United States Electricity Market and System Operators

2009 APEX Annual Meeting

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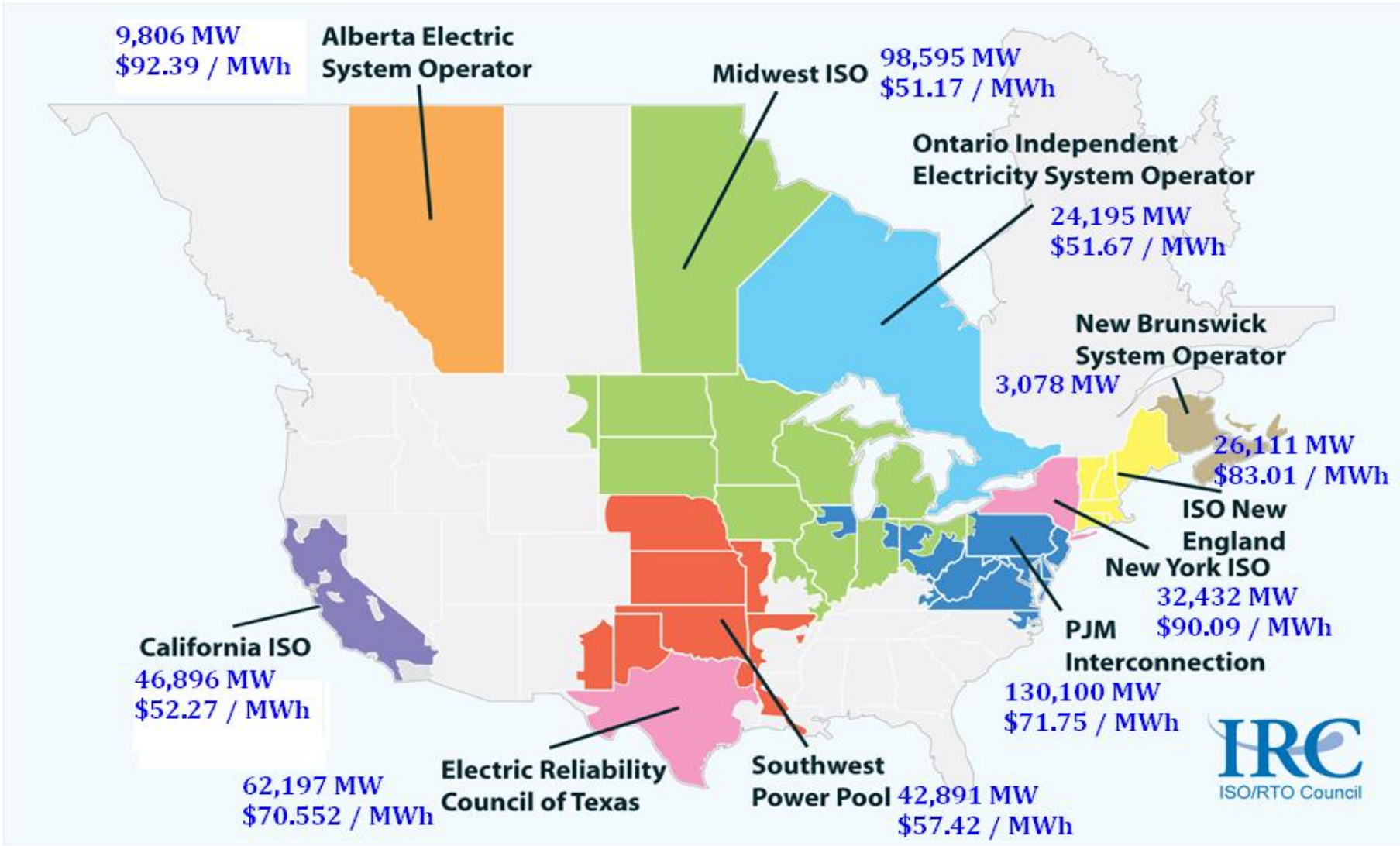
North American Electric System Operators



Major Roles and Responsibilities of System and Market Operators

- Reliable Operation Of The Electric Power System
- Oversee Competitive Wholesale Power Markets
- Regional Planning For Development Of Electric System Infrastructure.

