Western Area Power Administration

Parker-Davis Project

Minimum Scheduling Requirements

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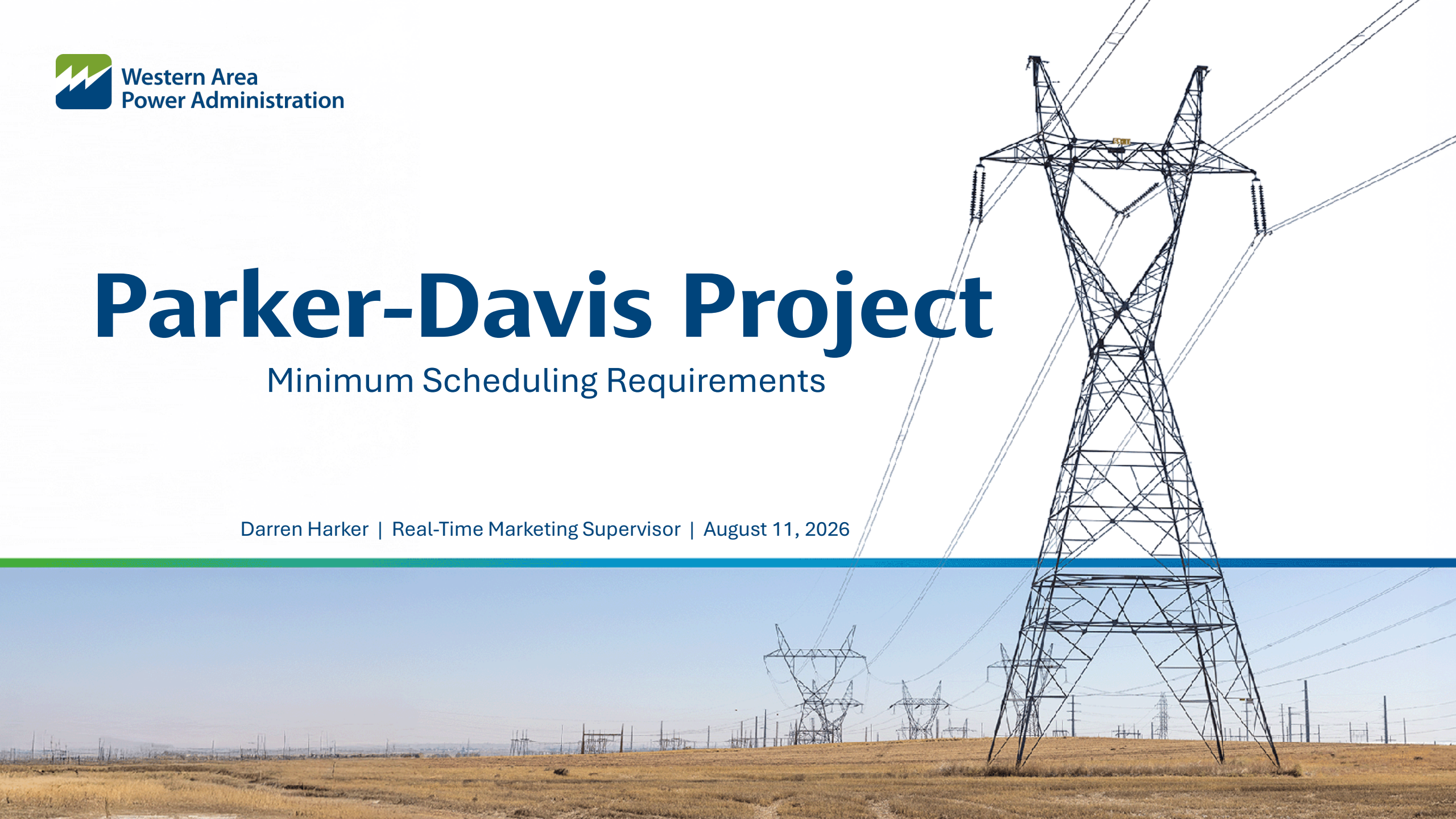
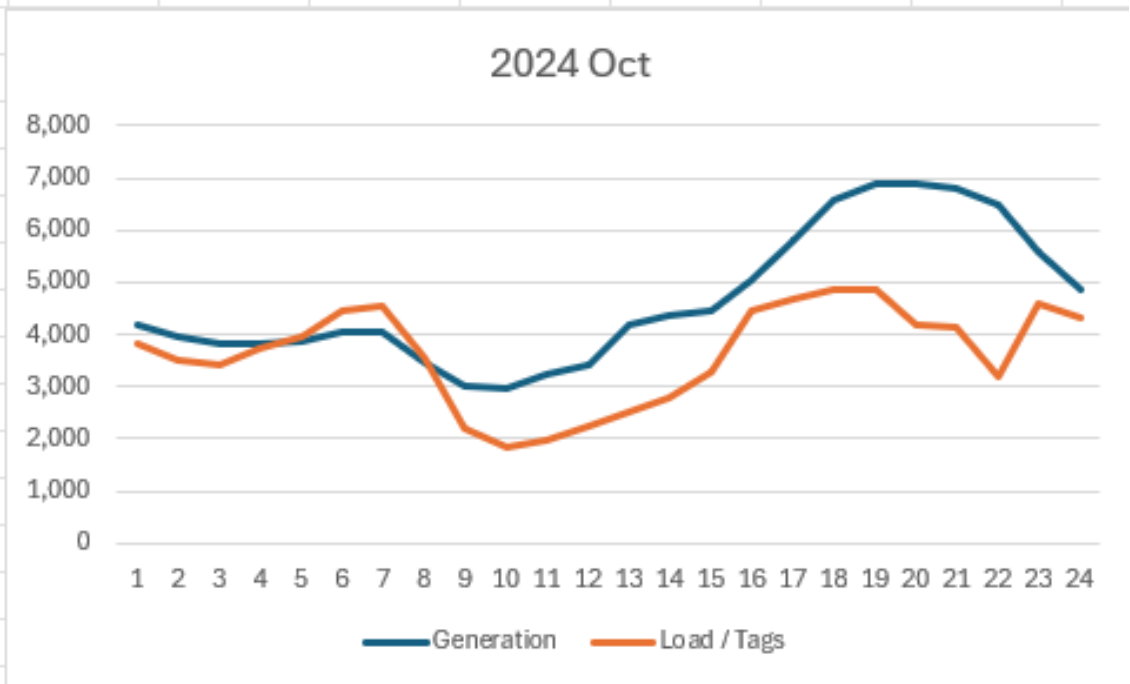


