Talk Outline

1) Regional Transmission Organization Overview

2) Decision Making and Policy Implementation within Different RTOs

3) Case Study: Transmission Planning within the MISO Region

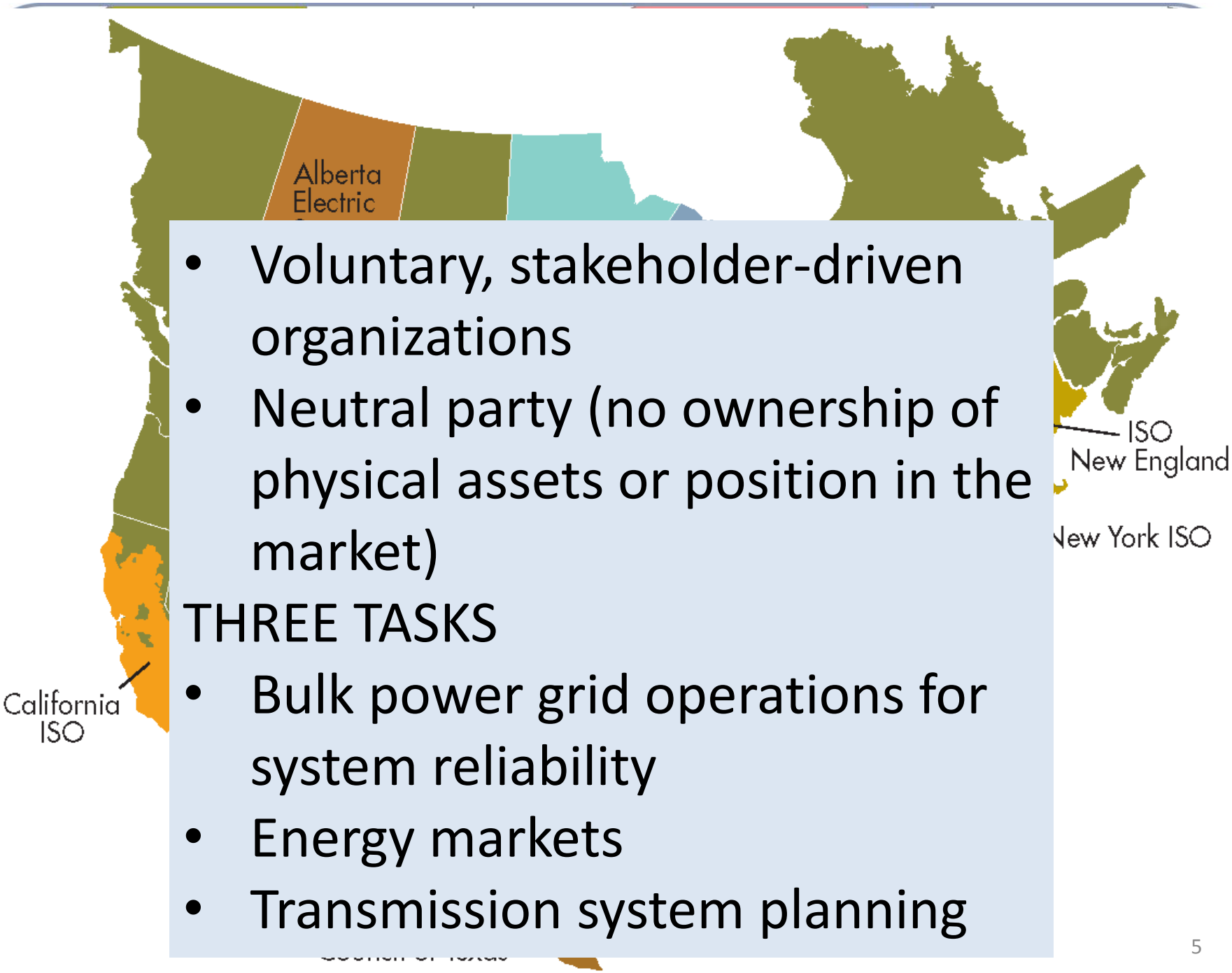
BONUS: Power, The Play

4) Future Research Directions for Energy and Policy Implementation

"We have a couple things we do at the ISO level… all we really are is the air traffic controller of what we call the bulk power supply, which is a lot more voltage than you have going to your house…These are kind of like the superhighways of electricity."

-RTO Focus Group participant

70%

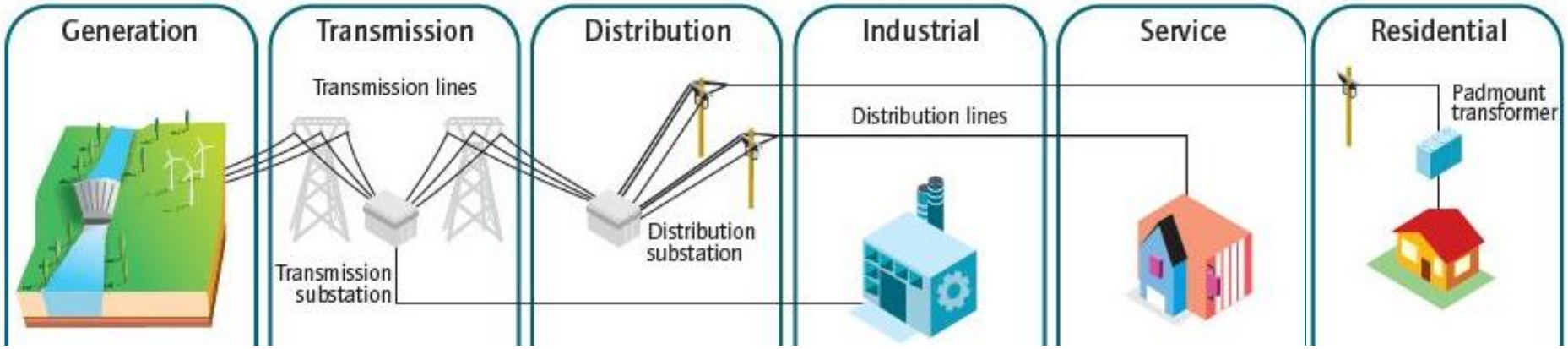


- Voluntary, stakeholder-driven organizations
- Neutral party (no ownership of physical assets or position in the market)

THREE TASKS

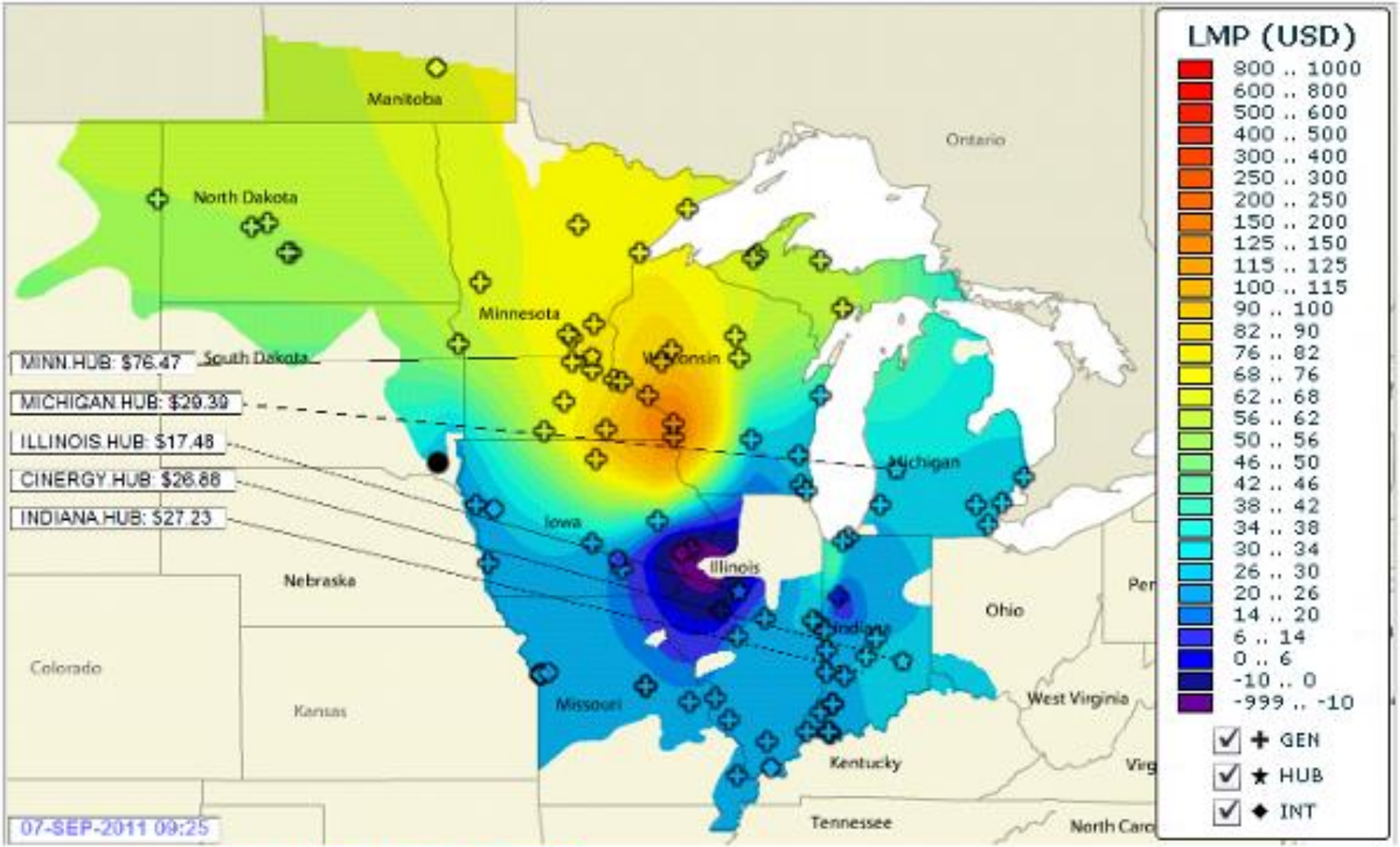
- Bulk power grid operations for system reliability
- Energy markets
- Transmission system planning

The Electric Grid

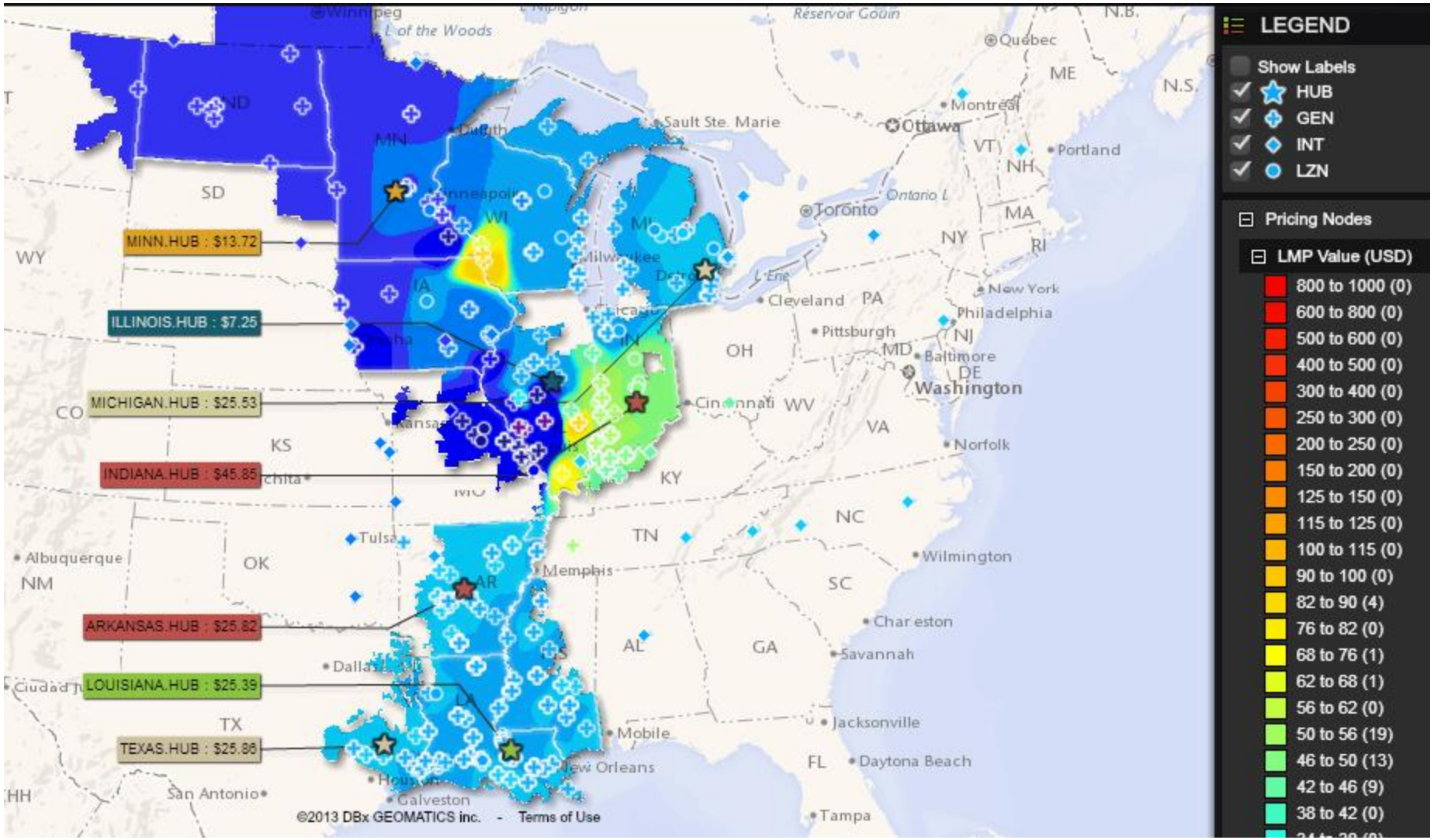


RTO/ISO

Midwest ISO real-time LMP, 9/7/2011, 9:25 a.m.



Source: Midwest Independent System Operator.


