Performance Metrics

For Independent System Operators And Regional Transmission Organizations

A Report to Congress In Response to Recommendations of the United States Government Accountability Office

Office of the Chairman Federal Energy Regulatory Commission April 2011 www.FERC.gov

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Federal Energy Regulatory Commission
Office of the Chairman

888 First Street NE, Washington DC 20426

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Message from the Chairman

To the Chairman and Ranking Member of the Senate Committee on Homeland Security and Governmental Affairs, and the Chairman and Ranking Member of the House Committee on Oversight and Government Reform:

I am pleased to submit a report on Performance Metrics for Independent System Operators and Regional Transmission Organizations. This report is being submitted in response to recommendations of the Government Accountability Office (GAO). As outlined in its report, *FERC Could Take Additional Steps to Analyze Regional Transmission Organizations' Benefits and Performance*, GAO recommended that the Federal Energy Regulatory Commission (FERC) develop standardized measures or metrics to track the performance of Independent System Operator (ISO) and Regional Transmission Organization (RTO) operations and markets.

Under my direction, Commission Staff has led an 18-month voluntary and collaborative process with ISOs, RTOs, transmission customers, market participants and other stakeholders and interested experts to develop metrics that track the performance of ISO/RTO operations and markets in delivering benefits to consumers for those ISO/RTOs under the jurisdiction of the FERC. This information provides the framework for an ongoing analysis of ISO/RTO performance; as well as a starting point for further evolution of these measures into industry best practices by ISO/RTOs.

The culmination of these efforts to date has been the submittal of performance metrics reports by each of the ISOs and RTOs which are attached in the Appendices to this report.. These reports, that represent the first step in a multi-year evaluation of performance for utilities under the jurisdiction of the FERC, provide a wealth of information on the ISO/RTO markets and operations over a five-year period (2005 – 2009) for 57 performance measures. As outlined in FERC's FY 2009-2014 Strategic Plan, next steps in this evaluation include development of performance metrics in non-RTO regions in fiscal year 2011 followed by development of common metrics for both ISOs/RTOs and non-RTO regions – thereby allowing for comparisons across all electric regions and markets – and further evaluation of the performance results in subsequent fiscal years.

Jon Wellinghoff
Chairman
Federal Energy Regulatory Commission

Commission Staff Analysis

This Commission Staff analysis[1] provides a high level overview of some of the more significant aspects of the performance metrics submitted by the ISOs and RTOs[2] in Appendices D through I. Commission Staff plans to continue to evaluate this large body of information and analysis that has been compiled for the first time. However, we believe the full value of this effort will take several years to materialize. In the longer term the metrics will assist the utility industry, stakeholders and the Commission in evaluating industry trends and best practices.

Before discussing our overview of the performance results, the basic characteristics of the ISOs and RTOs under the Commission's jurisdiction must be understood. Each ISO/RTO is responsible for managing the high-voltage electric transmission assets of its member utilities and the wholesale electricity market(s) for the region it serves. As can be seen on the ISO/RTO Map, however, there are significant differences in the geographic scale of the ISOs and RTOs. NYISO and CAISO operate within a single state, while others operate in a multi-state environment, such as the Midwest ISO which operates in all or parts of 13 U.S. states and the Canadian province of Manitoba. There are also differences in the scope of their respective operations. For example, in addition to providing open-access transmission services, SPP operates a single real-time balancing market for its members whereas other ISO/RTOs operate a number of markets, including longer-term energy markets, ancillary services markets and capacity markets.

