MOTHERSHIPENERGYGROUP.COM

Committee on Energy Choice's Technical Working Group

July 2017

NEVADA OPEN ENERGY MARKET DESIGN & POLICY

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Committee on Energy Choice
Technical Working Group on Open Energy Market Design & Policy

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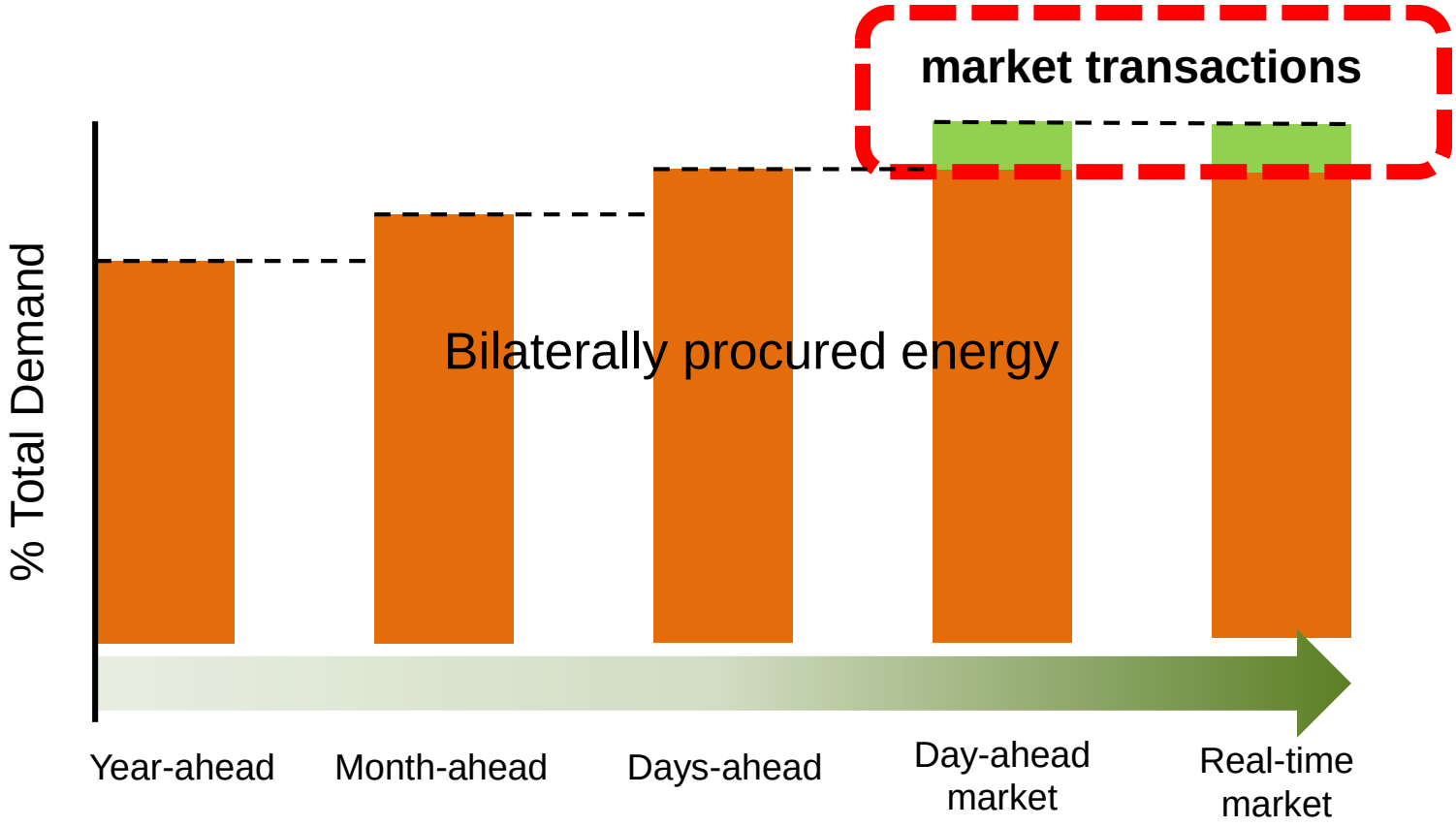
July 10, 2017

Market operators are essential elements of an open, competitive market

- Serves as a platform for buying and selling power
- Supports a day-ahead market for optimized procurement of energy and ancillary services
- Supports a real-time market for spot market transactions
- Procures essential reliability services for the systems

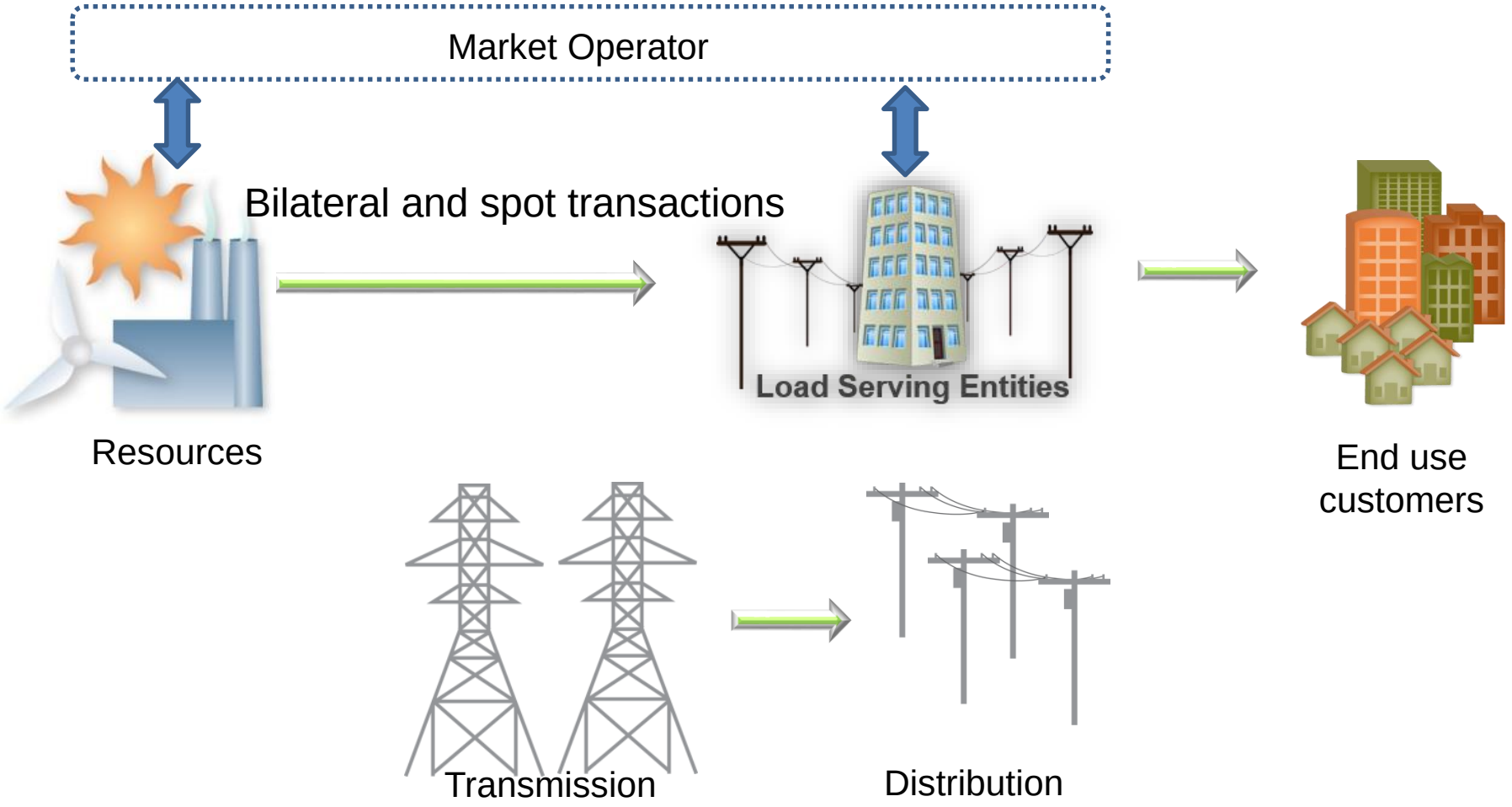
Demand is often met in advance of the market through utility-owned or bilaterally procured resources



Responsibilities of a vertically integrated utility shift when creating a market operator

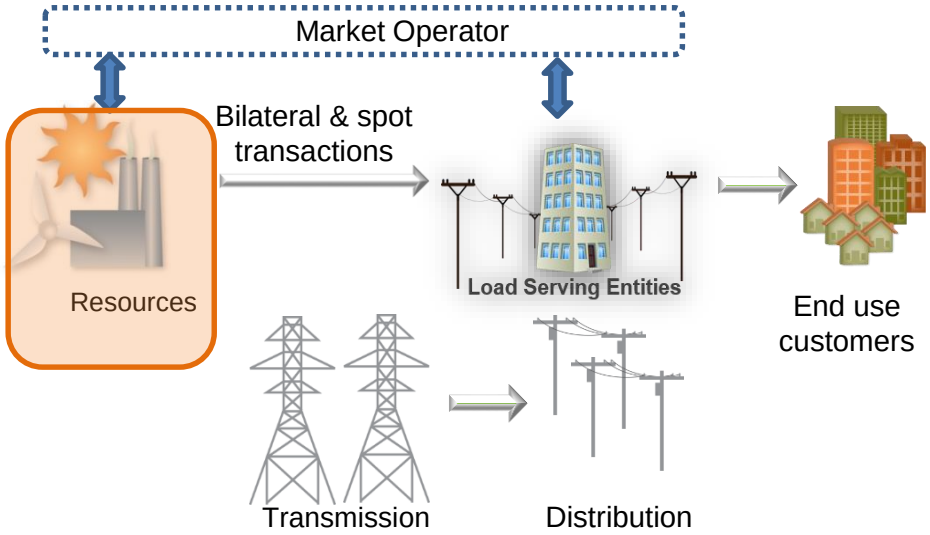
Market Operator	Utility
• Balancing Authority Area responsibilities • Transmission-level generation interconnections • Generation Dispatch • Transmission Planning • Transmission access service	• Transmission ownership and maintenance • Distribution system operations • Distribution level generation interconnections • Distribution planning & service to customers • Load interconnection • Load metering

Typical competitive market model



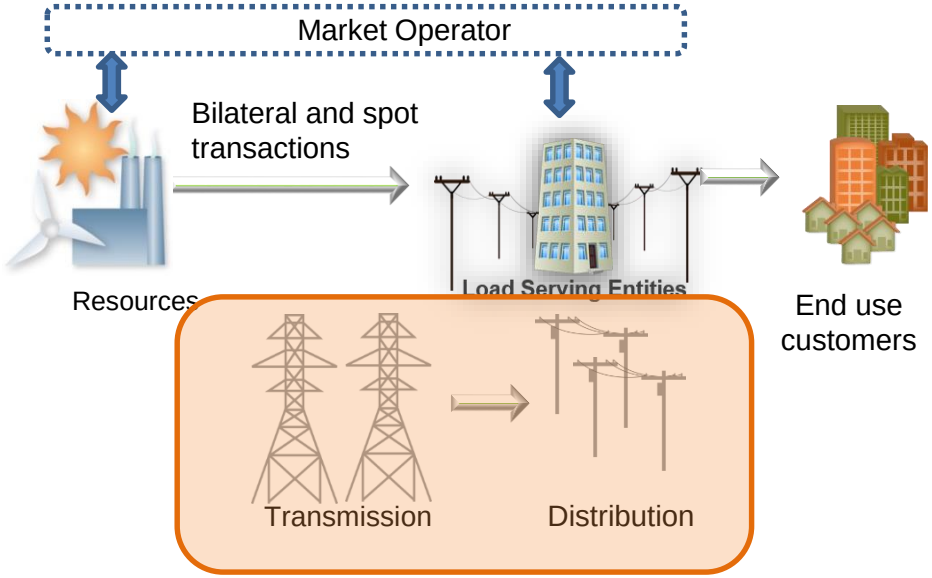
Competition needs to be created among generating resources but decisions need to be made

- Book value of generation is far more than the market
- PPAs are long-term contractual obligations of NV Energy
- Stranded asset treatment is the biggest policy issue in this area



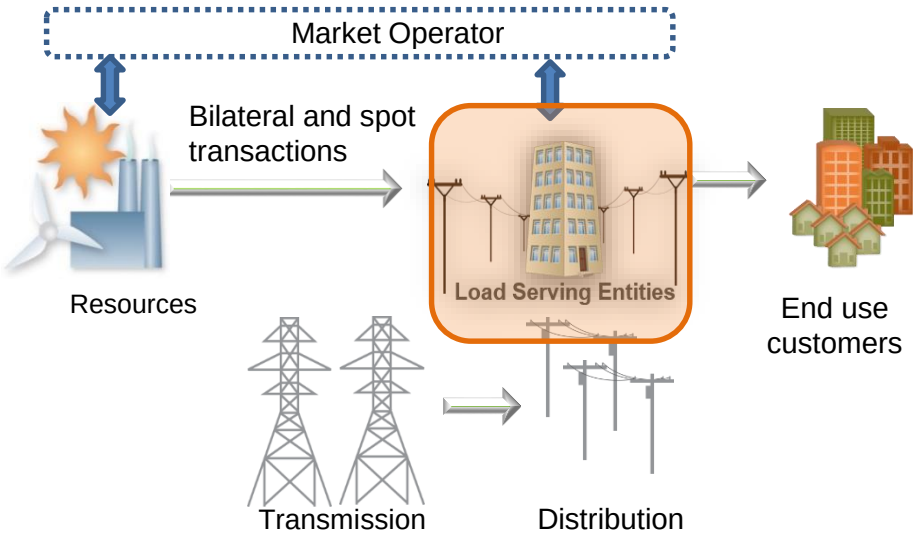
Transmission and Distribution are assumed to remain monopoly, regulated elements of the system