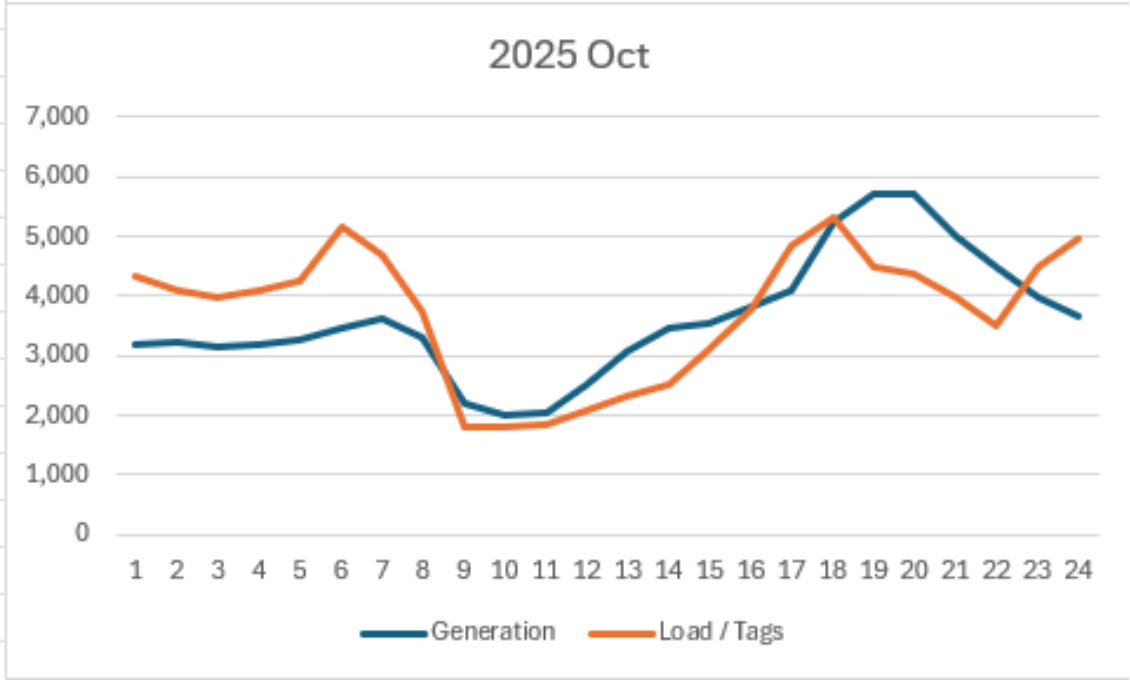
Agenda

- The Imbalance Problem and Law of the River Constraints
- Monthly Minimum Scheduling Method and Key Terms
- How the Model Works – Four Steps
- Financial Risk: Sell Value vs Worst-Case Buyback
- 2026 Outlook, Examples, and Monthly Deliverables

The Imbalance

- Generation and load must match every hour
  - When Gen > Load — sell surplus
  - When Load > Gen — buy energy back to serve load
  - Why not simply reduce generation?
- Water delivery obligations and downstream storage limits prevent it (Law of the River)





Law of the River — Water Priorities

Priorities for Water Scheduling (Boulder Canyon Project Act, Section 6):

- Water Delivery Obligation — meet legal downstream irrigation and municipal orders
- Downstream Storage Management — Davis Dam buffers reservoirs like Lake Havasu
- Environmental & Safety — maintain required flows for ecosystem and public health