MINN.HUB : $13.72
ILLINOIS.HUB : $7.25
MICHIGAN.HUB : $25.53
INDIANA.HUB : $45.85
ARKANSAS.HUB : $25.82
LOUISIANA.HUB : $25.39
TEXAS.HUB : $25.86
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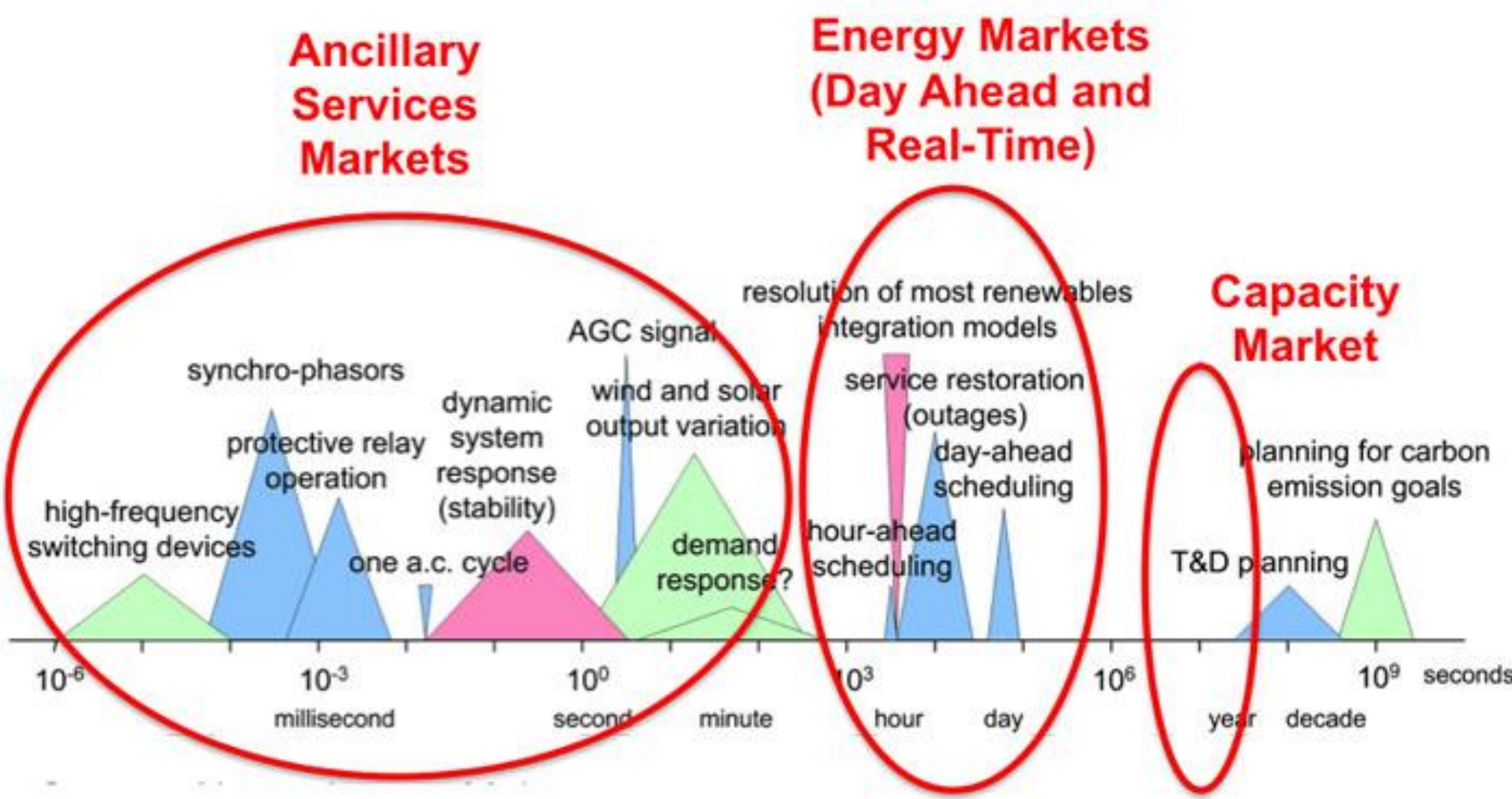
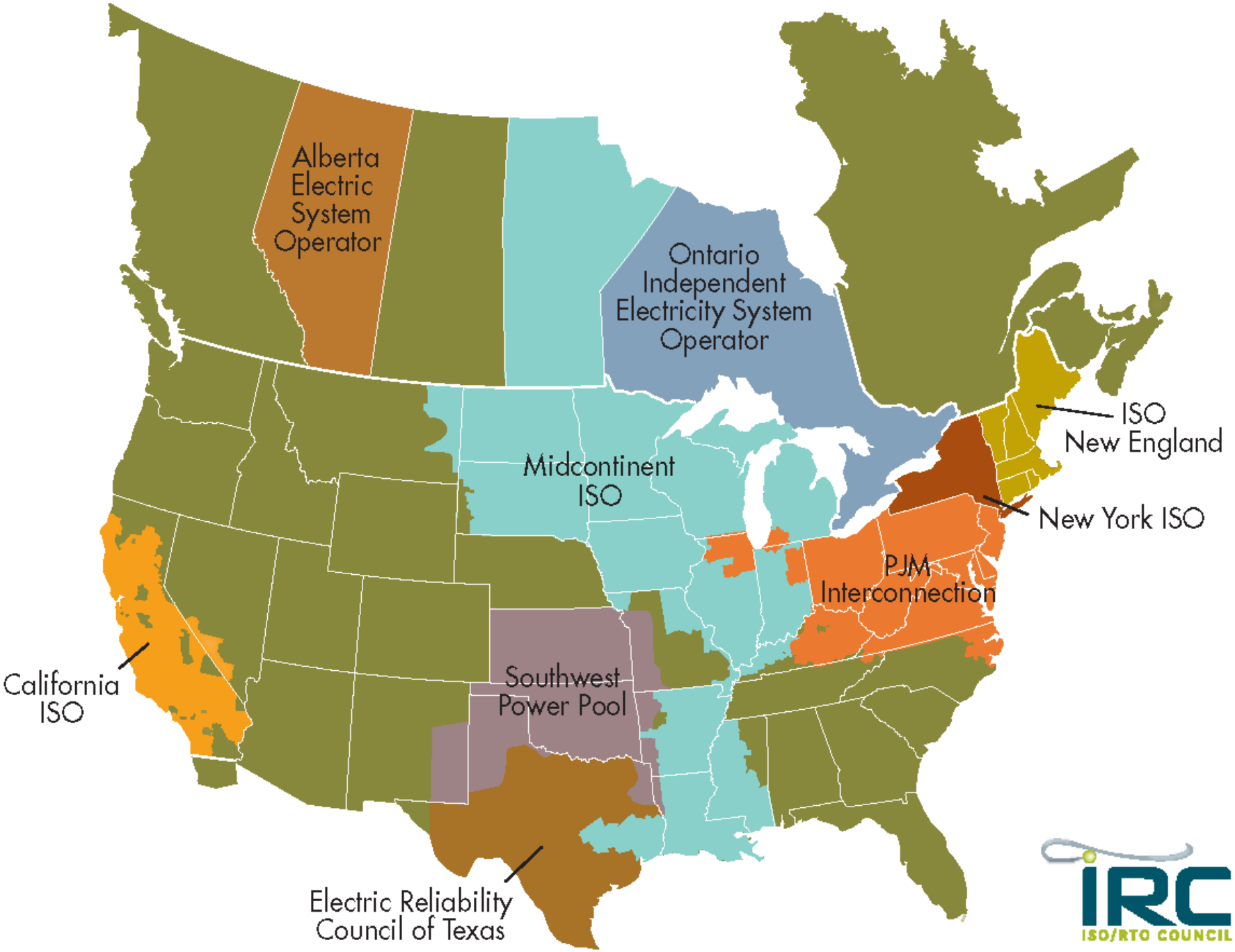
LEGEND
Show Labels
HUB
GEN
INT
LZN
Pricing Nodes
LMP Value (USD)
800 to 1000 (0)
600 to 800 (0)
500 to 600 (0)
400 to 500 (0)
300 to 400 (0)
250 to 300 (0)
200 to 250 (0)
150 to 200 (0)
125 to 150 (0)
115 to 125 (0)
100 to 115 (0)
90 to 100 (0)
82 to 90 (4)
76 to 82 (0)
68 to 76 (1)
62 to 68 (1)
56 to 62 (0)
50 to 56 (19)
46 to 50 (13)
42 to 46 (9)
38 to 42 (0)



From Sascha von Meier

Regional Transmission Organization	Jurisdiction	Customers	Generation capacity	Miles of HV Transmission Line (km)
PJM	Multi-state	61 million	183,000 MW	63,000 (101,000)
ISO-NE	Multi-state	14 million	32,000 MW	8,000 (13,000)
MISO	Multi-state	48 million	205,759 MW	65,000 (104,000)
SPP	Multi-state	15 million	77,366 MW	48,000 (77,000)
ERCOT	Single state	23 million	84,000 MW	40,500 (65,000)
CA-ISO	Single state	30 million	59,000 MW	25,900 (41,000)
NYISO	Single state	19.5 million	37,925 MW	11,005 (18,000)


Alberta Electric System Operator
Ontario Independent Electricity System Operator
ISO New England
New York ISO
Midcontinent ISO
PJM Interconnection
California ISO
Southwest Power Pool
Electric Reliability Council of Texas
IRC
ISO/RTO COUNCIL

NSF PROJECT: Decision Making within RTOs

Review of documents and observation of meetings

Stakeholder Meetings

Stakeholder meetings provide Members with the opportunity for communication and interaction. The purpose of stakeholder meetings is to foster collaboration, not legislation. The two types of meetings are stakeholder groups and symposiums and forums.

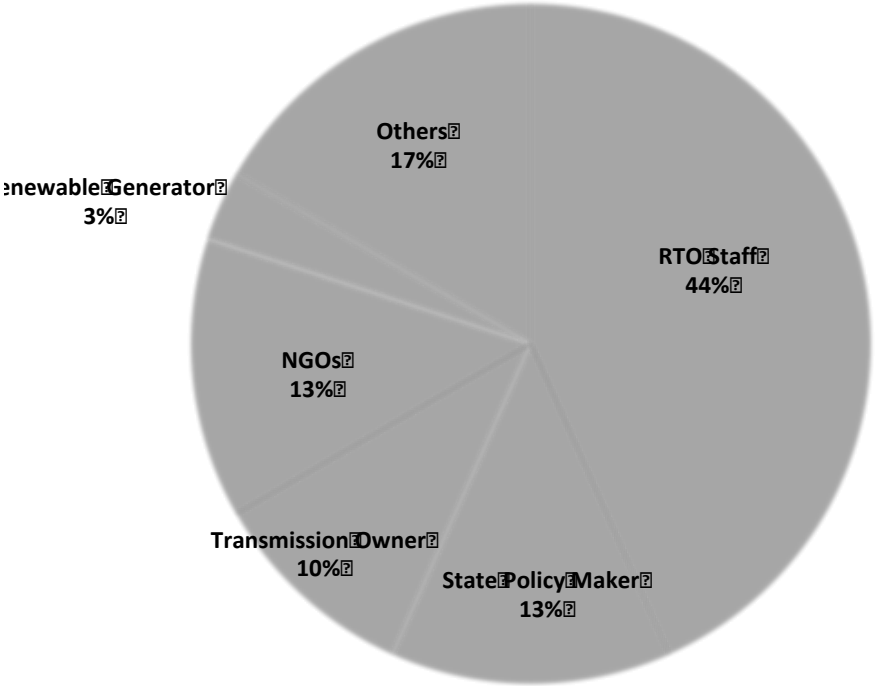
Stakeholder Groups

- eData/eDataFeed Stakeholder Group
- PJM Online Tools Refresh
- General Session
- Inter-Regional Planning Stakeholder Advisory Committee - MISO

Symposiums and Forums

PJM annual meeting 2014 of members

Semi-structured interviews with stakeholders



48 interviews in PJM/MISO /CAISO to date

Theoretical Frameworks

- RTOs as Boundary Organizations
- Consensus/Dissensus
- Policy Innovation and Implementation in Practice

EFFECTIVE IMPLEMENTATION *in* PRACTICE

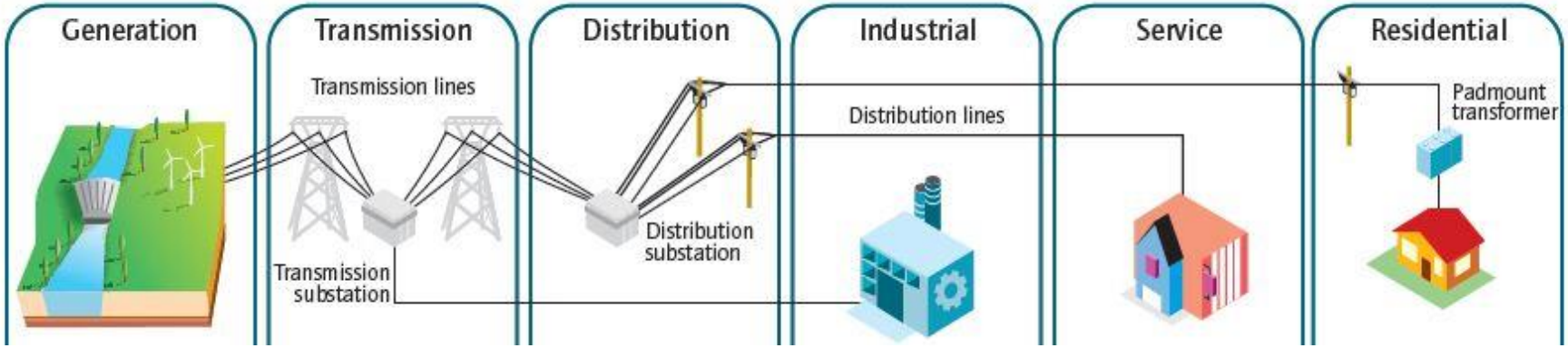
Integrating Public Policy and Management

JODI SANDFORT and
STEPHANIE MOULTON

JOSSEY-BASS™
A Wiley Brand

Key Actors in RTO Decision Making

Electric System



Stakeholders

RTO/ISO

Generation Utilities

Distribution Utilities

State- PUC, Energy Office (Policies &Planning), Environmental Office (Siting)

Industrial, Commercial & Residential Consumers

FERC

Federal and State Courts

Civil Society Stakeholders

Stakeholder Classes

PJM (5)

- Transmission Owners
- Generation Owners
- Electricity Distributors
- End Use Sectors
- Others

CAISO (6)

- Transmission Owners
- Generation Owners
- Transmission Dependent Utilities
- End Users & Retail Energy Providers
- Alternative Energy Providers
- Public Interest Groups
- Marketers

MISO (10)

- Transmission Owners
- Generation Owners/Independent Power Producers
- Power Marketers
- Transmission Dependent Utilities (munis/co-ops)
- Eligible End Use Customers
- Coordinating Members
- Transmission Developers
- State Regulators (OMS)*
- Consumer Advocates*
- Environmental/Other*

* Non Paying

PJM

"We are 17 years into it.
We're making it up as we go."

--PJM Stakeholder

- Evolved from long-standing power pool
- States have aggressively embraced deregulation
- 5 stakeholder classes
- Committee voting is binding
- Demand Response & capacity markets

MISO

- Evolved from agreements by transmission owners
- 1 state of 15 restructured
- 10 stakeholder classes
- Committee voting is advisory

"Overall, the **climate change** discussion is still a very difficult one in MISO overall. […] You have some states who are on the leading edge, like Minnesota. Then you've got some states who just don't want to talk about it. It's not in their vocabulary yet, or if it is, they don't have anything good to say about it. The longer they can hold it off, the better."

--MISO Stakeholder

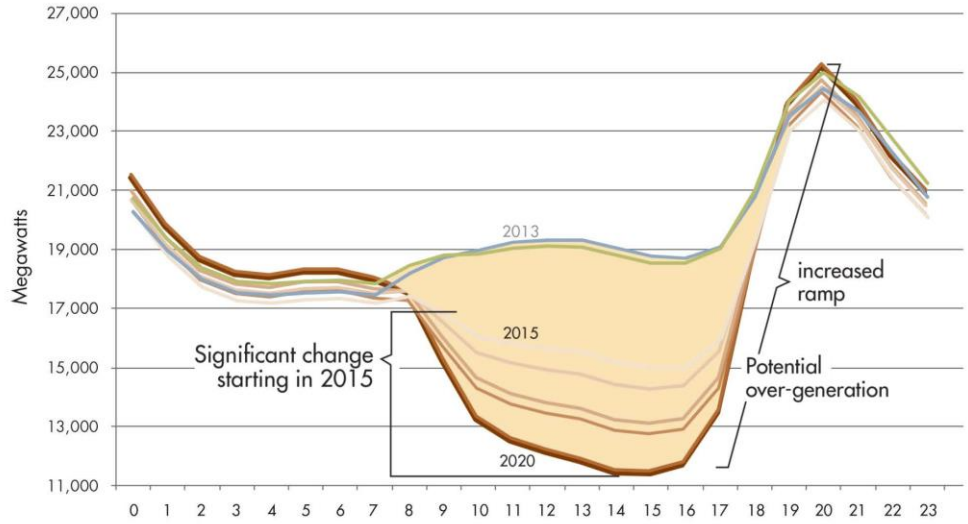
CAISO

"The California legislature and the California Public Utilities Commission and Governor's Office all signed off on this idea of creating an Independent System Operator, but they didn't let go of the idea that it was still a thing—a creature of the state of California."