- Commission would maintain regulatory jurisdiction over this element
- Assumed to be new role of NV Energy



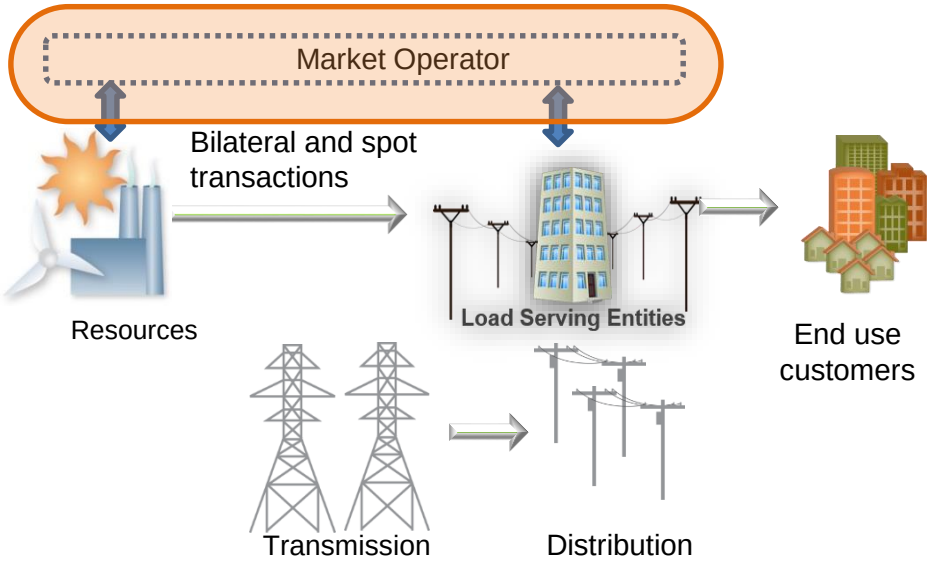
Load serving entities will be the primary procurer of power and will interface with end-use customers

- Load serving entities (or similar names) are key players in an open market
- Access to a market is essential
- Switching from LSE to LSE will need to be centrally managed
- Meter reads will need to be handed from the distribution operator to the LSE
- Possible to have the incumbent bill on behalf of the LSE



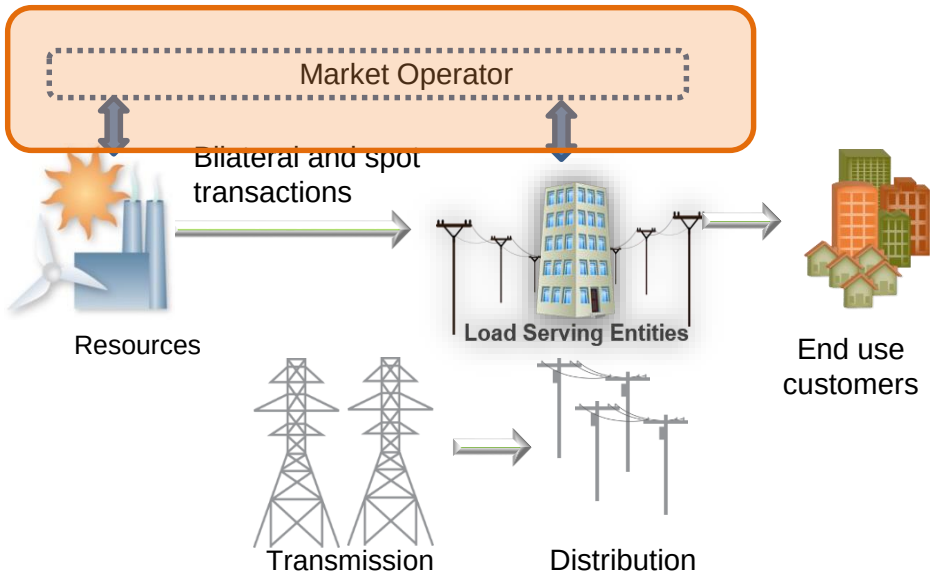
A market operator is required to provide an independent platform for trading

- Creating a new ISO could cost upward to $500 million
  - CA ISO's nodal market went live in 2009 at $200 million
  - Texas' nodal market cost $600 million.
- Technology and software investment is immense
- Market rules are complicated and likely will take 2 – 3 years to develop and be approved
- Capacity markets, if pursued, add even more complexity
- Will be FERC jurisdictional



Leveraging an existing market will dramatically shorten the timeframe, cost and effort of establishing a market operator

- The California ISO has a mature, well-functioning market
- There is immense transfer capability between California and Nevada
- Nevada would retain it prerogative over resource mix
- Existing governance is a challenge

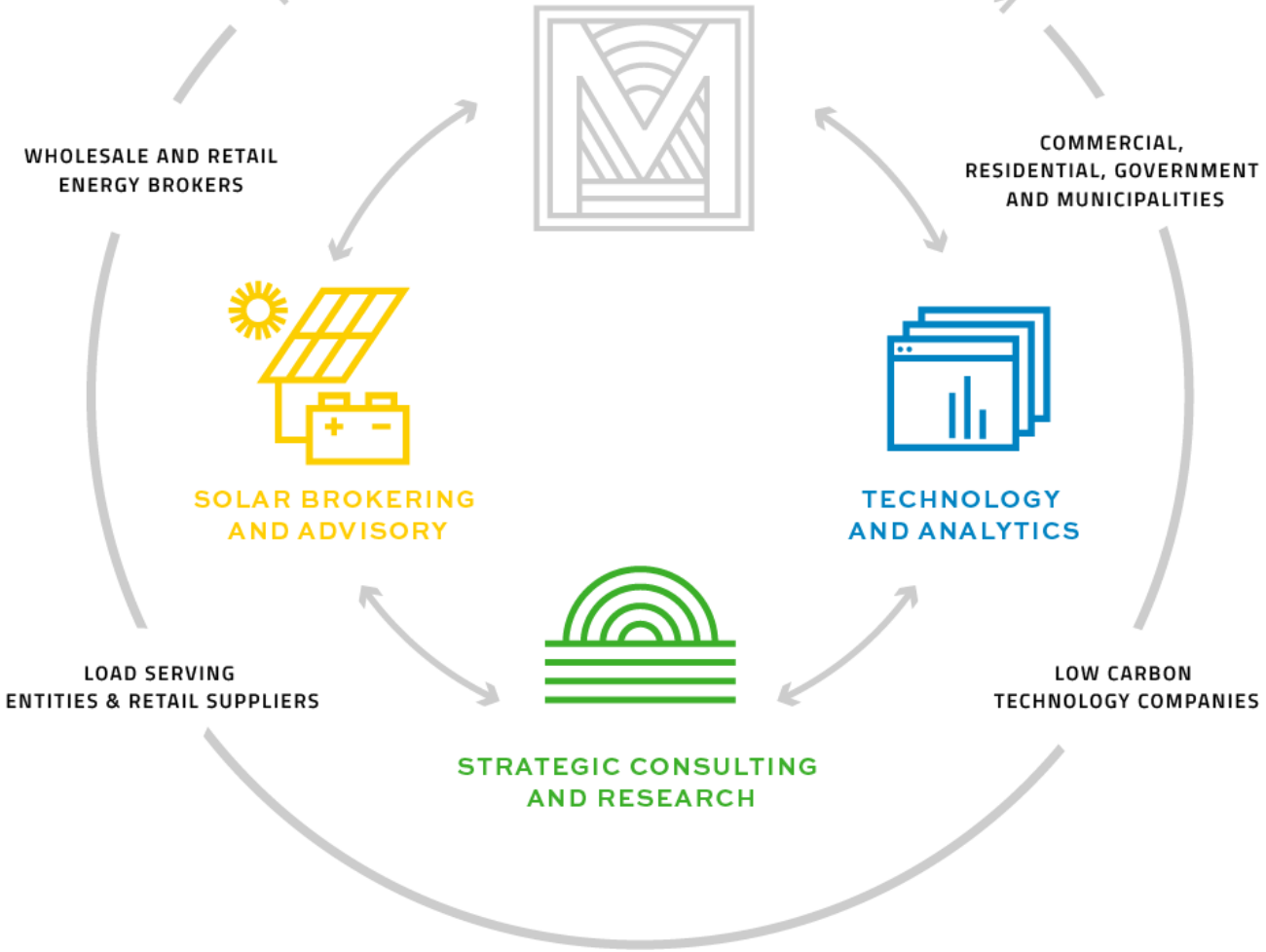


MOTHERSHIP ENERGY GROUP is an energy solutions company providing renewable consulting, advisory and analytic services for energy management to a wide range of clients in the energy space.

OUR COMPANY was founded by former energy traders, wholesale commodity merchants, finance professionals, retail energy specialists and renewable technology veterans with a combined 30+ years experience in the energy industry.

OUR TEAM has distinguished experience working on strategies, structuring and execution of innovative new market solutions across the country.

THE MOTHERSHIP ECOSYSTEM



Topics Discussed

I. ERCOT Market Background & Structure

- Parties to the Transaction
- How Power is Bought & Sold

II. Risk in the Market

- Settlement & Pricing
- Supply Hedging & Rates
- Consumer Protection

III. Market Efficiencies & Customer Benefits

- Retail Supply: Product & Rate Innovation
- Technology & Customer Experience Innovation

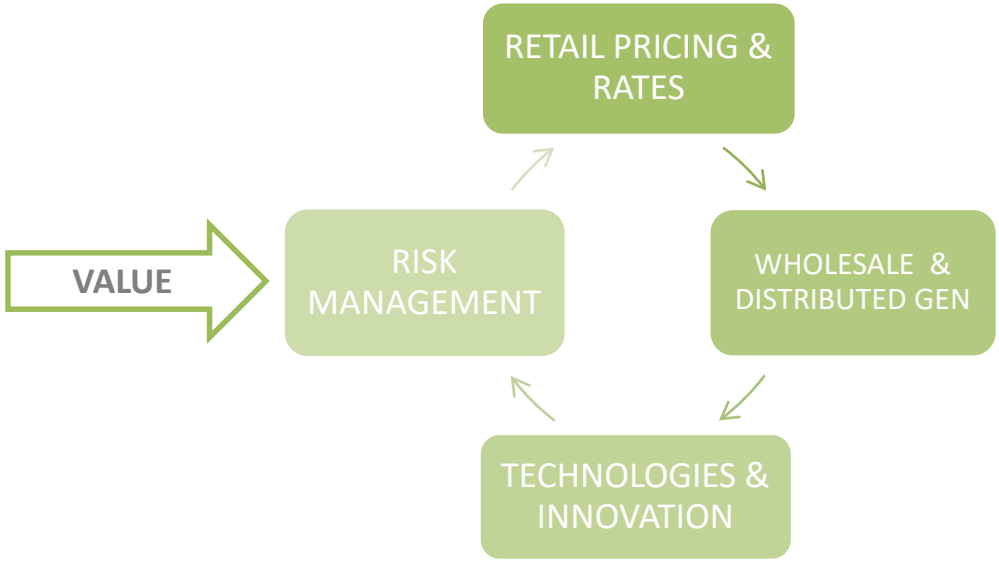
MACRO POSITION

Restructured Markets > Regulated Markets

MICRO POSITION

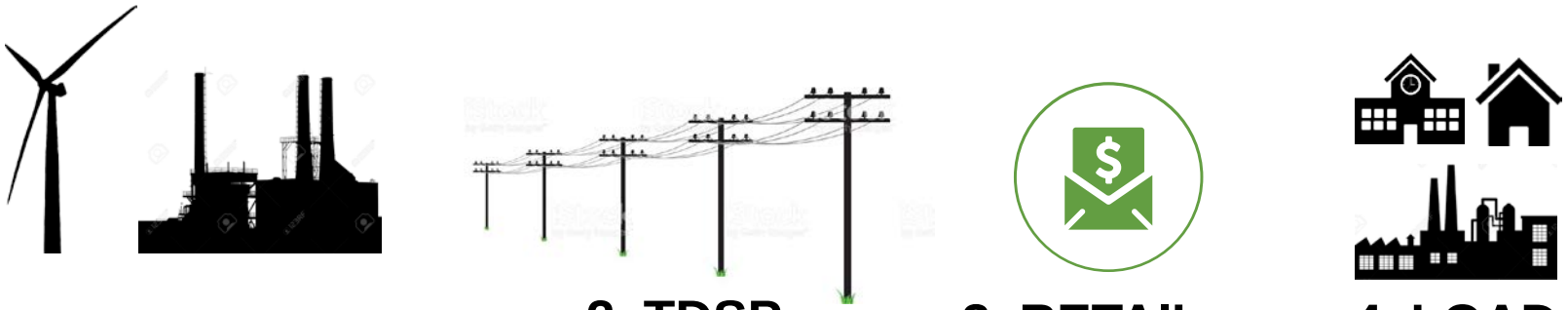
Retail restructured markets provide more transparency and delivers Customers tailored energy solutions that are more aligned with what they *CHOOSE TO VALUE*, including:

(1) how their electricity is procured & (2) what they're willing to pay for



ERCOT Background

ERCOT Market Participants



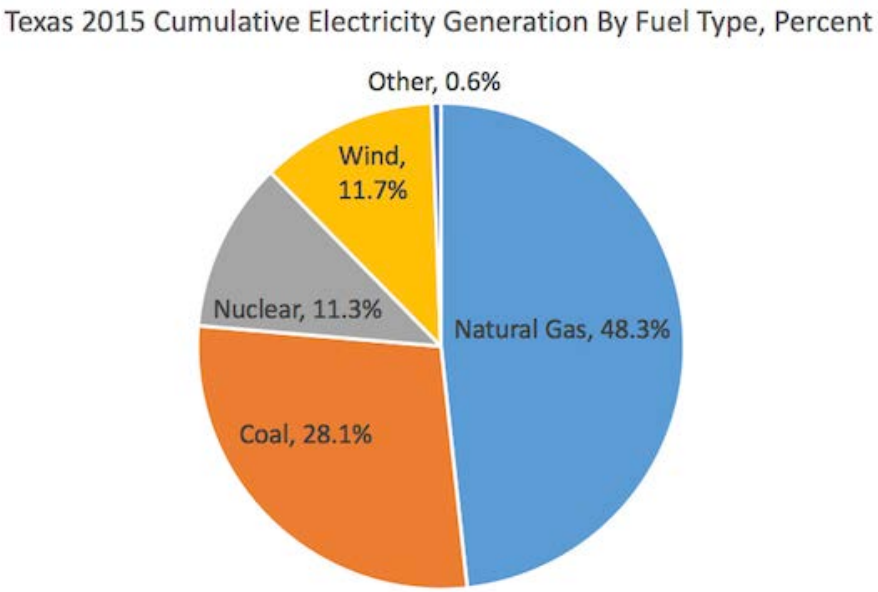
1. WHOLESALE (Generators) → **2. TDSP** (Trans & Dist Provider) → **3. RETAIL** (Suppliers, aka 'REPs') → **4. LOAD** (Customer/ End User)

- Utility-Scale Resources
- Distributed Generation Resources
- Ancillary Services
- Ancillary Services (Behind-the-Meter)
- Distributed Generation (Behind-the-Meter)

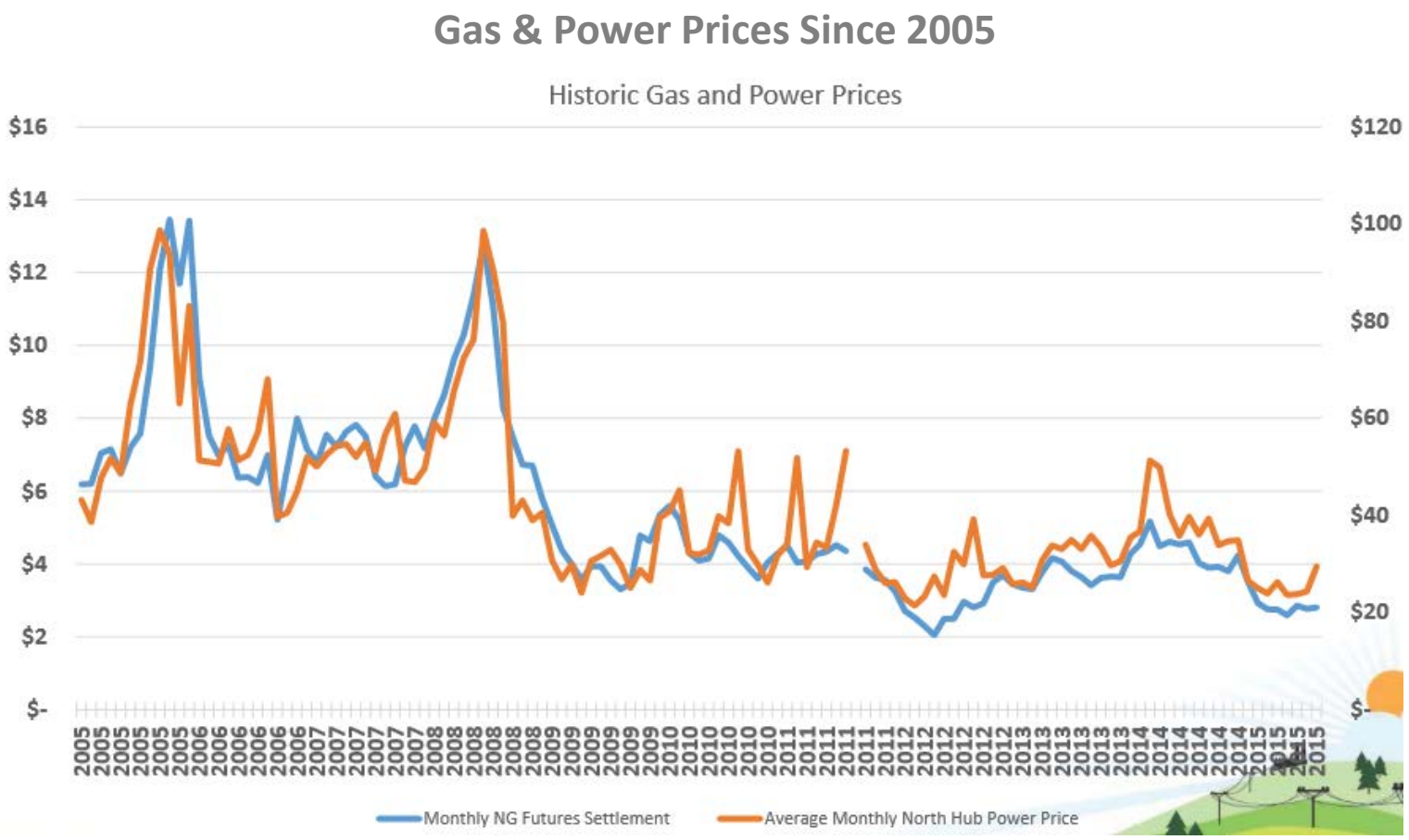
ERCOT Background

GENERATION

- Generation & Retail Restructured
- Energy-only market
- Physical power
- 10 MW DG Threshold
- WIND-HEAVY market
  - Recent record wind generation: 17 GW
  - Penetration: 50%
- Solar Installed Capacity: ~650 MW utility scale
- 1,800+ market participants
- 7 million advanced meters deployed



ERCOT is a Gas-Indexed Market



ERCOT is a Weather-Sensitive Market

REAL TIME PRICE INTENSITY 12x24

RT Price Intensity North Load Zone - 2011 to 2014

	1	2	3	4	5	6	7	8	9	10	11	12
1	$ 22.16	$ 21.96	$ 23.81	$ 26.37	$ 23.96	$ 28.85	$ 25.65	$ 24.71	$ 25.65	$ 24.49	$ 27.73	$ 27.02
2	$ 20.99	$ 20.88	$ 20.49	$ 24.48	$ 21.87	$ 24.12	$ 23.83	$ 23.04	$ 22.79	$ 22.01	$ 24.43	$ 24.36
3	$ 20.56	$ 20.75	$ 19.90	$ 21.69	$ 20.48	$ 21.79	$ 22.79	$ 21.94	$ 21.21	$ 19.54	$ 23.38	$ 23.38
4	$ 21.37	$ 24.63	$ 20.31	$ 21.65	$ 19.82	$ 21.15	$ 22.07	$ 21.06	$ 20.31	$ 19.39	$ 23.15	$ 21.95
5	$ 27.78	$ 27.37	$ 21.65	$ 21.93	$ 20.69	$ 21.03	$ 21.79	$ 20.92	$ 20.81	$ 20.30	$ 23.24	$ 22.53
6	$ 26.44	$ 54.40	$ 27.18	$ 24.75	$ 24.27	$ 21.96	$ 22.33	$ 21.73	$ 22.32	$ 22.97	$ 25.14	$ 28.33
7	$ 94.69	$ 71.92	$ 59.12	$ 44.80	$ 26.59	$ 22.23	$ 22.80	$ 22.69	$ 24.58	$ 29.85	$ 27.41	$ 32.76
8	$ 53.38	$ 54.47	$ 41.69	$ 28.69	$ 24.44	$ 23.82	$ 23.86	$ 22.90	$ 23.74	$ 25.13	$ 30.86	$ 27.58
9	$ 34.58	$ 52.63	$ 35.07	$ 29.54	$ 25.68	$ 25.72	$ 25.95	$ 24.55	$ 25.00	$ 25.17	$ 36.24	$ 28.47
10	$ 34.51	$ 50.82	$ 37.34	$ 30.68	$ 26.77	$ 27.48	$ 27.92	$ 27.51	$ 26.53	$ 31.30	$ 29.96	$ 30.19
11	$ 27.73	$ 57.97	$ 35.25	$ 30.56	$ 28.52	$ 29.48	$ 31.39	$ 31.12	$ 28.29	$ 28.46	$ 30.57	$ 28.16
12	$ 24.43	$ 45.85	$ 32.24	$ 32.61	$ 29.41	$ 31.81	$ 35.35	$ 36.04	$ 33.44	$ 31.01	$ 29.45	$ 26.87
13	$ 23.38	$ 32.02	$ 32.48	$ 31.52	$ 34.04	$ 36.07	$ 39.59	$ 42.93	$ 34.98	$ 30.89	$ 30.56	$ 25.62
14	$ 23.15	$ 30.57	$ 30.94	$ 33.93	$ 34.47	$ 43.66	$ 42.47	$ 73.00	$ 37.86	$ 33.82	$ 28.59	$ 24.77
15	$ 23.24	$ 28.35	$ 33.90	$ 37.36	$ 42.52	$ 60.82	$ 55.25	$ 168.47	$ 42.07	$ 39.41	$ 27.41	$ 24.20
16	$ 25.14	$ 27.99	$ 32.81	$ 47.94	$ 47.12	$ 80.38	$ 61.89	$ 225.54	$ 56.29	$ 52.64	$ 27.13	$ 23.88
17	$ 27.41	$ 28.80	$ 52.94	$ 53.99	$ 45.22	$ 58.22	$ 67.09	$ 232.94	$ 68.77	$ 55.03	$ 27.85	$ 24.28
18	$ 30.86	$ 34.15	$ 36.87	$ 41.77	$ 37.42	$ 43.83	$ 50.63	$ 91.91	$ 40.44	$ 35.09	$ 63.53	$ 46.13
19	$ 36.24	$ 57.46	$ 59.05	$ 33.88	$ 32.34	$ 38.02	$ 41.40	$ 42.06	$ 34.19	$ 34.11	$ 51.53	$ 39.69
20	$ 29.73	$ 38.48	$ 39.17	$ 31.35	$ 29.84	$ 33.80	$ 36.44	$ 37.72	$ 33.58	$ 38.91	$ 32.49	$ 29.83
21	$ 27.02	$ 35.50	$ 38.51	$ 38.70	$ 31.57	$ 32.62	$ 35.12	$ 37.19	$ 31.69	$ 28.79	$ 27.67	$ 28.42
22	$ 24.36	$ 30.36	$ 31.46	$ 31.01	$ 32.32	$ 31.73	$ 33.23	$ 32.68	$ 28.63	$ 27.49	$ 26.80	$ 27.27
23	$ 23.38	$ 28.13	$ 30.69	$ 30.89	$ 29.21	$ 32.38	$ 30.50	$ 29.89	$ 28.35	$ 26.46	$ 28.65	$ 29.50
24	$ 21.95	$ 23.38	$ 24.86	$ 29.69	$ 27.27	$ 27.30	$ 27.70	$ 26.56	$ 26.68	$ 23.89	$ 23.15	$ 25.27