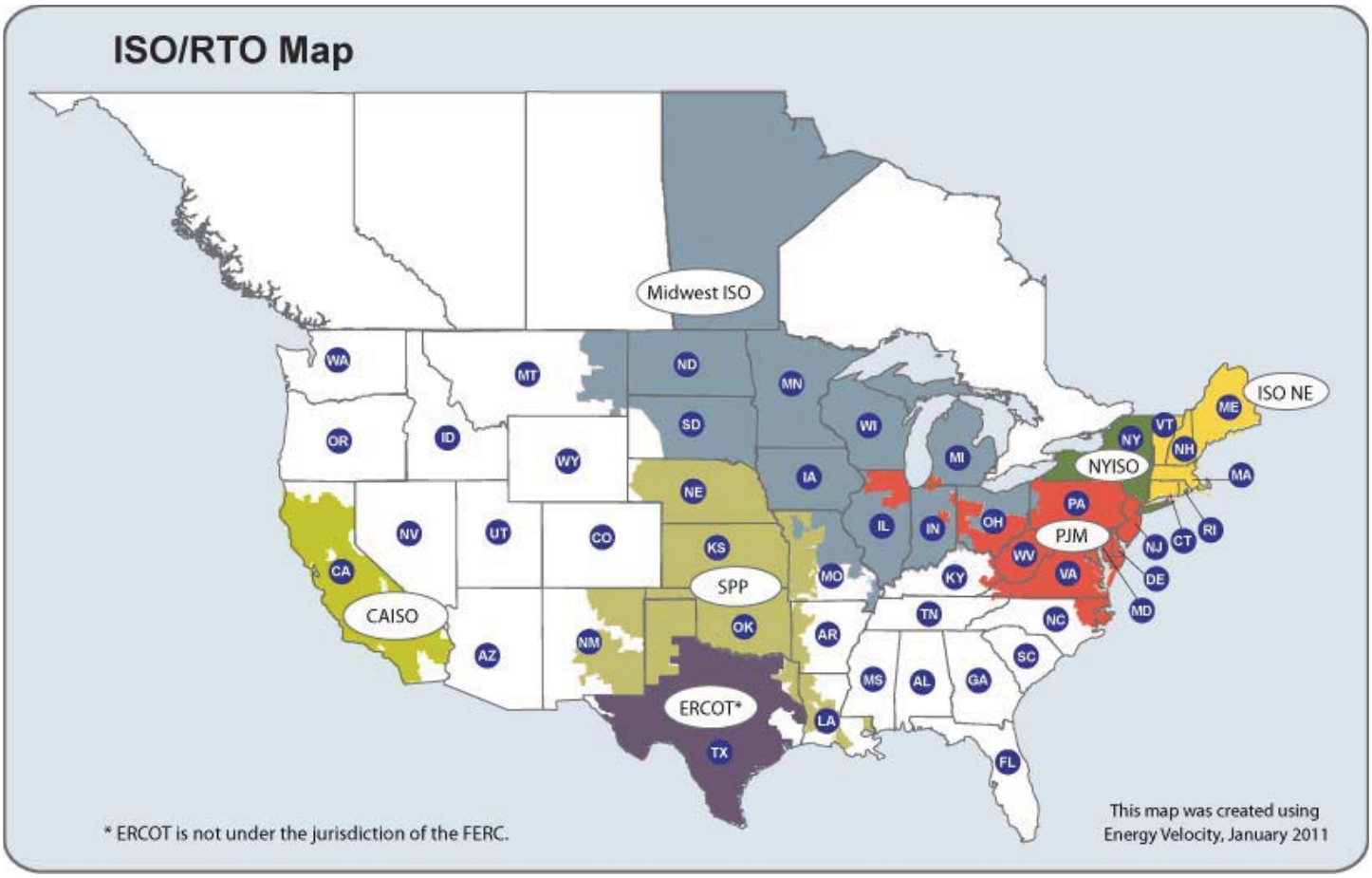
These differences must be kept in mind when evaluating performance results across the ISOs and RTOs. Recognizing these differences, ISO/RTO performance can be compared in the following ways:

- Direct comparisons can be made of performance for certain metrics that reflect activities under the control of ISOs/RTOs and that are not a function of the scale and scope of the ISOs/RTOs. Metrics in this category include a metric that compares ISO/RTO actual administrative spending with budget forecasts, as well as metrics on billing audits and customer satisfaction indices.

- Other metrics are best compared in terms of their performance trends over the 2005-2009 review period. Clearly, some of the performance results reflect the impact of a wide range of factors beyond simply performance. Differences in market prices between the ISOs and RTOs, for example, reflect

1 The opinions and views expressed in this staff analysis do not neccessarily represent those of the Federal Energy Regulatory Commission, its Chairman, or individual Commissioners, and are not binding on the Commission.

2 The ISOs and RTOs providing information for this report are ISO New England (ISO-NE), New York Independent System Operator, Inc. (NYISO), PJM Interconnection, L.L.C. (PJM), Midwest Independent Transmission System Operator, Inc. (Midwest ISO), Southwest Power Pool, Inc. (SPP), and the California Independent System Operator Corporation (CAISO).



different resource profiles in the various ISO/RTO regions. Since entities other than ISOs and RTOs develop and operate resources, ISOs and RTOs must work within the parameters of their given resource profiles to improve efficiency in the markets within their regions. While market prices within ISOs/RTOs differ, the five year trend for each ISO/RTO will provide a better basis to compare the relative performance among ISOs/RTOs, particularly with respect to market metrics that more directly measure costs that can be influenced by ISO/RTO programs designed to make markets operate efficiently, as discussed more fully below.

- As explained in the narratives provided in the ISO/RTO performance reports, all metrics must be evaluated in the context of all of the factors that influence performance, to determine the extent to which the metrics are measuring ISO/RTO performance and the extent to which they reflect the impact of other factors.

Review of Performance Results

ISO/RTO metrics were designed to measure performance on three dimensions: (1) market benefits; (2) organizational effectiveness; and (3) reliability. The following provides highlights of the performance results in each of these categories.

