

The case for LMPs

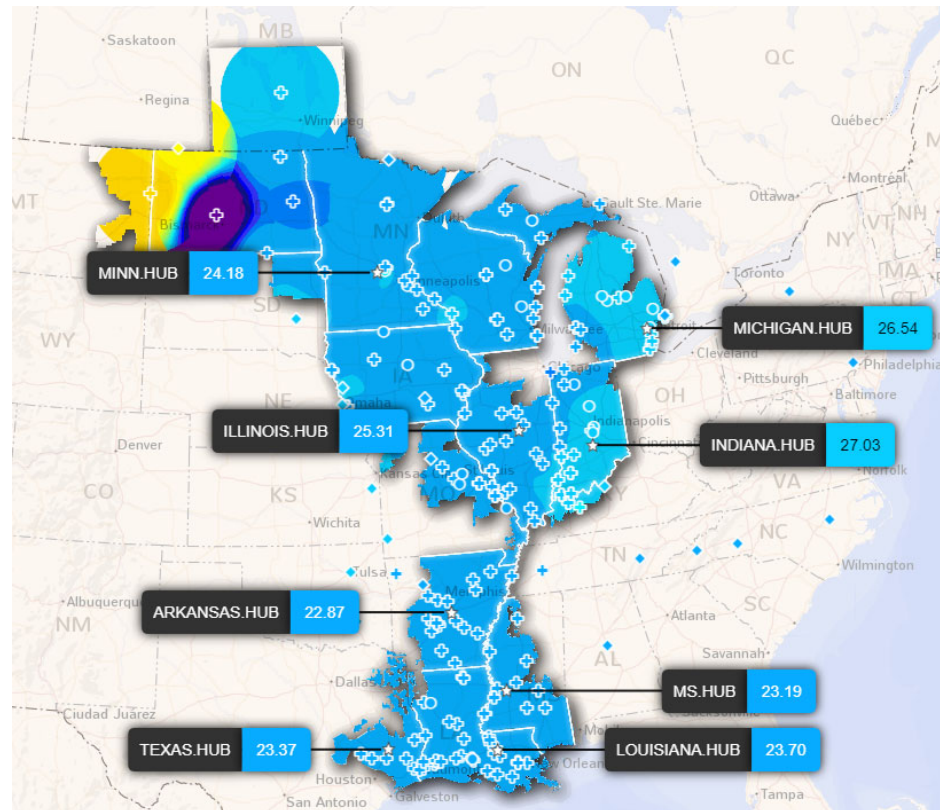
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Disclaimer: The views expressed here are solely those of the author. Her views do not necessarily reflect those of the Federal Energy Regulatory Commission, its Chairman, Commissioners, or Staff.

Locational Marginal Prices

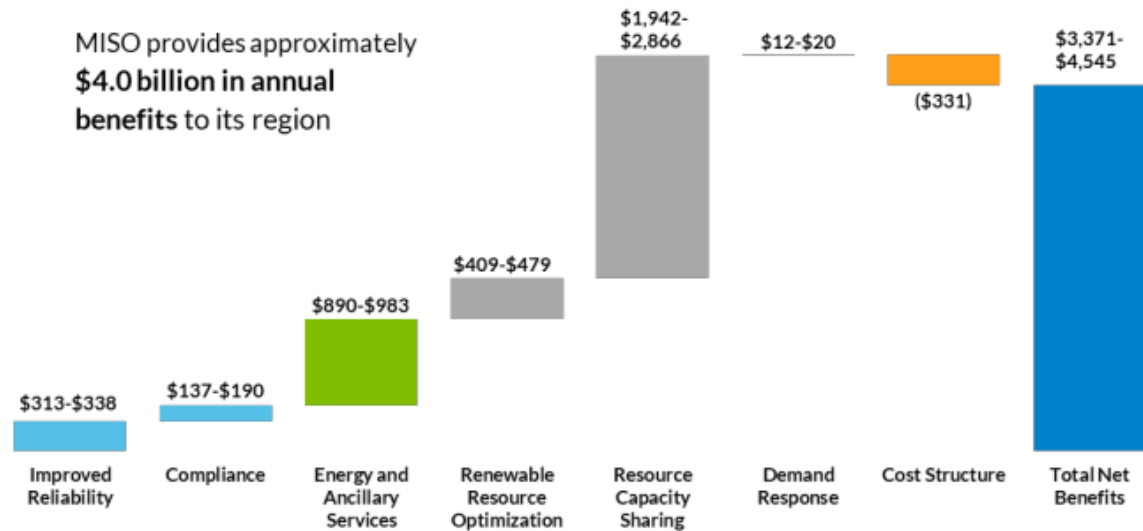
- Beautiful marriage between engineering and economics
- Transparent information about expected (day-ahead LMPs) and actual (real-time LMPs) system conditions inform short- and long-run decision making
 - Day-ahead and real-time markets inform forward energy and capacity sales
 - LMPs inform policy makers, including in states with vertically-integrated utilities