Law of the River - Generation Constraints

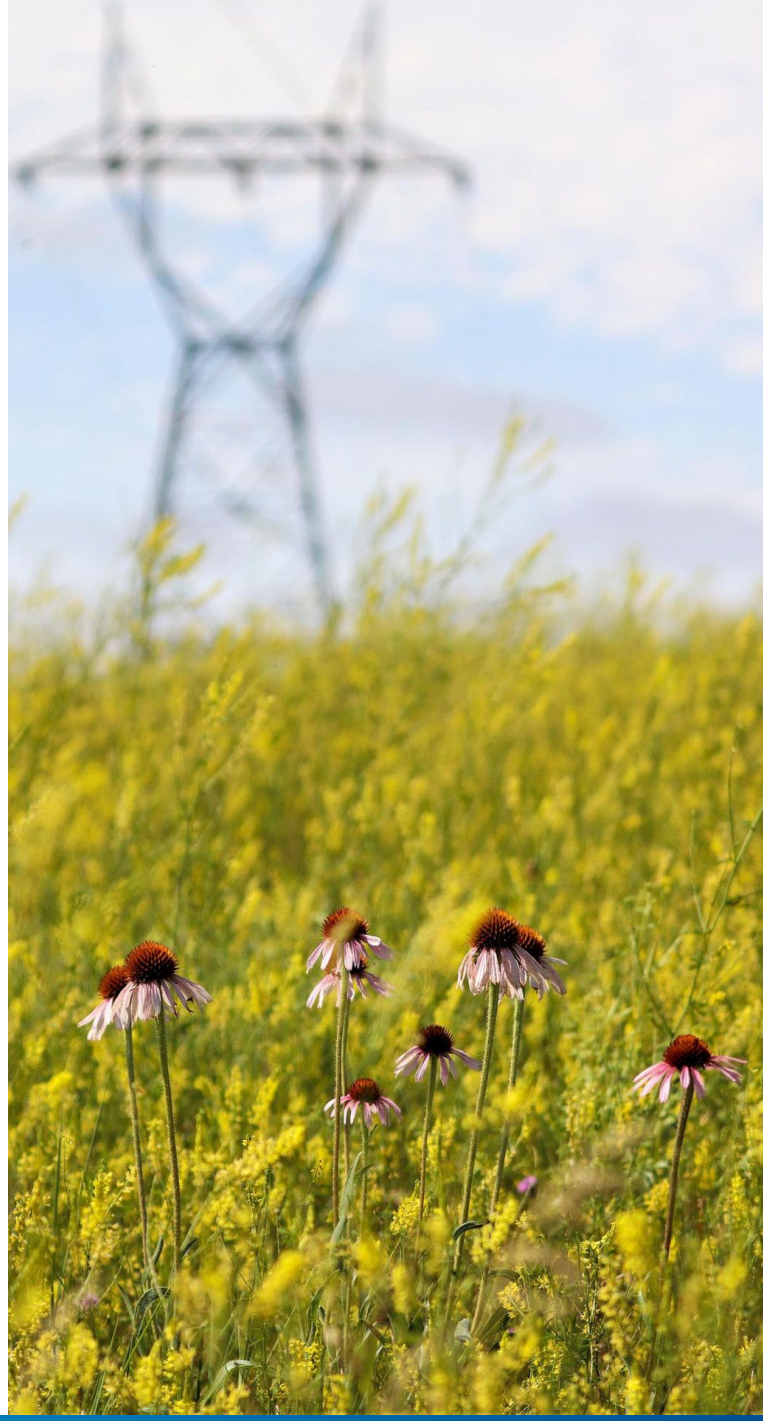
- Recreational and local needs are considered, but these yield first to higher-priority demands
- Hydroelectric generation is a secondary benefit of water already scheduled for release
  - WAPA and Reclamation coordinate to maximize the value of water releases for our power customers
- This is why imbalance must be managed through market scheduling, not simple generation curtailment

Monthly Minimum Scheduling Method

The Solution

Key Terms

DA / RT	Day-Ahead and Real-Time
HE	Hour Ending (hour-ending clock hour, 1–24)
Imbalance	Difference between scheduled generation and load
LMP	Locational Marginal Price ($/MWh) in the CAISO market
P-DP	Parker-Davis Project
Quarterly Energy	Pro rata share of seasonal CROD
WEIM	Western Energy Imbalance Market



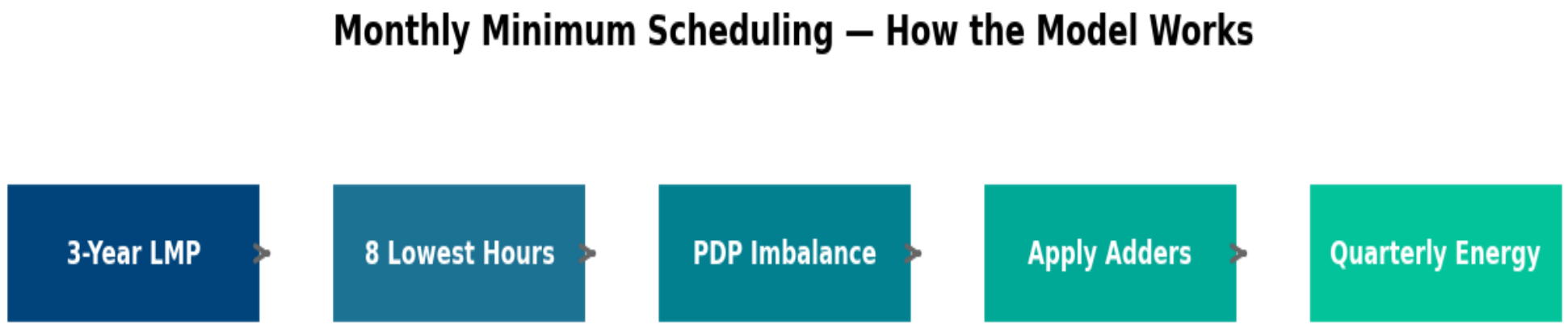
Why Minimum Scheduling?