Market Benefits

ISO and RTO markets provide benefits to energy producers and consumers to the extent their markets are competitive and their programs for making their markets operate more efficiently are successful in lowering customer costs. ISO/RTO security-constrained economic dispatch[3] is intended to facilitate maximum participation by all resources and maximum utilization of the least-cost resources, thereby enhancing competition and ensuring a reasonable cost of energy for customers. ISO/RTO efficiency programs, such as incentives to induce resources to be available, are intended to ensure the full benefits of competition are realized.

Of the 16 metrics developed to measure the performance of ISOs and RTOs in delivering market benefits, and that are detailed in the reports in Appendices D through I, we focus below on one of the competition metrics, several efficiency metrics, such as generator availability, and the market price measures.

The price-cost metric (Chart 1) compares the marginal price to the marginal cost of energy production. The closer the marginal price is to the marginal cost, the more competitive the market. Performance against this metric supports the proposition that all ISOs/RTOs have competitive markets, as reflected in the close parity of marginal prices and marginal costs.[4] However, there are some differences in data reported by the ISOs and RTOs that result from historical differences during the reporting period. CAISO's report for this metric relies on estimates based on bilateral price indices and cost estimates for the earlier years. Only the 2009 data represents actual market data, because CAISO did not have a forward energy market prior to that time. As a result, while the CAISO trend appears to show marginal prices and marginal costs converging, indicating more competitive conditions, such a conclusion may not be accurate. We also note that while it appears that the PJM price-cost markup in 2007 reflects less competitive conditions, a substantial portion of the 2007 markup occurred on high-load days. Therefore, it is likely that the higher prices were the result of administratively-determined scarcity pricing rather than the exercise of market power.

3 Security-constrained economic dispatch is the operation of generation facilities to produce energy at the lowest cost to reliably serve consumers, recognizing any operational limit of generation and transmission facilities. See Energy Policy Act of 2005, section 1234.

4 SPP does not report a price-cost mark-up. Its Independent Market Monitor assesses its market to be competitive based on an evaluation of threshold tests for market-based rate applications.

Chart 1: Price-Cost Mark Up 2005-2009*

* Price-Cost Mark Up Definition: Load-weighted average mark up on cost-based offer divided by load-weighted price offer, expressed as a percentage. Positive percentage indicates that the marginal price is higher than the marginal cost. Negative percentage indicates the marginal cost is higher than the marginal price.

Source: Derived from content presented in Appendices D through I

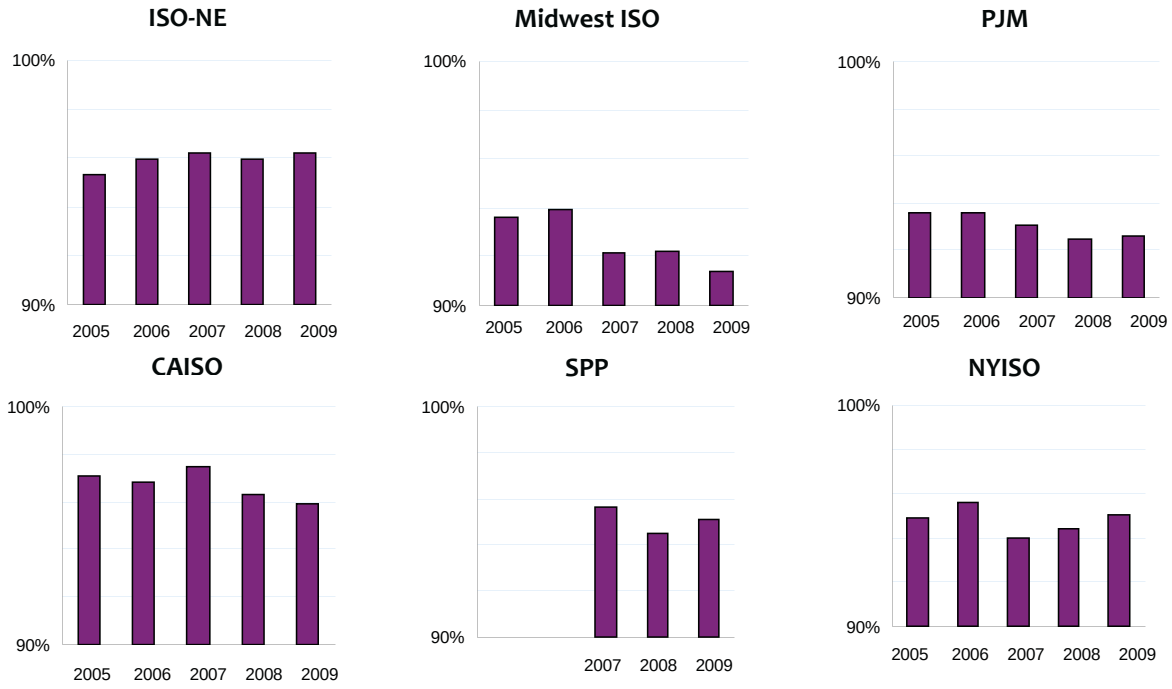
Commission Staff plans to continue to monitor this metric in future reports as additional actual market data is generated and included in the metric.