Quantified ISO market benefits: MISO

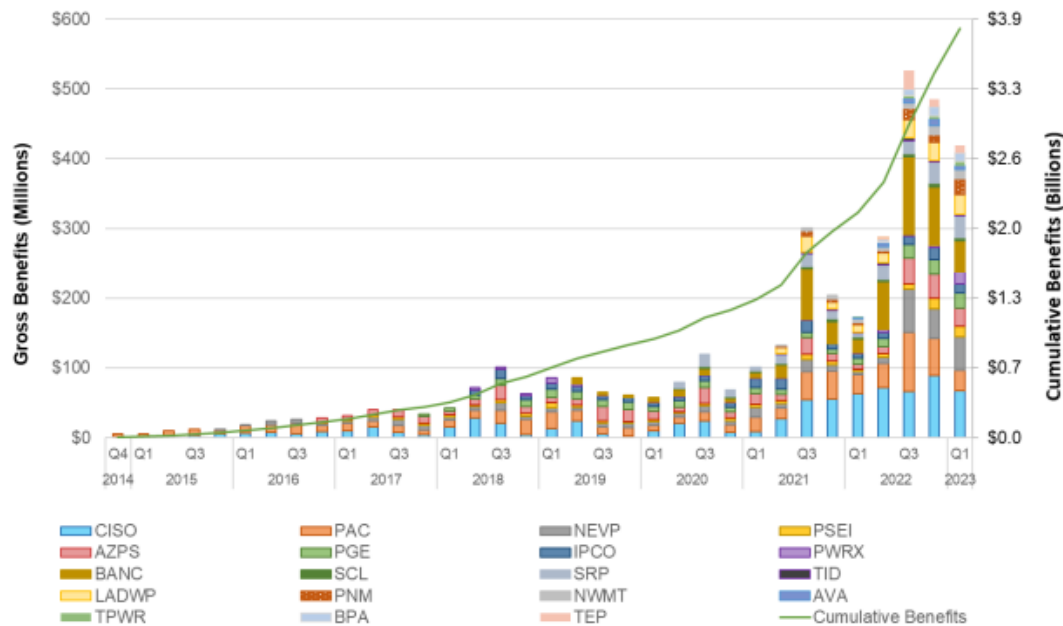
- \$4 billion net benefits in 2022
- \$40 billion in cumulative net benefits
- 2022 benefits vs. costs (“cost structure in graph”)

2022 Benefit by Value Drivers, \$millions



Source: MISO Value Proposition Annual View, 2022 Overview, March 2023

Quantified ISO market benefits: Western Energy Imbalance Market



GRAPH 1: Cumulative economic benefits for each quarter by BAA

Source: <https://www.westerneim.com/Pages/About/QuarterlyBenefits.aspx>

- WEIM produced \$3.82 billion in gross benefits since Nov. 2014, as of 5/31/2023
- Non-CAISO WECC considering a day-head market

Benefits of LMP

- Granular information about the cost of serving load at specific times and locations and the shadow price of transmission constraints
- LMPs enable efficient load participation
 - State and federal policies to support inverter-based resources (IBRs), vehicle electrification, and distributed energy resources will make demand-side participation *more* important in the future
 - How can loads efficiently and autonomously participate in ISOs without an efficient price signal? Unaware of a better signal to send loads than short-run marginal cost (LMP)
 - Retail loads may not pay LMP, but LMPs nonetheless facilitate retail time-of-use rates

Benefits of LMP (cont.)

- Incentive compatible dispatch signals to resources in line with system needs
 - Critical for any centralized co-optimized dispatch
 - Harvey and Hogan, 2022 explained that zonal/non-nodal pricing requires side payments to eliminate profitable deviations from dispatch signal
- LMPs enable financial transmission rights (FTRs) that facilitate bilateral trades of various durations and delivery periods
 - Even without FTRs, LMPs send valuable information to market participants and stakeholders about the expected cost to serve electric loads in the future
- Leverage markets to expand set of resources available to serve new and emerging system needs
 - operational flexibility (e.g., dispatchable, fast responding, low min-run time or EcoMin)
 - demand-side resources
 - long-duration storage

Arguments posed against LMP

- In my view, *Christie 2023* EBA article has most sophisticated and intellectually honest arguments for reassessing LMPs and uniform clearing
 - Agree with Cmr. Christie this discussion is worth having
 - I think LMPs are worth defending
- **Claim:** Subsidies to IBRs make LMP unworkable
 - no empirical evidence cited but subsidies do change market dynamics
 - academic research suggests LMP pricing can continue to function
 - abandon the benefits of ISO markets & LMPs? Or efficiently dispatch the system we have given the subsidies?
- **Claim:** European markets departed from uniform clearing prices
 - change made during a geopolitical crisis
 - current EU proposal would *not* extend “decoupled” clearing mechanism

Arguments against LMP (cont.)