- When generation exceeds load → WAPA sells surplus
- When load exceeds generation → WAPA buys power
- Physical constraints (Law of the River) limit our ability to simply reduce generation
- Minimum schedules ensure WAPA is balanced and meeting WEIM sufficiency requirements

Goal: Transparent, data-driven requirements that protect operations and minimize overall WAPA costs

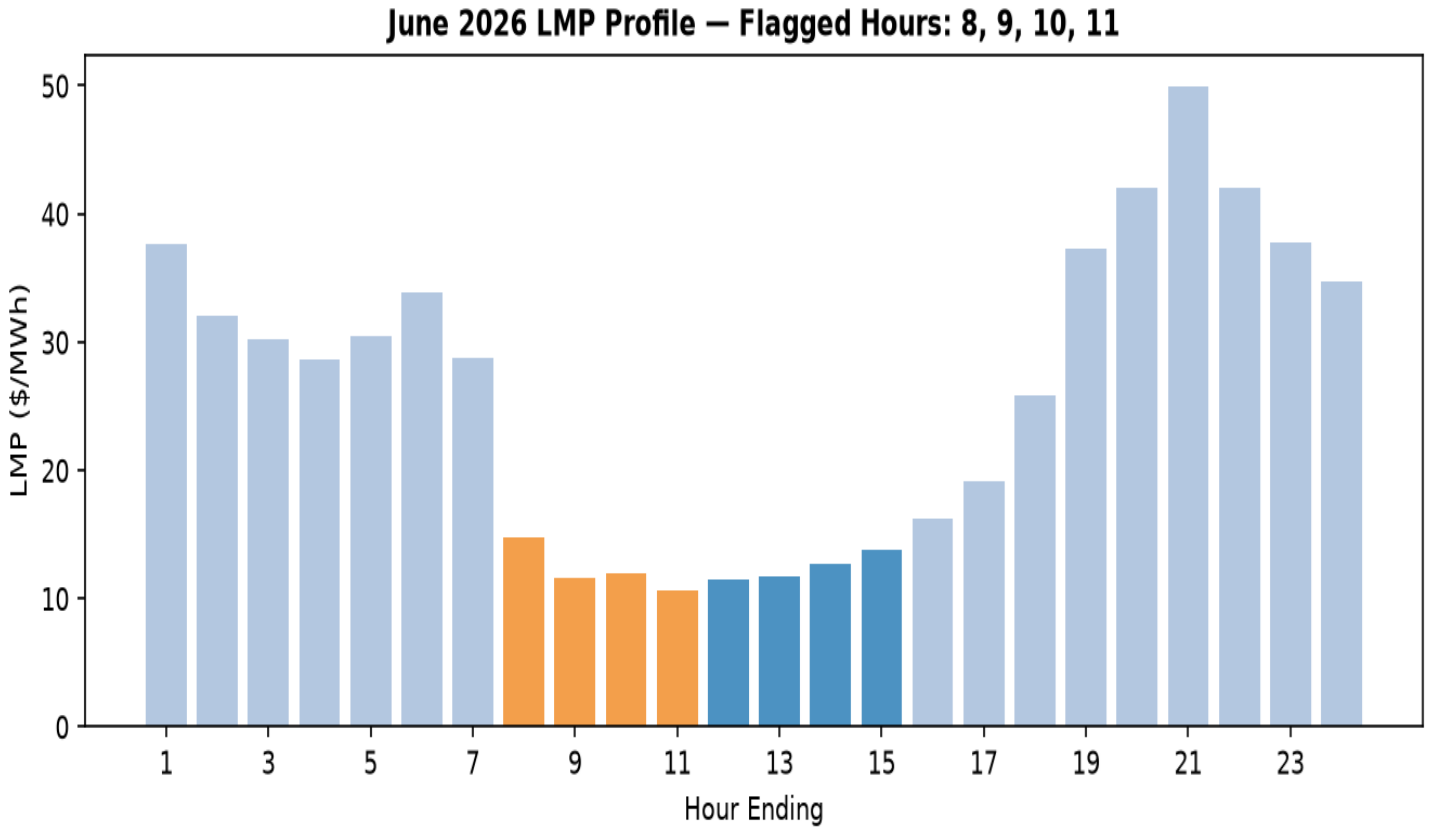
How the Model Works

- Analyze 3 years of CAISO LMP and PDP operating data
- Identify the 8 daily-averaged, lowest-priced hours for the given month
- Flag hours with positive historical PDP imbalance
- Apply Monthly and Daily Adders, then allocate by Quarterly Energy



Step 1 — Build the Price Profile

- Pull 3 years of CAISO DA and RT LMP for the month
- Combine DA and RT into a single 24-hour profile
- Identify the 8 lowest-priced hours
- Same profile applies to every day in the month



Step 2 — Imbalance Flag

- From the 8 lowest-priced hours:
  - Check 3-year average PDP imbalance for each
    - Positive Imbalance → core flagged hour
    - Zero / Negative Imbalance → not flagged as a core hour
- Find the highest LMP among the core flagged hours
- Apply a minimum schedule to every hour priced at or below that LMP

Step 3 — Size the Minimum

Monthly Adder: Scales overall required schedule (default 100%)

Daily Adder: Fine-tunes daily minimum per flagged hour (default 100%)

Required % per hour = Historical Generation % × **Monthly Adder**

Monthly Minimum (MWh) = Ceiling (Quarterly Energy × **Required %**)

Daily minimum (MWh) = Floor (**Monthly Minimum** ÷ days in month × **Daily Adder**)

Quarterly Energy = Contractor Share of the 24-month Generation Forecast Total

Step 4 — Fair Allocation by Quarterly Energy

- Quarterly Energy = Pro rata share of 24-month generation forecast total based on seasonal CROD (MWh)
- Winter (Oct–Feb) and summer (Mar–Sep) use different seasonal shares
- Minimum schedules allocated proportionally — same formula for everyone

June 2026 Example (monthly MWh)