RT Price Intensity North Load Zone - 2014

2014	1	2	3	4	5	6	7	8	9	10	11	12
1	$ 23.90	$ 29.78	$ 28.41	$ 32.39	$ 28.72	$ 31.76	$ 27.21	$ 27.35	$ 27.87	$ 27.98	$ 30.34	$ 28.22
2	$ 23.05	$ 27.06	$ 24.23	$ 30.54	$ 26.32	$ 30.35	$ 25.66	$ 25.91	$ 25.84	$ 26.30	$ 27.37	$ 24.99
3	$ 22.98	$ 27.03	$ 24.65	$ 25.52	$ 24.53	$ 27.03	$ 24.63	$ 24.78	$ 24.76	$ 20.89	$ 25.68	$ 23.18
4	$ 24.44	$ 27.85	$ 26.14	$ 26.29	$ 23.70	$ 26.11	$ 23.59	$ 23.91	$ 23.77	$ 21.05	$ 25.58	$ 21.67
5	$ 28.15	$ 30.80	$ 29.17	$ 27.14	$ 26.06	$ 25.87	$ 23.23	$ 23.81	$ 24.67	$ 22.04	$ 25.22	$ 19.91
6	$ 36.57	$ 37.82	$ 42.47	$ 32.73	$ 28.75	$ 27.23	$ 24.48	$ 24.51	$ 26.28	$ 23.92	$ 28.39	$ 22.07
7	$ 184.58	$ 77.21	$ 134.90	$ 58.43	$ 27.50	$ 27.98	$ 24.64	$ 25.35	$ 28.77	$ 26.37	$ 33.63	$ 27.16
8	$ 110.51	$ 47.86	$ 76.59	$ 35.17	$ 28.57	$ 29.68	$ 26.37	$ 25.49	$ 27.18	$ 26.45	$ 35.64	$ 24.80
9	$ 56.08	$ 51.39	$ 68.24	$ 40.09	$ 30.24	$ 31.46	$ 28.26	$ 27.08	$ 28.32	$ 26.62	$ 38.96	$ 24.72
10	$ 52.93	$ 50.54	$ 63.61	$ 36.77	$ 33.43	$ 31.95	$ 29.85	$ 28.73	$ 29.36	$ 28.49	$ 33.76	$ 26.42
11	$ 30.34	$ 55.36	$ 54.16	$ 38.68	$ 36.68	$ 33.91	$ 32.18	$ 32.73	$ 31.32	$ 29.76	$ 36.43	$ 26.27
12	$ 27.37	$ 50.08	$ 43.54	$ 38.16	$ 34.60	$ 35.75	$ 34.52	$ 37.53	$ 33.25	$ 30.68	$ 30.93	$ 24.74
13	$ 25.68	$ 48.13	$ 49.45	$ 36.85	$ 38.78	$ 39.61	$ 37.35	$ 40.79	$ 40.82	$ 34.17	$ 31.61	$ 23.74
14	$ 25.58	$ 45.81	$ 40.64	$ 42.42	$ 45.06	$ 42.59	$ 40.10	$ 47.60	$ 40.21	$ 42.93	$ 30.29	$ 23.42
15	$ 25.22	$ 42.69	$ 47.05	$ 40.07	$ 47.32	$ 44.83	$ 42.47	$ 58.48	$ 46.58	$ 48.35	$ 28.29	$ 23.09
16	$ 28.39	$ 42.52	$ 36.70	$ 48.83	$ 65.50	$ 49.68	$ 48.74	$ 61.37	$ 54.95	$ 58.65	$ 28.03	$ 22.76
17	$ 33.63	$ 45.38	$ 34.32	$ 52.63	$ 65.66	$ 47.89	$ 54.42	$ 54.55	$ 46.64	$ 56.94	$ 28.88	$ 23.17
18	$ 35.64	$ 61.30	$ 35.70	$ 41.95	$ 47.32	$ 44.82	$ 45.18	$ 45.40	$ 42.28	$ 42.00	$ 78.48	$ 47.03
19	$ 38.96	$ 106.86	$ 81.88	$ 37.11	$ 38.50	$ 41.03	$ 39.78	$ 40.45	$ 35.53	$ 40.04	$ 52.00	$ 30.90
20	$ 36.07	$ 59.28	$ 73.70	$ 37.69	$ 35.96	$ 37.25	$ 35.79	$ 37.76	$ 35.90	$ 45.61	$ 43.25	$ 27.15
21	$ 28.22	$ 53.00	$ 68.36	$ 41.03	$ 39.28	$ 36.73	$ 34.78	$ 37.22	$ 34.29	$ 30.84	$ 30.98	$ 26.24
22	$ 24.99	$ 44.57	$ 43.84	$ 36.14	$ 34.48	$ 35.75	$ 32.81	$ 33.62	$ 31.33	$ 28.25	$ 29.14	$ 24.42
23	$ 23.18	$ 39.16	$ 34.14	$ 43.06	$ 36.41	$ 33.86	$ 31.16	$ 32.36	$ 29.43	$ 28.91	$ 31.44	$ 35.92
24	$ 21.67	$ 30.22	$ 27.89	$ 38.12	$ 37.03	$ 32.12	$ 28.96	$ 27.69	$ 28.25	$ 25.66	$ 23.77	$ 26.93

10 MW NZ SOLAR SHAPE 12x24

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0.1	0	0	0	0	0	0
7	0	0	0	0.2	0.6	0.7	0.5	0.3	0.2	0	0	0
8	0.1	0.4	1.0	1.9	2.5	2.5	2.6	2.1	1.9	1.4	0.6	0.2
9	1.4	2.2	3.2	4.3	4.7	4.9	5.2	4.7	4.2	3.9	2.8	1.6
10	4.0	4.8	5.4	6.4	6.8	6.9	7.0	6.8	6.3	5.8	4.9	4.4
11	6.0	6.4	7.1	7.7	8.1	8.1	8.4	8.2	8.0	7.7	6.6	5.9
12	6.9	7.0	7.3	8.3	8.5	8.7	8.8	8.8	8.1	8.2	7.0	6.5
13	7.1	7.3	7.9	8.4	8.9	9.1	9.2	8.8	8.3	8.2	7.4	6.9
14	7.1	7.3	7.9	8.0	8.4	8.9	8.9	9.1	8.1	8.2	6.8	6.7
15	6.4	6.6	7.5	8.0	7.6	8.1	8.1	8.3	7.1	6.9	5.7	5.7
16	4.7	5.4	6.4	6.7	6.5	7.1	6.7	6.6	6.2	5.3	4.1	4.1
17	2.4	3.1	4.3	4.9	4.3	5.1	5.0	4.5	3.7	2.7	1.5	1.2
18	0.4	0.8	1.6	2.1	2.0	2.7	2.7	2.2	1.3	0.5	0.1	0.0
19	0	0	0.1	0.2	0.4	0.6	0.7	0.4	0.1	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0.1	0	0	0	0	0	0
7	0	0	0	0.2	0.6	0.7	0.5	0.3	0.2	0	0	0
8	0.1	0.4	1.0	1.9	2.5	2.5	2.6	2.1	1.9	1.4	0.6	0.2
9	1.4	2.2	3.2	4.3	4.7	4.9	5.2	4.7	4.2	3.9	2.8	1.6
10	4.0	4.8	5.4	6.4	6.8	6.9	7.0	6.8	6.3	5.8	4.9	4.4
11	6.0	6.4	7.1	7.7	8.1	8.1	8.4	8.2	8.0	7.7	6.6	5.9
12	6.9	7.0	7.3	8.3	8.5	8.7	8.8	8.8	8.1	8.2	7.0	6.5
13	7.1	7.3	7.9	8.4	8.9	9.1	9.2	8.8	8.3	8.2	7.4	6.9
14	7.1	7.3	7.9	8.0	8.4	8.9	8.9	9.1	8.1	8.2	6.8	6.7
15	6.4	6.6	7.5	8.0	7.6	8.1	8.1	8.3	7.1	6.9	5.7	5.7
16	4.7	5.4	6.4	6.7	6.5	7.1	6.7	6.6	6.2	5.3	4.1	4.1
17	2.4	3.1	4.3	4.9	4.3	5.1	5.0	4.5	3.7	2.7	1.5	1.2
18	0.4	0.8	1.6	2.1	2.0	2.7	2.7	2.2	1.3	0.5	0.1	0.0
19	0	0	0.1	0.2	0.4	0.6	0.7	0.4	0.1	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0

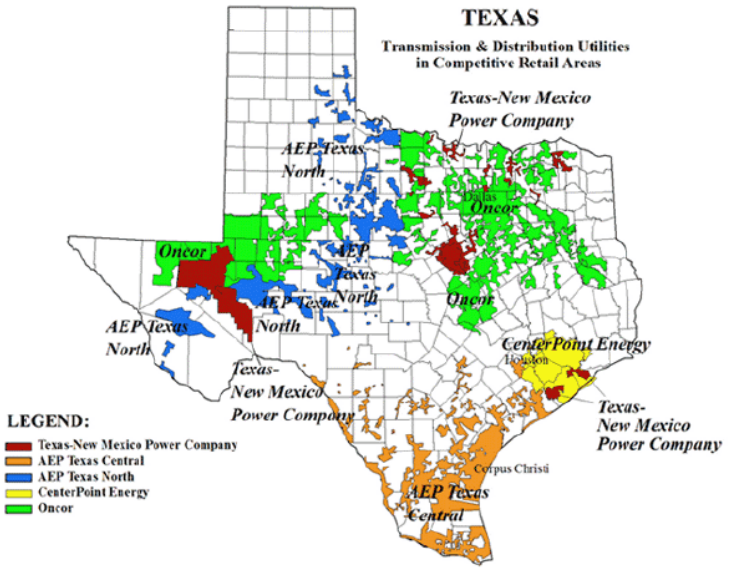
TDSPs in ERCOT

The only 'Regulated' Party in the Market

TDSP RESPONSIBILITIES

- Regulated by Texas PUC
- Own transmission lines, meters, etc.
- Read meters and send data to REP's
- Service the meters and lines
  - Fix outages
  - Meter swaps
  - SOLAR INSPECTIONS
  - Provide historic usage records
  - …and more!

****All REP's in Texas "pass through" TDSP charges to the customer****



Average TDSP costs for a residential customer (avg monthly usage):

- 648 kWh = ~$26
- 1,222 kWh = ~$45
- 1,692 kWh = ~$64
- 2,214 kWh = ~$79

TDSPs in ERCOT

Sample Residential TDSP Monthly Charges

TDSP Charges			
Nuclear Decommissioning (NDF)	2,214	0.00020	$ .37
Customer Charge	1	0.78000	$ .78
Transmission Cost Recovery Factor	2,214	0.01220	$26.99
Transition Charge (TC2)	2,214	0.00090	$2.09
Energy Efficiency Cost Recovery Factor (EECRF)	2,214	0.00100	$2.27
Advanced Metering Cost Recovery Factor	1	2.19000	$2.19
Metering Charge	1	2.28000	$2.28
Transition Charge	2,214	0.00050	$1.16
Distribution System Charge	2,214	0.01860	$41.14
Subtotal – TDSP Charges			$74.02

= fixed monthly charges

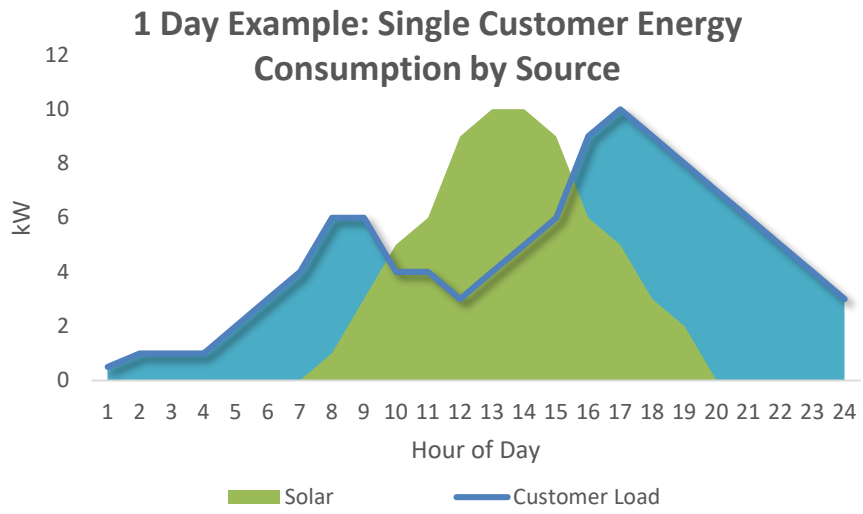
= volumetric monthly charges

Retail Supply via REP

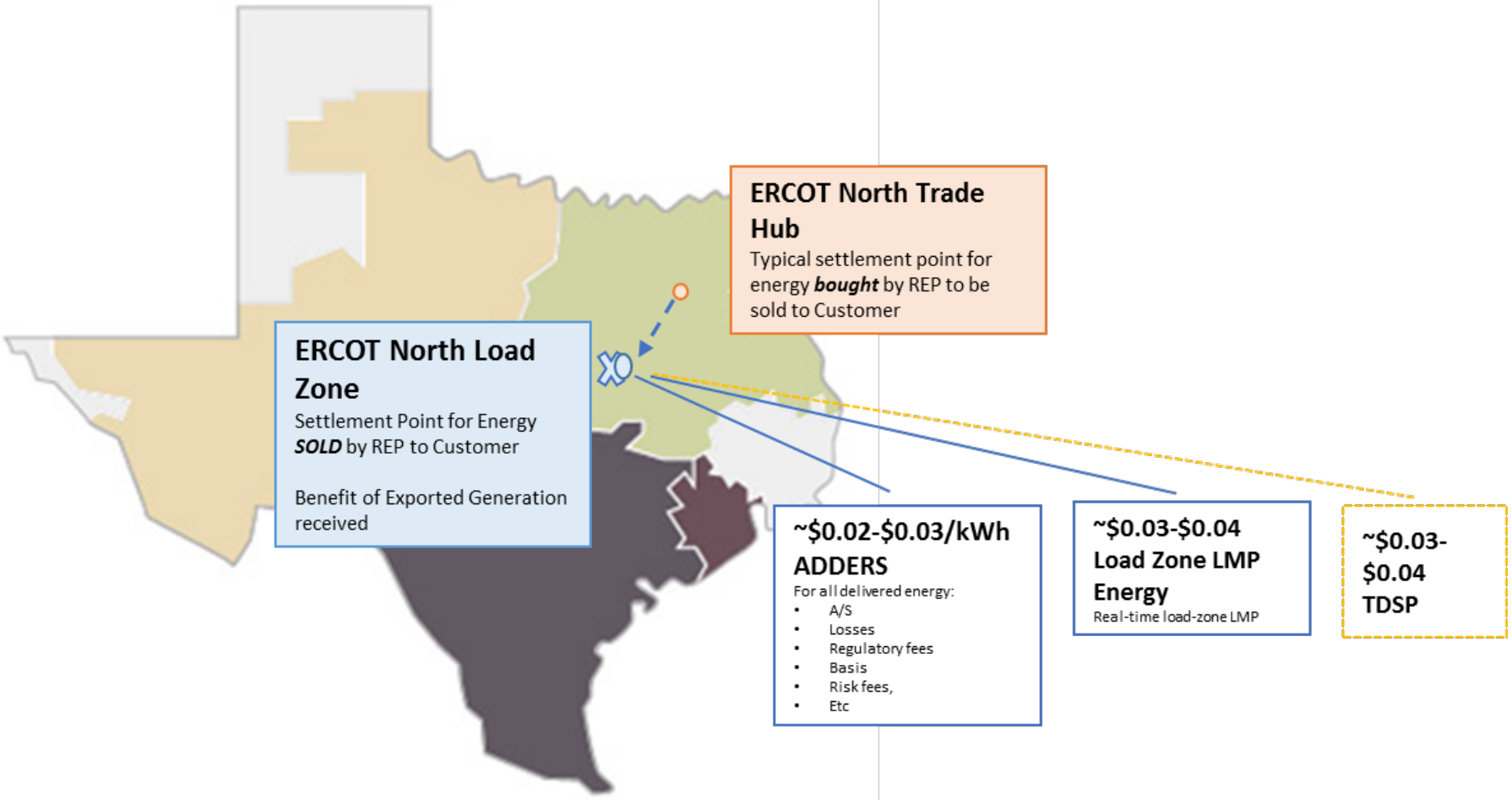
Buying Energy + Adders, Passing Through Demand