Additional indicators that support the conclusion that ISO/RTO markets are competitive are low market concentration indices, as discussed in more detail in the individual ISO/RTO performance reports,[5] and energy market prices are closely tracking fuel costs, discussed further below. Also, demand response entering markets as new resources have provided additional competition.

The market benefits of ISO/RTO programs for making their markets operate more efficiently can be measured by the generator availability, demand response availability and congestion management metrics. While resource availability and congestion management are influenced by market factors, incentive programs for resource participation and effective transmission planning by ISOs/RTOs to manage congestion can also improve efficiency.

5 See, for example, Appendix F at p. 106.

Chart 2: Generator Availability Range 2005-2009*



*Generator Availability Definition: The capacity of a generator adjusted for planned outages, expressed as a percentage of hours available over a year.
Source: Derived from content presented in Appendices D through I.

Generator availability (Chart 2) was in the range of 91 to 98 percent over the 2005 – 2009 period. It is noteworthy that the five-year trend in ISO-NE generator availability reflects improvements in the availability of generators using all fuels except coal generation that declined slightly. The trend in decreasing availability in PJM reflects the impact of decreased availability of older coal-fired generation units that outweighed reduced outage rates system-wide over this period.[6] It is not possible to assess the causes of the decreasing generator availability reflected in the Midwest ISO generator availability metric because the Midwest ISO based the data reported for the years prior to 2009, in part, on North American Electric Reliability Corporation (NERC) industry-wide class average estimates[7] rather than on actual data provided by generators in the Midwest ISO.

ISOs and RTOs have evaluated demand response availability during emergency events, such as the August 2006 heat wave, as discussed in their reports. It is not possible to show this information on a chart due to the lack of comparable information across all ISOs and RTOs. ISO-NE estimated the availability of

6 See Appendix H at p. 300 for a complete discussion.

7 NERC estimates class average capacity factors for the various types of generation based on historical data.

all demand response resources, passive and active, to be 84 percent based on events from August 1, 2006 through August 25, 2009. In NYISO, demand response provided 865 MW on August 2, 2006 and 345 MW on July 27, 2006 during emergency conditions. In PJM, demand response availability was 121 percent in 2006 and 118 percent during testing in 2009/2010.

Congestion costs[8] vary between the ISOs and RTOs, reflecting differences in system topologies and shifts in loads over the evaluation period, as detailed in the discussion in the Appendices. Nonetheless, ISO/RTO programs can have an impact on congestion, for example through transmission planning initiatives. As an example, PJM's Regional Transmission Expansion Plan includes increases in transmission system capacity that are expected to alleviate 90 percent of the current congestion costs in the region.

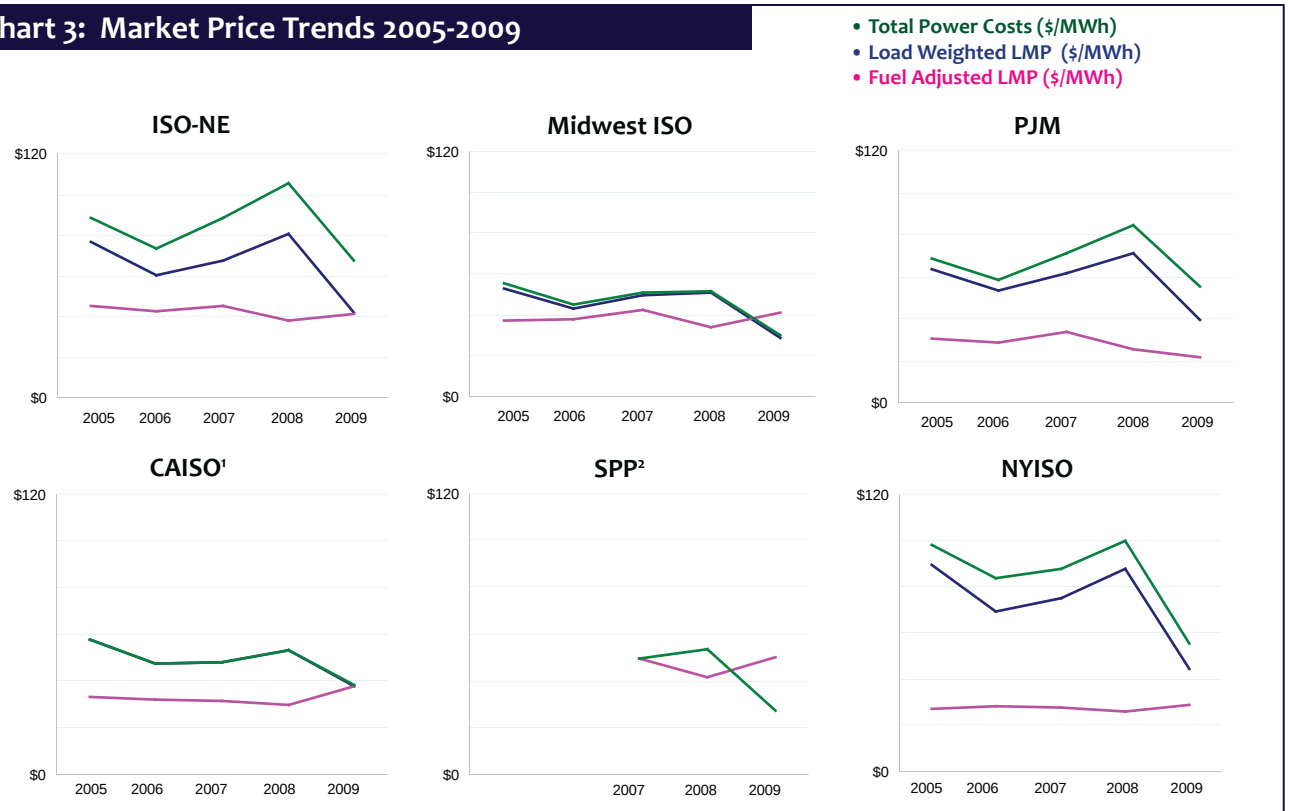
Finally, with respect to the bottom line for consumers – their costs – security constrained economic dispatch and ISO/RTO efficiency programs have yielded benefits. For example, PJM was able to reduce annual generation production costs by $122 million due to improved generation dispatch in 2009. Security constrained economic dispatch also reduced reliance by ISOs and RTOs on less efficient and less reliable physical and manual procedures, such as transmission loading relief, to resolve system constraint problems. Midwest ISO was particularly successful in reducing transmission loading relief,[9] from 842 in 2006 to 371 in 2009.

