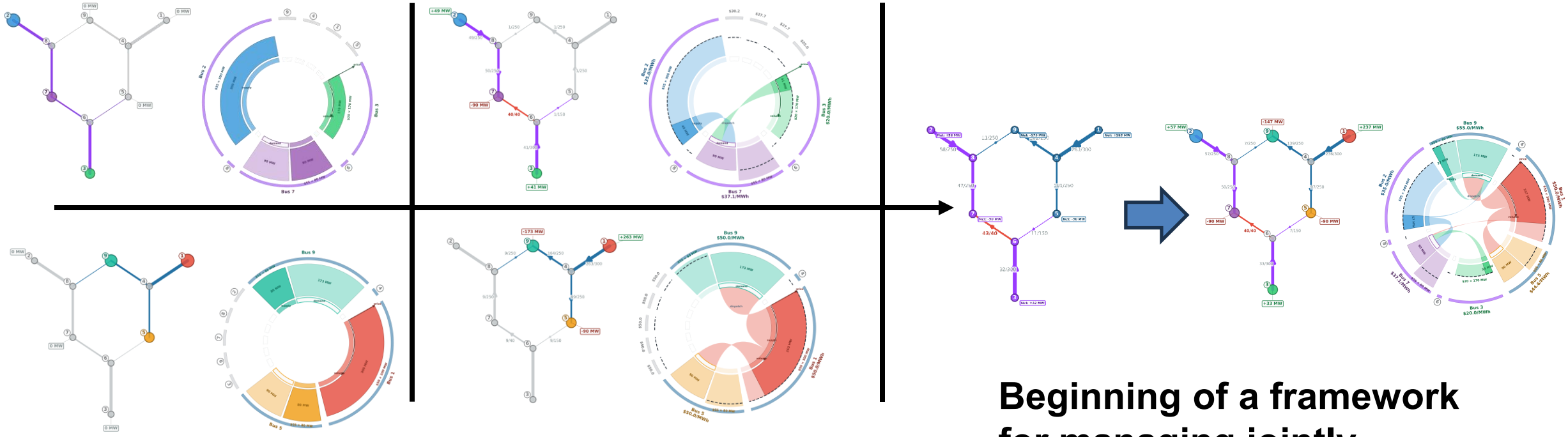


Coordination of parallel processes

Inputs

Optimization

Reconciliation



Beginning of a framework for managing jointly impacted constraints

Developing a framework for managing jointly impacted constraints

- Eligibility criteria and process to identify constraints materially affected by multiple markets
- Methodology for determining relief obligations
- Agreement on methodology for providing relief through markets

CONGESTION MANAGEMENT EDUCATION PRESENTATIONS

Moderator:

Jeff Droubay
WECC

Panelists:

- **Casey Cadle** — SPP
- **Paul Dockery** — CAISO

Western Seams Coordination

CAISO–SPP Joint Report to FERC

High-level responses and joint priority objectives

FERC Docket No. AD26-10-000 | Filed September 30, 2026

Topics of joint report and workshops

	Category	Joint Report Question	Seams Workshops
Q1	Status	What efforts have ISO and SPP undertaken to date on seams and market coordination? Which other have ISO and SPP engaged in discussions on these issues?	Workshop #1, July 31, 2026: Key issues & regulator perspectives
Q2	Issues	Identify specific seams and market coordination issues created by the ongoing development of organized wholesale markets in the West, including (but not limited to):	
		(a) Explain how ISO and SPP will resolve potential operational and communication challenges regarding transmission commitment, reservation, and use, given their differing market rules	Workshop #2, August 18, 2026: Transmission constraints and congestion management Workshop #3, September 16, 2026: Transactions across market boundaries
		(b) Explain how congestion management will work between (1) the three markets (EDAM, Markets+, and SPP's expanded RTO) and (2) the market operators and the bilateral markets	
		(c) Explain how ISO and SPP will manage loop flow issues between the markets	
Q3	Plan	Submit a plan and schedule for addressing each of the issues in question (2) based upon the relative prioritization of those issues for both importance and timing.	Workshop #4, October 22, 2026: Western Loading Relief process, roadmap & next steps
Q4	Gap	Identify any areas in which the market operators are not yet aligned on a path forward.	

Six joint priority objectives

Listed in priority order and worked concurrently — five near-term workstreams plus a longer-term market-to-market plan.

#	Priority objective	What it means	Timing
1	**Education & training**	Common understanding of how transactions move across multiple market footprints.	**Ongoing**
2	**Enhanced data exchange**	Improve frequency, granularity, timeliness and quality of operational information.	**Through 2027**
3	**Full network model alignment**	Maintain aligned full-network models and a common mapping standard.	**Ongoing**
4	**WLR process & ECC**	Standardized, flow-based identification of constraint contributions and relief obligations.	**Target: end 2027**
5	**Jointly impacted constraints**	Framework to identify shared constraints, assign relief and deliver relief through each market.	**Target: end 2027**
6	**Longer-term market-to-market**	Develop a plan for future coordinated congestion management, optimization and settlement.	**After operating experience and near-term work completed**

Path forward

Now–2027

Education, additional seams workshops, data exchange, model alignment; develop WLR/ECC and joint-constraint framework development

Oct. 1, 2027

Markets+ implementation; target effective date for CAISO–SPP seams coordination agreement

End of 2027

Expanded WLR/ECC capability targeted for implementation

Longer term

Evaluate market-to-market optimization, redispatch and settlement based on operating experience

Items still to resolve and work through

- Market seams coordination governance: where specific obligations ultimately reside
- Long-term design: coordinated market-to-market relief, optimization and settlement

Closing Remarks

Carrie Simpson
Vice President
Markets, SPP

California ISO

SPP
Powering Progress

WECC

Closing Remarks

Anna McKenna
Vice President
Market Design and Analysis, CAISO

Comments and next meeting

- Comments: Please submit stakeholder comments on the October 22 workshop by visiting Meetings | Market Seams | California ISO and completing the comment template Word document. Upon completion of this template, please submit it to isostakeholderaffairs@caiso.com. Written comments are due by end of day Nov. 5, 2026.

- Next meeting: The California ISO and Southwest Power Pool are planning to continue the Joint Market Seams Workshops in 2027. The plan is to continue hybrid in-person and remote attendance with quarterly cadence. Submit comments with preferred topics or additional feedback on the meeting series.

- Seams Webpage: More information is at Seams | Western Energy Markets