

November 2019

# Market Monitoring for Electricity Markets

## Experience from the United States and Recommendations for Regulation of Spot Markets

# 电力市场监测

## 美国的经验和建立现货市场监管的建议

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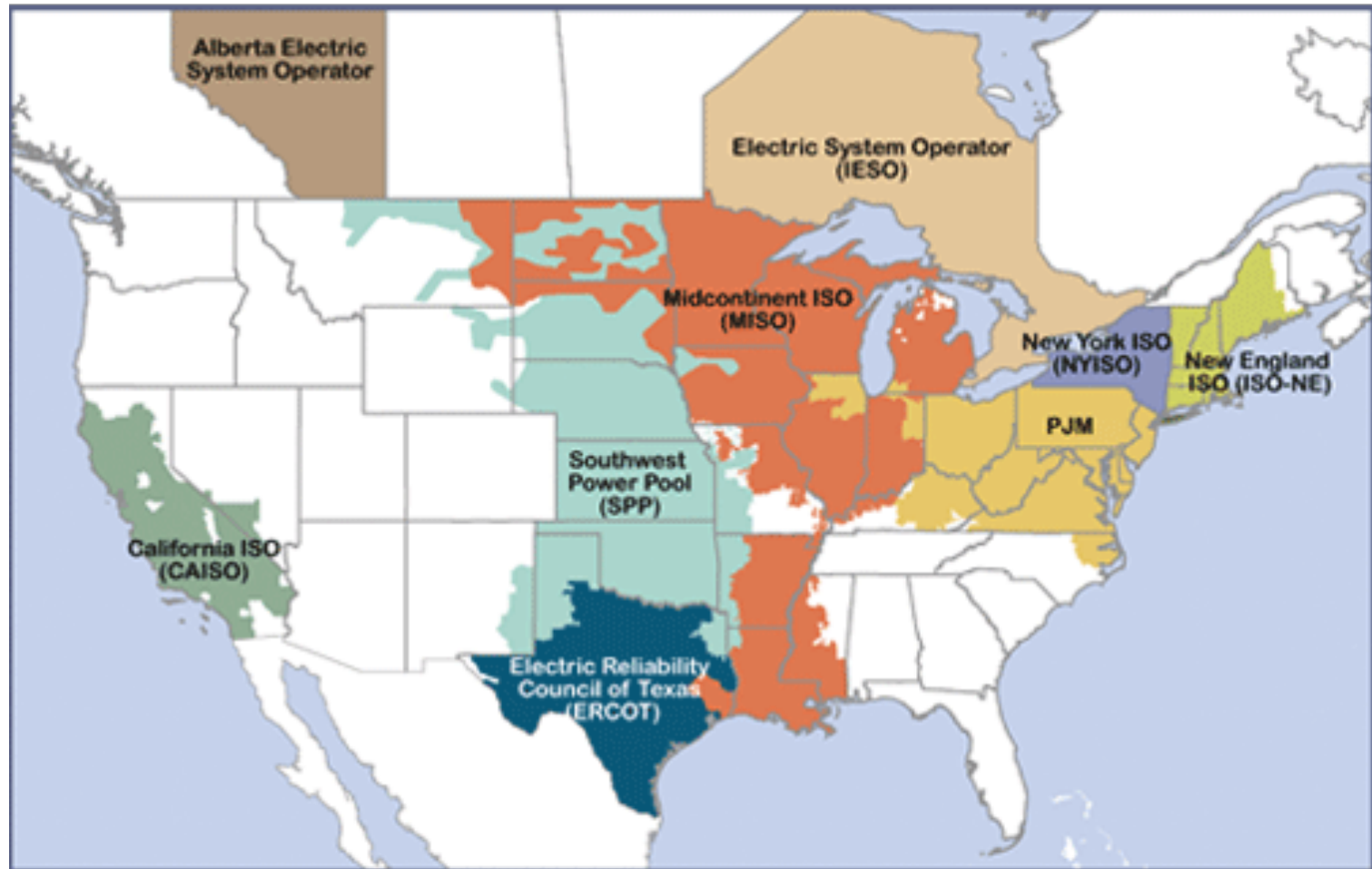