Market price trends in Chart 3 (on next page) reflect the impact on market prices of market factors such as fuel costs as well as ISO/RTO efficiency programs. The top two lines in Chart 3, the energy cost and total power cost metrics, illustrate the impact of fuel price trends. As detailed in the ISO/RTO performance reports, the nation-wide increase in fuel costs in 2008 and the decrease in 2009 were closely tracked in wholesale energy prices. More relevant to an assessment of ISO/RTO performance is the bottom line in Chart 3, the market price adjusted for fuel costs. This metric, when compared to unadjusted market prices, shows the impact of security constrained economic dispatch, incentives for improved generator availability, investment in more efficient generating units and other factors on prices. Therefore, this metric provides a measure of the efficiency of the ISO/RTO markets, and how that efficiency provides a benefit to consumers in their cost of energy. It should be noted that each of the ISOs/RTOs uses a different base year for their fuel adjustments and different fuel mixes and therefore direct comparisons among the ISOs/RTOs are not meaningful. The meaning and significance of the trends in this metric for each ISO/RTO are of particular interest to Commission Staff and will be evaluated further in future reports.

8 Congestion occurs when the physical limits of a line prevent load from being served with the least cost energy. Congestion costs measure the difference between the actual cost of energy and least cost energy.

9 Transmission loading relief is an action taken by a Reliability Coordinator to ensure that reliability is maintained within the operating limits of a transmission system. Such actions include curtailment of transmission transactions and load shedding.

