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An efficient Western Energy Imbalance Market with conflicting carbon policies

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ABSTRACT

A reform of the Western Energy Imbalance Market should target the right problem. Import leakage is a problem; resource shuffling is a solution. Proposed modifications for the existing EIM design target the wrong problem and would work at cross purposes to the very reasons for the EIM's existence. There is a better approach that would address the right problem and preserve the critical elements of the existing EIM design.

1. Introduction

The launch of the new website for the Western Energy Imbalance Market (EIM) serves as a milestone for a critical element of an open and non-discriminatory electricity market.[1] Operated by the California Independent System Operator (CAISO), the EIM is a response to the growing challenges of changing electricity markets, especially in managing the short-term dynamics of efficient operation of the grid in the presence of increasing penetration of intermittent renewable energy generation.

The small volumes in the EIM do not imply that it is unimportant. Rather, the real-time imbalance market sets prices and expectations for all other transactions. The design of the imbalance market is the most important element in an open access and non-discriminatory system for an electricity market. The EIM operates on an integrated grid where different regions have different carbon policies. In particular, the California cap-and-trade system encompasses electricity trade with regions that are otherwise not covered by the same carbon policies.

This essential market has been criticized for allowing "resource shuffling" and unwanted effects on carbon emissions. The CAISO has been working on a series of possible modifications of the EIM to mitigate the impacts of resource shuffling. The EIM's own importance warrants close attention to developments in the market design. In addition, other organized markets have suggested adopting the proposed modifications for the EIM (PJM, 2017).

The latest proposals for revising the EIM are problematic. The proposed modifications would reintroduce errors of the past that fundamentally undermine an open and non-discriminatory market in electricity. Arguments that dismiss these problems as too small to be important should, at a minimum, bear a burden of proof for ignoring the unhappy prior experience. A better approach would be to revisit the concern with resource shuffling and recognize that the main elements of the existing EIM dispatch should be preserved.

2. Coordination for competition

Although it is not easy, the CAISO is able to manage the interacting requirements of balancing supply and demand, while dispatching within the static and dynamic limits of transmission grid power flows, to minimize costs and maintain secure operations. The existing EIM applies the basic framework by following the general principles of bid-based, security-constrained, economic dispatch with locational prices (LMPs) to organize the sometimes rapidly changing output of generation sources while producing the associated locational prices to support that solution (California Independent System Operator, 2017a, sec. 1.2.26.2). This basic economic dispatch is the only approach that implements open access and non-discrimination in electricity markets (Hogan and Pope, 2017, pp. 6–12).

The new EIM web site describes the process of efficient operation and reports on the substantial benefits that have been achieved through the existing market design. Part of the reason for the success of the EIM is the application of an efficient pricing mechanism that supports the dispatch. Under the simple economic dispatch framework, the prices are consistent with the dispatch, and a price-taking competitive market

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[1] See July 11, 2017 CAISO press release for www.westerneim.com,

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participant has no incentive to change its offers or to deviate from the efficient dispatch (Gribik et al., 2007).

As everyone should remember, especially those in California, this efficient market design and the associated supporting prices have not always been embraced in the electricity market. As a prominent example from 1998, the California market launched under a design rubric of a restricted ISO and a separate Power Exchange (PX). This design was built on the fallacy that it is possible to separate market transactions from transmission operations. The flawed approach had strong backing among the market participants, who dismissed analyses at the time showing that the market could not work in theory, and probably would not work in practice.

The Federal Energy Regulatory Commission (FERC) recognized the flaws in the market design, but reluctantly deferred to the consensus view of the California parties. This would turn out to be perhaps its worst decision as FERC managed the development of open electricity markets.

Amongst other features, this flawed ISO/PX design explicitly precluded economic dispatch, and required imbalance market pricing rules that could not support the associated ISO dispatch for congestion management. This created perverse incentives for market participants to manipulate offers and schedules to take advantage of the inefficient dispatch and pricing rules under the separation fallacy. By the end of 1999, the FERC found that the design was "fundamentally flawed" (Hogan, 2002), and directed the CAISO to fix the market in a process that came to be called Comprehensive Market Redesign.

In 2000 this flawed market was hit with the California electricity crisis where fundamental market conditions interacted with the broken market design to overwhelm most market participants and the regulators. After the crisis, the CAISO organized a long-term effort to arrive at a much-improved electricity market design based on the principles of bid-based, security-constrained, economic dispatch with locational prices and financial transmission rights. In essence, CAISO eventually adopted the workable design that had been explicitly rejected in the process that led to the formation of the initial California market.