--CAISO Stakeholder

legislation

- Ad hoc committees
- Shaped by energy crisis
- State interests/political agenda

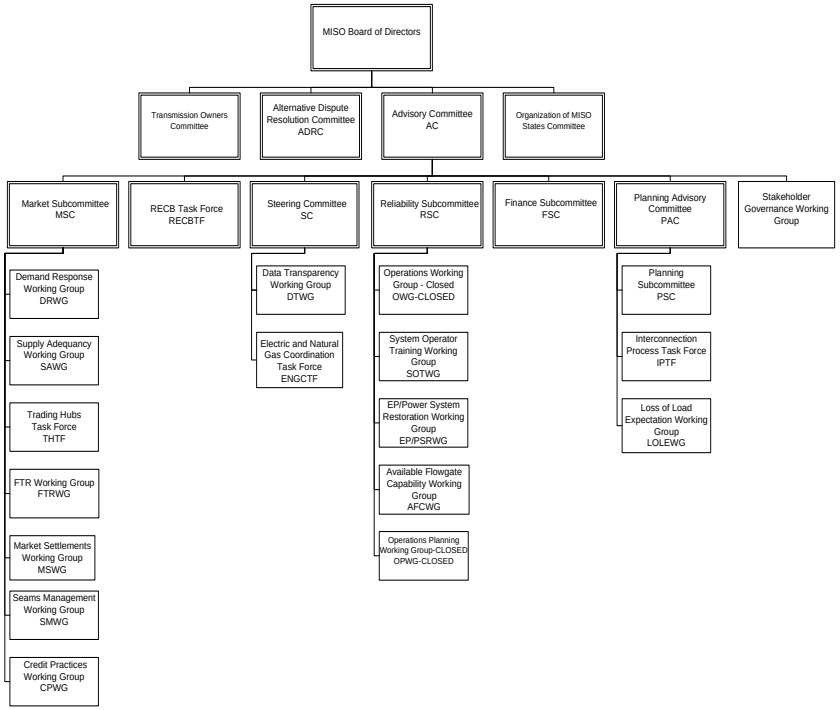


Critical dimensions of difference

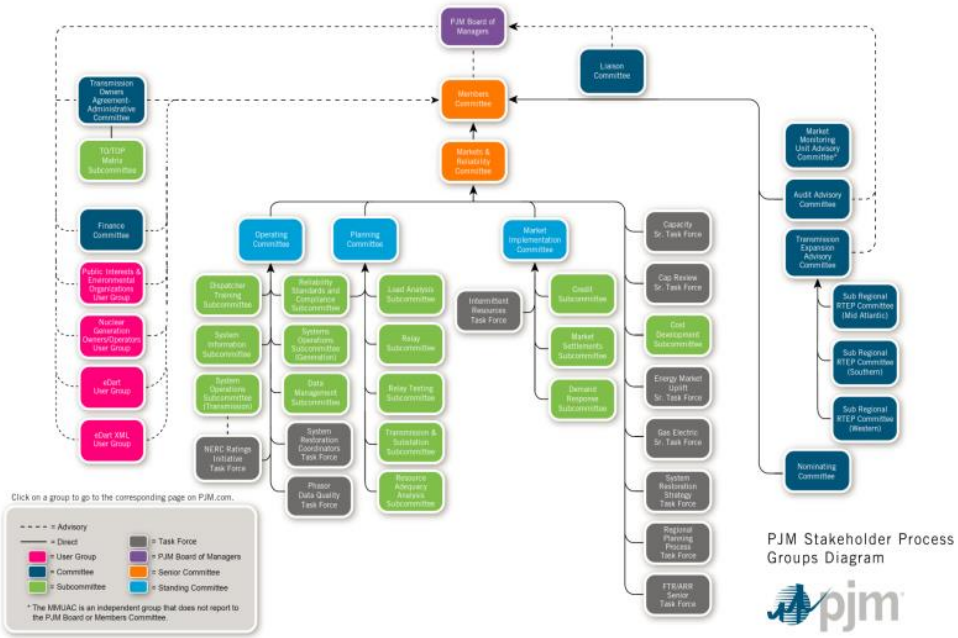
- Single or multi-state
- Member state politics/interests
- Traditionally structured or restructured markets
- RTO member, voting and advisory structure
- RTO stakeholder interests, power and opportunities
- Role of FERC (and shifting politics of FERC)

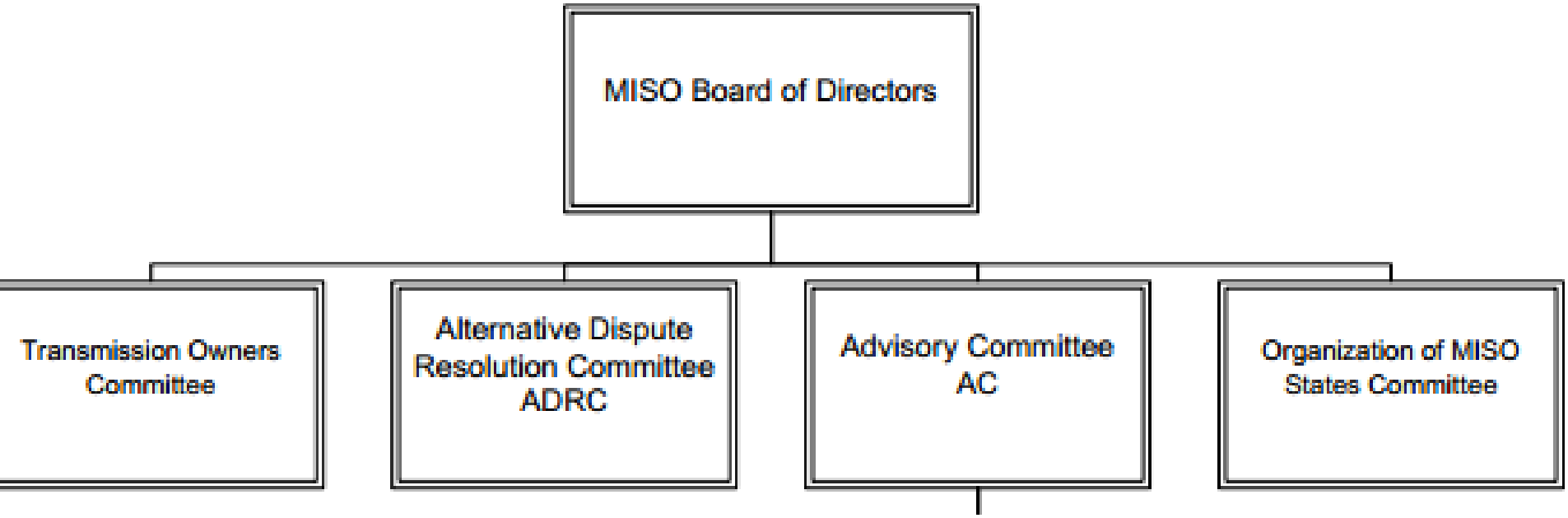
How RTOs Make Decisions (on paper)

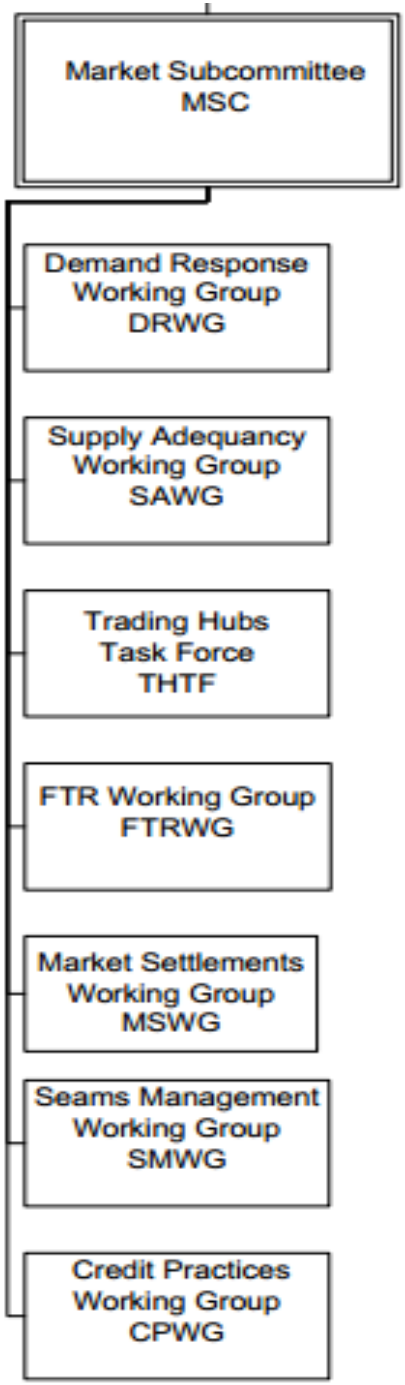
MISO Org. Chart

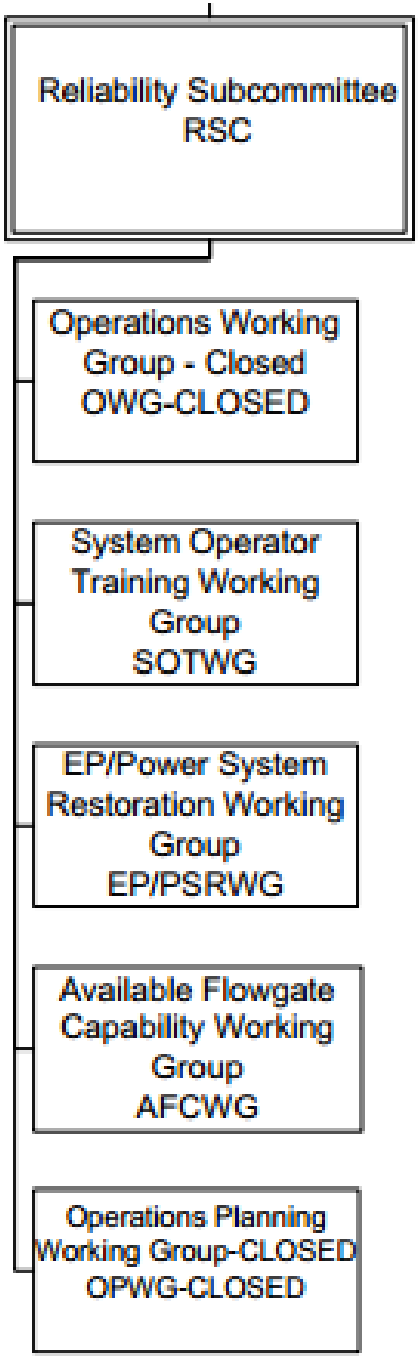


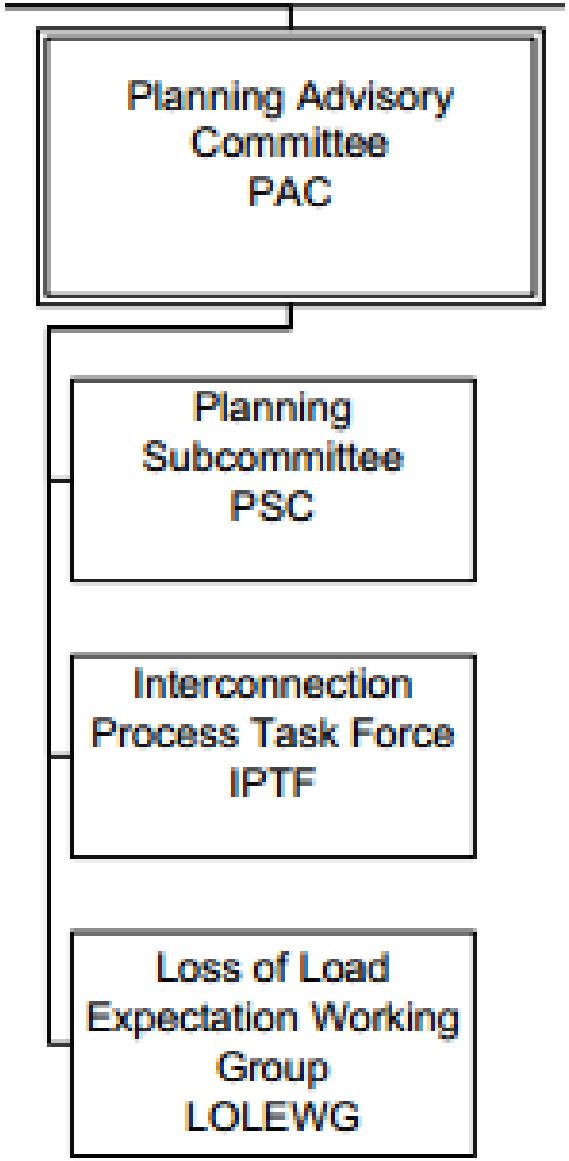
PJM Org. Chart




MISO Board of Directors
Transmission Owners Committee
Alternative Dispute Resolution Committee ADRC
Advisory Committee AC
Organization of MISO States Committee

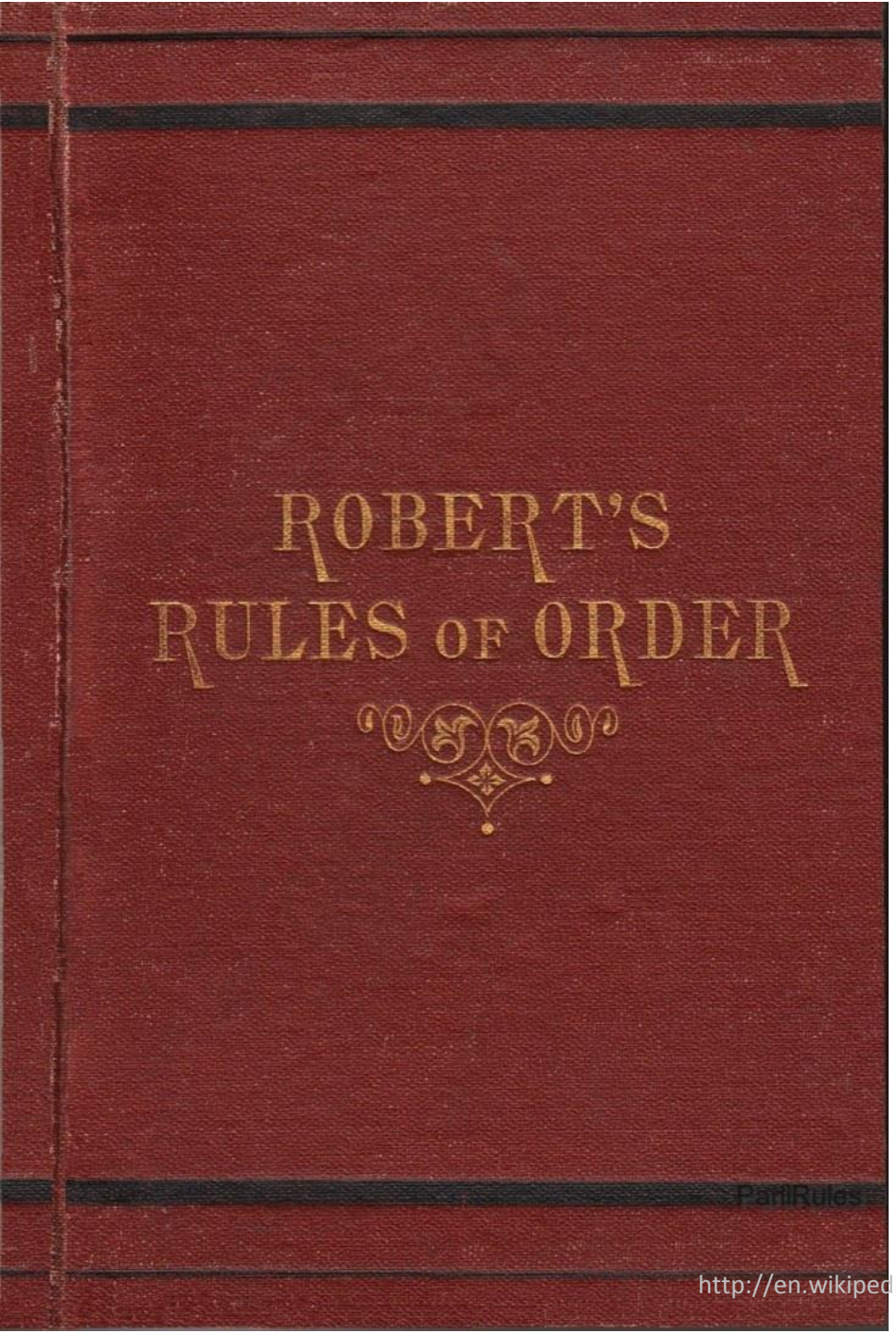

Market Subcommittee
MSC
Demand Response Working Group
DRWG
Supply Adequancy Working Group
SAWG
Trading Hubs Task Force
THTF
FTR Working Group
FTRWG
Market Settlements Working Group
MSWG
Seams Management Working Group
SMWG
Credit Practices Working Group
CPWG


Reliability Subcommittee
RSC
Operations Working Group - Closed
OWG-CLOSED
System Operator Training Working Group
SOTWG
EP/Power System Restoration Working Group
EP/PSRWG
Available Flowgate Capability Working Group
AFCWG
Operations Planning Working Group-CLOSED
OPWG-CLOSED


Planning Advisory Committee
PAC
Planning Subcommittee
PSC
Interconnection Process Task Force
IPTF
Loss of Load Expectation Working Group
LOLEWG

"[I]t's one vote per member in the market subcommittee. They've got two people in the room. One has his transmission owner hat on. The other has their marketer hat on. However they vote, they've only got one vote. […] Our members have some real challenges themselves."

