



# Governance of Multi-jurisdiction Power Pools in the United States

David J. Hurlbut, Ph.D.  
Power Pool Consultations (U.S. Dept. of Commerce)  
New Delhi, India  
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# Topics

- 1 Power Pooling and Cross-Border Energy Trading (New NREL Analysis)**

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# Power Pooling and Cross-Border Energy Trading

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Overview of key results from recent modeling of India, Nepal, and Bangladesh conducted by NREL

# Cross-Border Energy Trade between Nepal and India: Assessment of Trading Opportunities

Full report available at  
<https://www.nrel.gov/docs/fy19osti/72066.pdf>



## Cross-Border Energy Trade between Nepal and India: Assessment of Trading Opportunities

Brendan McBennett, Amy Rose, David Hurlbut,  
David Palchak, and Jaquelin Cochran

*National Renewable Energy Laboratory*

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**Technical Report**  
NREL/TP-6A20-72066  
April 2019

# India-Nepal CBET scenario elements

## Regulatory/operations

### **Business as usual**

*Current bilateral tariffs between Nepal and India; guaranteed purchase prices for IPP hydro in Nepal*

### **Coordinated operations**

*Nepal treated the same as Indian states*

### **Independent System Operator (ISO)**

*Full integration among Nepal, Bhutan, Bangladesh, India's Eastern Regional Load Dispatch center*

## Nepal hydro

### **4.55 GW (high)**

*All new capacity planned for 2022 is built*

### **2.84 GW (base)**

*62% of new capacity planned for 2022 is built (historical delay/cancellation rate)*