RETAIL SUPPLIER RESPONSIBILITIES

- Provide balancing energy and "firms" intermittent BTM resources to make sure the customer receives reliable power and isn't unnecessarily exposed to market volatility
- Sell and schedule electricity to end-user
- 3 types of REPs---Option 1, 2, 3
- BILL customers for electricity based on what is delivered---and includes pass-through of TDSP charges
- Create the "rates"
- Compensate for any excess generation from a non-ERCOT DG resource
- 24,000,000 ESI IDs



How Retail Power is Bought/Sold



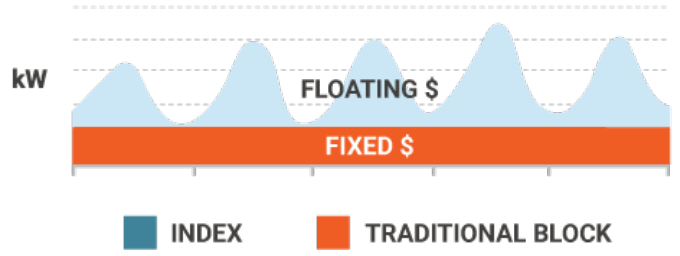
Retail Supply Rate Structures

Suppliers are having to compete for business on more than price.

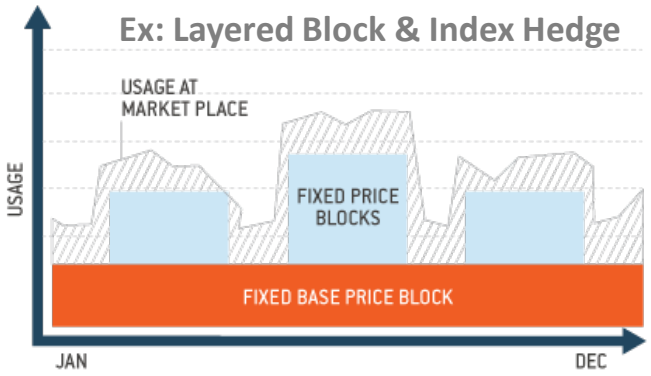
They now differentiate based on: Hedge Product, Type, and Term

Type of Hedge Product	Pricing Structure for Hedge
1. Block & Index	Fixed Price or Heat Rate + Index (LMP)
2. Shaped Block w/ swing	Fixed Price or Heat-Rate
3. Full Requirements	Fixed Price or Heat-Rate
4. Unhedged/Real-time	Day Head/LMP
5. Layered Block & Index	Fixed Price or Heat-Rate + Index (LMP)
****SELF-PROCUREMENT****	REP Service Fee**

Ex: Block & Index Hedge



Ex: Layered Block & Index Hedge



RISK IN THE MARKET

1. Retail Settlement & Price Points
2. Retail Supply Hedging & Rates
3. Consumer Protection

Risk: ERCOT Settlement & Pricing

Weather/natural gas volatility and grid congestion cause price retail risk

NODAL PRICE=

☑ UTILITY SCALE GEN 'SELL' PRICE

Unique busbar pricing for every utility-scale generation resource

TRADE HUB PRICE=

☑ RETAIL SUPPLY 'BUY' PRICE

Single price point reflecting the simple average of all Nodes in each of the four Load Zones

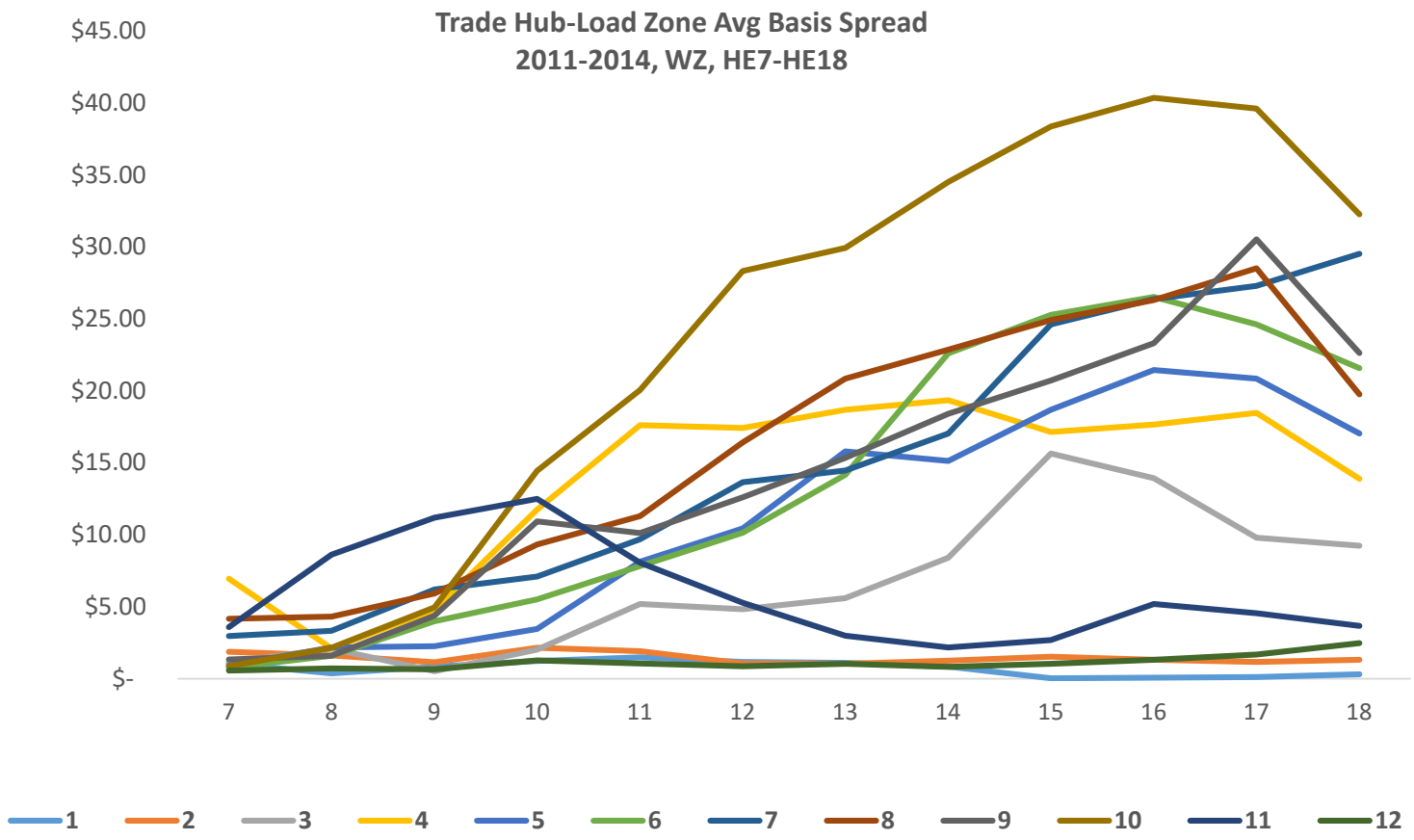
LOAD ZONE PRICE=

☑ LOADS 'BUY' PRICE
☑ BTM DIST GEN 'SELL' PRICE

Single price point reflecting the load-wtd avg price of all Nodes in each of the four Load Zones

Risk: ERCOT Settlement & Pricing

Basis, Basis, Basis!



Risk: Retail Supply Hedging & Rates

"Cost of Service" rate-making….Hedging based on Customer Value

Retail Supply Cost Components	% of total Energy Supply Price	Market Hedge Available?
Trade Hub Energy	67.77%	Yes
Shaping	7.68%	No
Imbalance	0.43%	N
Straddle	2.07%	N
Energy Losses	4.12%	Y
Ancillary	4.01%	Y
RUC	0.13%	Y
RTRNA	0.43%	Y
ISO Fees	2.07%	N
Load Zone Basis	1.73%	Y
REC	0.24%	Y
Voluntary REC	0.00%	Y
Credit Fee**	2.53%	N
Broker & REP Fee**	5.00%	N
Margin**	3.00%	N
CRR Adjustment	-1.20%	N

Considerations like….

1. Long-term price certainty?
2. Load shape?
3. Completely de-risked supply?
4. Renewables?
5. Low-cost power?
6. Load growth?
7. Reliability and back-up generation?
8. Monetizing onsite assets?

CUSTOMER NEEDS & VALUES DRIVE RETAIL PRODUCT (hedge) SELECTION

TDSP CHARGES CANNOT BE HEDGED and make-up 30-40% of customer bill

Risk: Consumer Protection

The Texas PUC Still Tightly Regulates Elements of the Residential Customer Acquisition via PURA Chapter 25, Subchapter R (Customer Protection)

Electricity Fact Label (EFL)

Electricity Facts Label
Green Mountain Energy Company (REP Cert. No. 10009)
Pollution Free™ Conserve 12 Choice
CenterPoint Energy Service Area
Date: 06/30/2017

Electricity price

Average monthly use:	500 kWh	1000 kWh	2000 kWh
Average price per kWh:	8.5¢	6.9¢	9.9¢

This price disclosure is based on the following components:

Base Charge: $10.00 per month
Energy Charge: (0 to 1000 kWh) 1.834300¢ per kWh
Energy Charge: (> 1000 kWh) 9.381300¢ per kWh
CenterPoint Energy Delivery Charges: $5.47 per month and 3.5686¢ per kWh

CenterPoint Energy Delivery Charges include all recurring charges passed through without mark-up. This price disclosure is an example based on average prices - your average price for service will vary according to your usage. The price you pay each month will consist of the Base Charge, Energy Charge, and CenterPoint Energy Delivery Charges.

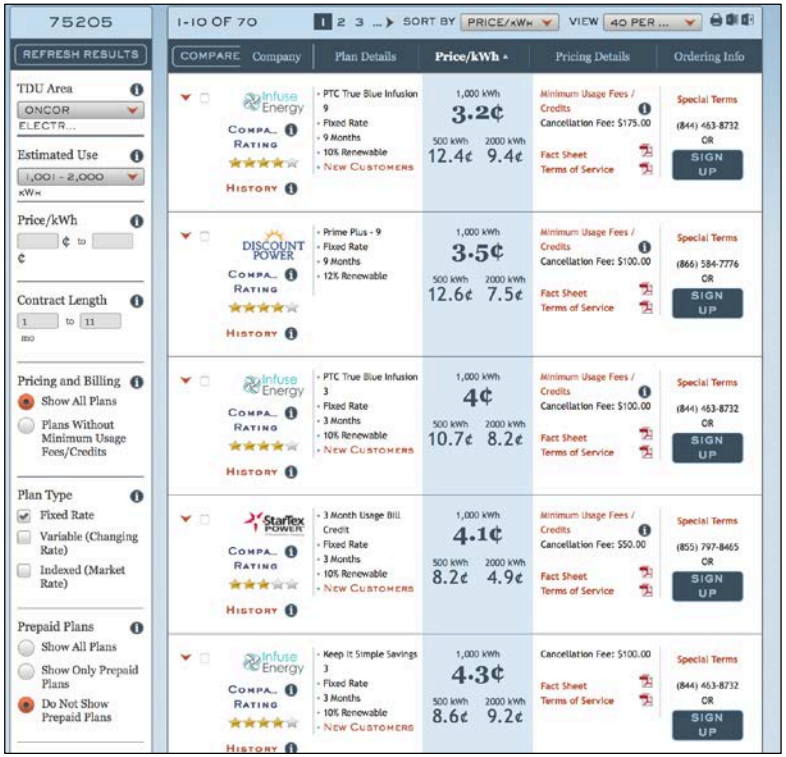
Other Key Terms and questions

See Terms of Service statement for a full listing of fees, deposit policy, and other terms.

Disclosure Chart

Type of Product	Fixed Rate
Contract Term	12 Months
Do I have a termination fee or any fees associated with terminating service?	Yes. $150 early cancellation fee.
Can my price change during contract period?	Yes, but only in the limited circumstances described below.
If my price can change, how will it change, and by how much?	The price can only change to reflect actual price changes that are allowed by Public Utility Commission rules due to changes in law or regulatory charges.
What other fees may I be charged?	If applicable, we may bill you for certain non-recurring late payment, insufficient funds, disconnection or other fees as described in Section 8 of your Terms of Service.
Is this a pre-pay or pay in advance product?	No.

