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Shaping a Renewed Future

# Discussion on energy imbalance market benefits study - 2014 Q4

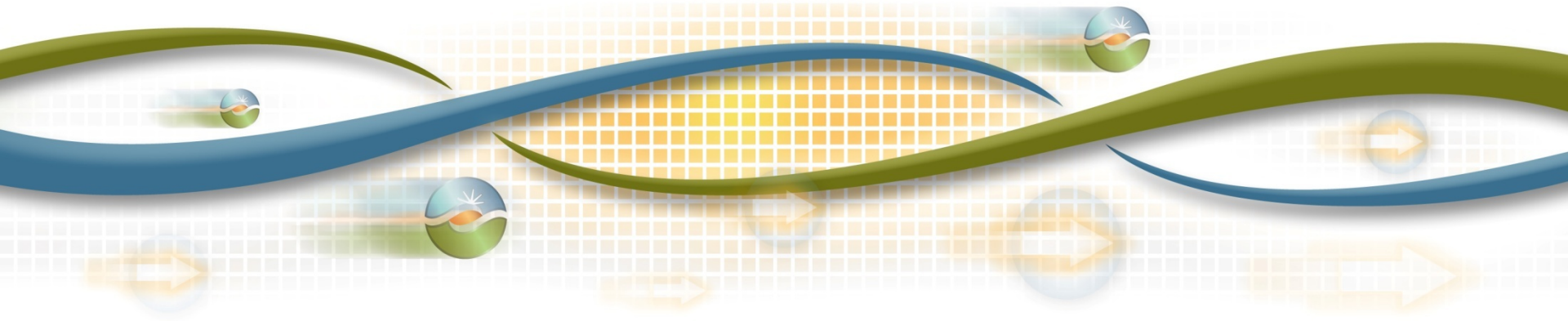
Lin Xu, Ph.D.

Lead Market Development Engineer

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# Background

- Method
  - The ISO proposed a method to calculate the benefits for participating in EIM in the 08/28/2014 Technical Bulletin
  - This method was discussed in the 08/22 MSC meeting
  - This online method is still under development
- Reporting
  - The ISO commits to reporting the EIM benefits quarterly
  - The first EIM benefits report for 2014 Q4 was posted on 02/11/2015
  - The ISO used a simplified offline method in the benefit calculation in the 2014 Q4 report

## Measure EIM benefit as proposed in the Technical Bulletin

- EIM benefit is characterized by the economic surplus gain (or cost saving) of having EIM
  - It is measured by the economic surplus (or bid cost) difference between EIM dispatch and without EIM (counterfactual) dispatch
  - The benefits are attributable to various sources
    - EIM energy transfers
    - New participating resources
    - Economic market clearing and congestion management
    - Flex ramp sharing and flex ramp transfers

# Comparison of the online method and the simplified offline method

<b>The online method (technical bulletin method)</b>	<b>The simplified offline method (2014 Q4 report method)</b>
Market reruns synchronized with production to produce counterfactual “without EIM” dispatch.	No market reruns needed. Counterfactual dispatch produced by offline optimization.
Co-optimize energy and flex ramp	Energy only, no flex ramp model
Model inter and intra zonal transmission constraints	Only model inter zonal transmission constraints (transfers)
Unit commitment	Fixed unit commitment
15-minute market (can be extended to 5-minute market, but difficult to implement)	15-minute market (can be extended to 5-minute market)

## Counterfactual dispatch in the simplified method

- Mimic imbalance operation within each BAA without transfers between PacifiCorp and ISO.
- The ISO's counterfactual dispatch
  - For transfer from PacifiCorp to ISO in EIM, the ISO would need to dispatch supply to replace it
  - For transfer from ISO to PacifiCorp in EIM, the ISO would need to back down supply to withhold it
- PacifiCorp East/PacifiCorp West BAAs (PACE/PACW) would need to meet demand
  - without transfer between PacifiCorp and the ISO
  - from a limited pool of resources which PacifiCorp manually dispatched to meet load prior to EIM
  - allow transfer between PACE and PACW

# Counterfactual dispatch for PacifiCorp

- Steps to construct counterfactual dispatch for PacifiCorp
  - Calculate the demand change from base schedule for each BAA (PACE and PACW)
  - If the demand change results in violations of the transfer limitations between PACE and PACW, then adjust base schedules from the limited pool in each BAA to resolve the overloads in the right economic order
  - Economically dispatch resources from the limited pool on top of the changed base schedules from step 2 to meet PacifiCorp demand without violating the transfer limitations between PACE and PACW

# Example of constructing counterfactual dispatch for PacifiCorp



	PACW			PACE			net demand change
	G	L	Transfer	G	L	Transfer	
1	190	40	150	60	10	50	50
2		40	-40		10	-10	
3				10			
4		40	-40	10	10	0	40
5	20			20			40
6							
7	20	40	-20	30	10	20	

1. EIM dispatch
2. Check PACE-PACW transfer limit violation due to load change
3. Adjust BS from the limited pool to resolve PACE-PACW transfer limit violation
4. After BS adjustment, PACE-PACW transfer overload is resolved
5. Additional dispatch from limited pool to meet PAC net demand (merit order but no violating PACE-PACW limit)
6. CF dispatch = BS adjustment + additional dispatch



# Summary of EIM benefits for the 4<sup>th</sup> Quarter 2014

BAA	November	December	Total
ISO	\$0.65	\$0.59	\$1.24
PACE	\$1.05	\$1.26	\$2.31
PACW	\$1.39	\$1.03	\$2.42
<b>Total</b>	<b>\$3.09</b>	<b>\$2.88</b>	<b>\$5.97</b>

- Results represent benefits from 79% of all the intervals where the largest absolute price difference between the MALIN\_500 and PACE or between the MALIN\_500 and PACW is less than \$50/MWh.



# Future enhancements

- Quantify 5-minute market benefit
- Develop the online method proposed in the Technical Bulletin, which includes flex ramp benefit
- Refine counterfactual dispatch algorithm