--MISO



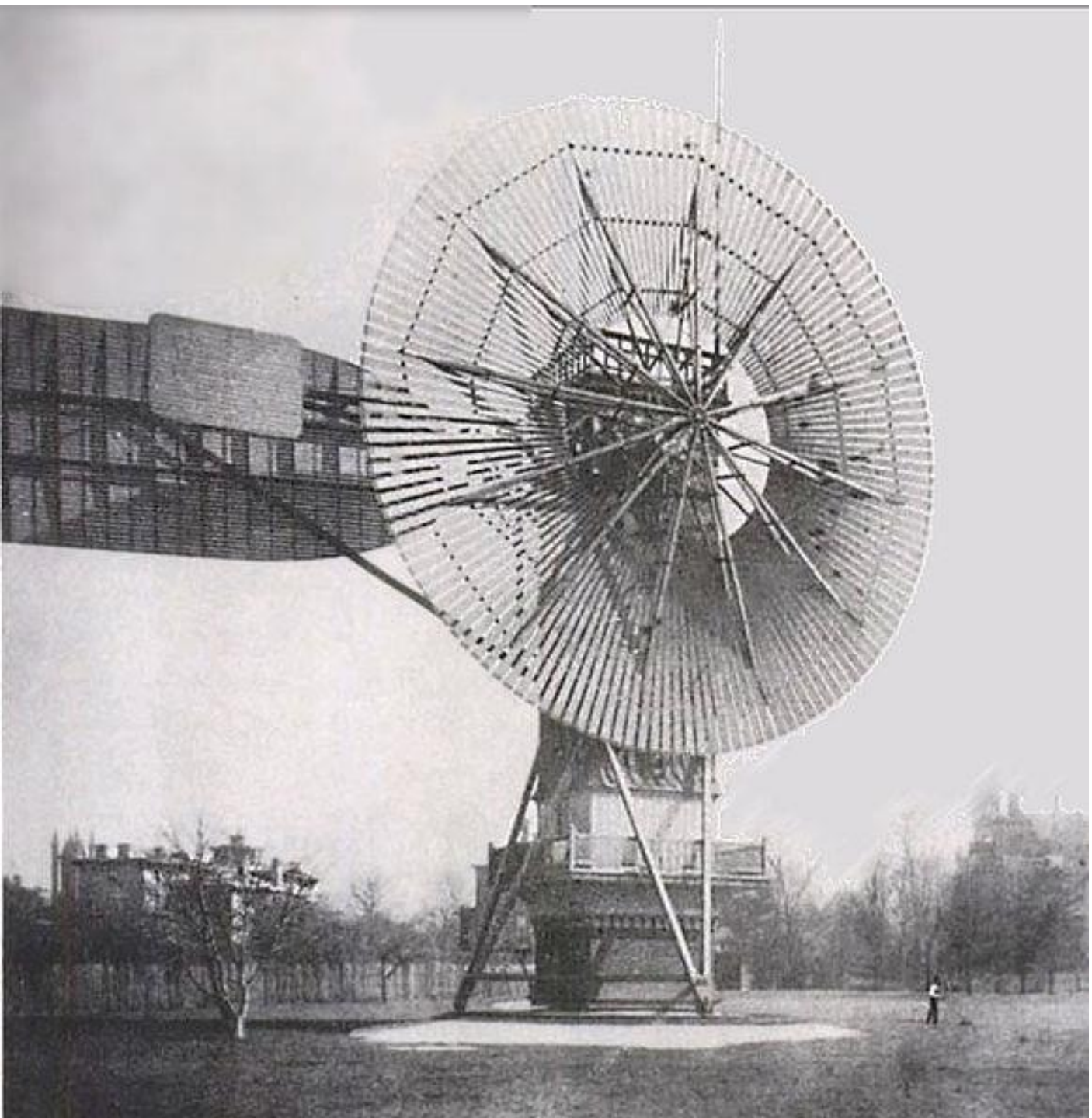
FOLLOW THE RULES

http://en.wikipedia.org/wiki/Robert%27s_Rules_of_Order

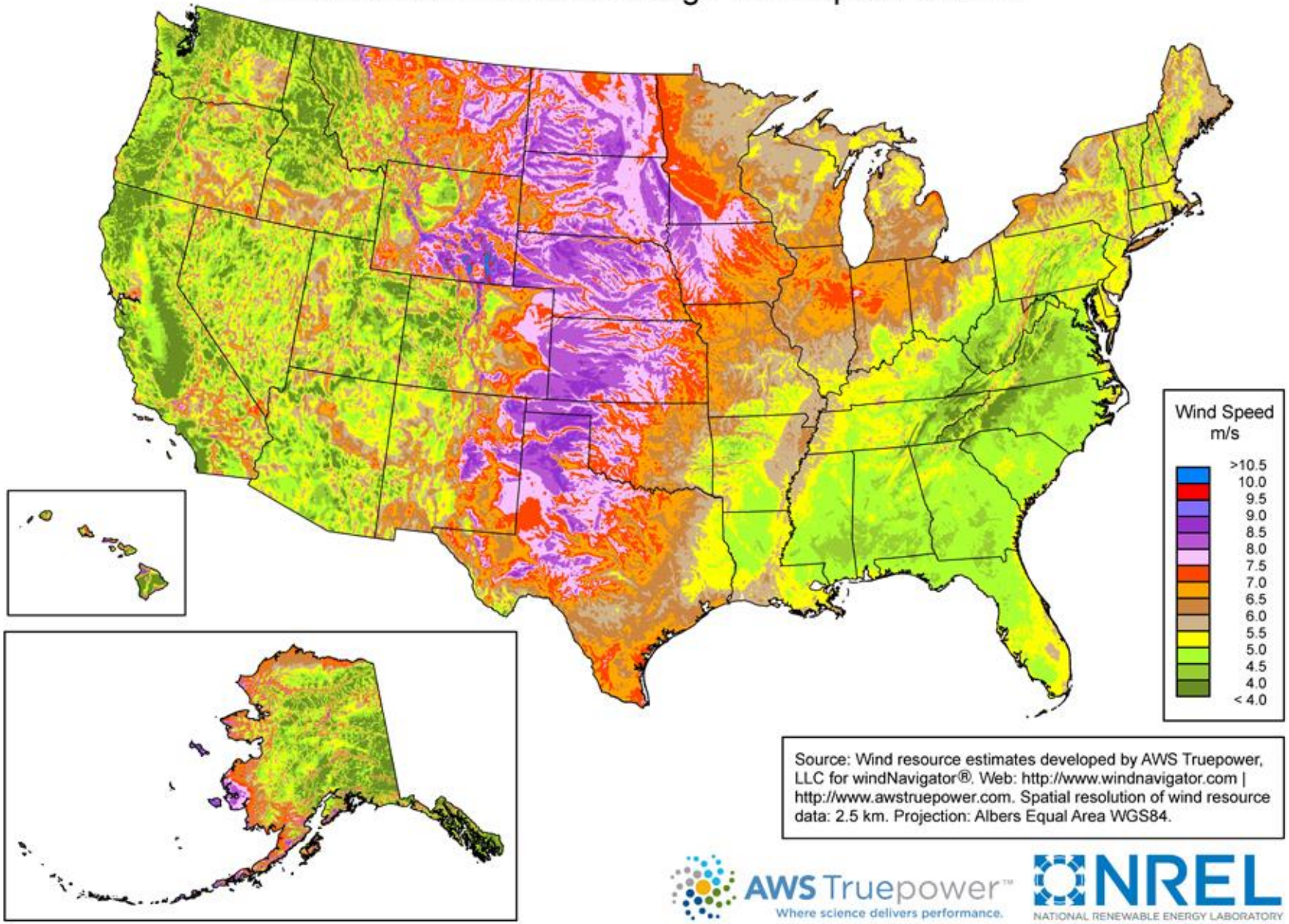
What is a Successful Stakeholder Process?

"Well, I feel that this has been very successful. Everyone is equally dissatisfied."

--*MISO*



United States - Annual Average Wind Speed at 80 m



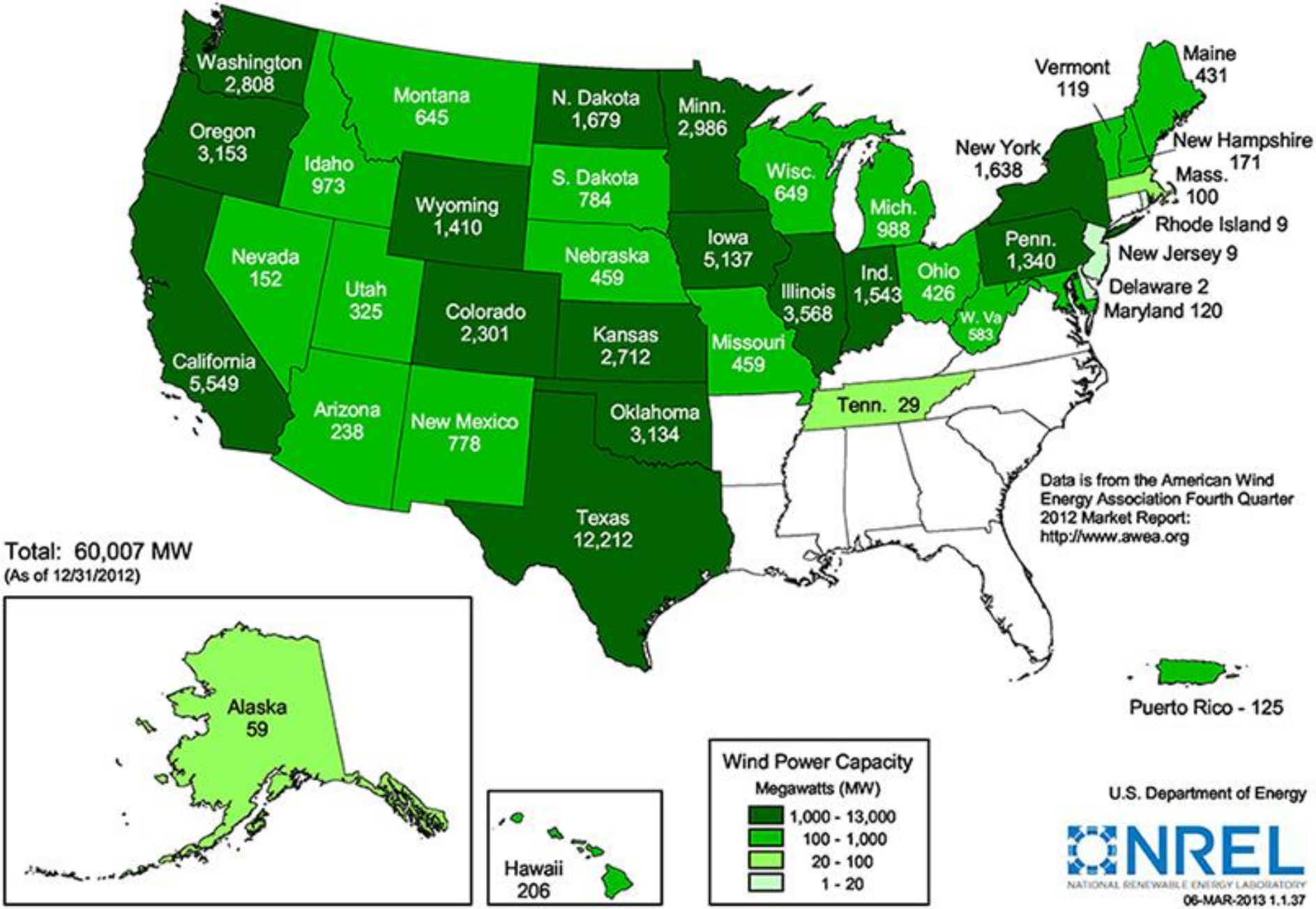
Source: Wind resource estimates developed by AWS Truepower, LLC for windNavigator®. Web: http://www.windnavigator.com | http://www.awstruepower.com. Spatial resolution of wind resource data: 2.5 km. Projection: Albers Equal Area WGS84.

AWS Truepower™
Where science delivers performance.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

01-APR-2011 2.1.1

2012 Year End Wind Power Capacity (MW)



"We have the gift of lots of wind, but it doesn't seem the transmission lines are in the right place. […]

'How do you get the wind from here to there without it being too expensive for the wrong people?' "

--*MISO Stakeholder*

Composite Wind Resource Map

Existing 765 kV
New 765 kV
AC-DC-AC Link

Transmission Lines
Voltage (kV)
345 - 499
500 - 699
700 - 799
1000 (DC)

Source: POWERmap, powermap.platts.com. ©2007 Platts, a division of the McGraw-Hill Companies

The remaining states use data from the 1987 "Wind Energy Atlas of the United States".

Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m²	Wind Speed [a] at 50 m m/s	Wind Speed [a] at 50 m mph
2	Marginal	200 - 300	5.6 - 6.4	12.5 - 14.3
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

[a] Wind speeds are based on a Weibull k value of 2.0

U.S. Department of Energy
National Renewable Energy Laboratory

NREL

19-APR-2007 15:9

"We could sit down with crayons and write on a map a few lines that would make all kinds of sense to make stuff move around. Then we would take 20 years to figure out who pays for it."

--CAISO Stakeholder

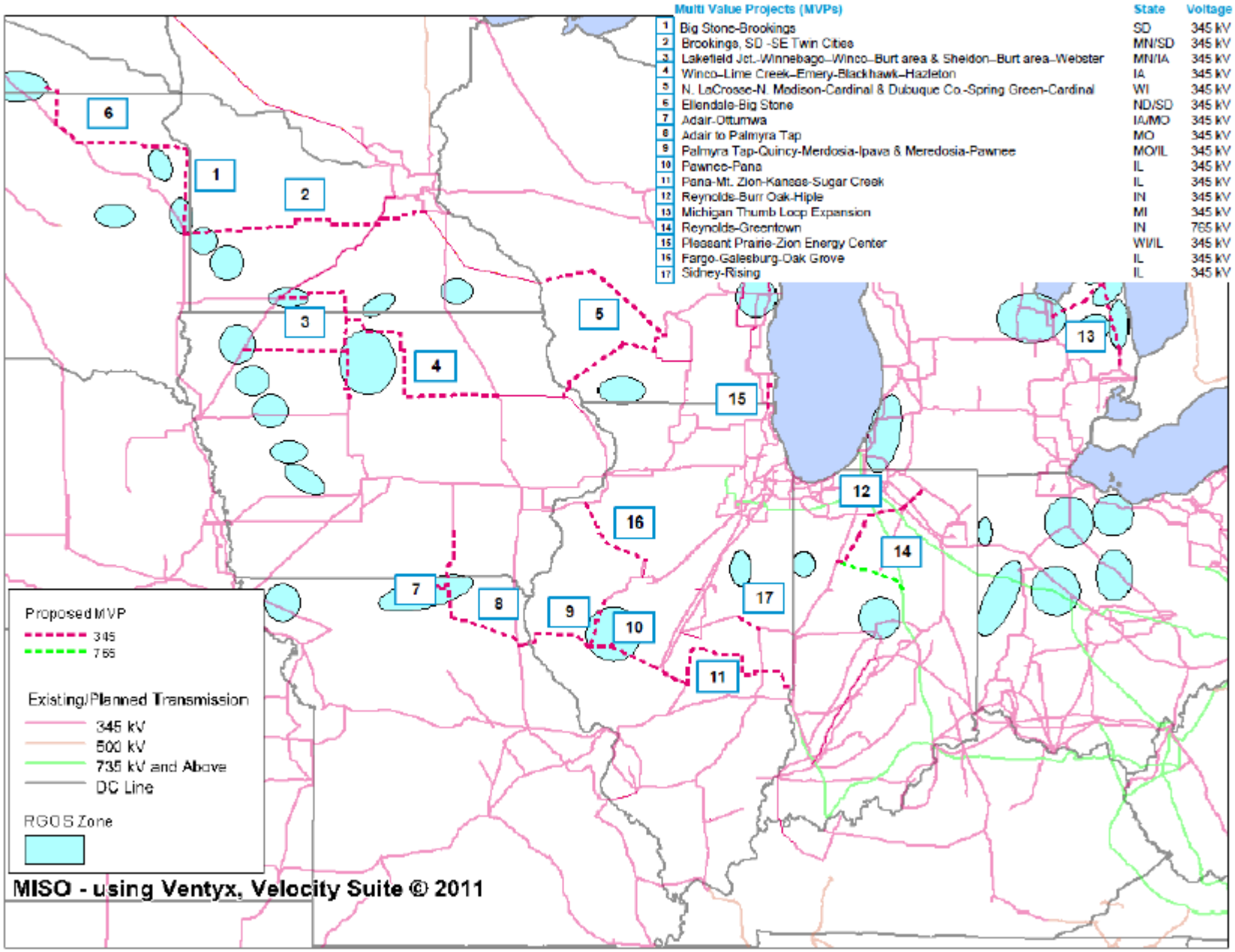
Powerline

The First Battle of America's Energy War

PAUL WELLSTONE and BARRY M. CASPER

Foreword by Tom Harkin

MVP Portfolio



	Multi Value Projects (MVPs)	State	Voltage
1	Big Stone-Brookings	SD	345 kV
2	Brookings, SD -SE Twin Cities	MN/SD	345 kV
3	Lakefield Jct.-Winnebago--Winco--Burt area & Sheldon--Burt area-Webster	MN/IA	345 kV
4	Winco--Lime Creek--Emery-Blackhawk--Hazleton	IA	345 kV
5	N. LaCrosse-N. Madison-Cardinal & Dubuque Co.-Spring Green-Cardinal	WI	345 kV
6	Ellendale-Big Stone	ND/SD	345 kV
7	Adair-Ottumwa	IA/MO	345 kV
8	Adair to Palmyra Tap	MO	345 kV
9	Palmyra Tap-Quincy-Merdosia-Ipava & Meredosia-Pawnee	MO/IL	345 kV
10	Pawnee-Pana	IL	345 kV
11	Pana-Mt. Zion-Kansas-Sugar Creek	IL	345 kV
12	Reynolds-Burr Oak-Hiple	IN	345 kV
13	Michigan Thumb Loop Expansion	MI	345 kV
14	Reynolds-Greentown	IN	765 kV
15	Pleasant Prairie-Zion Energy Center	WI/IL	345 kV
16	Fargo-Galesburg-Oak Grove	IL	345 kV
17	Sidney-Rising	IL	345 kV