Power to Choose website



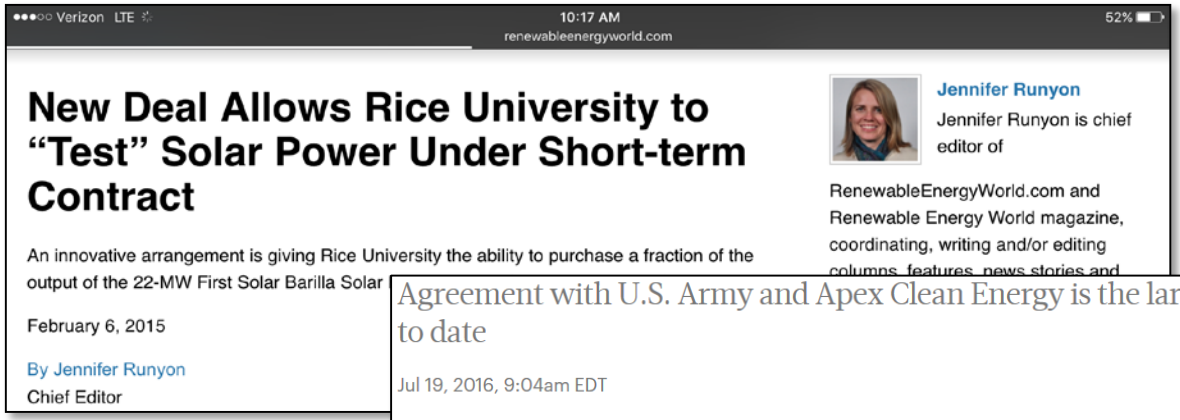
MARKET EFFICIENCIES & CUSTOMER BENEFITS

CUSTOMER CHOICE→ VALUE→ INNOVATIVE TECHNOLOGY & RETAIL PRODUCTS

1. Retail Supplier Rate & Product Innovation
2. Experience & Technology Innovation

Retail Supplier Rate & Product Innovation

Loads have more control over HOW their power is supplied…
Renewables are more easily accessed, independent of regulatory mandates or approval requirements


Verizon LTE 10:17 AM renewableenergyworld.com 52%

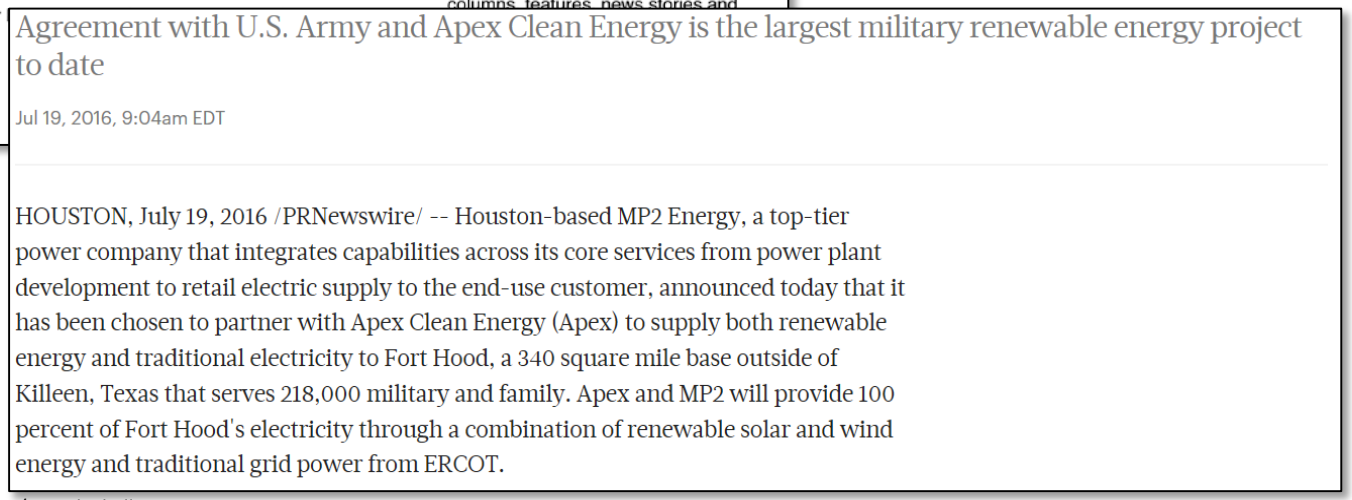
New Deal Allows Rice University to "Test" Solar Power Under Short-term Contract

An innovative arrangement is giving Rice University the ability to purchase a fraction of the output of the 22-MW First Solar Barilla Solar

February 6, 2015

By Jennifer Runyon
Chief Editor

Jennifer Runyon
Jennifer Runyon is chief editor of RenewableEnergyWorld.com and Renewable Energy World magazine, coordinating, writing and/or editing columns, features, news stories and


Agreement with U.S. Army and Apex Clean Energy is the largest military renewable energy project to date

Jul 19, 2016, 9:04am EDT

HOUSTON, July 19, 2016 /PRNewswire/ -- Houston-based MP2 Energy, a top-tier power company that integrates capabilities across its core services from power plant development to retail electric supply to the end-use customer, announced today that it has been chosen to partner with Apex Clean Energy (Apex) to supply both renewable energy and traditional electricity to Fort Hood, a 340 square mile base outside of Killeen, Texas that serves 218,000 military and family. Apex and MP2 will provide 100 percent of Fort Hood's electricity through a combination of renewable solar and wind energy and traditional grid power from ERCOT.

http://www.renewableenergyworld.com/articles/2015/02/new-deal-allows-rice-university-to-test-solar-power-under-short-term-contract.html

http://www.bizjournals.com/prnewswire/press_releases/2016/07/19/CL49507

Retail Supplier Rate & Product Innovation

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
Adobe	B	23%	37%	23%	11%	B	A	B	B	A
Alibaba.com	D	24%	3%	67%	3%	F	F	C	F	D
amazon.com web services	C	17%	24%	30%	26%	F	D	C	C	B
	A	83%	4%	5%	5%	A	A	A	A	B
Baidu 百度	F	24%	3%	67%	3%	F	F	D	F	F
	A	67%	7%	15%	9%	A	A	A	A	B
Google	A	56%	14%	15%	10%	B	A	A	A	A
hp	C	50%	17%	27%	5%	D	B	C	B	C
IBM	C	29%	29%	27%	15%	C	B	C	C	F
Microsoft	B	32%	23%	31%	10%	B	B	C	B	B
NAVER	C	2%	19%	39%	31%	B	B	B	D	D
ORACLE	D	8%	26%	36%	25%	D	D	F	D	F
salesforce	B	43%	12%	16%	15%	B	A	C	B	B
SAMSUNG 삼성SDS	D	11%	19%	29%	31%	C	D	C	D	C
Tencent 腾讯	F	24%	3%	67%	3%	F	F	D	F	F

Businesses make major decisions based on power supply options

← **Example: Clicking Clean Report, 2017**
http://www.clickclean.org/usa/en/

Retail Supplier Rate & Product Innovation

Regulated Rates (eg NEM) in Restructured Markets are surfacing in order to facilitate new technology deployment, too

CleanTe
news & ana

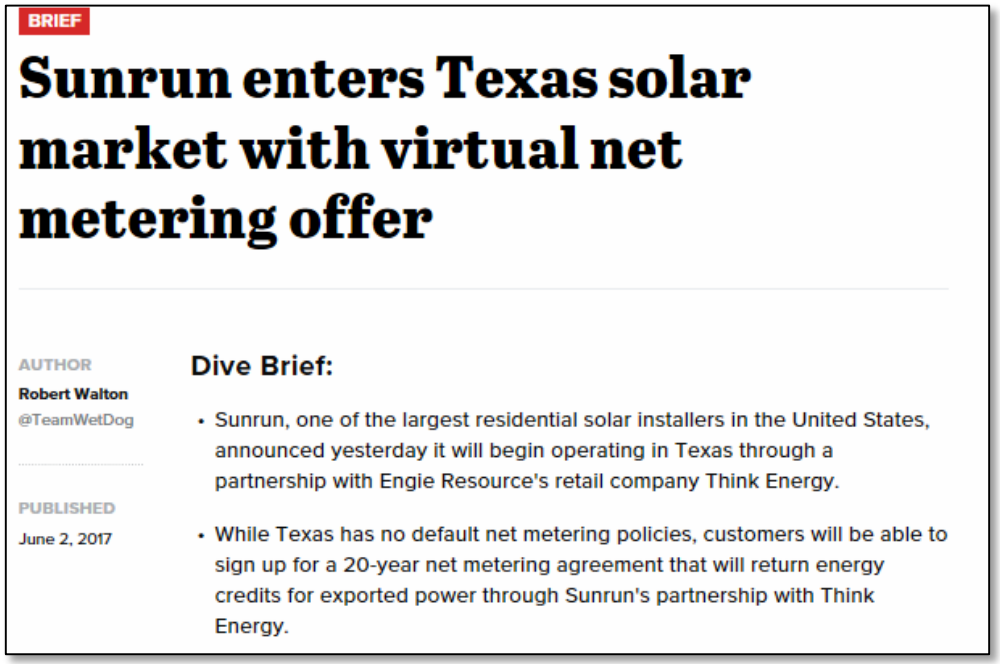
About Electric Car Reviews Exclusives Power

SolarCity Bringing "Full Net Metering" To Texas (This Is Big)

March 11th, 2015 by James Ayre

The prominent solar leasing company SolarCity is partnering with the utility company MP2 Energy to bring "full" net metering to the Dallas–Fort Worth region of Texas — thereby putting solar energy in a very competitive position with utility power — according to recent reports.

https://cleantechnica.com/2015/03/11/solarcity-partnering-mp2-energy-bring-full-net-metering-texas/



BRIEF

Sunrun enters Texas solar market with virtual net metering offer

AUTHOR
Robert Walton
@TeamWetDog

PUBLISHED
June 2, 2017

Dive Brief:

- Sunrun, one of the largest residential solar installers in the United States, announced yesterday it will begin operating in Texas through a partnership with Engie Resource's retail company Think Energy.
- While Texas has no default net metering policies, customers will be able to sign up for a 20-year net metering agreement that will return energy credits for exported power through Sunrun's partnership with Think Energy.

http://www.utilitydive.com/news/sunrun-enters-texas-solar-market-with-virtual-net-metering-offer/444076/

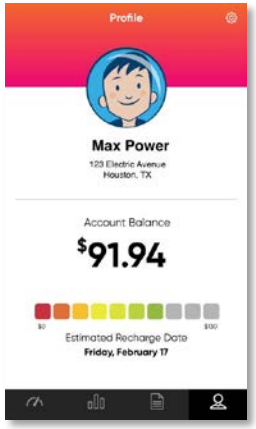
Experience & Technology Innovation

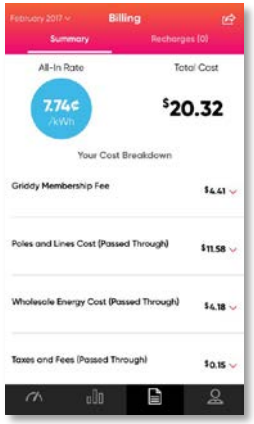
Customers want to be more engaged in their electricity consumption

griddy

For only $9.99 a month, they give Customers direct access to real-time electricity prices, so Customers pay the same price that the REPs pay for electricity real-time

They've engineered smart energy tools that connect to the house smart meter, providing Customers with real-time electricity prices and forecasts of future prices to help know how much they're using and saving. Pay-as-you-go billing allows anyone to use Griddy. Simply establish a minimum account balance of $49 at sign-up to enroll.





