

An Introduction to Energy Imbalance Markets

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The Essentials

- An Energy Imbalance Market (EIM) would pool in electricity generation within a region and dispatch resources.
- This could moderate the variability of renewable generation resources and electricity demand on a least-cost basis. Participation is voluntary.
- The Public Utility Commission Energy Imbalance Market¹ has proposed an EIM for the Western Interconnection.
- The EIM would lead to lower reserve requirements and increases reliability especially during unexpected generation outages and high peak demand.
- The EIM brings with it concerns about new reliability problems and costs that could outweigh the estimated benefits.

What is “energy imbalance”?

Energy imbalance on an electrical grid is the difference between the real-time demand for electricity generation and load consumption, and what is prearranged through schedules. The western United States and Canada is served by the Western Interconnection electrical grid (see map at right).

As an equation, an energy imbalance would be expressed as:

Energy Imbalance = Actual Production or Usage - Scheduled Production or Usage

The current situation in the Western Interconnection electrical grid

Balancing authorities (BAs) throughout the U.S. and Canada, including in the Western Interconnection, maintain load-resource balance and stability of alternating current (AC) frequency within an area. BAs are regulated by North American Electric Reliability Corporation (NERC). Currently most BAs do not participate in organized electricity markets. Instead, much of this interchange energy is exchanged via long-term bi-lateral contracts, delivering energy in hourly blocks, corresponding to the general practice of hourly interchange between balancing areas.

Addressing the problem of variable generation

Variable electricity generation due to the anticipated increase in renewable generation such as wind and solar power over the next several years has raised questions about maintaining balance between electricity production and demand. If a BA underestimates the amount of balancing reserves needed, the BA may run short, resulting in violations of NERC Reliability Standards. It could cause problems on the grid, such as changes in frequency leading to instability and a risk to the interconnection. In response, some BAs require curtailments of variable generation sources when their balancing reserves are depleted.

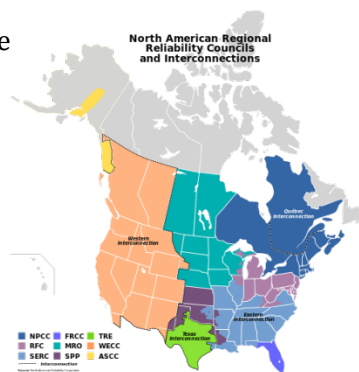


Fig. 1 Interconnection map of U.S. and Canada. Source: <http://www.nrel.gov/docs/fy13osti/57115.pdf>

¹The PUCEIM group is composed of researchers from the National Renewable Energy Lab, the Western Governors Association, and multiple independent agencies, <http://www.greentechmedia.com/articles/read/for-western-states-transmission-will-there-be-strength-in-unity>.

An EIM can address this problem by:

- Aggregating variable generation imbalances within the BA.
- Redispatching available generation on a West-wide basis, thereby reducing the risk of an individual BA running out of balancing reserves. As an additional benefit, any imbalance-related redispatch will be made on a least cost basis.

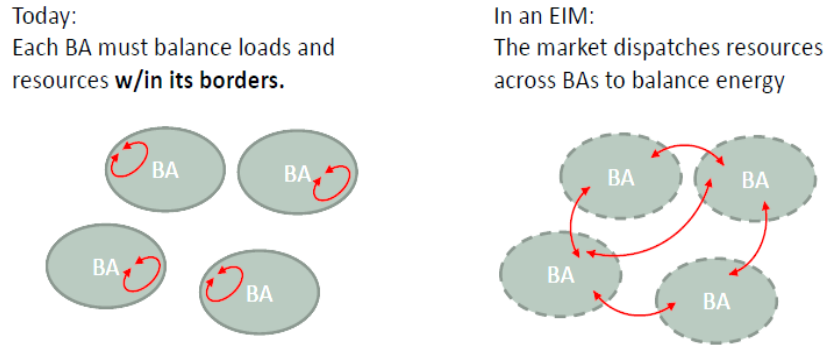


Fig 2. BAs without and within an EIM.
Source: Victoria L. Ravenscroft , CO PUC Information Meeting,
Western Interstate Energy Board, March 7, 2012

Potential Benefits from the EIM

- Less requirement of large buffers in line capacity are created to guard against contingencies.
- Improved operational reliability over a wider area by enabling decision-making and response based on near-term system data.
- Centralized, automated, and region-wide generation dispatch for imbalances.

An EIM would imply

- Decreased levels of reserves
- Economic efficiency
- Decreased integration costs

Concerns

- There are concerns about start-up costs, cost shifting (generation paid for by customers in one region will now be dispatched to benefit other customers) and new reliability problems. An April 2012 analysis by Argonne National Laboratory ² noted that, in an EIM “offers are not required to reflect actual unit production costs,” and that “market distortions could more than erase cost savings from lower EIM production costs.
- A concern voiced by the American Public Power Association (APPA), a utilities advocate which PUC’s EIM taskforce has stated that their intent is that such an EIM would not be an RTO, although opposes a Western Interconnect EIM, is its potential to quickly evolve into a Regional Transmission Organization (RTO).

² NREL Draft Final Report on EIM Analysis November 13, 2012

³ <http://www.dis.anl.gov/pubs/73032.pdf>

This would mean tough financial penalties imposed on generators if they fail to meet scheduled power deliveries which may act as a market barrier to intermittent renewable energy technologies⁴.

- The APPA further contends that infrastructure and operating costs “could, in some scenarios, outweigh the estimated benefits, with the net costs potentially reaching \$1.25 billion in net present value terms over the first ten years.” Additionally, EIM rates, terms, and conditions would likely be subject to FERC jurisdiction.

An EIM could create

- New reliability problems
- Costs that outweigh the estimated benefits.

If not an EIM, then?

- As part of the Joint Initiative (JI), WestConnect, Columbia Grid and Northern Tier Transmission Group (NTTG) have defined the Intra-hour Transaction Accelerator Platform (ITAP) that allows for bi-lateral, on-demand schedule changes on the half-hour. Subscribers to the ITAP have the ability to create a schedule modification with short notice, once a counter party has been identified and agrees to the schedule change.
- Other aspects of the JI include the Dynamic Scheduling System (DSS), which allows participants to create a dynamic schedule on short notice, and the area control error (ACE) Diversity Interchange (ADI), which nets regulation across the participating balancing areas.

Entities Discussing an EIM

- Western Balancing Authorities
- WECC (Western Electricity Coordinating Council)
- ColumbiaGrid
- WestConnect
- FERC (Federal Energy Regulatory Commission)
- WSPP (Western Systems Power Pool)
- SPSC (State/Provincial Steering Committee)
- DOE (Department of Energy)
- Federal Power Agencies – WAPA and BPA
- Non-BA entities, e.g., Tri-State
- PUC EIM Group

Read more

- NREL Report on Energy Imbalance Markets , September 2012 : <http://www.nrel.gov/docs/fy12osti/56236.pdf>
- Energy Imbalance Market, Joe Taylor, Xcel Energy : [Energy Imbalance Market, Xcel Energy](#)
- EPIC brief sheet titled “Energy Imbalance Markets: What it holds for the Western Interconnection”.

⁴ NREL report, “The Implications of Regional Transmission Organization Design for Renewable Energy Technologies,” May 2002.