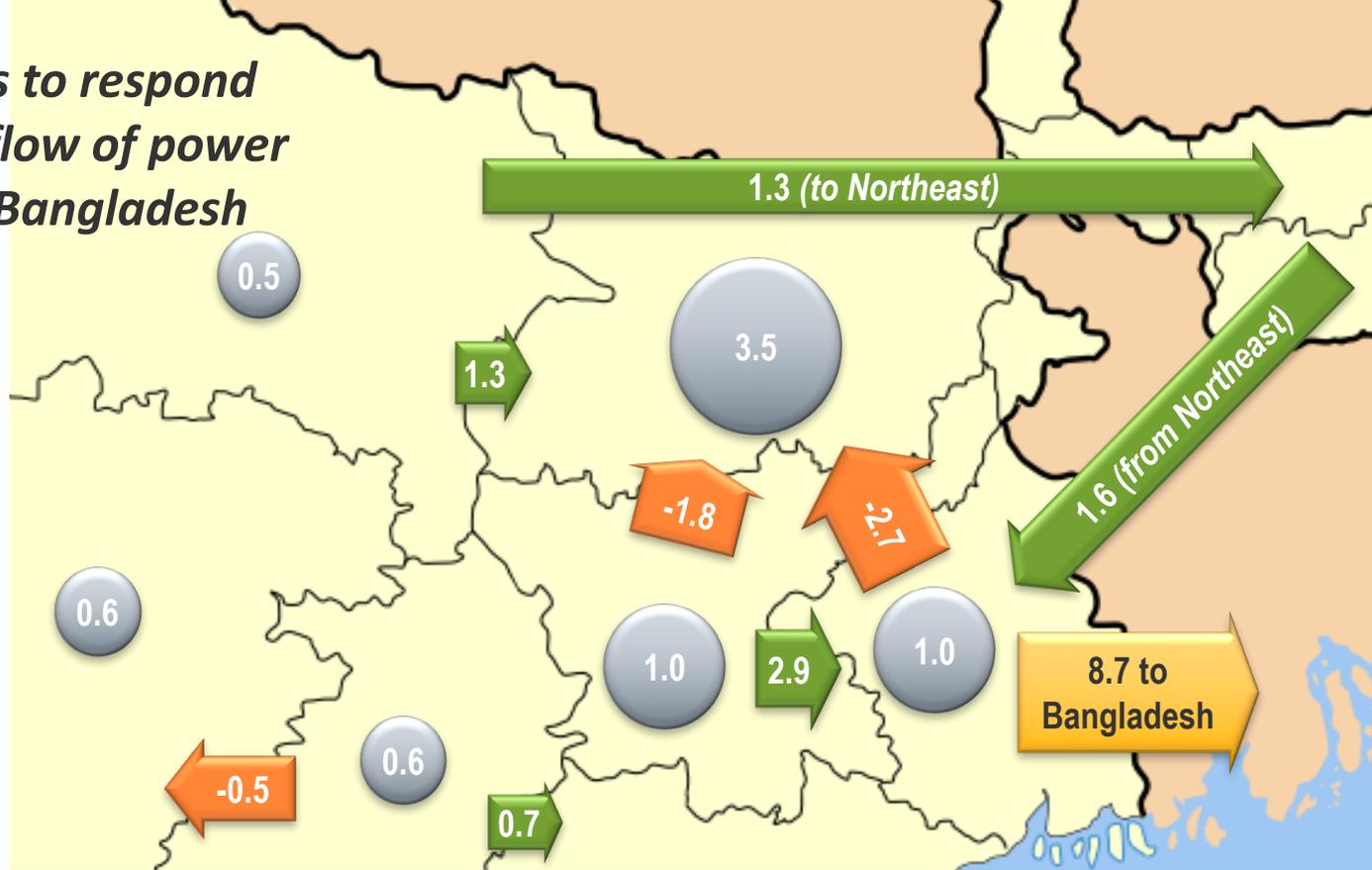
## Other elements

Doubling India-Bangladesh DC tie

India wind/solar integration

## How the system tends to respond when increasing the flow of power from West Bengal to Bangladesh

-  Increase in State's Net Generation
  -  Additional Interstate Flow
  -  Reduced Interstate Flow
- (TWh per year)



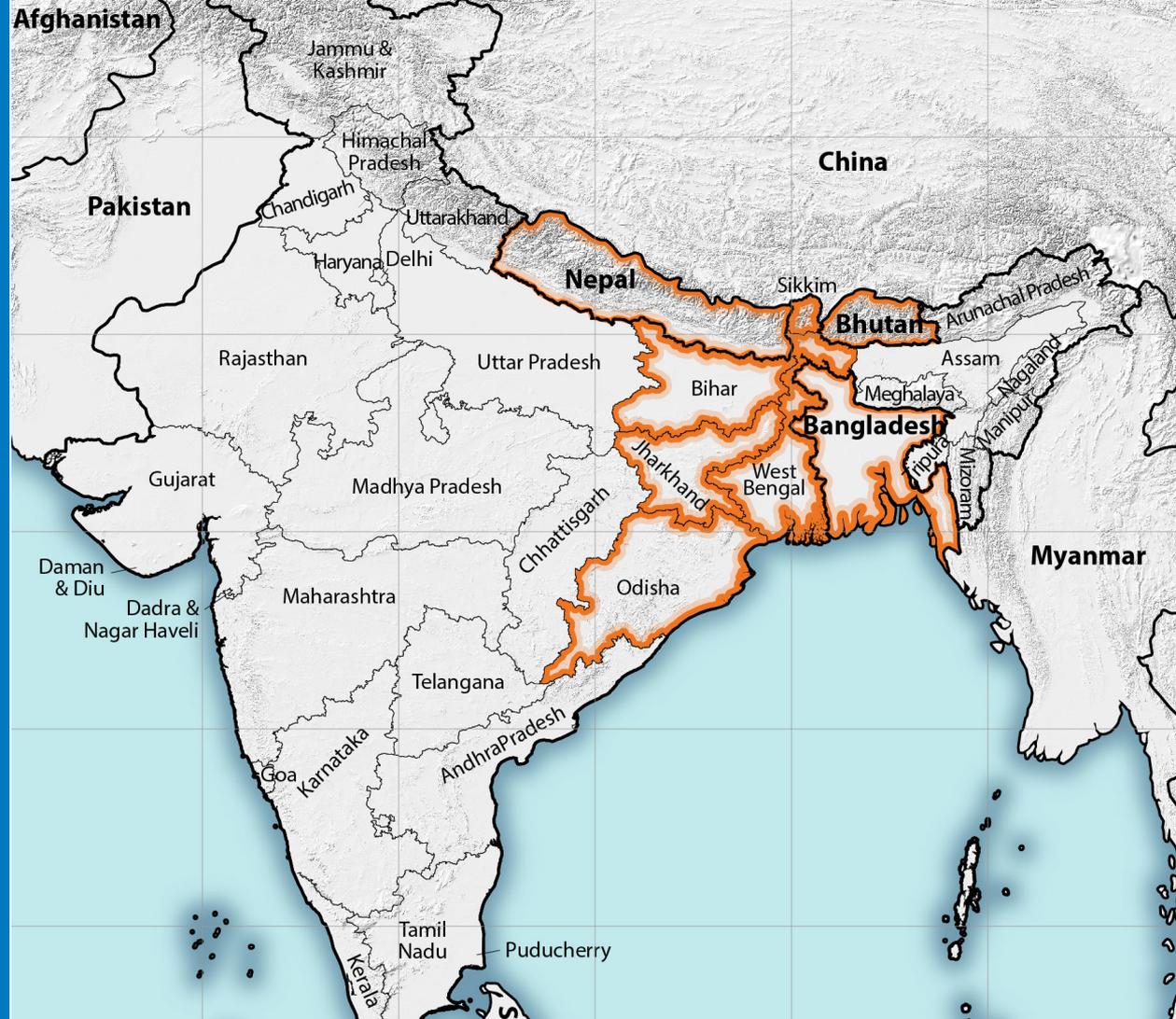
## Efficiency is dynamic

Pooling and central dispatch can coordinate complex combinations of changing flows on the network