Cost Allocation

=

Blood Sport

Figure A51: Day-Ahead Scheduling Versus Real-Time Wind Generation
2012–2013

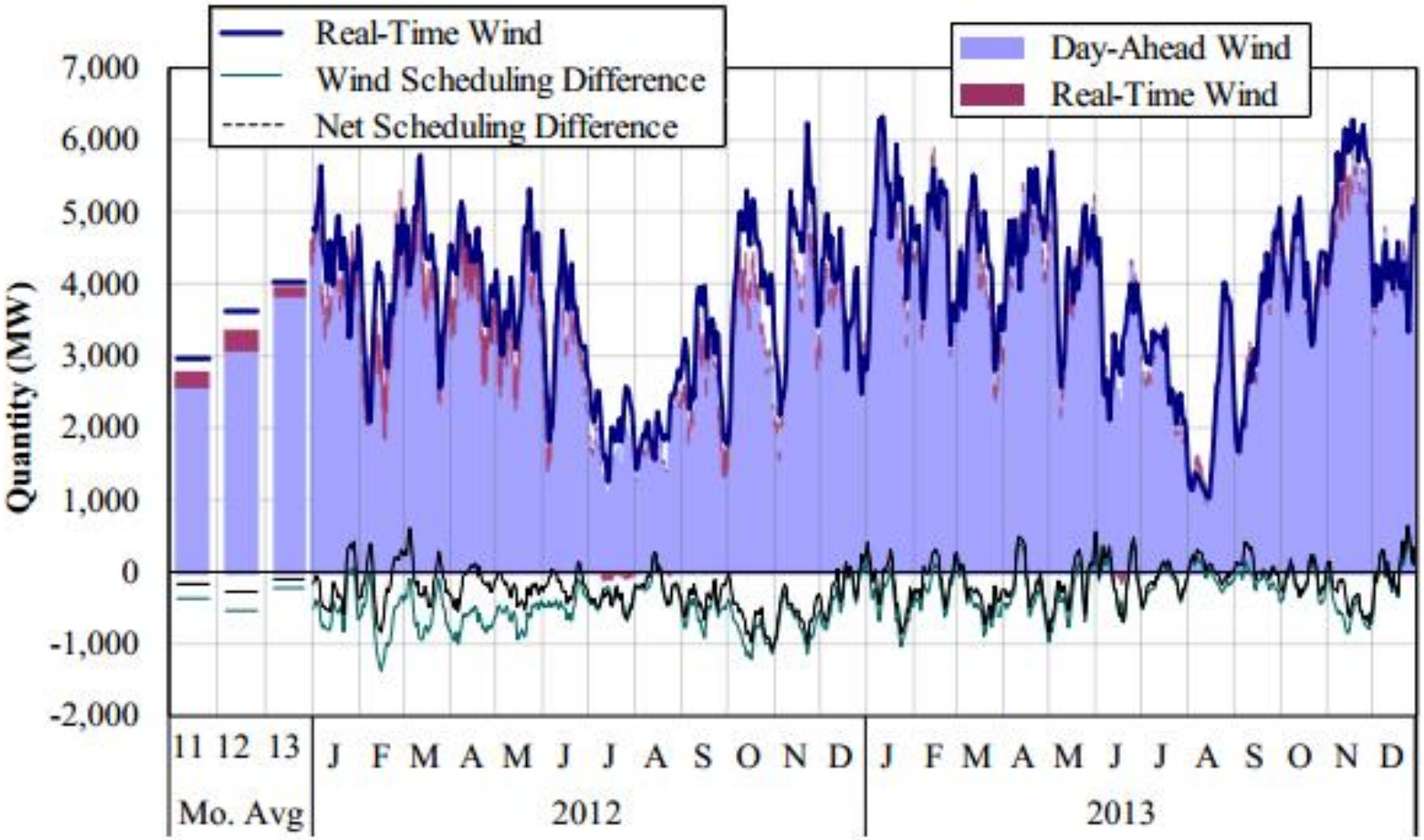


Figure A52: Seasonal Wind Generation Capacity Factors by Load Hour Percentile

https://www.misoenergy.org/Library/Repository/Report/IMM/2013%20State%20of%20the%20Market%20Analytical%20Appendix.pdf

"Come into my algorithm, and I can dispatch you down for five minutes rather than for five hours, and then bring you back up once my congestion issue is gone."

- MISO Focus Group participant

JPMorgan to Pay $410 Million in U.S. FERC Settlement

By Brian Wingfield and Dawn Kopecki | Jul 30, 2013 2:09 PM CT | - Comments Email Print

JPMorgan Chase & Co. (JPM) will pay $410 million to settle U.S. Federal Energy Regulatory Commission allegations that the bank manipulated power markets, enriching itself at the expense of consumers in **California** and the Midwest from 2010 to 2012.

The bank agreed to pay a U.S. civil penalty of $285 million and return $125 million in ill-gotten profits to electricity ratepayers, according to a FERC order today. JPMorgan also agreed to give up claims to $262 million worth of disputed payments from California's grid operator, the state authority said in a separate statement.

July 30 (Bloomberg) -- Bloomberg News' Dawn Kopecki breaks down JPMorgan's agreement to pay $410 million to settle a U.S. Federal Energy Regulatory Commission investigation that the company manipulated energy markets in California and the Midwest. The agreement includes also giving up $125 million in profits. She speaks on Bloomberg Television's "In The Loop."

http://www.bloomberg.com/news/2013-07-30/jpmorgan-to-pay-410-million-in-u-s-ferc-settlement.htm
For more: http://www.ferc.gov/enforcement/market-manipulation.aspl

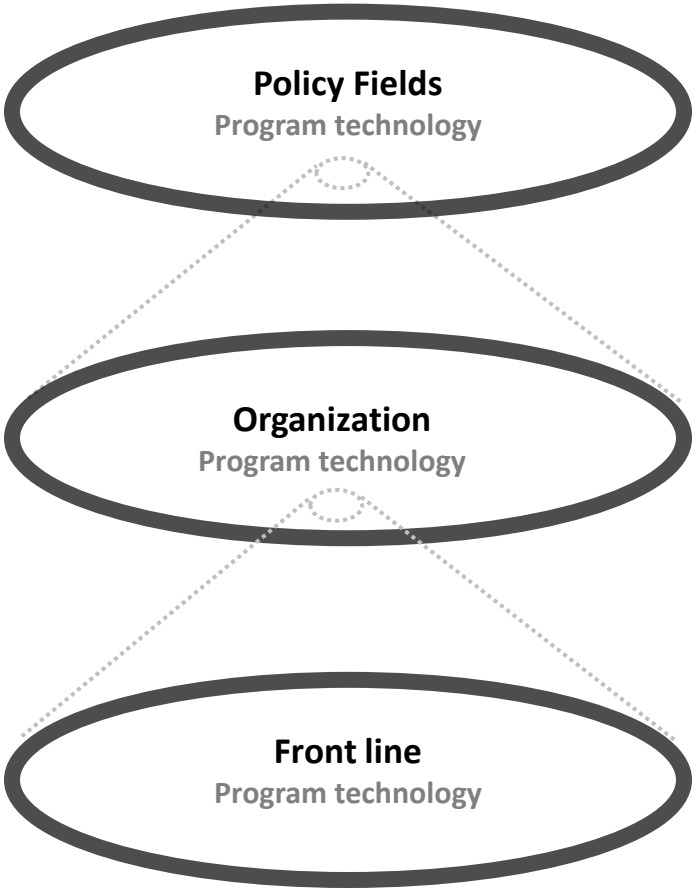
“We’re not going be going back to the base load system, and nobody’s going to head back to the idea that more bilateral contracts are better in the market.”

--CAISO Stakeholder

RTO Relevant Research

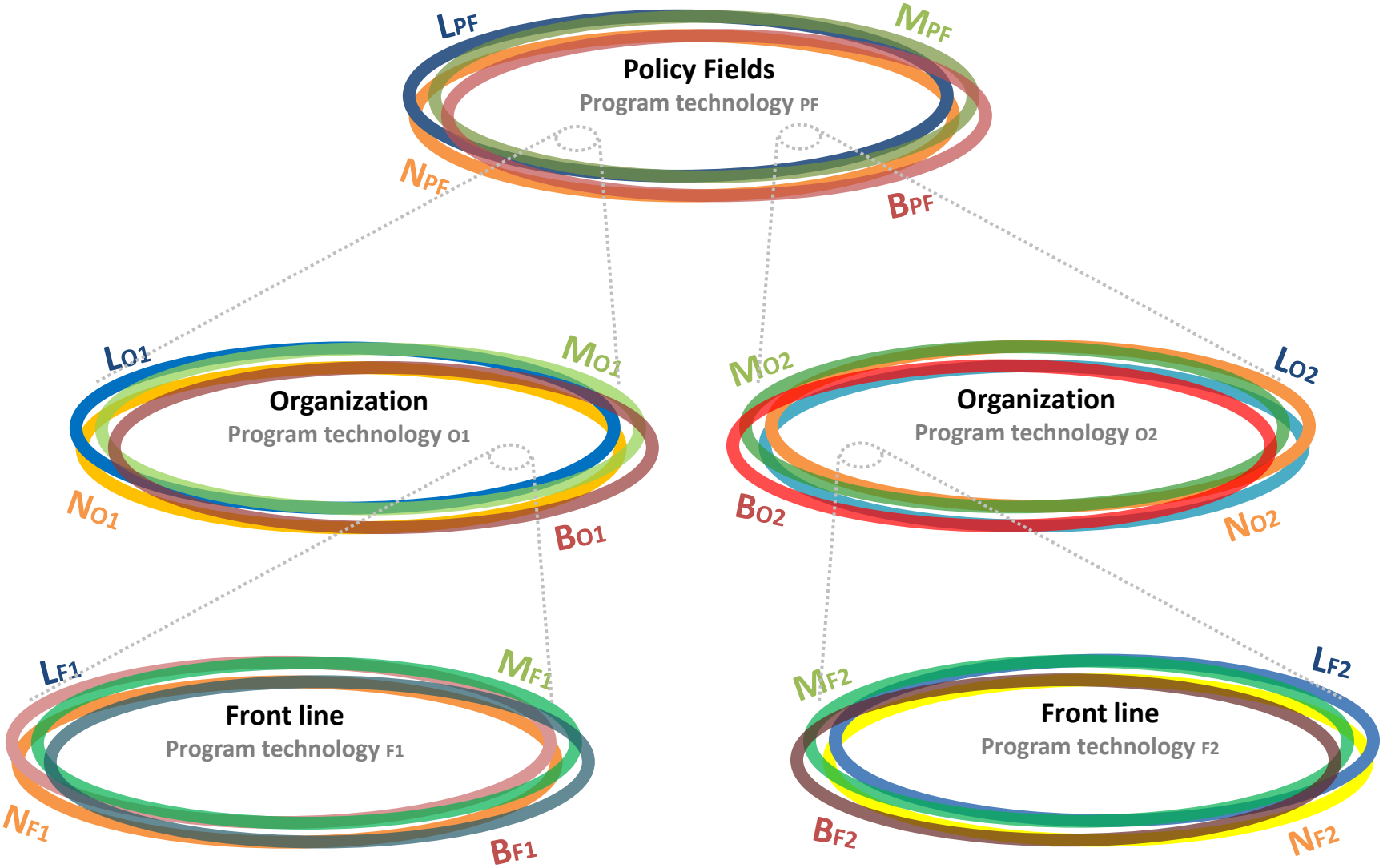
- Flexibility
- Distributed Energy Resources: EE/DSM/DG
- New market products (inertia, reactive power, ASM for renewables)
- Effects of different market rules/access on technology value and operations
- Implementing “non-wire” solutions
- EPA CAA Section 111(d) and state coordination
- Seams
- Politics of power
- Value proposition for consumers within/across RTO

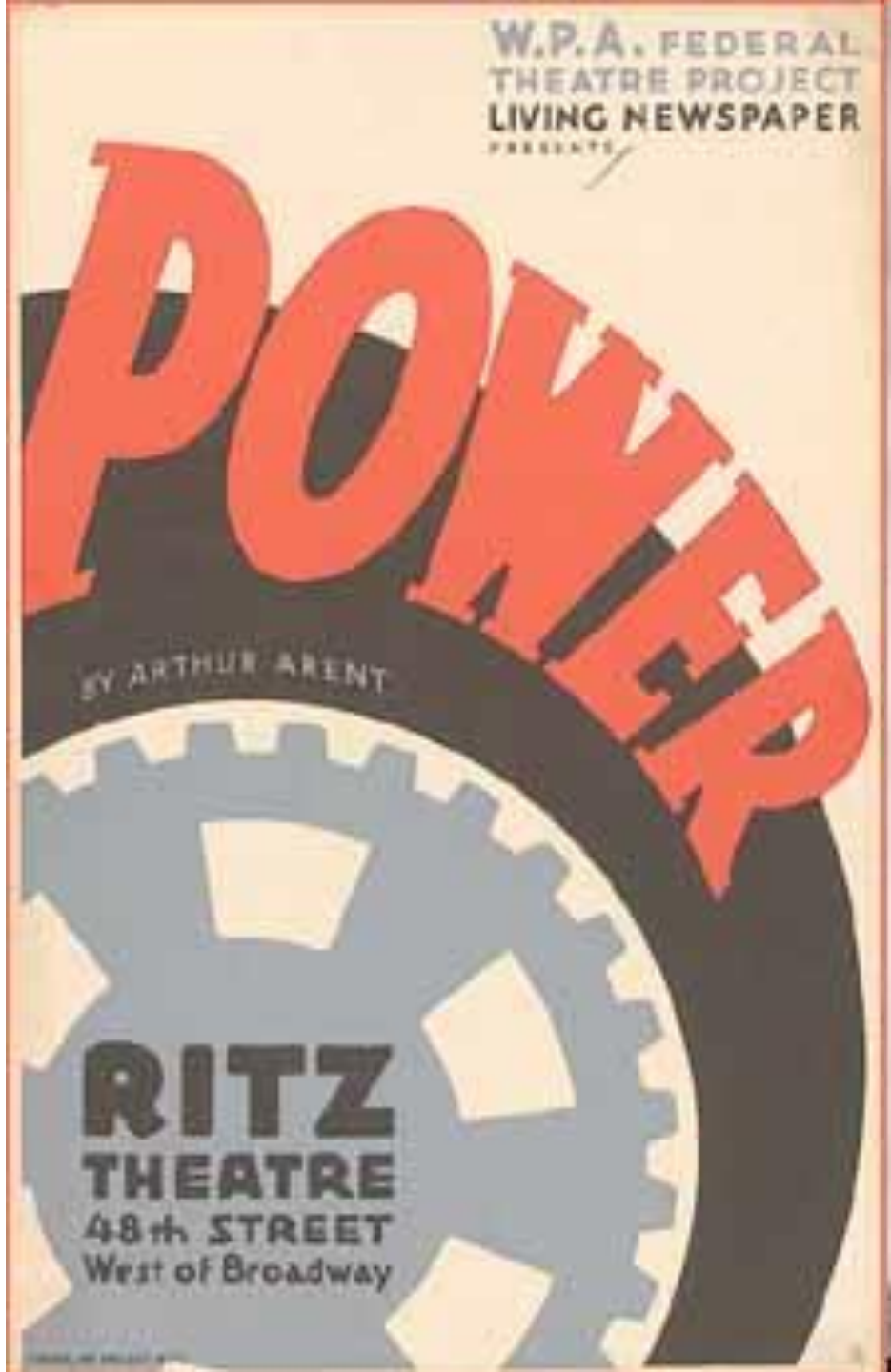
Policy Implementation Research
A Simple Model



With Jodi Sandfort and
Stephanie Moulton

A Model of a System




W.P.A. FEDERAL
THEATRE PROJECT
LIVING NEWSPAPER
PRESENTS
POWER
BY ARTHUR ARENT
RITZ
THEATRE
48th STREET
West of Broadway

"Scientific ingenuity has demonstrated that, in the electric world, to get the most economical results, we must have monopoly. [...] [I]f we are subjected to the will of a great monopoly that reaches from the Canadian boundary to the Gulf of Mexico [...] we will become in reality, **slaves**...."