Monthly Minimum Schedules	Quarterly Energy	% Required
Total CRC: 3,507 MWh	28664.43 MWh	12%*
IID: 2,005 MWh	16383.22 MWh	12%*
Agua Caliente: 64MWh	506.80 MWh	12%*
San Luis Rey: 126MWh	1013.60 MWh	12%*

*Percentages rounded

Monthly Adder Example

Quarterly Energy: 1000 MWH

Historical Gen % (HE9): 3.5%

Monthly Adder: 100%

Therefore

Monthly Minimum MWH

1000 MWH * 3.5% * 100% =

35 MWH for HE9

Quarterly Energy: 1000 MWH

Historical Gen % (HE9): 3.5%

Monthly Adder: 97%

Therefore

Monthly Minimum MWH

1000 MWH * 3.5% * 97% = 33.5 =

34 MWH for HE9

Financial Risk of Imbalance

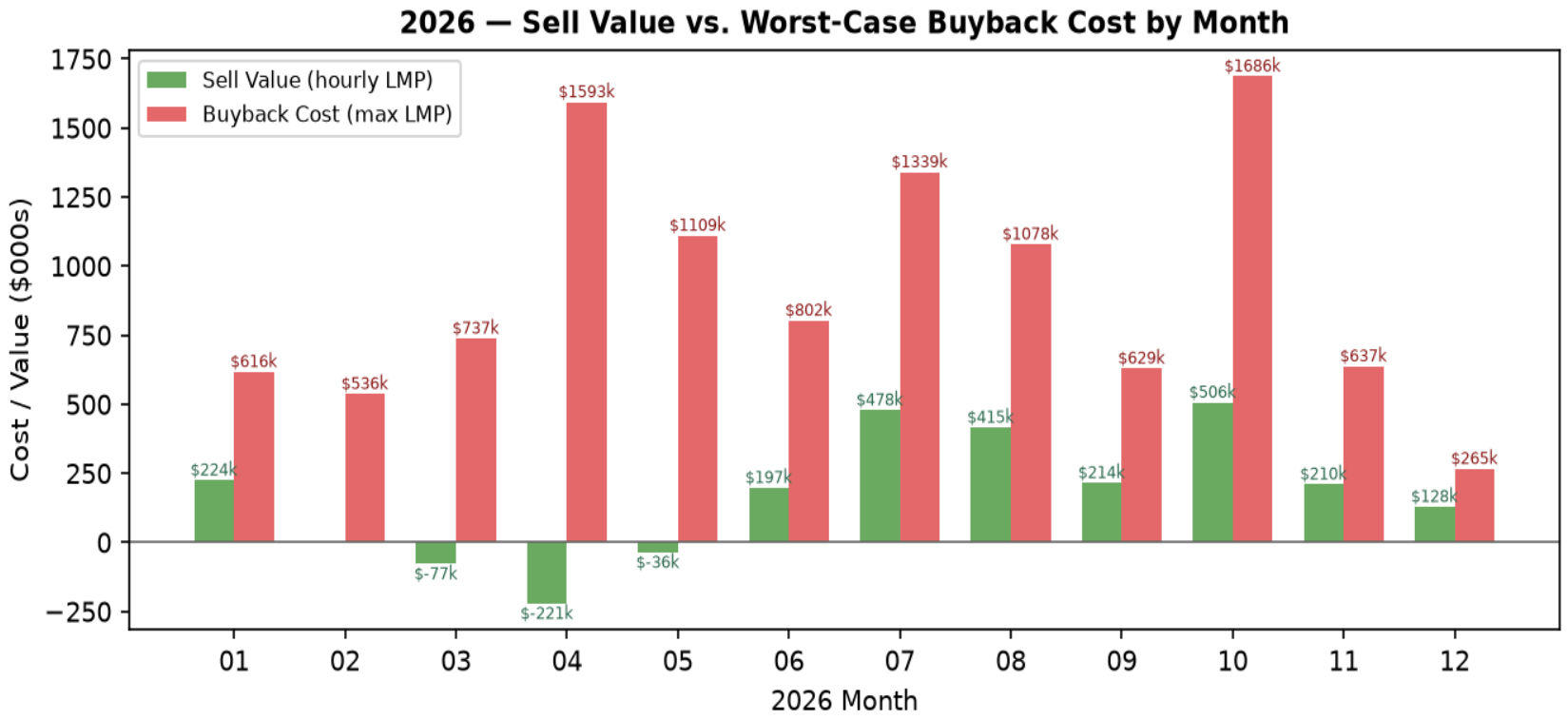
Sell Value vs. Buyback Cost

The Buyback Risk

- If generation exceeds load during low-priced hours, surplus energy is sold into the market
  - That same energy may need to be bought back during higher-priced hours to serve load
- Sell Value = minimum schedule MWh × each hour's LMP (shown in monthly reports)
- Worst-Case Buyback = total monthly MWh × highest LMP in the month
  - June 2026: sell $196,654 vs. buyback $802,213
  - Net Imbalance Exposure: $605,559