# What might happen with full coordination through a BBIN ISO?

## Key modeling assumptions:

- No obstacles among states within ISO
- Same state-to-state obstacles between ISO and non-ISO states



# Highlights of findings (scenarios with Bangladesh)

	BAU	CO	ISO	Change, BAU to CO	Change, CO to ISO
<b>Total Generation (TWh)</b>					
BBIN	215	221	225	2.8%	1.8%
Rest of India	1,450	1,444	1,440	-0.4%	-0.3%
<b>Total Production Cost (USD million)</b>					
BBIN	\$7,458	\$7,249	\$7,301	-2.8%	0.7%
Rest of India	\$40,872	\$40,574	\$40,439	-0.7%	-0.3%
<b>Total Production Cost (USD per MWh)</b>					
BBIN	\$34.67	\$32.78	\$32.42	-5.4%	-1.1%
Rest of India	\$28.19	\$28.10	\$28.09	-0.3%	negligible

*BBIN generates*

*more, exports to  
rest of India*

*Cost per MWh is*

*lower for all  
areas*

## Key findings (focus on CBET and pooling)

Without greater regulatory coordination, more hydro development in Nepal might not increase CBET significantly

With coordinated operations (Nepal treated the same as Indian states in power pooling arrangements), more hydro from Nepal could reduce India's generation costs by 1.3%

- Benefit to Eastern RLDC: production costs 3.8% lower

While CBET benefits to all of India might be negligible, benefits to Bihar, UP and states close to Nepal (where generation costs per MWh tend to be higher than India average) could be significant

# Power Pooling Models in the United States

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Full (security-constrained economic dispatch by RTO)

Limited (energy balancing, sharing area control error)

# Regional transmission organizations

Single open-access transmission tariff approved by regulator

## Unit commitment

- Review hour load forecasts
- Review unit scheduling

## Ancillary services

- Determine MW needed for each service
- Conduct AS market

## Day-ahead market

- Dispatch based on load forecast, generator offers

## Real-time market

- Dispatch based on real-time imbalances

Long-term resource adequacy  
*Forward capacity market*  
*Scarcity pricing*

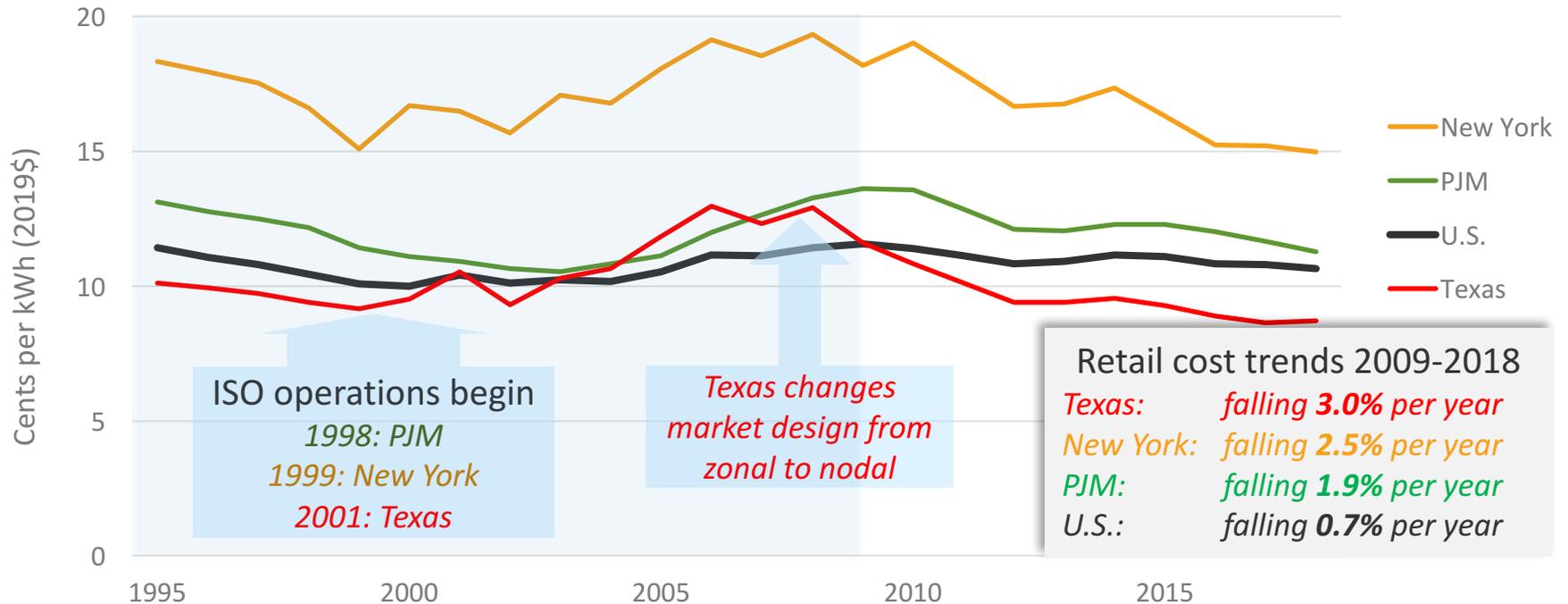
Financial transmission rights  
*Competitive auction for surplus revenues due to congestion*