Restructured Market: Summary Thoughts

RISK & CUSTOMER CHOICE→ *drive*

VALUE PROPOSITION & TRANSPARENT COMPETITIVE PRICING→ *creating*

INNOVATIVE PRODUCTS, TECHNOLOGIES, & EXPERIENCES→ *leading to*

ECONOMIC DEVELOPMENT & HAPPY CONSTITUENTS ☺

www. MothershipEnergyGroup.com

3773 Richmond Ave, Ste 555
Houston, Texas 77046

Maura@MothershipEnergyGroup.com

Committee on Energy Choice

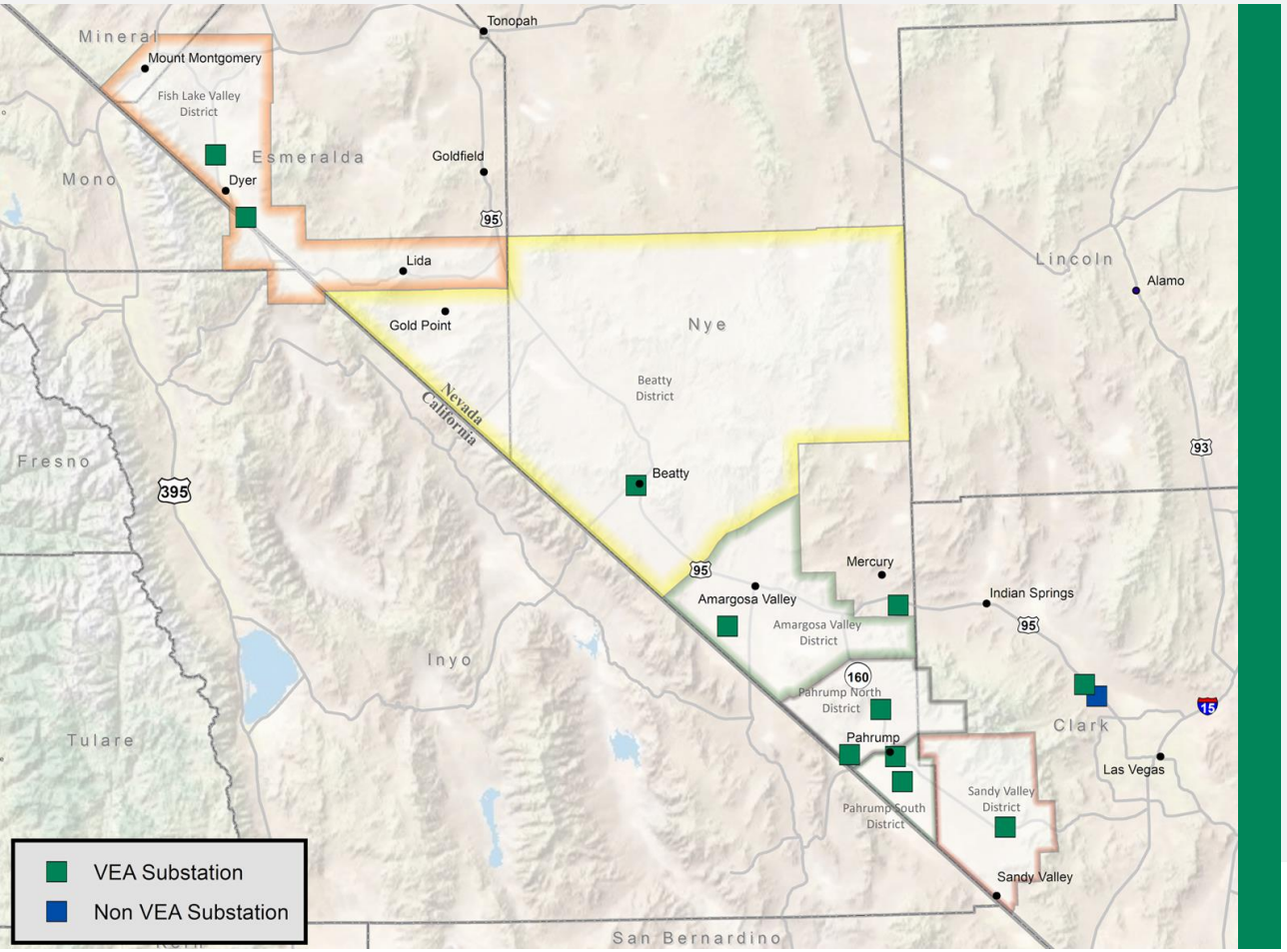
ENERGY MARKET DESIGN & POLICY

AUGUST 8, 2017

Valley Electric Association, Inc.

A Touchstone Energy® Cooperative

About **VALLEY ELECTRIC**



- Our history began in 1965 as an Electric Coop
- 17,500 members across 6,800 sq. miles and a population base of 40,000+
- We serve in Clark, Nye, Esmeralda, and Mineral counties in NV as well as Inyo and Mono counties in CA
- We are the first non-California member of the CAISO and only Nevada utility in an organized wholesale market

Valley Electric Association, Inc.
A Touchstone Energy® Cooperative

Our **VISION**

- To continue to be our consumers'/members' innovative energy partner and stay on the leading edge of energy developments that provide solutions and alternatives in a changing industry.
- Promote structured regionalized markets that foster efficient utilization of generation, transmission, and delivery resources — resulting in lower costs, innovative technologies, and environmental stewardship.
- To employ technology and communications to bridge to a smart grid/smart community, empowering consumers, choices, and markets.

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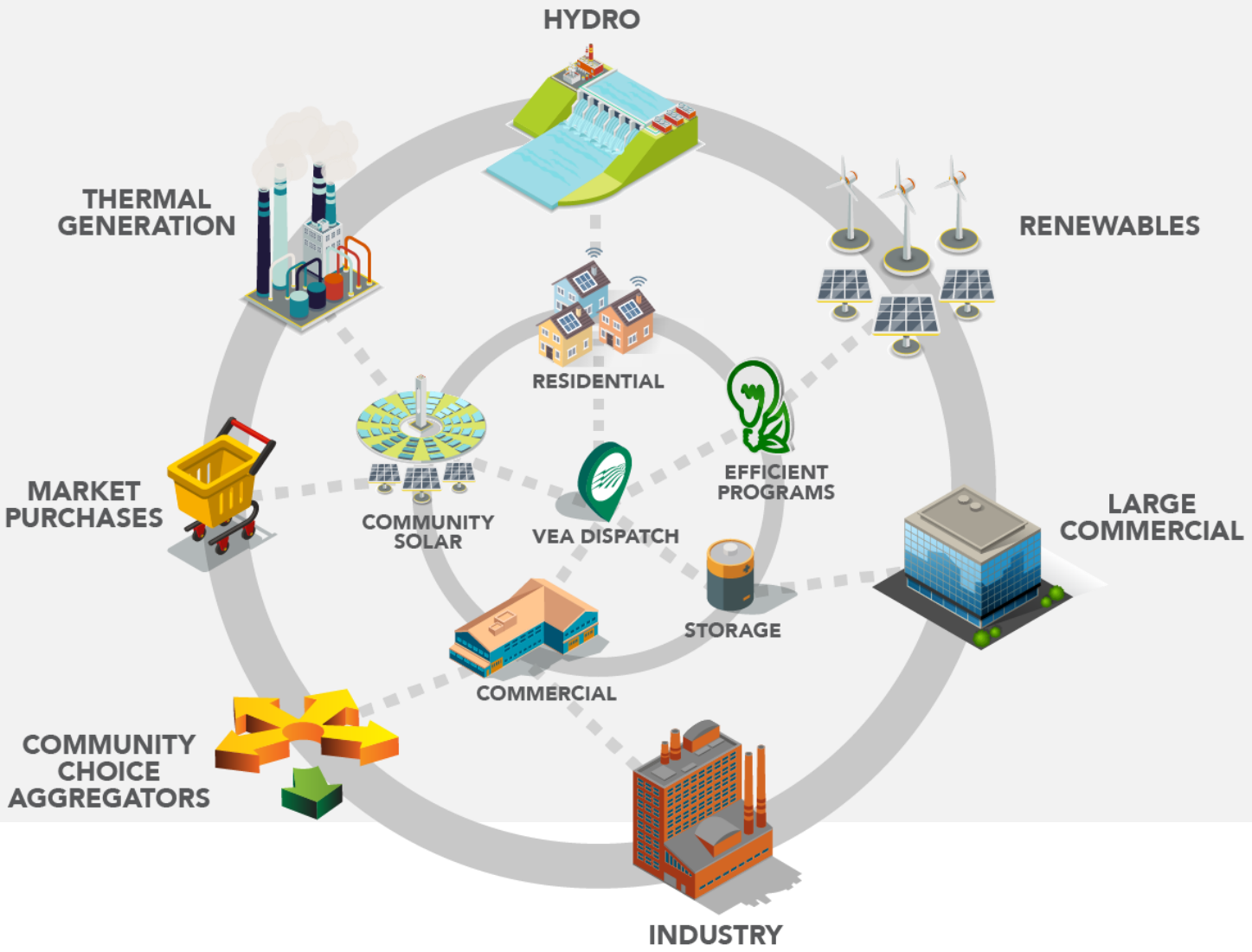
Energy of **TOMORROW**



- Interactive Smart Grid System

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VEA **SMART PROJECTS**

2009

Largest Solar Water Heater Program in US

2012

NNSS and Creech AFB

2013

Joined CAISO

2015

Largest Community Solar Project in the US

High-Speed Communications Infrastructure in Rural Nevada

Strategic Communications Partnership

2016

First Charging Station on Nevada's Electric Highway

Strategic Transmission Partnership

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What **WE DO**

- Provide Wholesale and Retail Electric Service
- Own and Operate Regional Electrical Transmission Systems
- Optical Fiber Services and Infrastructure (Wholesale & Retail)
- Own and Operate Military Electrical Distribution System
- Comprehensive Operating/Dispatch System

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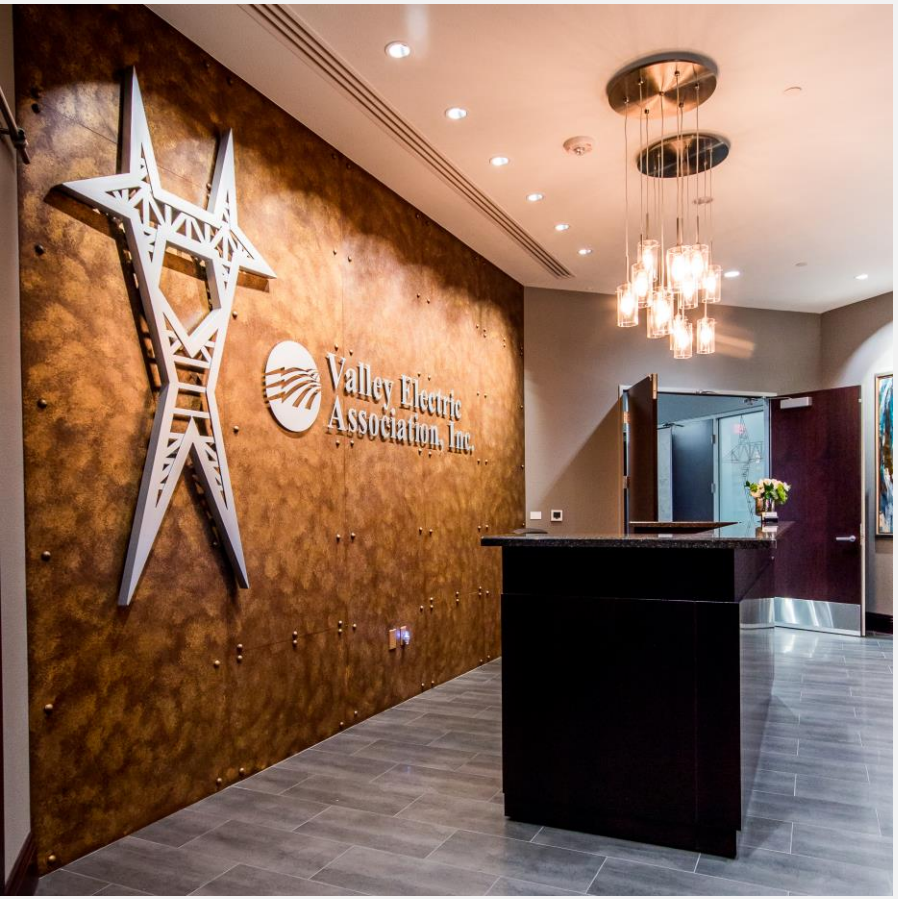
How **WE DO IT**



- **Valley Electric Association, Inc.** (VEA) - 1965
- **Valley Electric Transmission Association** (VETA) - 2010
- **Valley Electric Energy Services** (VEES) - 2014
- **Valley Electric Utility Service** (VEUS) - 2014
- **Valley Communications Association** (VCA) - 2015

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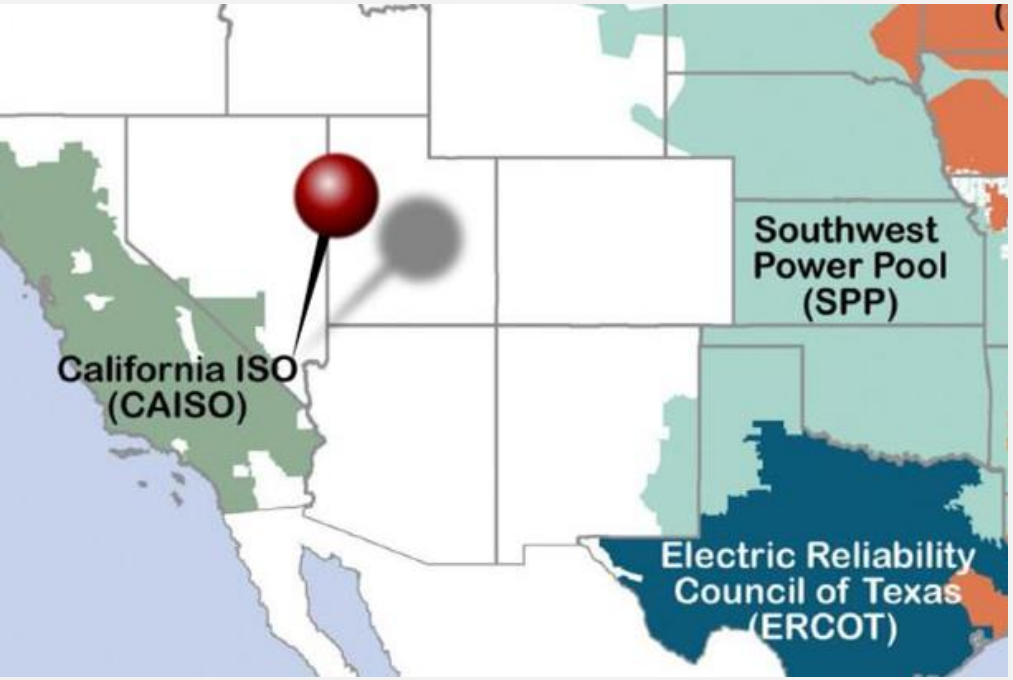
Need for **REGIONALIZATION**