The core elements of this fundamental reform were transferred to the EIM. A complication for the EIM arises from the interaction with the carbon regulations in California as administered by the California Air Resources Board (CARB). In essence, the EIM needed to straddle both market regions that are subject to carbon constraints and those regions with different approaches to treating carbon emissions. The regulations under the California cap-and-trade system require carbon emission permits for electricity generation in California, which is relatively straightforward, and for electricity imports, which is not straightforward. For both legal and practical reasons, the solution adopted for the EIM was to identify generation outside California that was deemed to provide exports to California with an accompanying settlement system that is consistent with the treatment of California resources. The basic EIM model produces a variant of an economic dispatch and efficient prices that support the economic dispatch. Market participants have no incentive to deviate from the dispatch and associated export schedules (Hogan, 2013).

3. Resource shuffling

This basic EIM design works. But it has been criticized because of concerns that it produces dispatch results that embody "resource shuffling" that assigns low carbon generation to California when the actual marginal source of generation might be a higher carbon emitter. The actual CARB definition of resource shuffling is somewhat vague.

> "Resource Shuffling" means any plan, scheme, or artifice undertaken by a First Deliverer of Electricity to substitute electricity deliveries from sources with relatively lower emissions for electricity deliveries from sources with relatively higher emissions to reduce its emissions compliance obligation." (California Air Resources Board, 2017)

An underling difficulty is the implicit assumption that the concept of "deliveries [to load] from sources" is a well-defined concept. In fact, power flows intermingle from all sources and the "deliveries from sources" are just after-the-fact accounting conventions that should be better labeled as "deemed deliveries." The substitutions are all on paper. Discussions of CARB concerns, that the EIM description of deliveries from sources to load does not capture the "atmospheric effect of ISO load relying on resources external to the ISO balancing authority," reveal how the accounting fiction is confused with the physical reality (California Independent System Operator, 2017b, p. 9).

In addition, the ambiguity stems from the inherent characteristics of different carbon policies operating under a single electricity market. The EIM must accommodate a market where the effective costs and prices for the same electricity have a different meaning and interpretation for different participants. There appears to be no perfect solution to this problem other than to extend the same carbon policy across the entire electricity grid. However, adopting a common carbon policy is not likely to happen soon.

Absent an operational definition of resource shuffling, the practice has been to identify transactions that are protected by a "safe harbor" as being deemed not to be resource shuffling. The EIM transactions have had this safe harbor protection (California Air Resources Board, 2017). However, the EIM rules have been a subject of continuing debate about the impact of resource shuffling and the CAISO has been discussing a series of modifications of the market design to address the issue of what can be deemed by CARB to be an acceptable import into California.

The problem is fundamental, and the CAISO recognizes this is a challenge. "[T]he solution must balance the objective of minimizing secondary dispatch with optimization solution performance and price/dispatch consistency." (California Independent System Operator, 2017b, p. 5) But the CAISO and other market participants have not defined the basic principles and shown that there is a consistent market design that is also consistent with these principles. In part, the nature of the problem involves defining a counterfactual that would serve as the guide for approximating the effect of the carbon regulations, while respecting the differences across the region.

The approach in the CAISO proposed revision of the EIM stage model is to start with a counterfactual that is a dispatch with different carbon policies but without imports. And the rules try to limit the deemed sources of imports that are allowed.

From California's perspective, an alternative counterfactual could begin with the ideal case that would be the result of a common carbon regime across the grid. The simplest case would be a common price on carbon emissions. This cost would be incorporated in all generation offers, just as it is already in California. Then the EIM would apply the standard principles of economic dispatch. The power prices would differ across locations because of losses and transmission congestion. But at each location the price of power would be the marginal cost of energy (including a capacity scarcity component) at that location plus the marginal emissions cost at that location. The dispatch would not specify the sources of individual deliveries to loads. The benefits captured by generators would reflect the difference between their individual emission costs and the marginal costs implied at their location. Hence, renewable generators, with essentially zero variable energy costs and no emission charges, would capture the greatest benefit. Marginal fossil units would just break even on their emissions and marginal costs of energy. The basic principles of economic dispatch would be preserved, and the prices would support the solution.

4. Two-stage EIM design

What is happening, by contrast, is that the CAISO and market participants have been proposing rules that seem in the spirit of reducing or preventing resource shuffling, by separating markets and discriminating across participants, but without any analysis of the implications for the operation of the EIM or the larger electricity market.