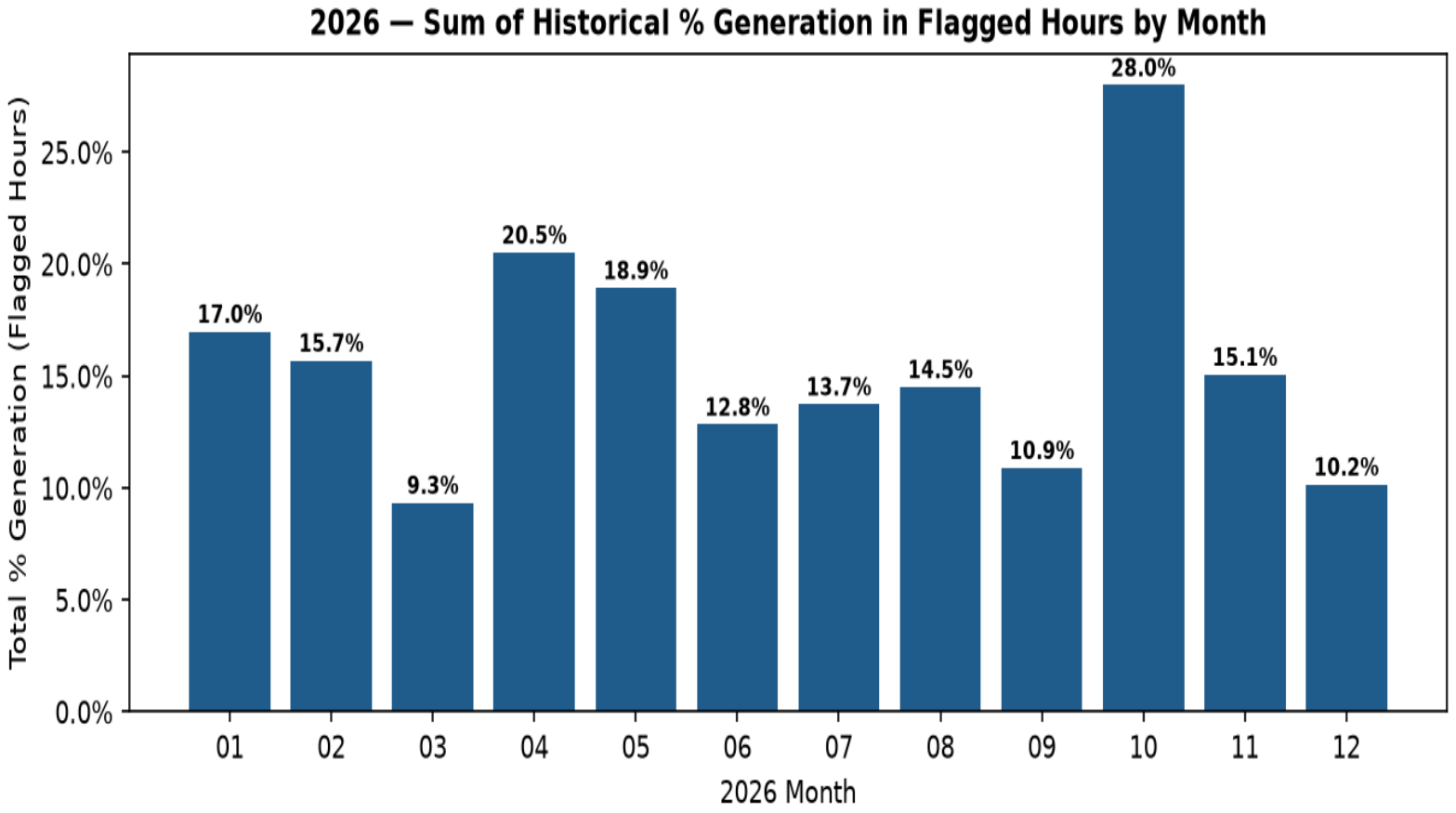
2026 — Sell Value vs. Worst-Case Buyback

- Green: Value if minimum-scheduled energy is sold at each hour's LMP
- Red: Worst-case cost to buy the same MWh at the month's peak LMP
- Difference = Imbalance exposure that minimum scheduling helps reduce



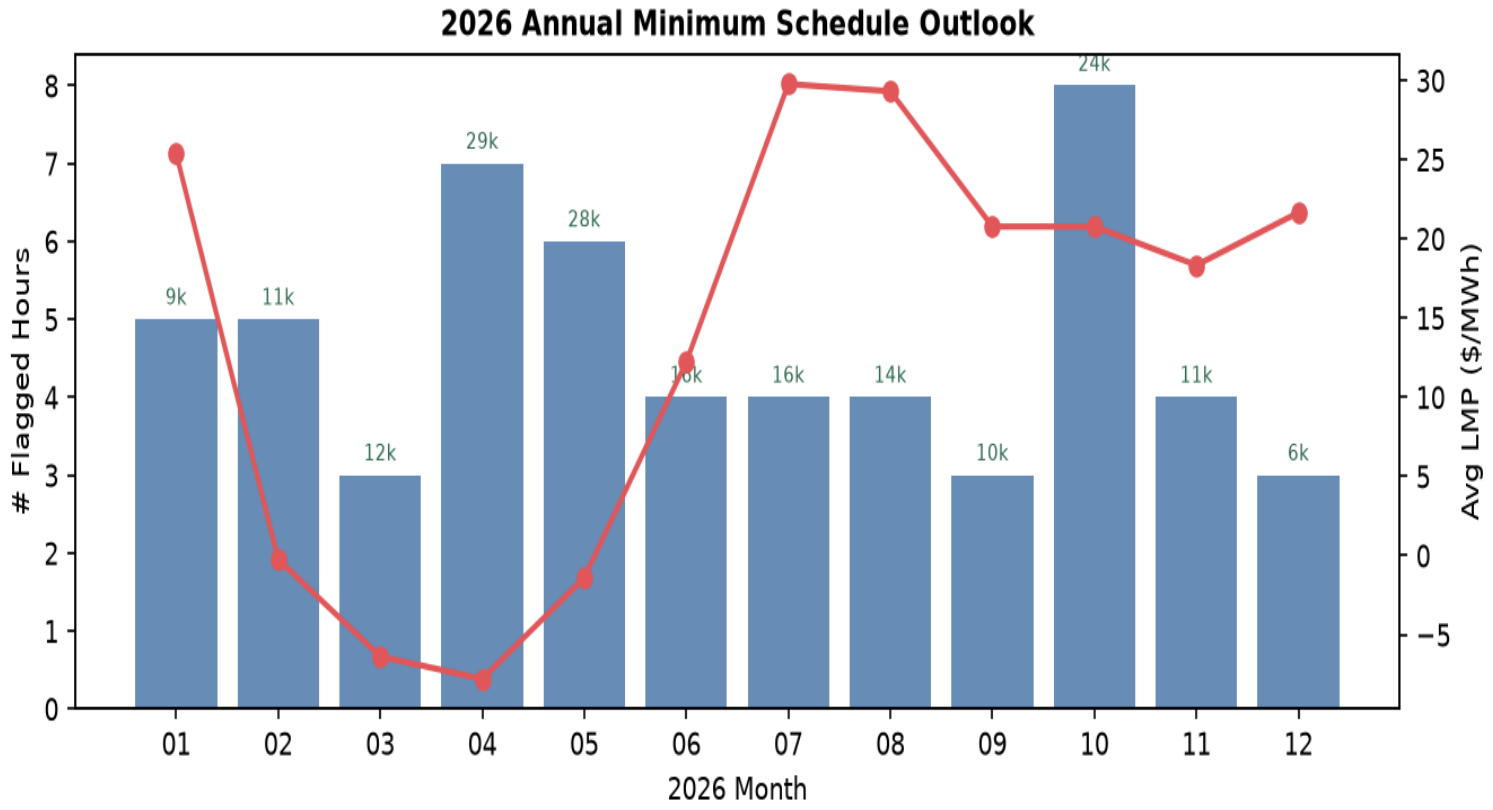
2026 — Flagged Hour % Generation by Month