## Market monitoring

*Detect anticompetitive behavior and market manipulation, provide evidence for prosecution*

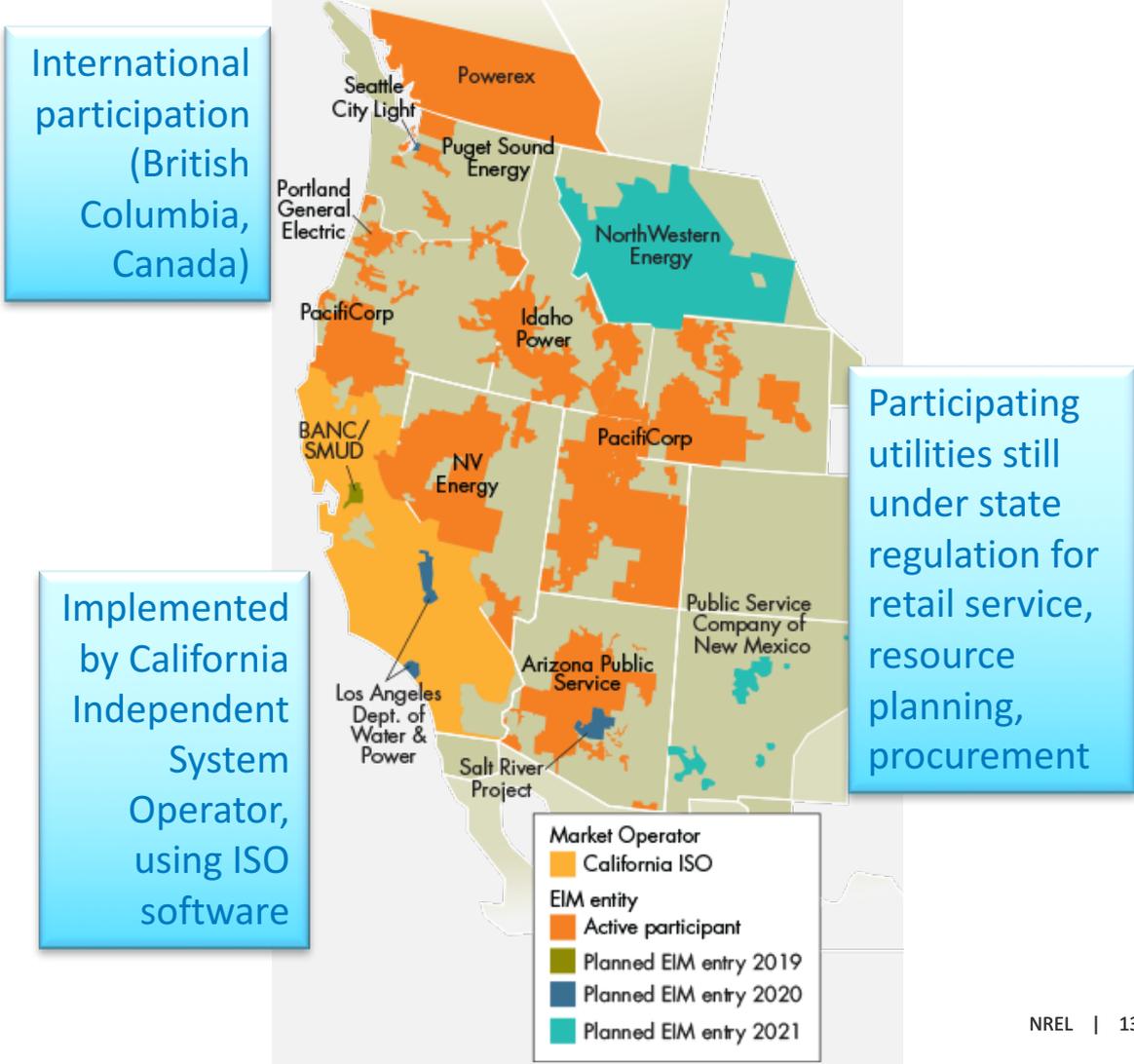
# Pool operations saving money for many customers

Inflation-adjusted retail electricity costs in selected U.S. states with RTOs



# Western Energy Imbalance Market

- Began in 2014
- Function: combine area control error, pool resources for energy balancing (no joint dispatch apart from balancing)
- Savings since inception: **\$565 million** (IRs 3,895 crore)



# Key lessons from U.S. experience

Full coordination through an ISO can yield significant economic savings, but it might take time to work out the problems

States can develop agreements for power pooling that preserve their jurisdictional authority while providing benefits to customers