Chart 3: Market Price Trends 2005-2009

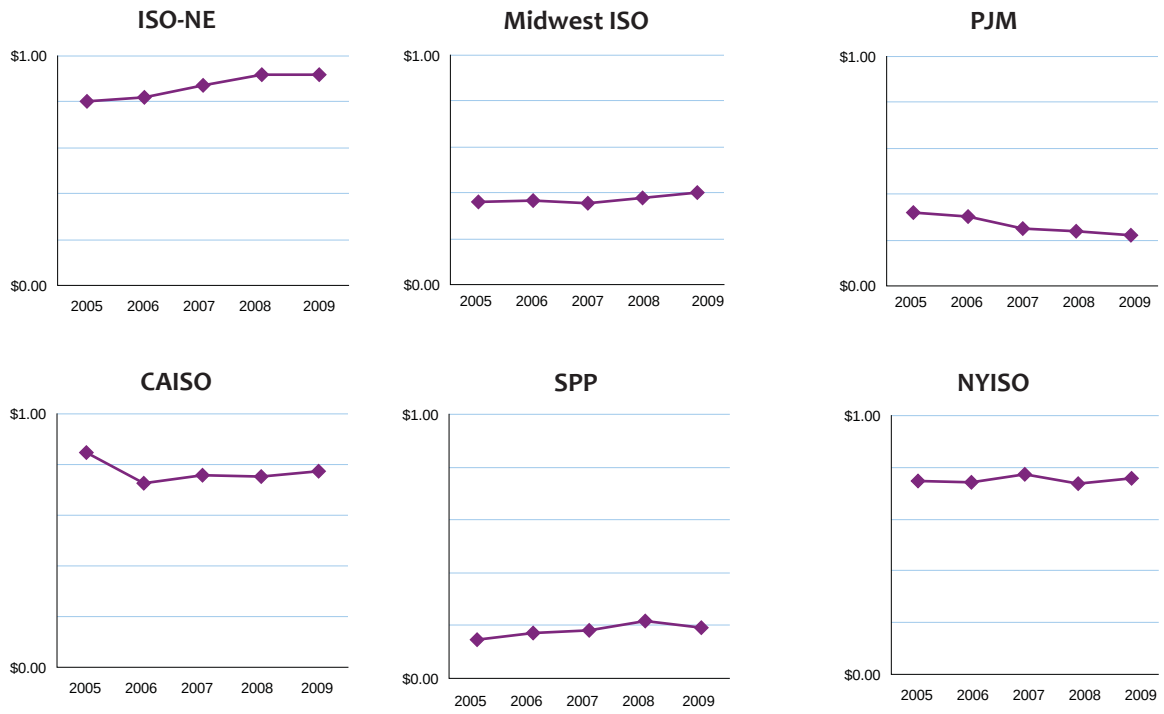


1. The CAISO Load Weighted LMP and Total Power Cost is the same for years 2005-2008.
2. Data for SPP is only available since 2007. The SPP Load Weighted LMP and Total Power Cost is the same for years 2007-2009.

Note: Total power costs include the cost of energy, transmission, capacity, ancillary services and administative costs. Load-weighted LMP represents the average load-weighted wholesale electricity energy spot prices in ISOs/RTOs. Fuel Adjusted LMP is derived by holding the fuel cost constant over the five-year period and represents the average load-weighted wholesale electricity energy spot prices that result from this adjustment.
Source: Derived from content presented in Appendices D through I

Demand response participation reduced market prices, as discussed in the ISO/RTO reports. It is not possible to show this information on a chart due to the lack of comparable information across all ISOs and RTOs. ISO-NE estimates that demand response participation reduced real-time prices from $0.04 to $1.43/MWh over the 2008 – 2009 period. Demand response in NYISO provided an average price reduction of $0.27 per MWh during 2005 – 2009 resulting in a total savings of $44 million over this period. PJM estimates that demand response saved $650 million during the August 2006 event and that wholesale energy prices were reduced by more than $300 per MWh during the highest usage hours. Demand response in Midwest ISO provided approximately 3000 MW during the August 2006 emergency event, reducing clearing prices by $100 - $200 per MWh for savings of over $3 million.

Chart 4: Administrative Costs 2005-2009 (in $/Mwh of Load)



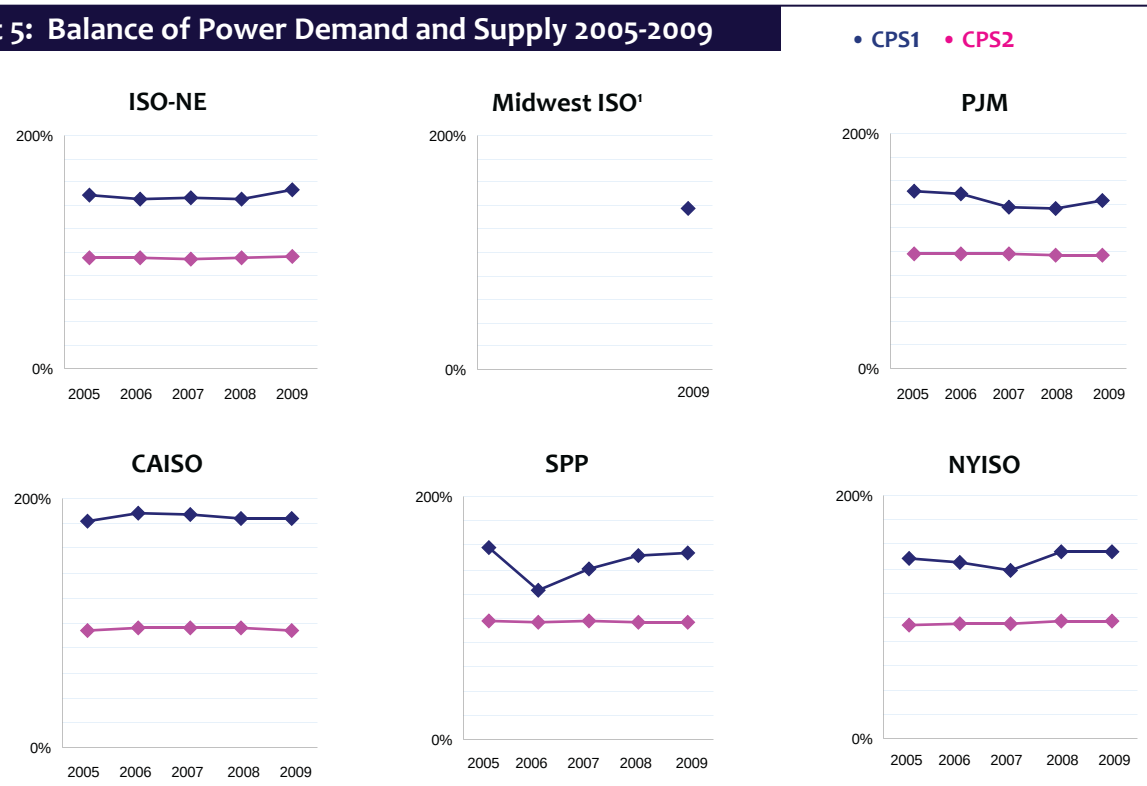
Source: Derived from content presented in Appendices D through I