Reliable Operation Of The Electric Power System

- Security Constrained Economic Dispatch
  - Maintains reliability
    - Operating Reserves
    - Voltage and Stability Control
    - Regulation
  - Increases efficiency
- Other services
  - Short term outage coordination and load forecasting

Oversee Competitive Wholesale Power Markets

- Most US Markets Have a Similar Structure
  - Locational Marginal Pricing –Prices Vary By Location When Transmission Constraints Bind.
  - Multi-settlement System – A Day-Ahead Financial Market And A Real Time Physical System
    - Provides Operators The Ability To Plan For A Reliable System And Market Participants The Ability To Hedge

U.S. Market Designs

- Markets with LMP and Multi-Settlement System
  - New England
  - New York
  - PJM
  - MISO
  - CA - Started Operation in April
- Texas is planning an LMP Market
- SPP has a locational imbalance market

Regional Planning Of Electric System Infrastructure

- Transmission System Planning
  - Coordinate Regional Planning of Transmission System
- Long Term Resource Adequacy
  - Set long term Resource Adequacy Requirements
  - Some Operators Run Capacity markets

Capacity Markets in the US

- New England
  - Auction Based Forward Capacity Market
  - Capacity purchased about 4 years in advance
- New York
  - Demand Curve based Monthly Capacity Market
  - Capacity Purchased each month
- PJM
  - Auction Based Forward Capacity Market
  - Capacity purchased about 4 years in advance

Generation Capacity Additions

Total Generation and Generation Capacity Added 2001-2008

(Summer Ratings in Megawatts)

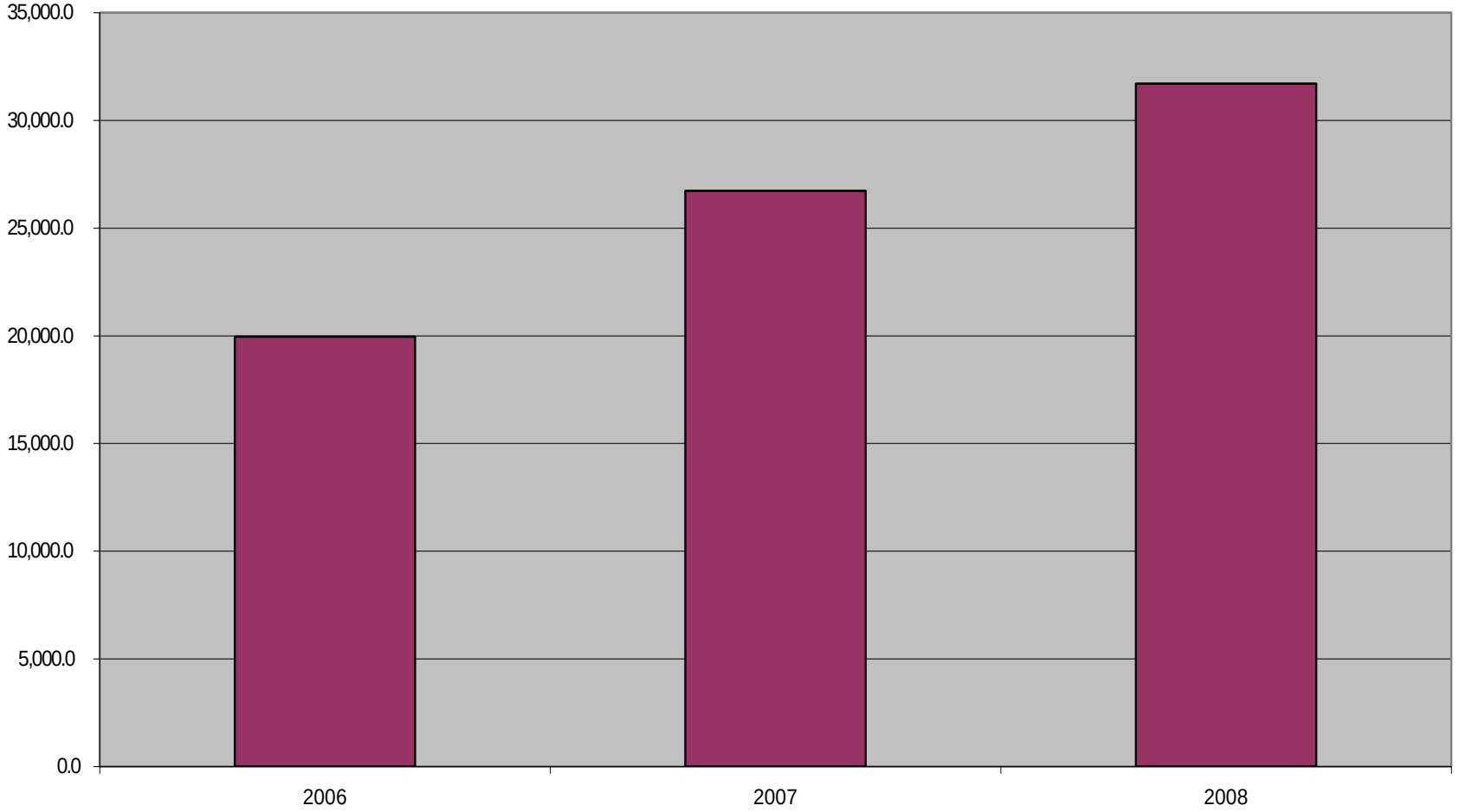
Region	2008 Installed Generation Capacity (MW)	New Generation Capacity (MW) 2001-2008	Percentage of 2008 Generation from New Capacity
AESO	12,159	3,251	26.7%
CAISO	55,098	15,194	27.6%
ERCOT	80,141	26,681	33.4%
MIDWEST ISO (a)	127,204	10,254	8.1%
IESO	33,121	4654	14.1%
NBSO	4,271	462	10.8%
ISO-NE	31,088	8622	27.7%
NYISO	40,187	7,314	18.2%
PJM	164,895	15,504	9.4%