# Monitoring Electricity Markets

## 电力市场监测

- Electricity markets can be susceptible to manipulation by market participants. 电力市场容易受到市场参与者（市场主体）的操纵
- A good market monitoring framework can mitigate market power and also help: 一个好的市场监测框架可以减轻市场力，也有助于：
  - ensure markets are producing fair, cost-effective, and efficient results; 确保市场结果公平、高效和具有成本效益；
  - promote economic and non-discriminatory system operation/dispatch; 促进经济性和非歧视性的系统运行/调度
  - revise market rules as experience with markets accumulates; and 随着市场经验的累积，修订市场规则；
  - deal with the challenge of integrating variable renewable generation, storage, and distributed resources. 应对可再生能源、储能和分布式资源并网带来的挑战。

# Market Monitoring in U.S. ISO/RTO Markets 美国ISO/RTO市场监测



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# Monitoring Electricity Markets

## 电力市场监测

**Three key topics: 三个关键因素:**

➤ **Collecting information on operational costs** 收集关于运营成本的信息:

Frameworks for gathering and assessing information on the operational costs of individual generators and other resources.

以此为框架，收集和评估关于各发电商和其他资源企业运营成本信息

➤ **Roles and responsibilities** 角色和职能:

Institutional structure, authority, and rules for market monitoring, including establishment of independent market monitor units.

市场监测的制度结构、权威和规则，包括建立独立的市场监测机构

➤ **Rules for market screening** 市场力筛选规则:

procedures for day-to-day screening and mitigation of market power.

对市场力进行日常筛选和缓解的程序

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收集和评估关于各发电商和其他资源运营成本信息的框架

- **Roles and responsibilities:** Institutional structure, authority, and rules for market monitoring, including establishment of independent market monitor units.
- **Rules for market screening:** procedures for day-to-day screening and mitigation of market power.

# Electricity Markets and Resource Cost Data

## 电力市场和发电成本数据

- U.S. ISO/RTO markets feature economic merit order approach to dispatch.  
美国ISO/RTO市场运用经济优先调度的手段。
- That is, resources are dispatched according to the operating cost associated with each resource, subject to availability, reliability, and transmission constraints.  
即，根据每个机组的运营成本来调度，服从可用性、可靠性和输电约束。
- Competitive electricity markets can reveal these operating costs via market-based price bids. 竞争性电力市场可以通过市场报价来揭示运营成本
- However, in addition to the price bids, ISOs/RTOs monitor collect detailed information on operating cost of resources, in order to

除了投标价之外，ISO/RTO监测机构还收集关于机组运行成本的详细信息，以便：

- monitor for and mitigate market power 监测和减缓市场力;
- assess market function and determine whether market design needs modification; and  
评估市场功能，并决定是否需要修改市场设计;
- help ensure that market and operational outcomes reflect the true underlying costs of various resources 确保市场和运行结果反映各机组的真正成本

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# Establishment of resource cost assessment framework

## 机组成本评估框架的建立

- Reference levels: estimation of operating cost for individual resources.

参考水平：机组的运营成本估算

- Data associated with individual generators is typically not made public. However, in aggregate form, it may be used in public market monitoring reports.

与发电商相关的数据通常不公开。但是，公共市场监测报告可以反映集体平均数据。

# Calculating Resource Reference Levels

## 计算机组参考水平

Heat Rate 热值

Fuel Price 燃料价格

Operating and maintenance costs 运维成本

Startup and no-load costs 启动和备用成本

Emission Costs 排放成本

*Detailed examples available online!*

*可在线查看详细案例!*

Eg PJM Cost Development Guidelines\*

比如, PJM成本指南\*



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市场监测的制度结构、权威和规则，包括建立独立的市场监测机构

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# Market Monitoring: Structure, Authority, and Institutional Roles

## 市场监测：结构，权威，以及制度角色

- FERC sets the broad requirements and ultimately oversees market monitoring and related mitigation and enforcement issues.