Organizational Efficiency

The five organizational effectiveness metrics are designed to measure ISO/RTO performance in accomplishing their objectives in a cost-effective manner that provides value to market participants.

Of particular interest in this regard is the administrative cost metric. Between 2005 – 2009, CAISO and PJM reduced administrative costs per MWh of load, NYISO costs per unit of load held steady and Midwest ISO's, SPP's and ISO-NE's costs per unit of load increased, as illustrated in Chart 4.

Chart 5: Balance of Power Demand and Supply 2005-2009



1. No CPS1 data available for 2005-2008. No CPS2 data available for 2005-2009. Midwest ISO was participating in Balance Authority Ace Limit (BAAL) Field Test.

Source: Derived from content presented in Appendices D through I

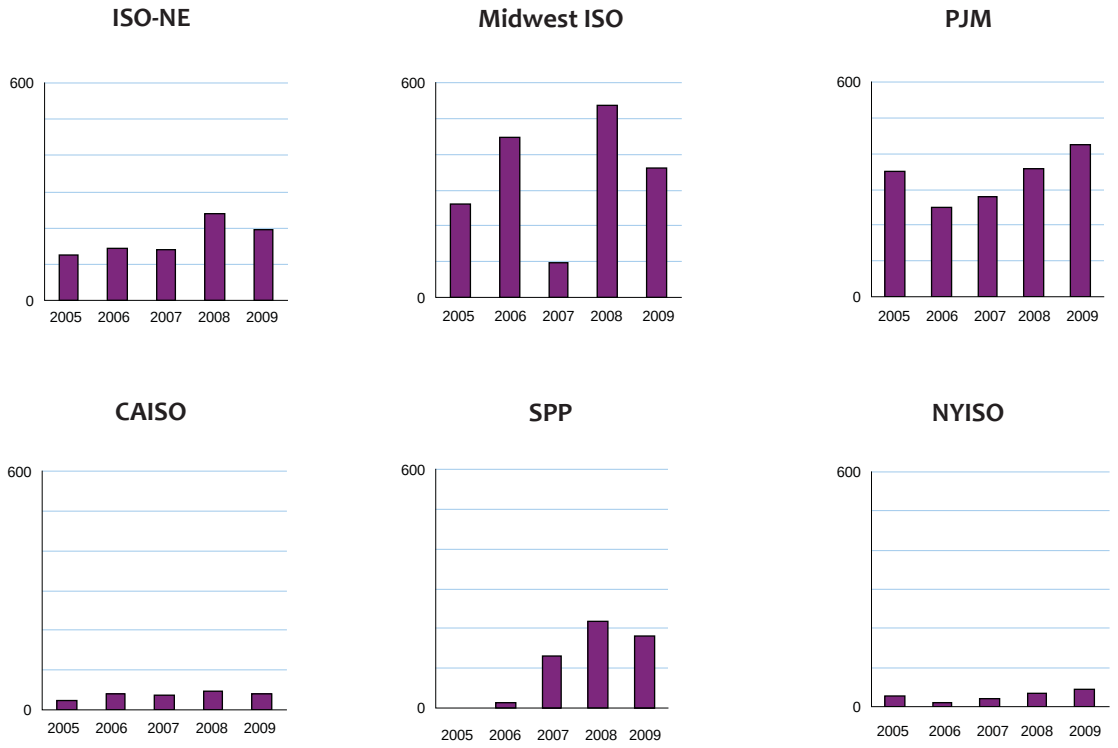
Reliability

The 36 reliability performance metrics were designed to measure both the reliability of day-to-day operations and long-term reliability. We focus on one of the day-to-day operational performance metrics and one of the long-term reliability metrics.