Senator George W. Norris
R-Nebraska
1903-1913 U.S. House
1913-1943 U.S. Senate

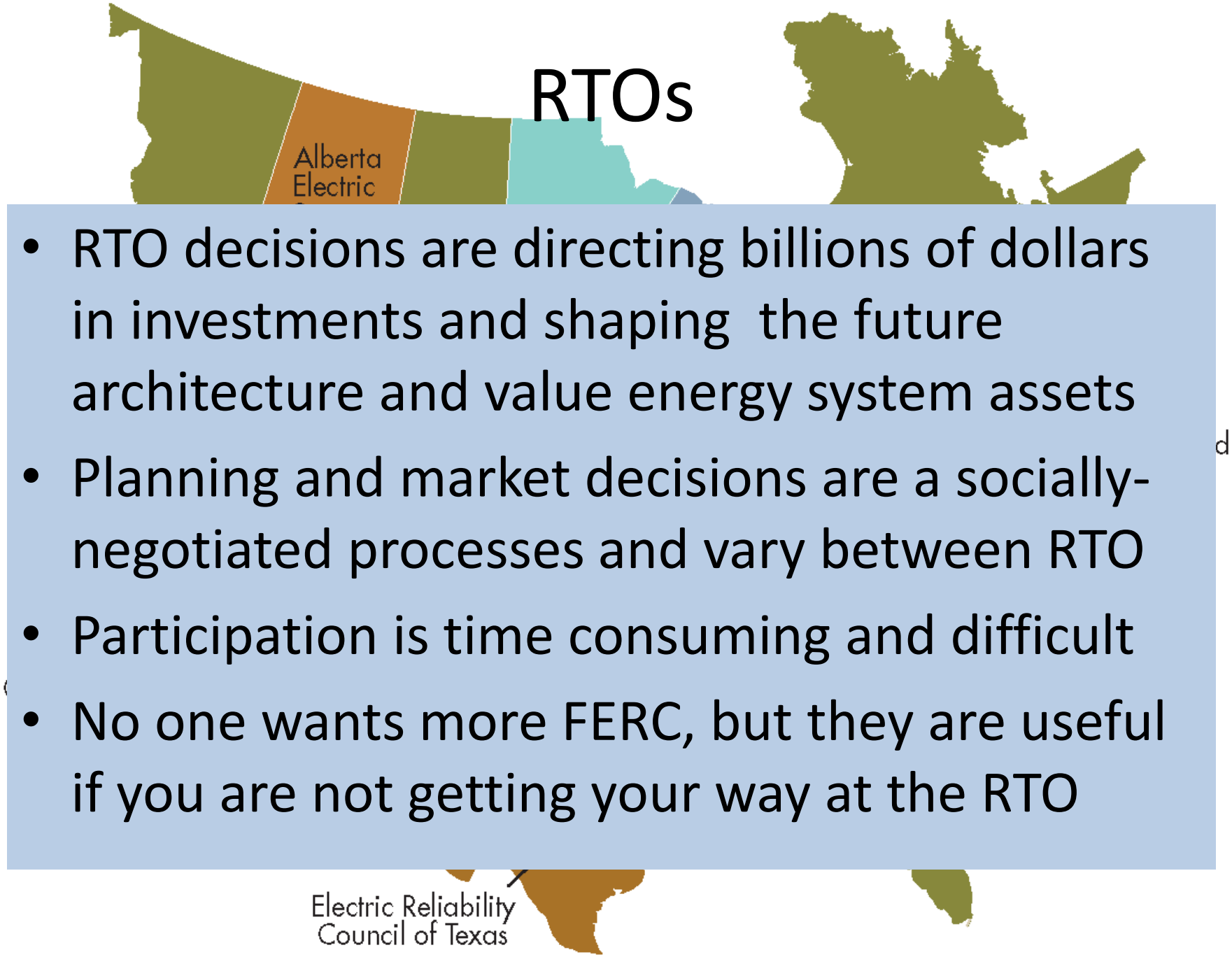
Congressional Record, **February 29, March 5 and 9, 1928**

“Look, dear. I'm just one little consumer. How can I fight a utility?”

Power, 1937 http://newdeal.feri.org/power/pwr1-15.htm

Change
can be
EASY and/or HARD

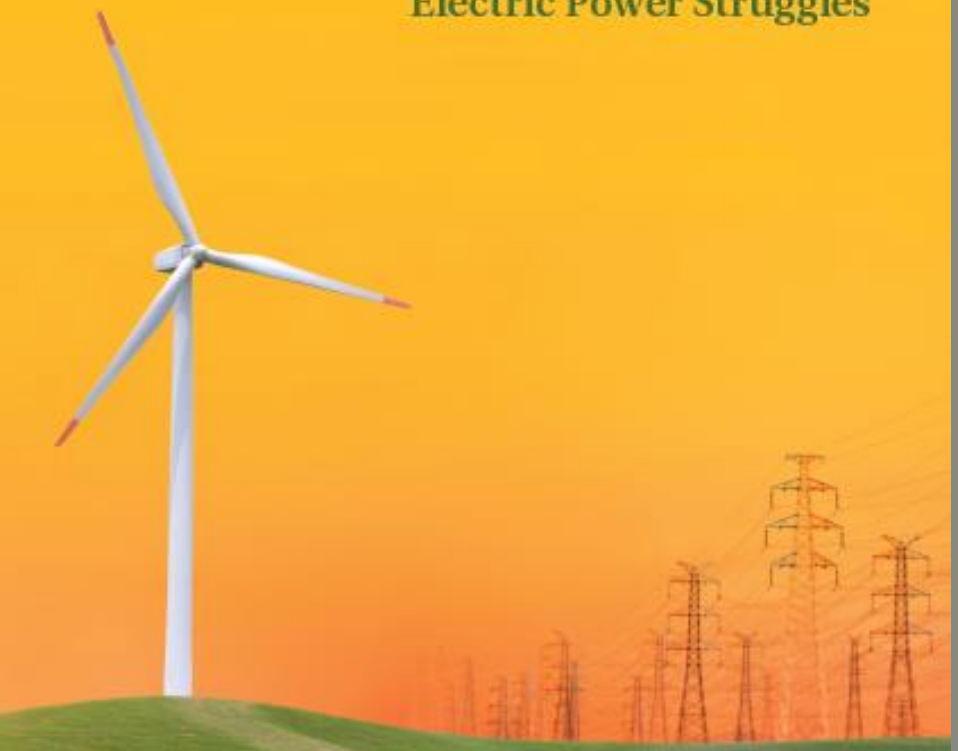
RTOs



- RTO decisions are directing billions of dollars in investments and shaping the future architecture and value energy system assets
- Planning and market decisions are a socially-negotiated processes and vary between RTO
- Participation is time consuming and difficult
- No one wants more FERC, but they are useful if you are not getting your way at the RTO

Smart Grid (R)Evolution

Electric Power Struggles



JENNIE C. STEPHENS
ELIZABETH J. WILSON
TARLA RAI PETERSON

AMERICAN CASEBOOK SERIES

Energy Law and Policy

Lincoln L. Davies, Alexandra B. Klass,
Hari M. Osofsky, Joseph P. Tomain,
& Elizabeth J. Wilson

Decision-Making in Regional Transmission Organizations

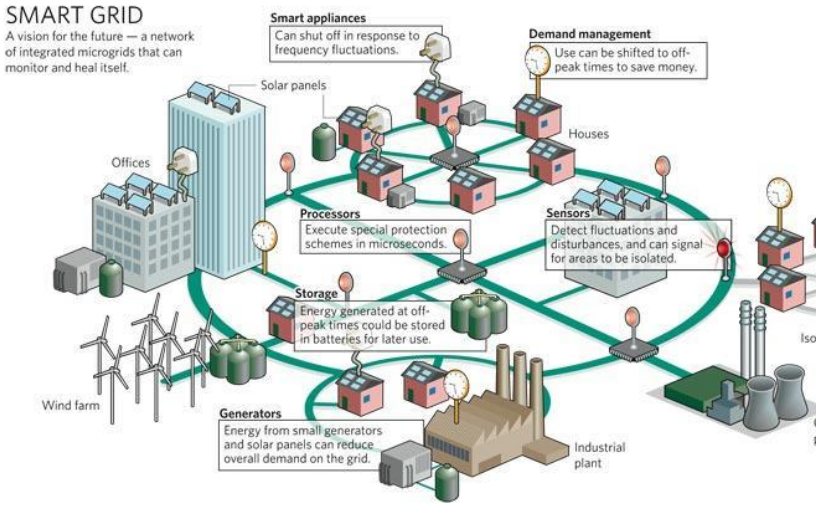
Co-conspirators: Natalie Nelson Marsh, David Solan, Stephanie Lenhart (Boise State)

Seth Blumsack and Nicholas Johnson (Penn State), Benjamin Stafford (UMN)

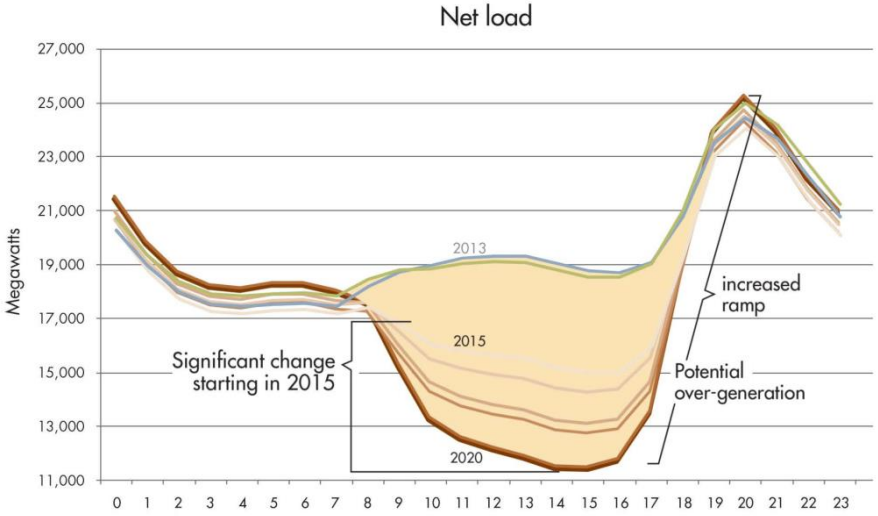
Acknowledgement: NSF #SES-1261867


Customer
customers
education
consumer
efficient
efficiency
technology
consumption
understanding
outage
supply
automation
outages
service
systems
Communications
advanced
increase
reliability
reliable
two-way
new
people
Consumer
Privacy
Demand
technologies
meters
manage
awareness
provide
business
peak
make
management
distribution
grid
Improved
utility
system
much
Cyber
TOU
network
Increased
real
Utility
flow
time
know
savings
information
control
data
electricity
electric
Reduce
renewable
lower
understand
help
cost
load
like
day
plants
integration
informed
resources
consumers
response
energy
customer
etc
New
money
remote
integrate
storage
sources
costs
way
equipment
term
power
meter
acceptance
smart
distributed
generation
use
Ability
reduce
change
demand
public
end
issues
inefficiency
processing
Cost
large
Efficiency
transmission
communications
products
amount
need
privacy
pricing
overall
reading
market
Allowing
implementation
improve
DR
Smart
Better
operation
usage
respond
home
communication
ability
utilities
better
increased
opportunities
electrical
benefits
lack
opportunity
effective
security
monitoring
means
Home
benefit
renewables
efficiencies
across
think
using
including
improved
effectively
Security
capabilities
infrastructure

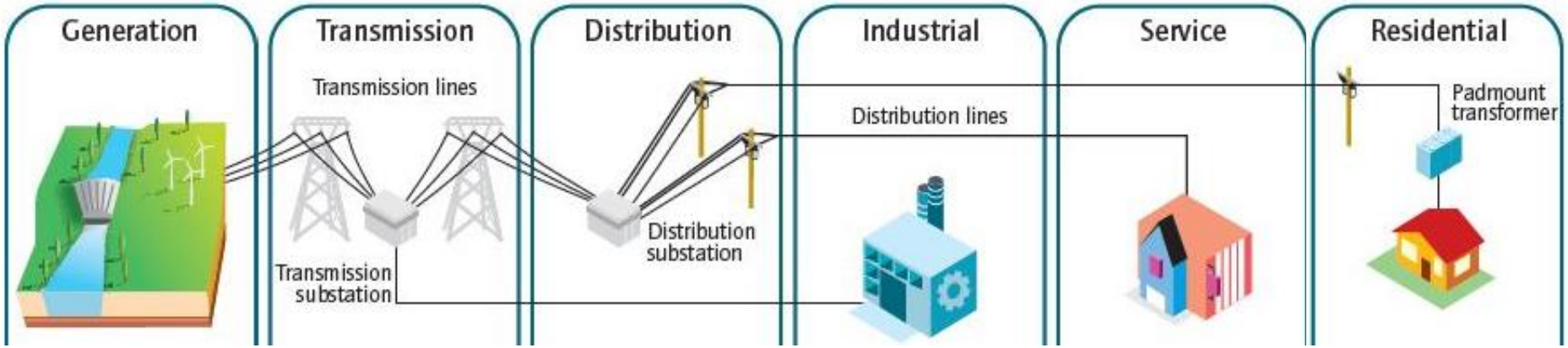
RTOs Do Not Operate in a Vacuum



Growing need for flexibility starting 2015



The Electric Grid



Efficiency

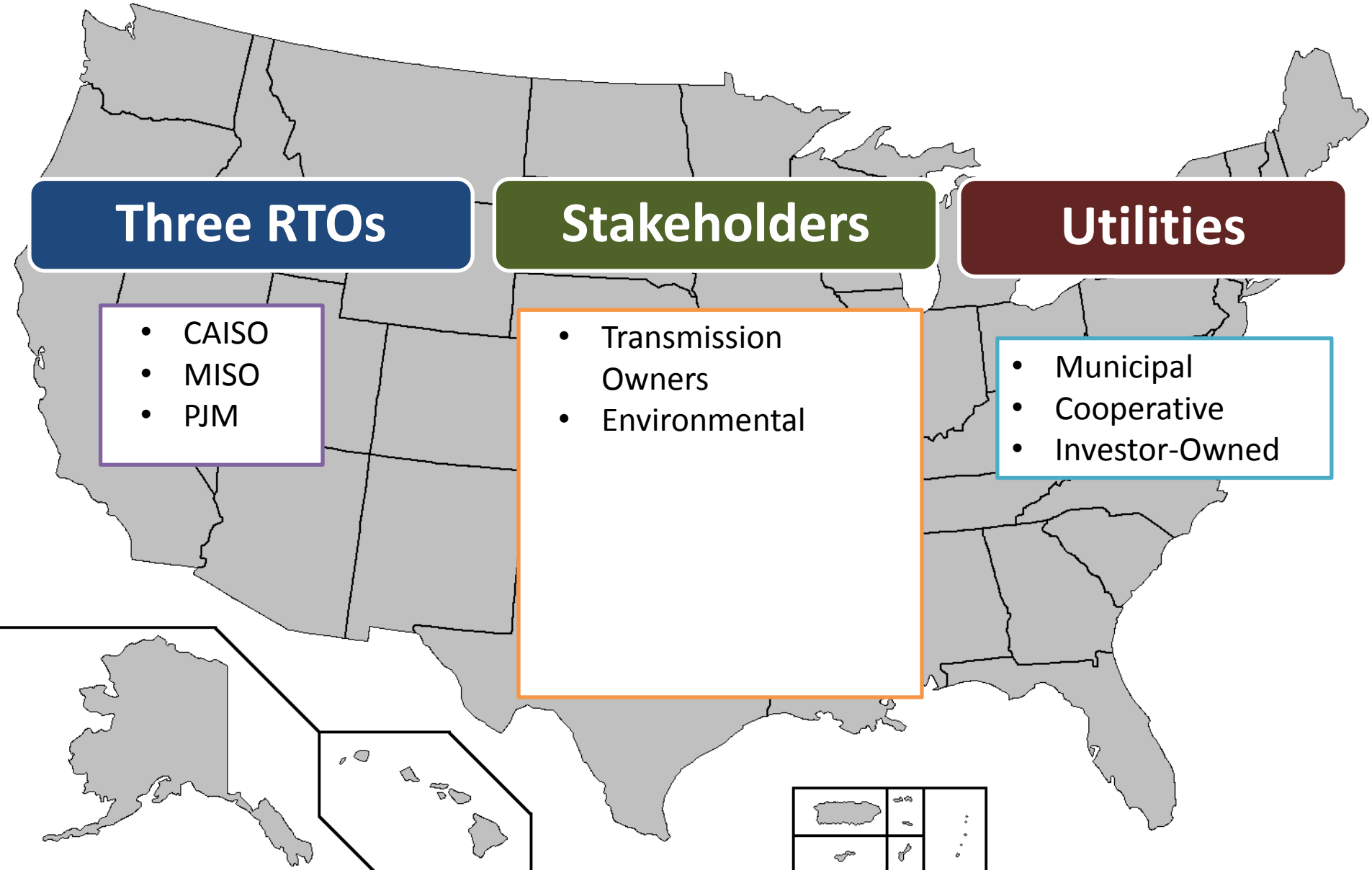
Reliability

Affordability

Resilience

Security

Sustainability


Three RTOs
CAISO
MISO
PJM
Stakeholders
Transmission Owners
Environmental
Utilities
Municipal
Cooperative
Investor-Owned

Need for Interdisciplinary Study:

[T]his is a team sport. It’s a complicated world.