美国联邦监管委员会（FERC）制定了诸多规定，并负责市场监测，市场力减缓和执行问题。

- Day-to-day market monitoring responsibility is carried out by the ISO/RTO entities that serve as system operator and market operator in each of the regional wholesale markets.

作为区域批发市场中的系统运营商和市场交易机构，ISO/RTO负责日常市场监测职责。

- FERC rules require that ISOs/RTOs have **market monitor units (MMUs)** that operate **independently** of ISO/RTO management.

FERC要求ISO/RTO设立独立运行于ISO/RTO管理之外的的市场监测机构(MMU)。

# Core Functions of Independent Market Monitors 独立市场监测机构的核心功能

- Evaluate existing and proposed market rules and market design elements and recommend changes to the ISO/RTO management, FERC, market participants, and other stakeholders. Review rules and implementation.

评估现有和拟议的市场规则和市场设计要素，并向ISO/RTO管理层、FERC、市场参与者和利益相关方提出修改建议。审查规则和执行情况。

- Publish reports on the performance of the ISO/RTO markets on (at least) a quarterly basis, including detailed annual reports.

(至少)每季度发布ISO/RTO市场运行报告，包括详细的年度报告。

- Provide inputs to the market power mitigation processes in each ISO/RTO, including inputs for operational cost assessments for generators and other resources, and identification of chronically constrained areas of the grid.

为每个ISO/RTO中市场力缓解过程提供帮助，包括用于发电商和其他资源的运营成本评估，发现电网阻塞等。

- Identify suspected rule violations on the part of market participants or the ISO/RTO management and report these to FERC. (MMUs also monitor the system operator and market operator!)

查明市场参与者或ISO/RTO管理层涉嫌违反规则的行为，并向FERC报告(MMU还监测系统运营商和市场运营商！)

# Independent Market Monitor Institutional Options

## 独立市场监测机构：机制选项

ISO/RTO	Structure 结构	Website for MMU reports MMU报告网站
<b>California ISO</b>	Internal MMU (ISO staff) 内部MMU (ISO员工)	<a href="http://www.caiso.com/market/Pages/MarketMonitoring/MarketMonitoringArchive/Default.aspx">http://www.caiso.com/market/Pages/MarketMonitoring/MarketMonitoringArchive/Default.aspx</a>
<b>ERCOT</b>	External MMU (consulting firm) 外部MMU (咨询公司)	<a href="https://www.potomaceconomics.com/markets-monitored/ercot/">https://www.potomaceconomics.com/markets-monitored/ercot/</a>
<b>MISO</b>	External MMU (consulting firm) 外部MMU (咨询公司)	<a href="https://www.misoenergy.org/markets-and-operations/independent-market-monitor2/">https://www.misoenergy.org/markets-and-operations/independent-market-monitor2/</a>
<b>ISO New England</b>	Internal MMU (ISO staff) and External MMU (consulting firm) 内部MMU (ISO员工) 和 外部MMU (咨询公司)	<a href="https://www.iso-ne.com/markets-operations/market-monitoring-mitigation/">https://www.iso-ne.com/markets-operations/market-monitoring-mitigation/</a>
<b>New York ISO</b>	External MMU (consulting firm) 外部MMU (咨询公司)	<a href="https://www.nyiso.com/market-monitoring">https://www.nyiso.com/market-monitoring</a>
<b>PJM</b>	External MMU (consulting firm) 外部MMU (咨询公司)	<a href="http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2019.shtml">http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2019.shtml</a>
<b>SPP</b>	Internal MMU (ISO staff) 内部MMU (ISO员工)	<a href="https://www.spp.org/markets-operations/market-monitoring/">https://www.spp.org/markets-operations/market-monitoring/</a>

# Independent Market Monitors: Data Access 独立 市场监测机构：获取数据

- FERC rules require RTOs/ISOs to “provide MMUs with access to market data, resources and personnel sufficient to carry out their duties.”