- **Claim:** Energy is a differentiated product and cannot be compensated through a single energy price (LMP)
 - Correct. ISO resources receive compensation for providing various products
 - energy (time and location specific)
 - standard ancillary service products (time and location specific or via contract)
 - ramp capability (CAISO, MISO, and SPP)
 - capacity
 - *See also:* ISO ancillary service reforms
 - operating reserve demand curve (ORDC) refinements
 - SPP Uncertainty Product approved by FERC
 - CAISO Day-Ahead Energy Market Enhancements (DAME) with stakeholders
 - ISO-NE Day-Ahead Ancillary Services Initiative (DASI) with stakeholders

Is there another way to operate and clear energy and ancillary services markets?

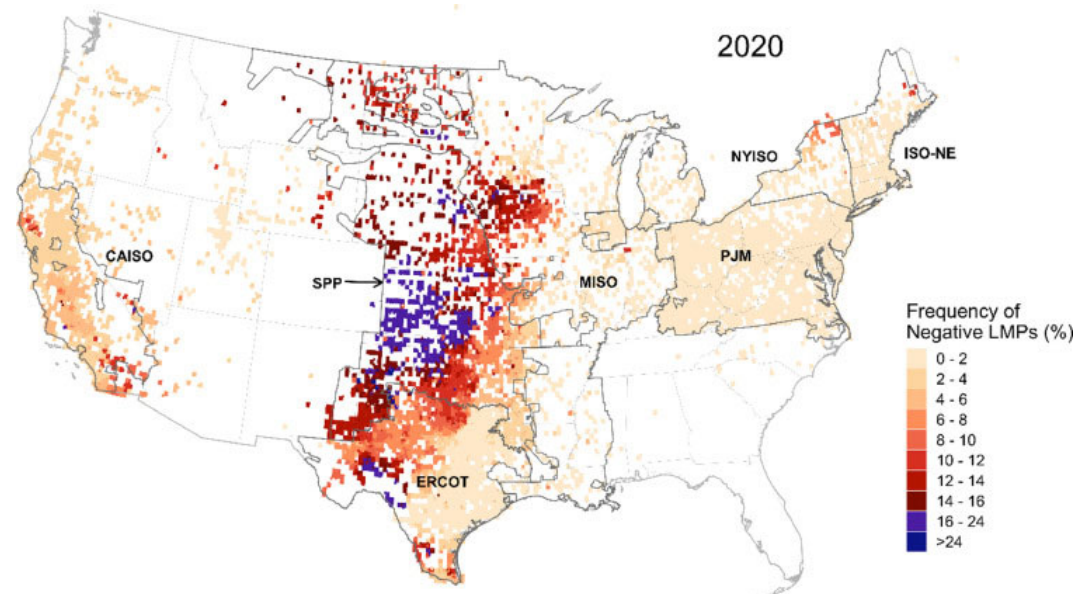
- If retain market for energy and ancillary services
 - Pay-as-bid will achieve roughly the same outcome and complicates market power mitigation given the incentive to bid expected clearing price
 - Convex Hull?
 - PJM considered and found was not computationally feasible. Without commitment period lengths, how do you publish prices in real-time/close to real-time?
 - uplift is a small proportion of total costs in ISOs
 - Joint dispatch agreements/power pools can achieve efficient dispatch but lack prices and associated transparency
- If abandon markets entirely
 - Return to average embedded cost or cost of service?
 - Other? And can that method achieve least cost security-constrained dispatch?

Always room for improvement...

- ISO markets are not designed to achieve state and federal policy goals but they can help make best use of the resources we have given state and federal policies and inform policymakers

*E.g., Implications of a subsidy that changes behavior on the margin

What's happening in non-ISO areas?



Source: J. Steel, D. Millstein, A. Mills, M. Bolinger, and R. Wieser, *Plentiful electricity turns wholesale prices negative*, *Advanced in Applied Energy*, Nov 2021, Vol 4:19.

Refinements to ISO markets

- As many have observed, low to zero marginal prices can stress current ISO market designs in the future
 - Inframarginal rents certain resources relied on from LMPs will fall and those costs will have to be recovered elsewhere *if the resource is needed*
 - Ancillary services markets and calculation of opportunity costs and will become more important and will need refinements
- State and federal policies are changing resource mix and load profiles in ISOs
 - Federal and state environmental policies affecting exit
 - Federal and state policies affect resource entry and load profiles, and thus system needs
- FERC explored needed ISO market reforms in Docket. No. AD21-10-000
 - Two technical conferences and staff paper in Fall 2021
 - April 2022 Order directing ISOs to file reports on their plans to meet changing system needs
 - ISOs filed responsive reports in October 2022
 - Comments on reports filed in January 2023

Thank you