- Even if limited to balancing, savings can be significant

Any pooling arrangement will re-define regulatory roles

- Less price setting, more policing and monitoring to prevent manipulation and anticompetitive behavior
- Processes tend to be more transparent, stakeholder-driven

# Two U.S. Models of Power Pool Governance

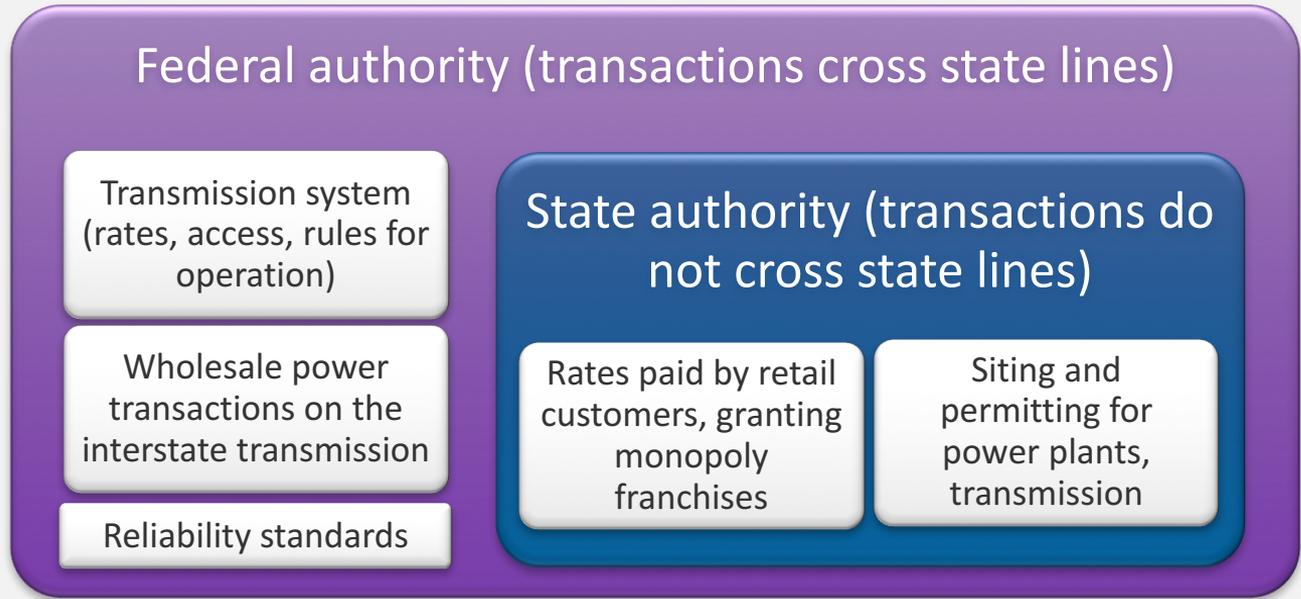
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Jurisdictional division

Southwest Power Pool

Western Energy Imbalance Market

In the United States, the business of generating and delivering electricity is often one creature with several masters regardless of pooling