Real-time dispatch reliability in ISOs and RTOs, a short-term reliability measure (shown in Chart 5), was maintained at levels that exceeded national and regional reliability required standards, based on Control Performance Standard 1 and 2 metrics that measure the ability of Balancing Authorities to balance power demand and supply in real-time.[10] Control Performance Standard 1 results were in the 188 to 123 percent range, significantly above the minimum required standard of 100 percent and Control Perfor-

10 Control Performance Standard 1 is a statistical measure of Area Control Error (or ACE, defined as the difference between actual and scheduled net interchange) in combination with the interconnection's frequency error. Control Performance Standard 2 is a measure of the magnitude of ACE. Some RTOs use Balancing Authority ACE Limit (BAAL) as an alternative metric. This metric requires the Balancing Authority to balance its resources and demands so that ACE does not exceed the BAAL limit for a time greater than 30 minutes and limits the recovery period to no more than 30 minutes for a single event.

Chart 6: Approved Reliability Transmission Projects 2005-2009



Source: Derived from content presented in Appendices D through I

mance Standard 2 results were in the 98 to 94 percent range, above the minimum required standard of 90 percent. These results indicate a strong level of compliance in this area of load-generation balancing under the current Reliability Standards.

ISOs and RTOs also play a role in ensuring long-term reliability through their long-term transmission planning programs that evaluate and prioritize regional reliability transmission projects. ISO/RTO long-term reliability transmission planning resulted in the approval of hundreds of reliability transmission projects over the 2005 – 2009 period as illustrated in Chart 6.

The transmission planning process is a comprehensive assessment that evaluates the impacts of a wide range of resource and load trends and technology innovations on the transmission system to ensure that the regional plans incorporate those transmission projects with the greatest reliability and economic benefit. Regional transmission plans include the consideration of demand response solutions to system requirements. Demand response accounts for 3 to 7 percent of installed capacity in a number of the ISO/RTO markets.

Next Steps

In closing, the foregoing summary is intended to be a high level introduction to the performance metrics discussed in greater detail in the performance report appendices that follow. Commission Staff will be evaluating these reports further. In assessing these initial reports, the ISOs and RTOs have identified several challenges that we will evaluate in the next report.

- The need for new transmission capacity to ensure reliability and to reduce congestion.
- The need for improved wind and solar forecasts to address an increase in variable energy resources.
- The need to address the control, communication and reliability challenges associated with intergrating demand response resources into energy and ancillary services markets.
- The need for more accurate transmission project cost estimates, thereby ensuring that the growing number of transmission expansion projects stay on schedule and obtain the support of stakeholders.

Further detail on these performance results as well as a complete assessment of the 57 performance metrics are provided in the Performance Metrics Summary in Appendix C and the individual ISO/RTO reports in Appendices D through I. Also, the ISO/RTO Performance Metrics Development Process in Appendix A describes the voluntary and collaborative process undertaken by Commission Staff to develop ISO/RTO performance metrics with input from the ISOs and RTOs, transmission customers, market participants and other stakeholders and interested experts. This voluntary and collaborative approach will be used to develop performance metrics for non-ISO/RTO regions during fiscal year 2011. The Commission Staff Report in Appendix B provides a summary of comments from stakeholders and other interested parties and Commission Staff's recommendations that resulted in the final list of metrics.

Appendix A

ISO/RTO Performance Metrics Development Process

» Commission Staff, at the Chairman's direction, initiated the development of ISO/RTO Performance Metrics in May 2009.

» Through the summer and fall of 2009 Commission Staff developed a list of proposed performance metrics and discussed them with a team of ISO and RTO staff representing the ISOs and RTOs under the jurisdiction of the Federal Energy Regulatory Commission.[1]

» In January 2011 Commission Staff held focused outreach meetings with a variety of industry, consumer and state regulatory associations.[2]

» On February 2, 2010 Commission Staff issued the proposed performance metrics for comment and reply comment.

» On March 5 and March 19, 2010 comments and reply comments were filed by 59 parties.[3]

» Commission Staff reviewed the comments and issued a Commission Staff Report on October 21, 2010 (Appendix B). In the report, Commission Staff revised the proposed metrics based on the comments received and addressed issues raised by commenters. Commission Staff also requested that ISOs and RTOs submit reports with three to five years of data for the recommended metrics.[4]

» On December 6, 2010 the ISOs and RTOs submitted their reports.

» On April 7, 2011 the Chairman submitted this report to Congress.

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1 These ISOs and RTOs are ISO New England, Inc. (ISO-NE), New York Independent System Operator, Inc. (NYISO), PJM Interconnection, L.L.C. (PJM), Midwest Independent Transmission System Operator, Inc. (Midwest ISO), Southwest Power Pool, Inc. (SPP), and the California Independent System Operator Corporation (CAISO).

2 American Public Power Association, Electricity Consumers Resource Council, National Rural Electric Cooperative Association, National Association of Regulatory Utility Commissioners, National Association of State Utility Consumer Advocates, Edison Electric Institute, American Wind Energy Association, New England Public Utilities Commissioners and the Electric Power Supply Association.

3 The parties are listed in the Commission Staff Report in Appendix B.

4 These reports are attached as Appendices D through I.