- Sum of historical % generation (gen pct) for all flagged hours
- Range: 9.3% (March) to 28.0% (Oct)
- Higher % means more generation historically concentrated in flagged hours



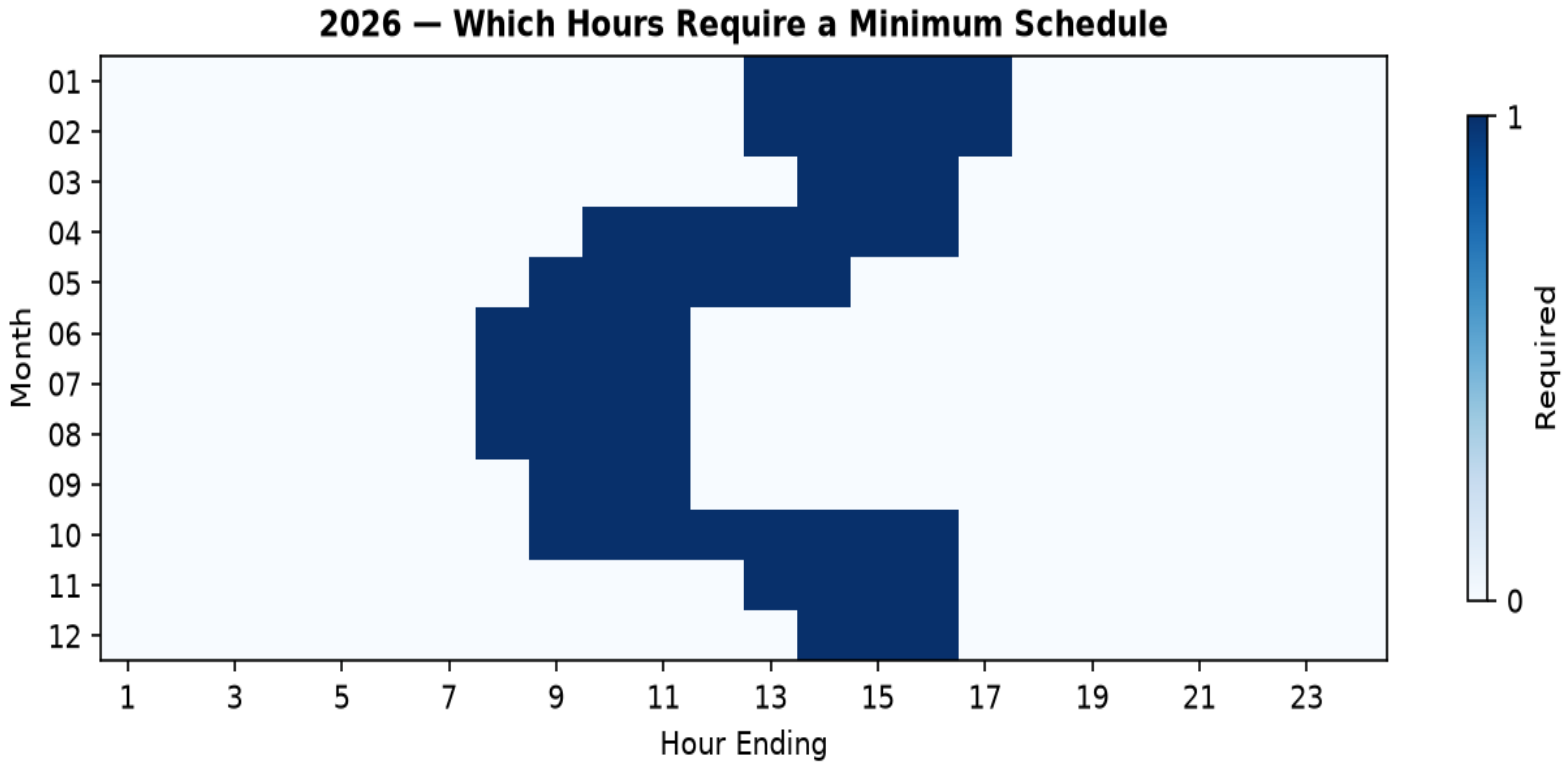
2026 Annual Outlook

- Total 2026 minimum schedule volume: 186,945 MWh
- Peak month: April (28,808 MWh)
- Blue: Count of flagged hours; red line: avg LMP in those hours