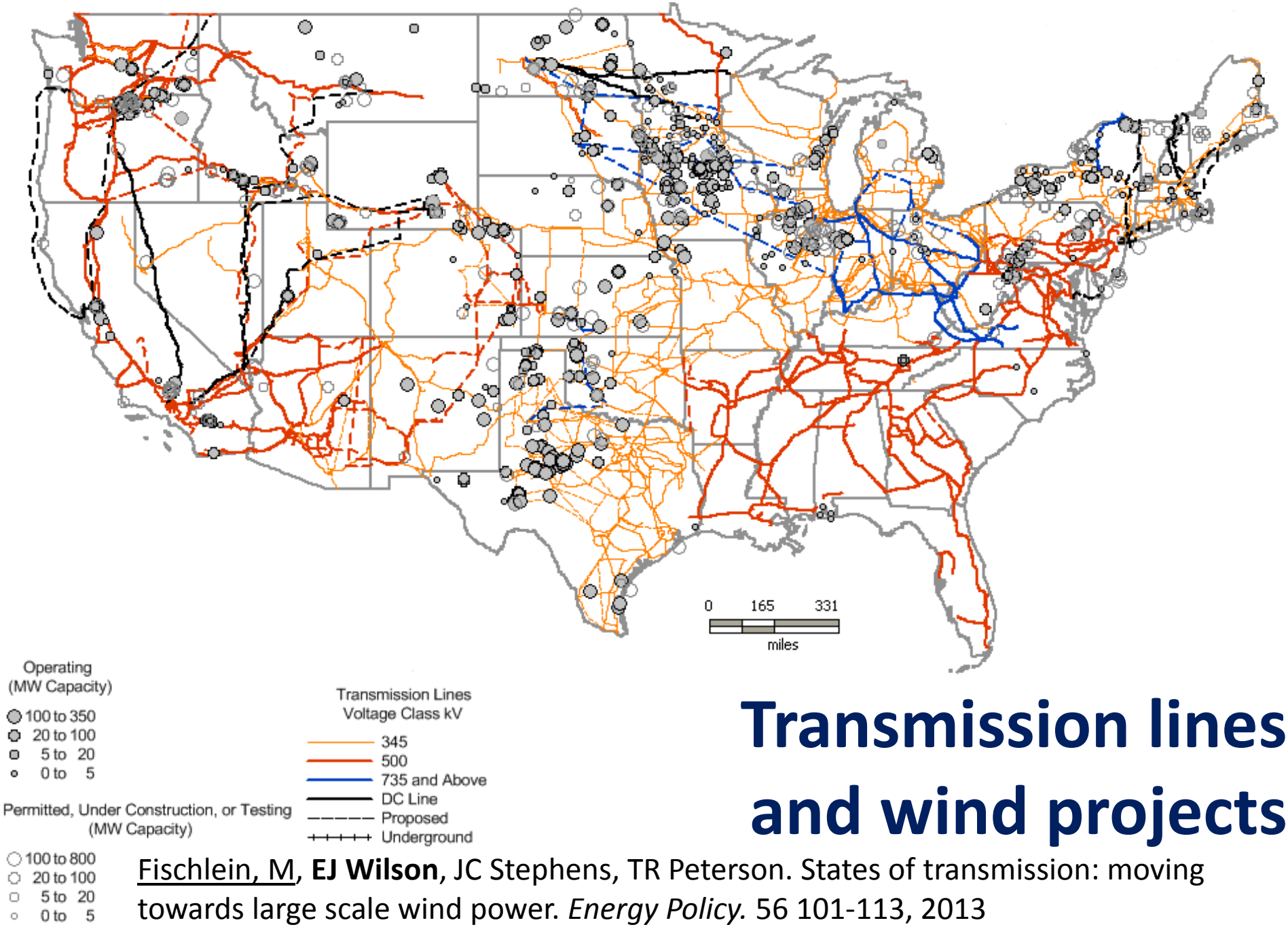
--MISO stakeholder


COMBUSTIBLE
CONTROLE DES EAUX
ALIMENTATION
COMBUSTIOMETRE
VAPEUR

Midcontinent Independent System Operator (MISO)

In the Midwest, we've got a pretty vast majority of our states are regulated. There are vertically integrated companies, so demand response is a challenge for it to take hold. I think there's great opportunity there, but it's hard to get to the end game.

MISO Focus Group participant



Transmission lines and wind projects

Fischlein, M, **EJ Wilson**, JC Stephens, TR Peterson. States of transmission: moving towards large scale wind power. *Energy Policy.* 56 101-113, 2013

Figure A53: Wind Curtailments
2012–2013

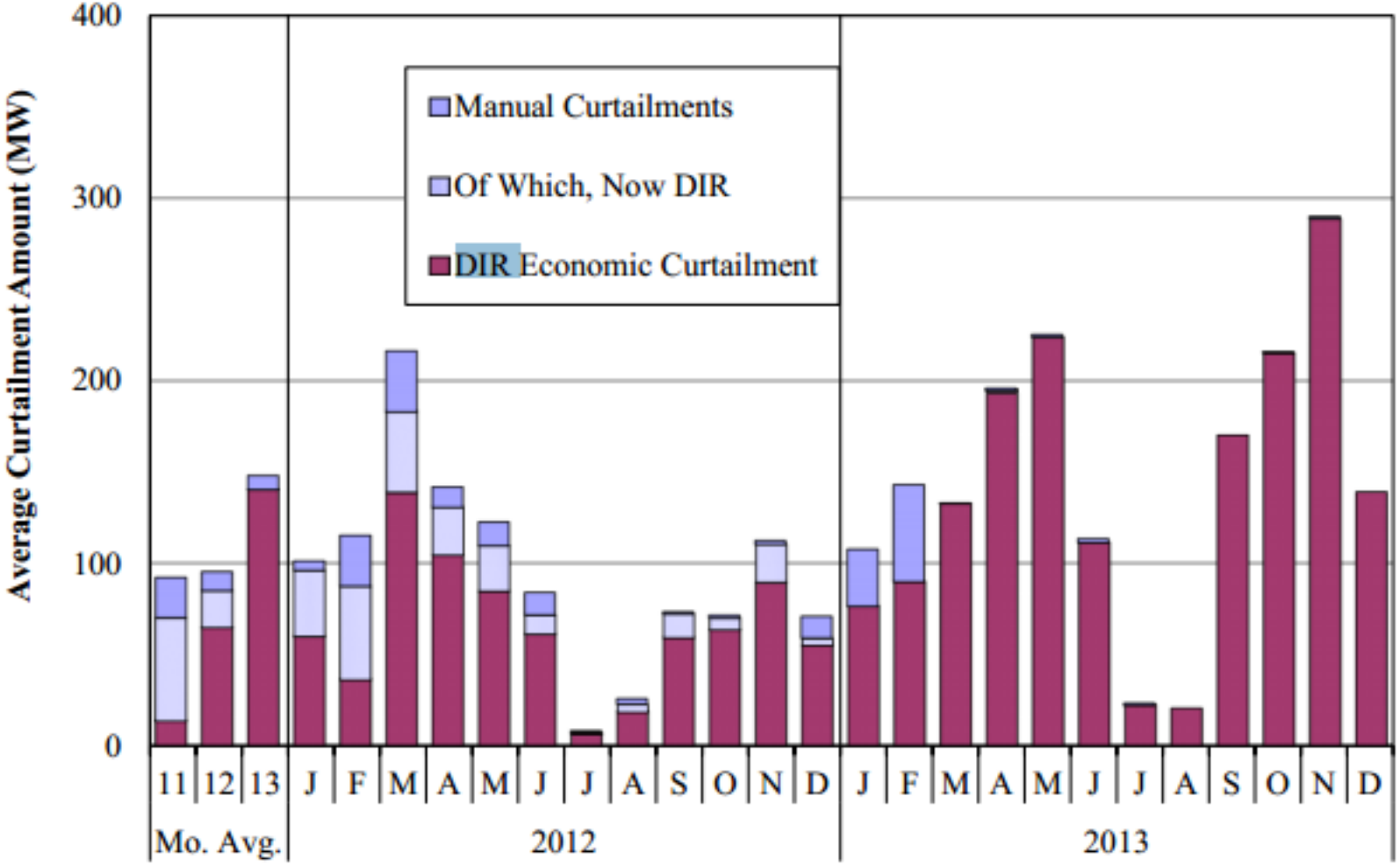
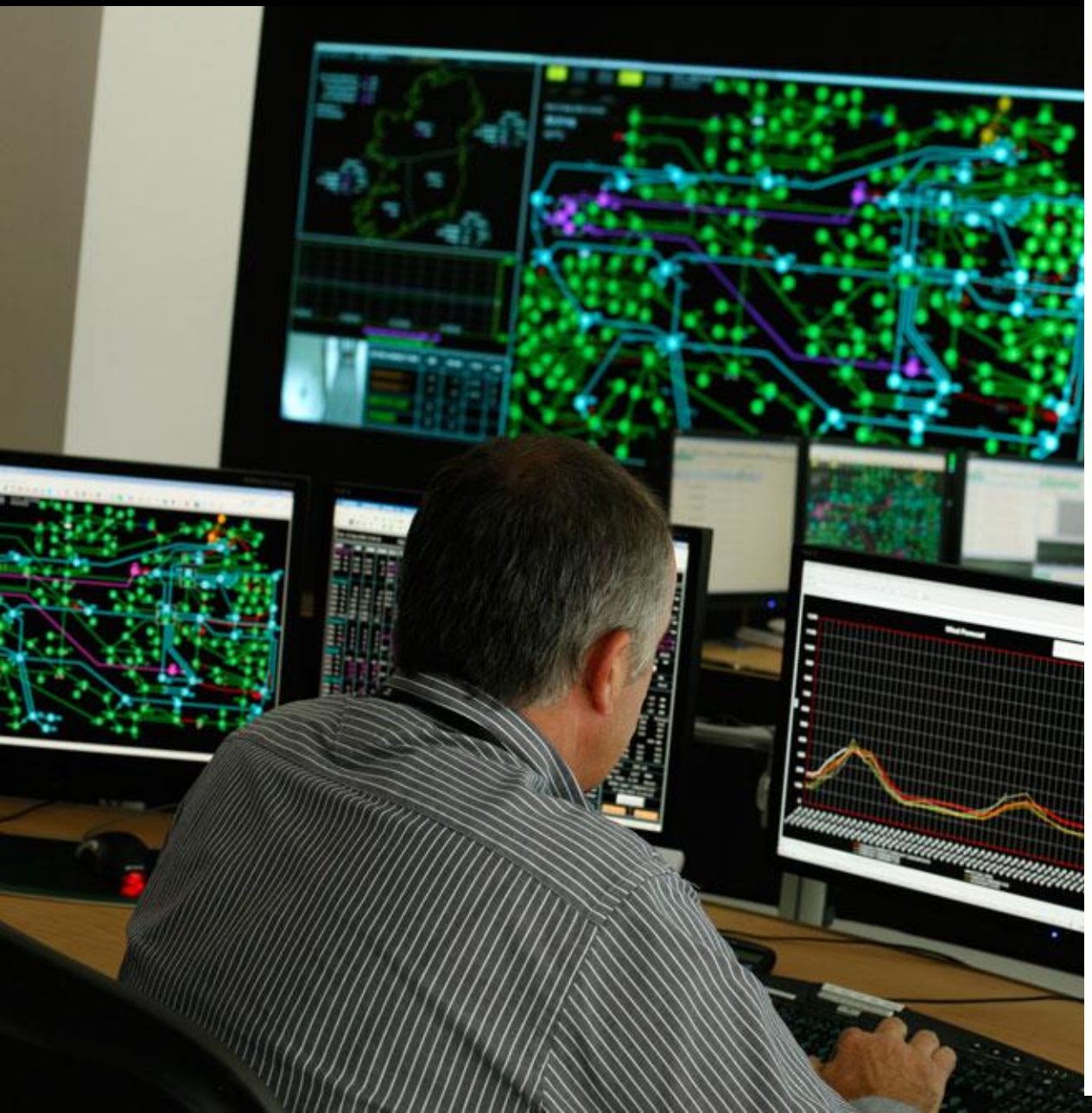
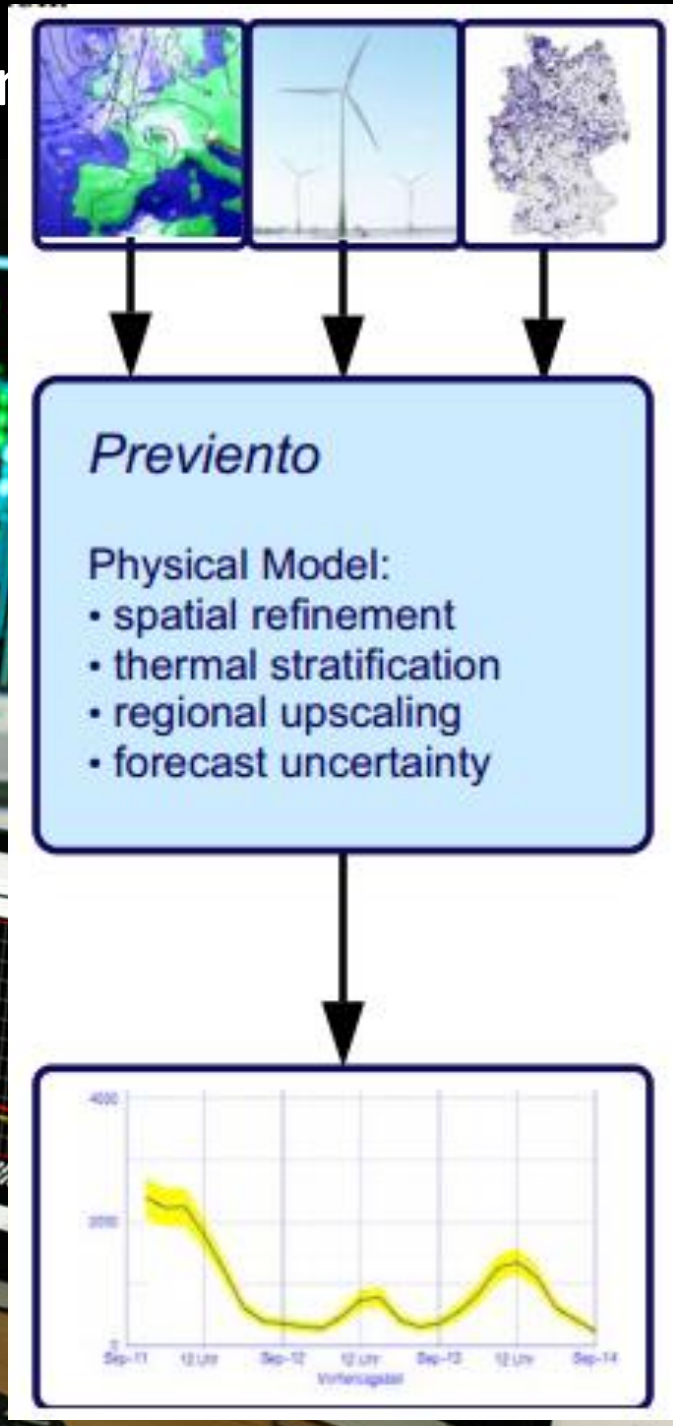


Figure A54: Wind Generation Volatility

https://www.misoenergy.org/Library/Repository/Report/IMM/2013%20State%20of%20the%20Market%20Analytical%20Appendix.pdf