## Reconciling authority across jurisdictions

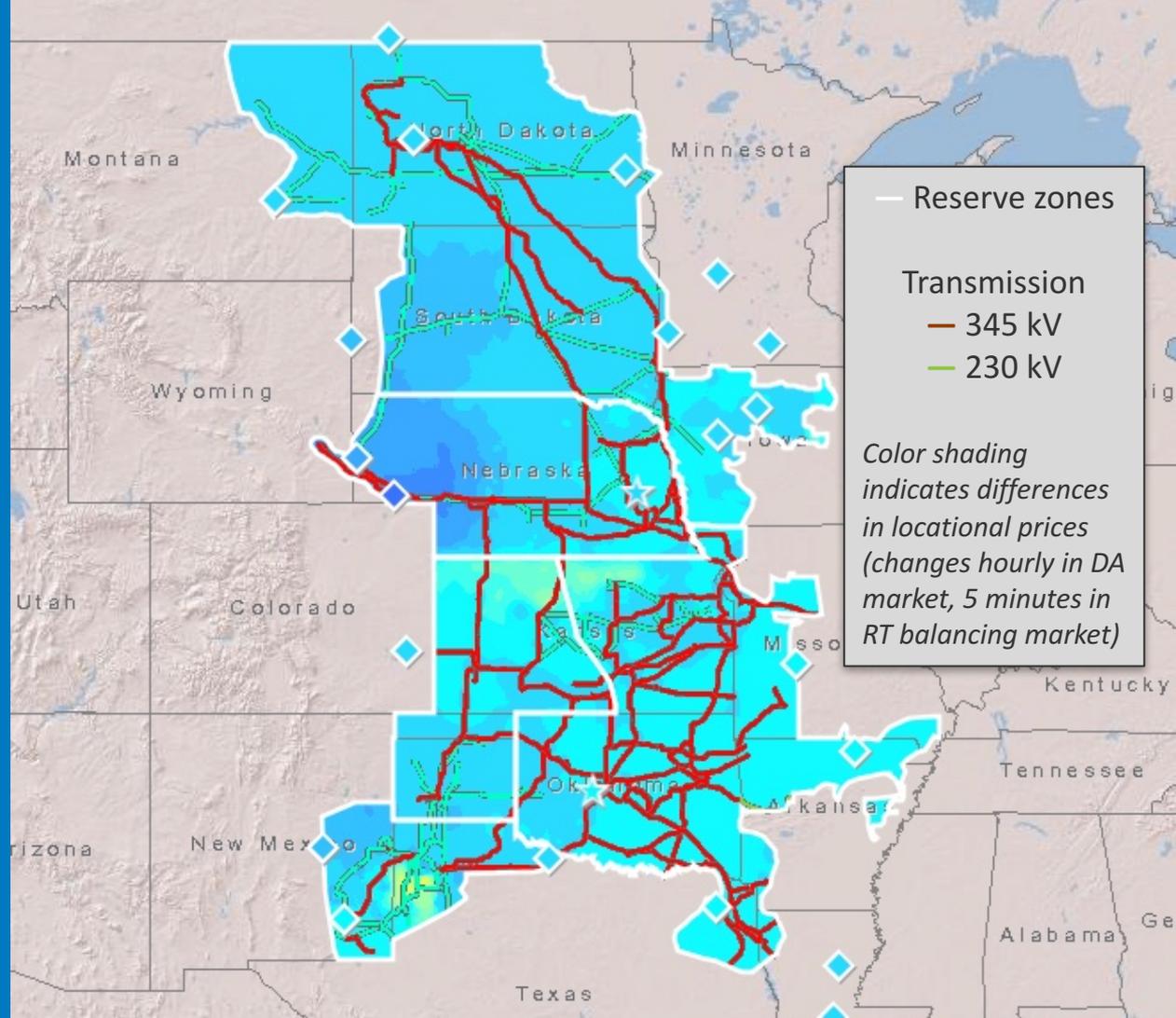
Under the U.S. Constitution, only the federal government may regulate the movement of goods or services across state boundaries

# Southwest Power Pool: Regional Transmission Organization (RTO)

Operates in central U.S.

Integrated market (real-time, day-ahead, ancillary services)

Market rules and tariff must be approved by federal regulators

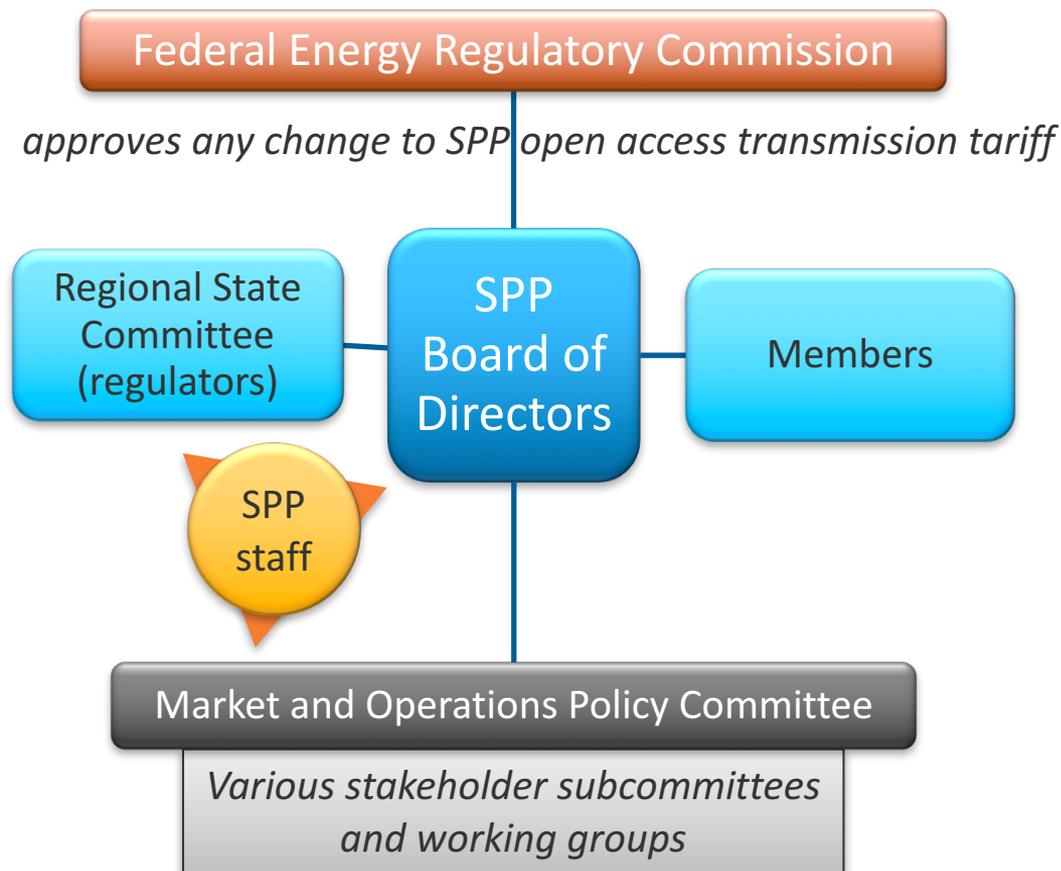


## Governed by an independent board of directors

“Independent” means no affiliation with any SPP member

Stakeholders provide input to market operations and policy through committees

Proposals to change OATT must come from board (or RSC)