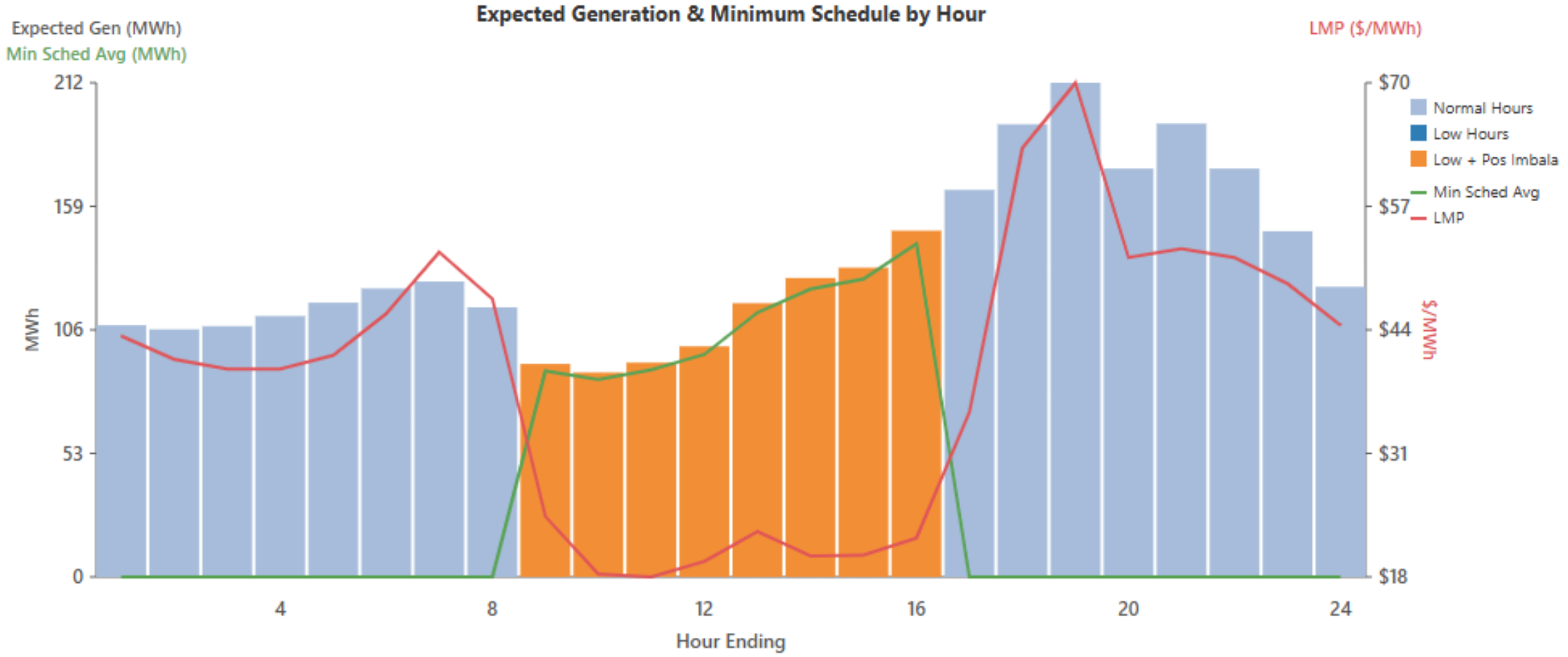


2026 — When Hours Require a Minimum

- Requirements shift seasonally with LMP and imbalance patterns
- Winter: Afternoon hours (HE 13–17) dominate
- Summer: Morning low-price hours (HE 8–11) dominate
- Monthly reports show exactly which hours apply to your schedule



Oct 2026 — Worked Example



What We Expect You To Receive Each Month

Monthly Report: Contains

- Daily Minimum: applies every day of the month in flagged hours
- Monthly Minimum: total MWh required for each hour across the month
- Charts, KPIs, sell value of minimum scheduled energy, and estimated worst-case buyback cost
- Note: It is expected that the monthly report will be created using the previous month's 24-Month Study, and will be considered finalized before the start of the month (Date to be determined)

Annual Report: Contains

- Monthly Total Minimum by hour for future months (long-term view): Will show you which hours you can expect to have a minimum schedule requirement.
- Note that future month schedule amounts (Actual MWH) may change with new 24-Month Forecast adjustments
- Consider annual report as most probable minimum scheduling requirement, and subject to change until monthly report is released

Key Benefits & Expected Outcomes

- Objective: Based on 3 years of market and operational data
- Protective: Minimums-only where historical imbalance shows risk
- Cost-effective: Targets the lowest-price hours in each month
- Transparent: Formula-driven allocation by published Quarterly Energy
- Flexible: Monthly and Hourly Adders tune output without changing logic
- Predictable: Annual outlook helps contractors plan months ahead

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