Regional Transmission Organ

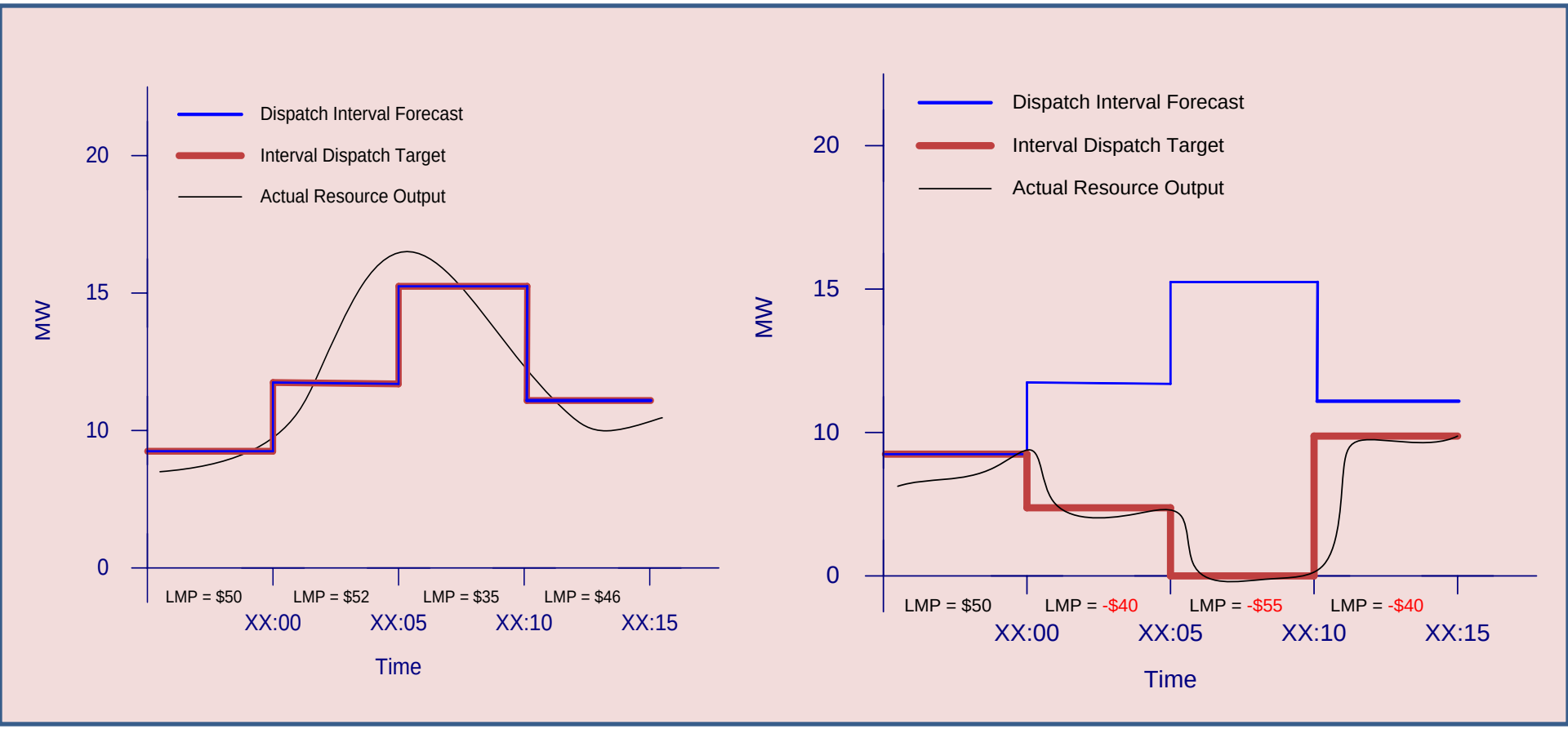




Rules Matter

(A lot)

Dispatchable Intermittent Resources (DIR)



Unconstrained

Nearby Congestion

Source: JT SMITH, MISO

	Total 2010	Total 2011	Total 2012	Total 2013 YTD
No of Wind Curtailments	2,117	2,034	889	185
Estimated MWHR Curtailed	824,399	720,190	266,383	65,010
Duration (Hours)	19,951	20,365	10,430	2,347
DIR Dispatch Down	N/A	130,296	582,653	972,580

MISO October 2013 DIR Figures

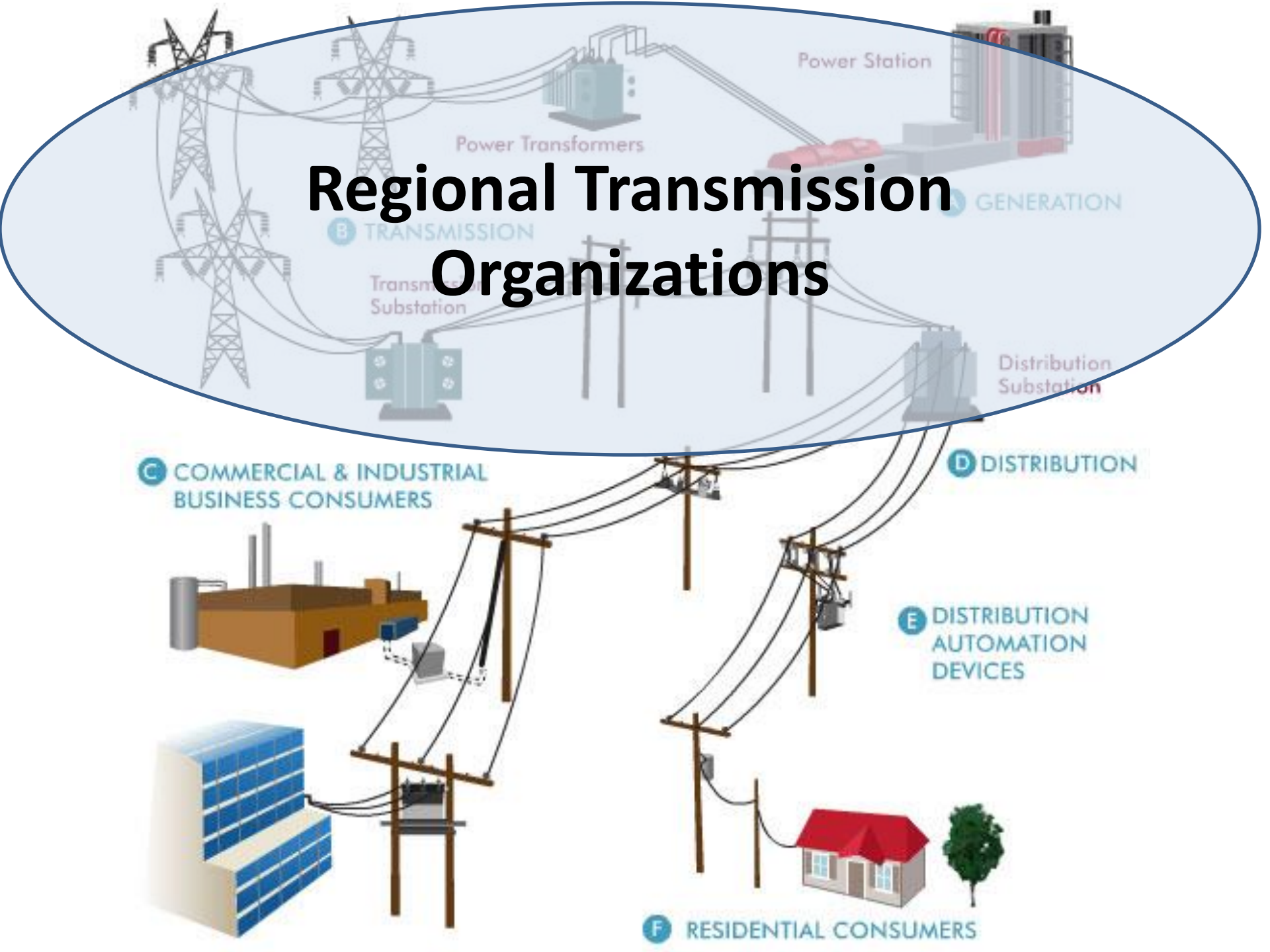
we just find that a workshop is another way to be able to get that engineering kind of stuff in a policy person's head.

Interviewer: Makes sense.

Interviewee: Dispatchable, Intermittent Resources was probably one of our most successful communication process thing, because we started with figuring out what people needed to understand. Then we got them up to speed. We were able to get that policy process easier. I don't wanna say push the policy, but move the policy discussion along.
--MISO Participant

Governance in Practice

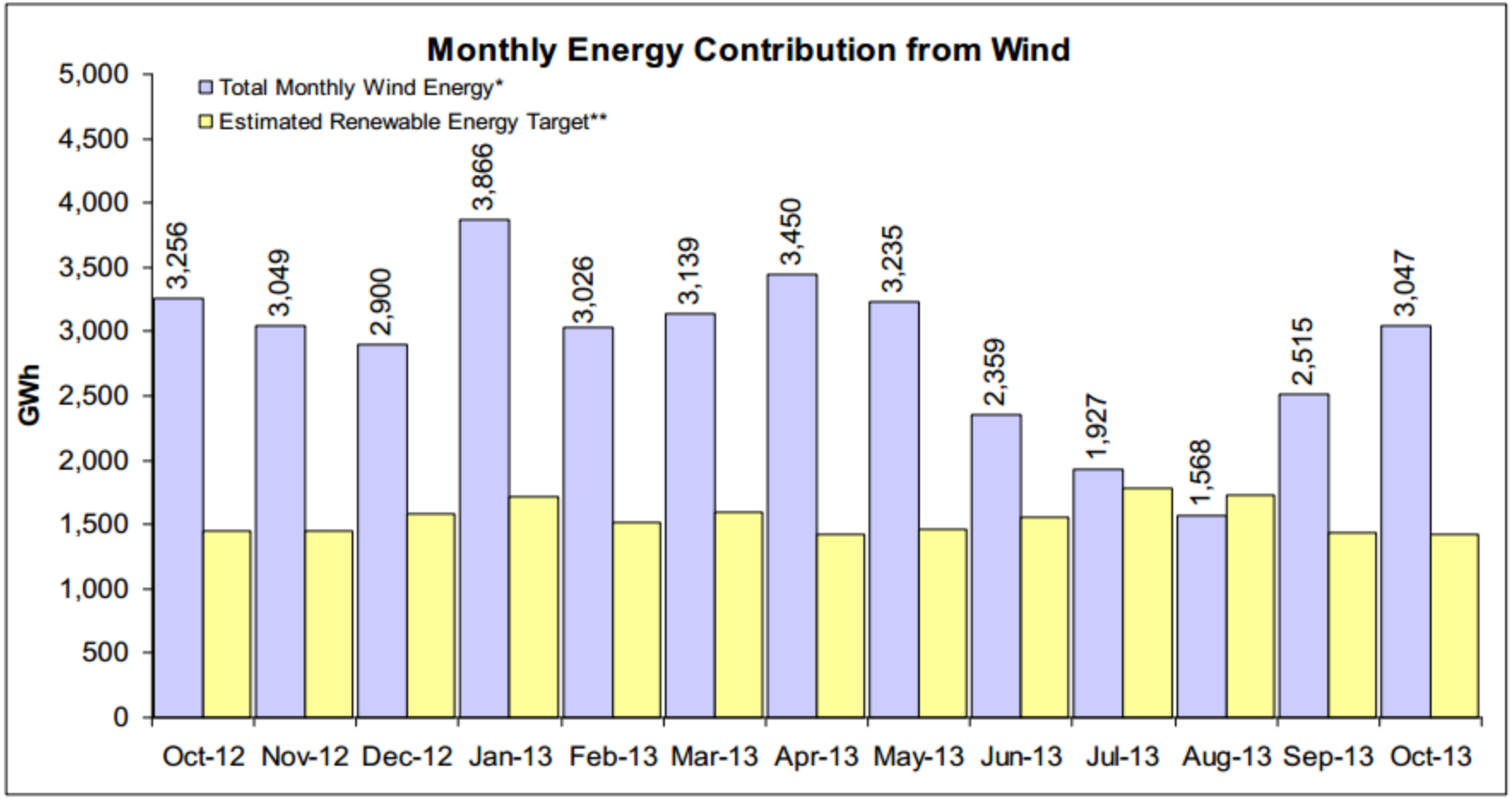
Regional Transmission Organizations



"So, although there is a process similar to other ISOs and RTOs where a headhunting firm recommends several candidates, in fact pretty much the candidates that the Governor of California wants end up on the board, regardless of how much they do or do not know about electricity."

- CAISO

MISO and the RPS



*Sum of hourly State Estimator data.

RPS data extracted on October 04, 2013. Values may change due to resettlement.

**Monthly wind energy generated (light blue) compared to monthly renewable energy target (yellow bar) to satisfy approximate aggregate State RPS mandates within MISO's market footprint. While wind may be in excess today, internal projections show that current wind production may not be sufficient to meet the future needs as soon as 2014. Additional information can be found under Stakeholder Center/Committees, Work Groups, and Task Forces/Informational Forum – Related Documents.

*** Yellow bar represents the annual renewable energy target distributed by month based on monthly capacity factor expectations of the MISO system.*

MISO

“We are 17 years into it.
We’re making it up as we go.”

--PJM Stakeholder

Restructured v. Traditionally Regulated

“They have a different problem
then we have because there’s no backstop
in the restructured states.
In our states the backstop is
the state and its regulation.”

MISO stakeholder

The **Steering Committee …**the people that vote :
Chair of the Market Subcommittee
Chair of the Planning Advisory Committee
Chair of the Reliability Subcommittee
Chair of the Finance Subcommittee
Chair of the Stakeholder Governance Working Group
Cost allocation. I think that's it. I don't think I missed anybody.

These four leaders—oh, and then you've got the Advisory Committee. That Chair and Vice Chair are the opposite in the Steering Committee. The Vice Chair of the Advisory Committee is the Chair of the subcommittee. These guys meet monthly. They all report up. *[Pause]* All the little guys report up to the market subcommittee and report up to—hopefully, these guys should have a holistic idea and a clue as to what their whole business unit's working on. *[Pause]* They should be able to come to the steering committee

Well, it may well play differently because of the different governance structures of the RTOs. The fact that we're a not-for a profit public interest is precluded from lobbying.
By law I can't have an opinion, officially, about a piece of legislation.
We're very clearly policy takers by governance.

Where the neighbors, PJM for example, is a, I think, they're a standard S corporation for-profit that operates in a non-profit status. They're not precluded from having an opinion about "is demanside management better than renewables?", where I kind of am.

The people that formed us were real clear that they wanted us to be policy takers. Facilitate the good application of policy as it develops, but tread lightly on advocating for one policy or another. We're the only one that is a not-for-profit public interest. Everybody else is something different.

MISO Stakeholder

Multi-State v. One state RTO

CalIso is a creature of California, so they're gonna do whatever the state tells 'em to do.
The board is appointed by their governor. Well, what does that mean? [*laughs*] Right?
In terms of advocacy and those kinds of things.
Our board is pristinely independent as a matter of our structure.
New York is a one state. ERCOT is a one state.
In terms of how those policy questions play out you might back up a layer
and look at whether the governance structures have influence over
the postures that the various RTOs take.

SPP

Where if you're Southwest Power Pool and you're organized as a business league.
Well, who gets the voice in a business league? Mostly the businesses.
How they listen to who may change based on where they come from.

MISO Stakeholder

“I do find one of the great challenges is the engineer—the engineer personality, or psyche.” ….

Engineers and communication:
“Then there’s a few others that they’re just—they’ve gotten better as time goes by, but I find in the committee world, that’s one of our challenges, is how to make our engineers who really know what they wanna communicate. How to effectively communicate it, which is part of the reason why workshops were—they’re a newer concept. “

Acknowledgements

Smart Grid Study

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Clark Team: Jennie Stephens (PI), R. Langheim
Texas A&M Team: Tarla Rai Peterson (PI), Adrianne Strubb
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State Difference Study

Minnesota Team: Elizabeth Wilson (PI), Miriam Fischlein, Joel Larson
Clark Team: Jennie Stephens (PI), Gabe Rand, Leah Melnick, Rumika Chaudry
Texas A&M Team: Tarla Rai Peterson (PI), Damon Hall, Andrea Feldspauch-Parker, Chara Ragland
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Alex Klass and Elizabeth Wilson
Supported by: (Just for Fun!)

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NSF SoO Decision Making in Regional Transmission Organizations

Seth Blumsack (Penn State), Dave Solon and Natalie Marsh (Boise State), University of Minnesota
Supported by: NSF Study of Organizations (NSF SES-1261670)

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