# SPP Regional State Committee of state regulators

- One regulatory commissioner from each SPP state
- No vote on SPP Board, but empowered to form proposals on key policy issues such as resource adequacy and cost allocation for transmission investments
  - Funding and staff support provided by SPP
- Any proposal must be approved by federal regulators, and SPP board can submit alternative proposals.
- Federal regulators tend to give great weight to positions taken by state regulators

# SPP Regional State Committee of state regulators

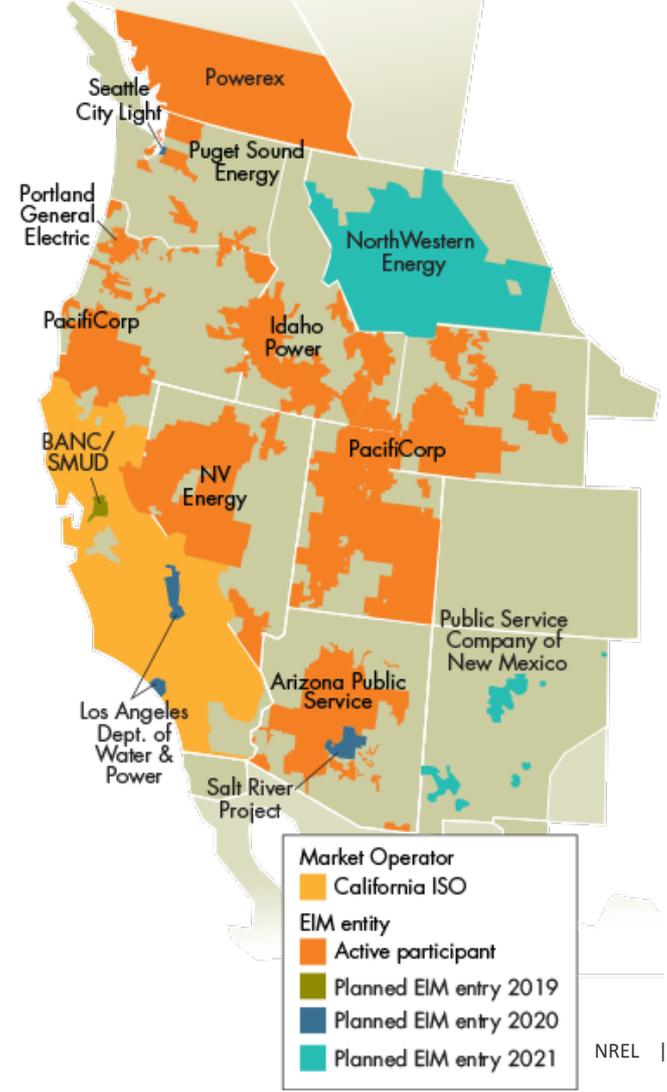
*(From SPP Bylaws)*

The RSC has primary responsibility for determining regional proposals and the transition process in the following areas:

- whether and to what extent participant funding will be used for transmission enhancements;
- whether license plate or postage stamp rates will be used for the regional access charge;
- FTR allocation, where a locational price methodology is used; and
- the transition mechanism to be used to assure that existing firm customers receive FTRs equivalent to the customers' existing firm rights.