a) **Midwest ISO data covers 2003-2008**

Markets Help Meet Major Policy Goals

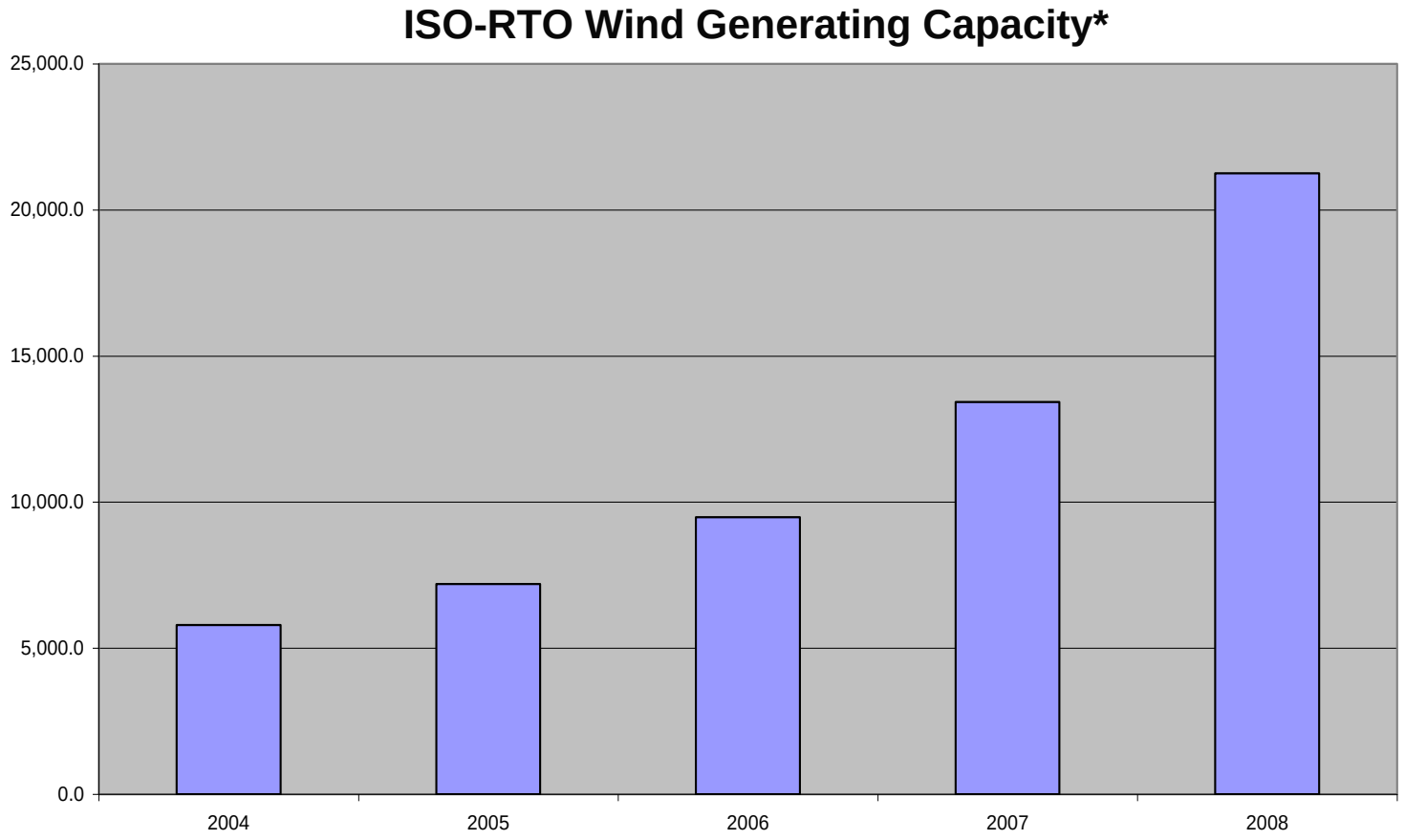
- Increased Participation of Demand in Markets
  - Lower Costs and Reduce Emissions
  - About 6.6% of Peak Demand
- Increase Penetration of Renewable Resources, especially wind
  - Reduce Emissions and Fossil Fuel Use

Demand Response



*Data on California ISO demand response is not available for 2006. Figure 6 assumes no change in California ISO demand response between 2006 and 2007.

Renewable Resources



*Data on MISO footprint wind generating capacity is not available for year end 2004. Figure 8 assumes no change in MISO wind generating capacity between 2004 and 2005.

ISO/RTO saw a fourfold increase of wind capacity being added to the nation's interconnected electric transmission system since 2004.