FERC要求RTO/ISO “向MMU提供足够的市场数据、资源和人员以履行其职责”。

- For example, SPP rules specify MMU ability to access to data, including

例如，SPP 规则指定了MMU访问数据的权限，包括：

- All individual offers/bids in markets.市场上所有个体的卖出价/买入价。
- Individual export interchange transaction bids and import interchange transaction offers.  
单个出口交易投标和进口交易报价。
- Actual commitment and dispatch of generation and other resources.  
发电和其他资源的实际机组组合和调度。
- Locational marginal prices and market clearing prices at all nodes for every period.  
每段时间内所有节点的节点边际电价和市场清算价格。
- Detailed balancing area operational data. 详尽的平衡区运营数据。
- “Conditions or events both inside and outside the SPP Balancing Authority Area affecting the supply and demand for, and the quantity and price of, products or services sold or to be sold...” ”  
在SPP平衡区内外发生的事件，影响到了出售和将要出售的产品和服务，供需，数量和价格...
- “Information regarding transmission services and rights, including the estimating and posting of Available Transfer Capability or Available Flowgate Capability...the operation and maintenance of the transmission system...”

有关输电服务和权利的信息，包括评估和发布可用输电能力或可用断面能力...输电系统的运维...

Regulatory Assistance regarding the nature and extent of transmission congestion. 输电阻塞的性质和程度的资料

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procedures for day-to-day screening and mitigation of market power. 对市场力进行日常筛选和缓解的流程

# Procedures for detecting and mitigating market power 检测和缓解市场力量的流程

- Each ISO/RTO has detailed rules are intended to screen offers/bids and correct the behavior of market participants **before the market clears**.  
每个ISO/RTO都有详细的规则来筛选报价/投标价，并在市场清算前纠正市场参与者的行为。
- Rules are subject to review and approval by FERC. 有关规定须经FERC审查和批准。
- FERC also has authority to investigate and penalize market participants who have exercised market power **in the past**. FERC还有权调查和惩罚过去曾行使市场力的市场参与者。
- Two major approaches to screening market power 筛选市场力的两种主要方法：
  - Structural tests 结构试验
  - Conduct and impact tests 行为和影响试验
- Mitigating Market Power 缓解市场力
  - In principle, mitigation is “designed to cause a market participant to offer as if it faced workable competition.”  
原则上，缓解措施“旨在使一个市场参与者在面临可行竞争的情况下提供服务。”
  - Replaces offer/bid with another based on operating cost.  
根据运营成本用另一个报价/投标取代。

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# Concluding Thoughts on Spot Market Regulation (1) 关于现货市场监管的几点思考(1)

- Consider establishing institutional structures with sufficient authority, clearly stated responsibilities, and sufficient access to market/operational data. Roles may include 建立具有足够权威、责任明确、且充分获得市场/运营数据的机构。职责包括：
  - evaluating market functioning and recommend rule changes to promote efficiency, including rules to ensure a level playing field for variable renewable generation and distributed resources;  
评价市场运作情况，并建议规则改革以促进效率，包括确保为可再生能源和分布式资源进行公平竞争的规则；
  - overseeing the development of ‘reference levels’ that assess each resource’s (e.g., each generation unit’s) operational costs;  
监督评估每种资源(例如，每台发电机组)运营成本的“参考水平”的制定；
  - issuing detailed quarterly and annual reports on market performance, including assessment of whether dispatch reflects a merit order approach to operational costs; and  
就市场表现发表详细的季度和年度报告，包括评估是否为经济调度，反映运营成本
  - reporting suspected rule violations (on the part of market participants, dispatch organizations, market centers, or grid companies) to the relevant government authorities.  
向政府报告涉嫌违反规则的行为(市场参与者、调度机构、市场中心或电网公司)。



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# Concluding Thoughts on Spot Market Regulation (2) 关于现货市场监管的几点思考(2)

- Restrictions on generation company market share at provincial level may be useful. But this is not enough, given the risk of temporary local market power in electricity markets.

限制发电公司在省级的市场份额可能是有用的。但这还不够，因为还存在临时本地市场力的风险。

- Consider developing and publishing detailed rules, including for 考虑制定和发布详细规则，包括：
  - reference level calculation 参考水平计算;
  - market power screening; and 市场力筛选;
  - mitigation procedures. 市场力缓解流程