# Western EIM

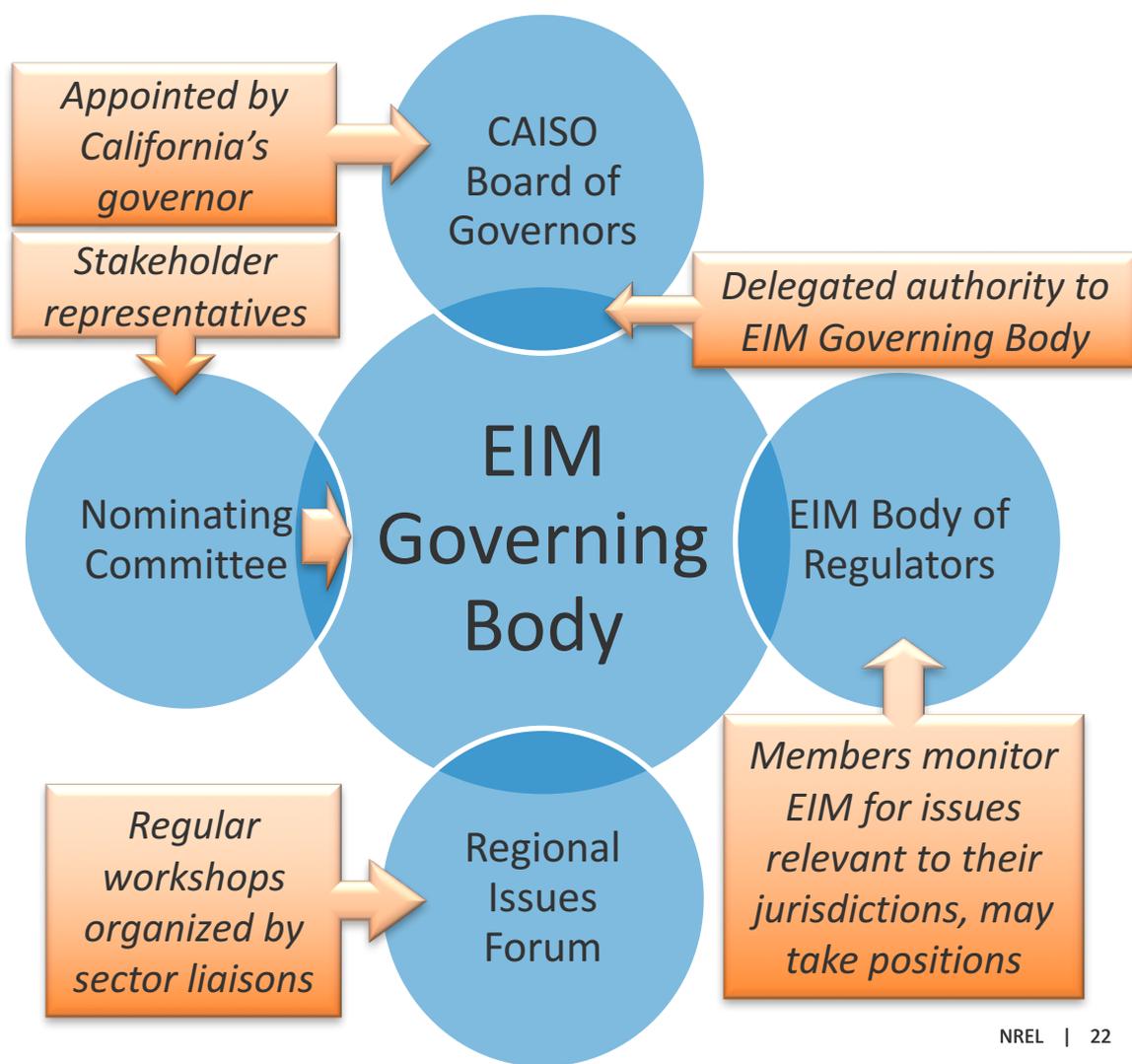
- Discussions began around 2010, with Western States seeking ways to integrate large amounts of wind and solar
  - Options ranged from modest (pooling area control error among participating states) to extensive (west-wide ISO)
  - California was reluctant to share control of CAISO; other states were reluctant to join a California-dominated ISO
- EIM was a middle path with extra potential benefits



## Division of authority for EIM governance

CAISO operates the EIM. It is primarily responsible to California officials, who consent to delegating EIM related authority to the EIM Governing Body.

Representatives of stakeholder groups form a nominating committee for Governing Body membership



# General governance principles

- Division of labor between stakeholders and regulators
  - Major policy issues are reserved to the ultimate regulatory authority (or to legislation)
  - Stakeholder processes aim for consensus on implementation details and operational matters
    - Regulatory body acts as an appeals court or arbitrator when stakeholders fail to reach consensus
  - Stakeholders are usually organized into sectors (e.g., transmission owners, merchant generators, distribution utilities, industrial customers, small customers); normally each sector has one seat on the governing board

# General governance principles

- “Collaborative federalism”
  - Central regulators might have ultimate legal authority, but state regulators often have special input through designated bodies
    - Effective if central regulators signal intent to place special weight on positions taken by state regulators
  - Multijurisdictional issues are easier when power pool is simpler
    - In the case of the Western EIM, federal regulators sought a governance model that would prevent one state (California) from dominating all others
    - Talks for full Western RTO stalled; California wants to retain CAISO control, other states want equal role in governance

# General governance principles

- Transparency
  - Nominees for governing board are often screened by a membership committee to ensure no conflict of interest, ensure diversity of expertise
  - Decisions made by pool's governing body and all operating committees are made in open meetings
  - Categories of competitively sensitive information are specified
- Market monitoring and oversight
  - All US RTOs have an independent market monitor (IMM)
  - Government prosecutes cases of market power abuse, anticompetitive behavior, market manipulation
  - IMM identifies and proposes improvements to market rules

# Questions and discussion

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[www.nrel.gov](http://www.nrel.gov)

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