- We Support Regionalization
- Only Nevada utility that is a full participant in an organized wholesale market
- First member of CAISO outside of CA
- Nevada lacks a robust regulated market (38 Balancing Authorities in the West is inefficient)
  - Fiefdoms and State Lines

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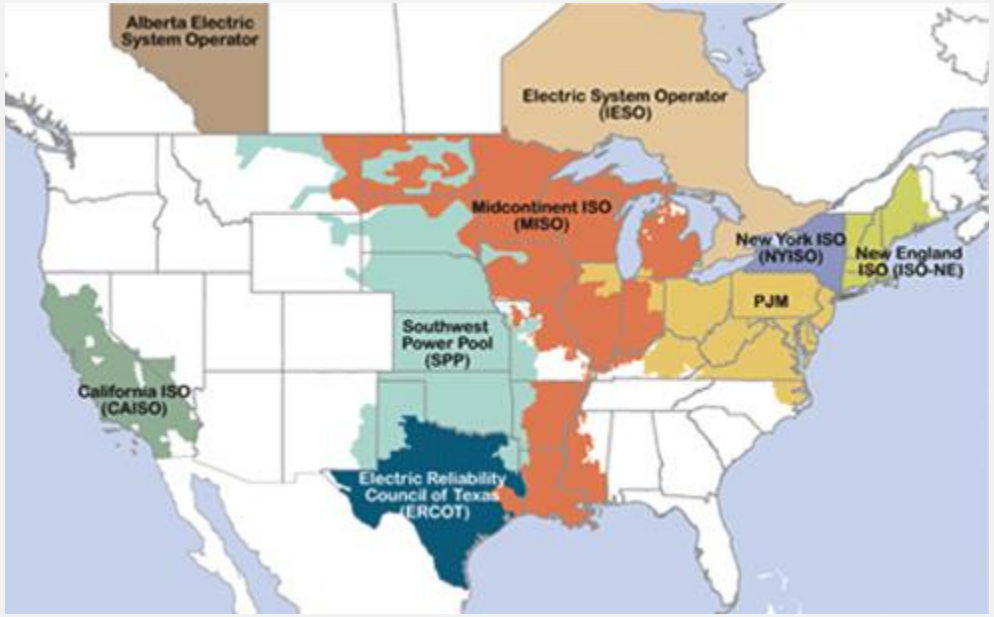
Benefits of **REGIONALIZATION**



- Development of additional renewables (development & market access enhanced)
- Lower Pricing with Wholesale Markets
- Unified Governance Policies
- Independent Oversight

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Why We **JOINED THE ISO**

California ISO
Shaping a Renewed Future

- Renewable Energy Development
- Robust Markets
- Fair Governance
- Lower Costs & Increased Revenues
- Daily Life In A Regional ISO/RTO

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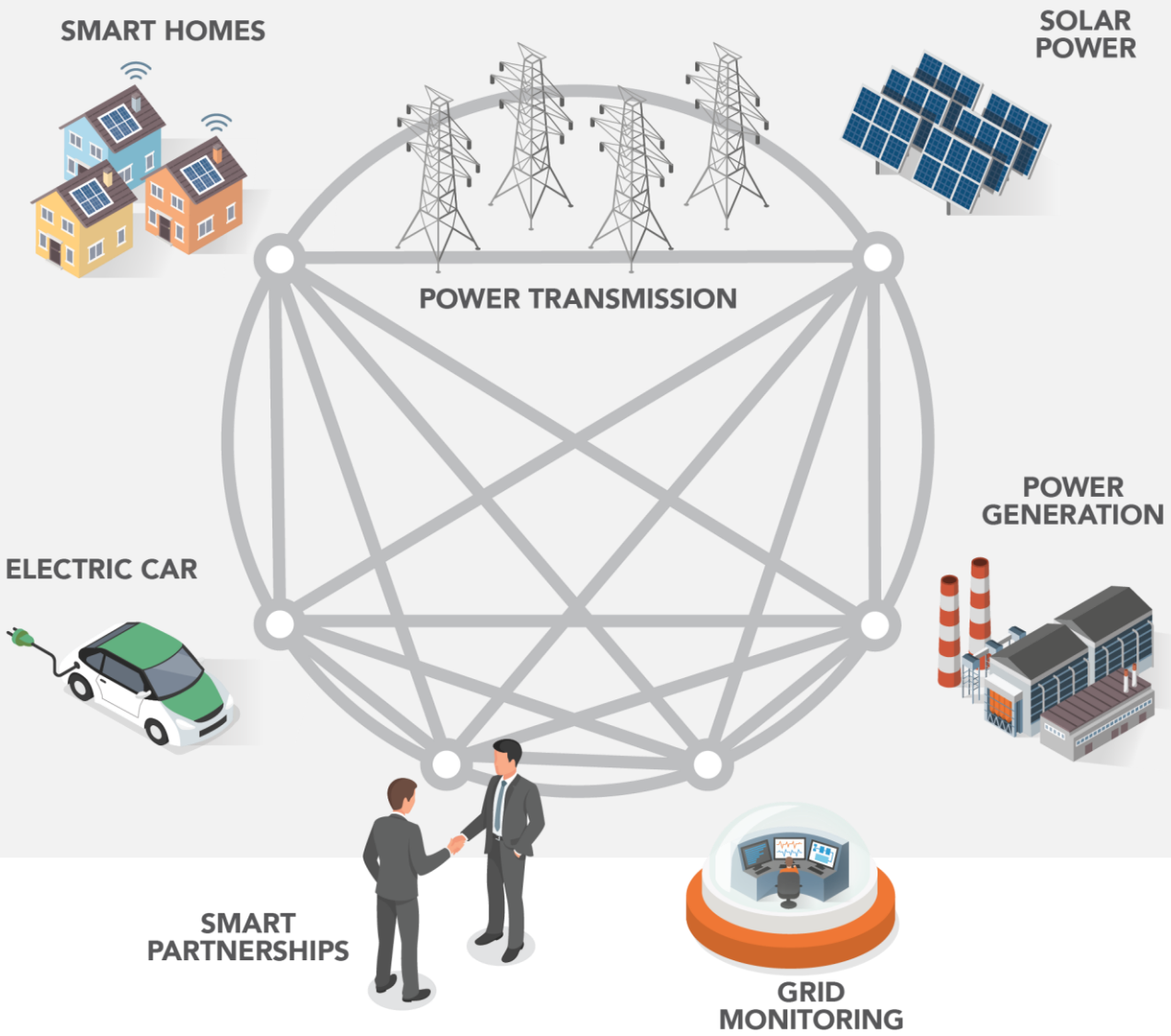
Retail Market: **SMART EVOLVING**



- We are creating a **SMART** Utility
- We are establishing **SMART** communities
- We are building **SMART** partnerships

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Retail Market: **STRUCTURE**

- PUCN Regulation of Retail Energy Providers
  - Fair and Transparent
- PUCN Customer Protection and Education
  - Unique Business Model Differences

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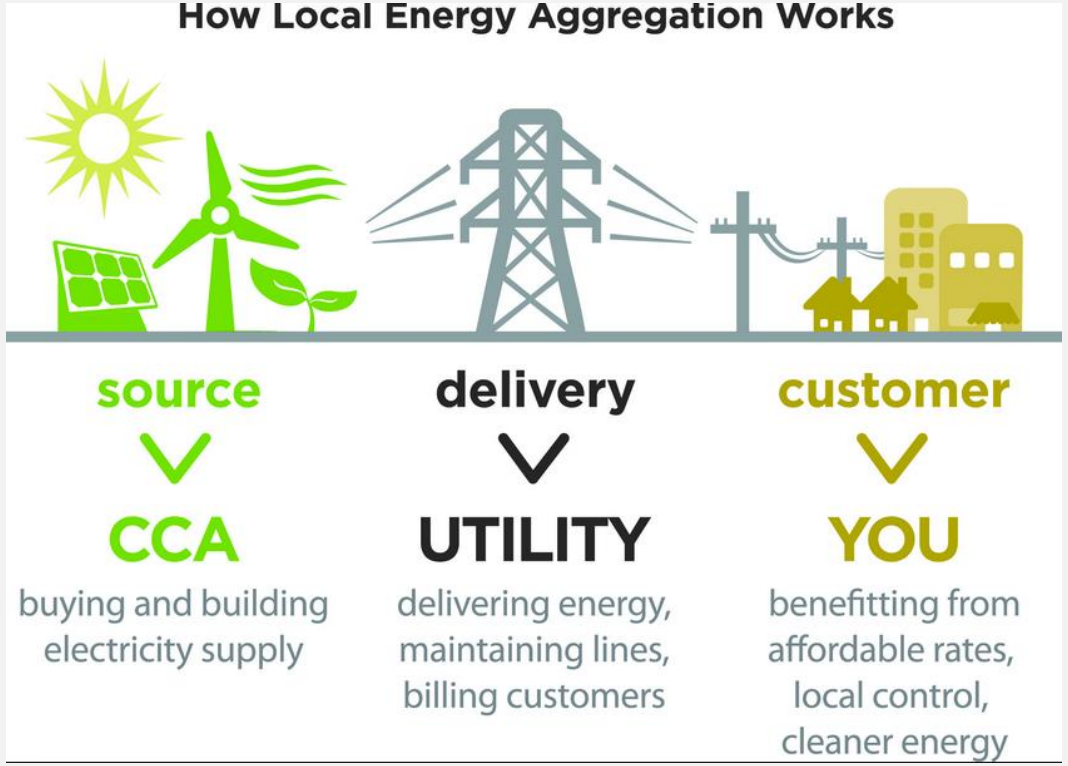
Retail Market: **ENERGY FOR ALL**



- Community Choice Aggregation
  - Potential model to Meet Needs of Low Income and Vulnerable Populations
  - Potential Model for Community Interest
- Conservation Funding Through Distribution Utility Aligns Incentives

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Provider of **LAST RESORT**

- Multiple Provider Areas has Precedent
- Community Choice Aggregation
- Competitive Bidding
- Through Valley Electric Energy Services, Valley Electric Association fully intends to participate

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Follow Up **QUESTIONS**

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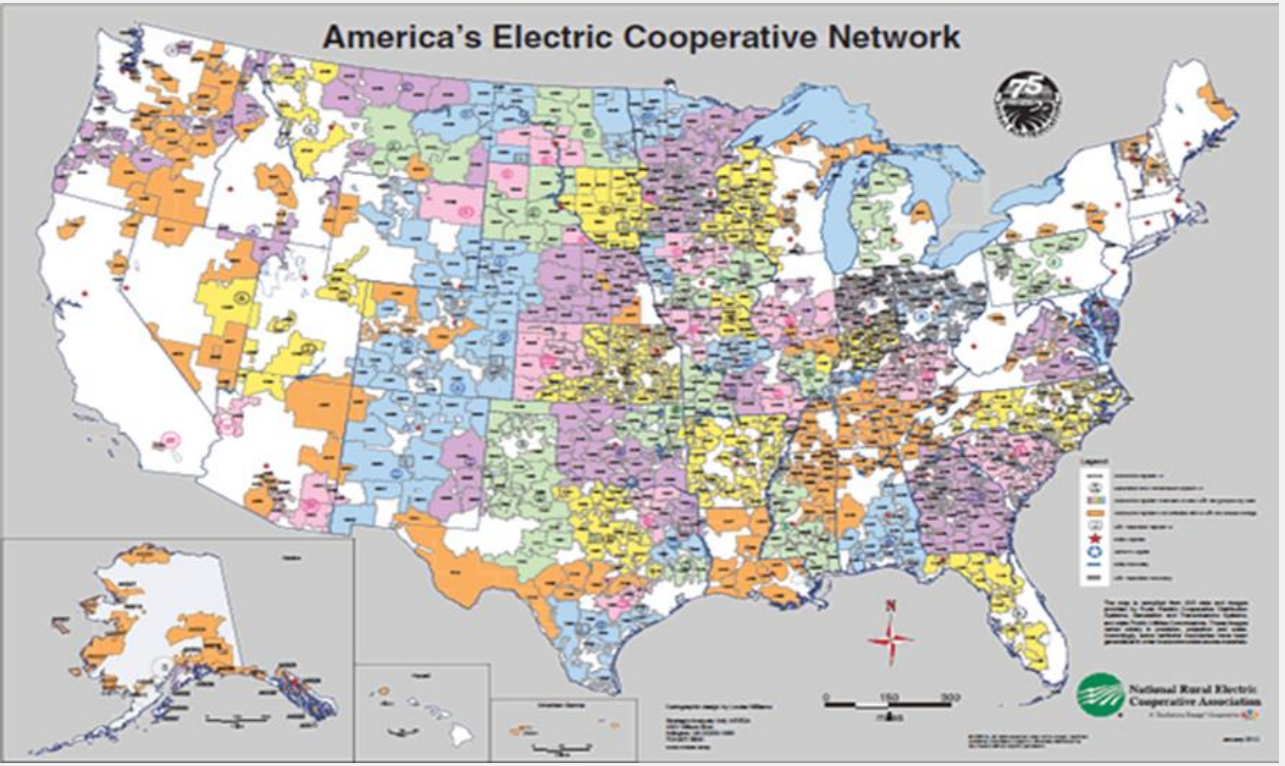
We are **A NETWORK**



- 1 of 900 Co-Ops in the country
- Community-formed
- Financial Capital Resources
- Risk Management & Insurance Resources
- Power Marketing Resources
- Communications

Valley Electric Association, Inc.
A Touchstone Energy® Cooperative

Updated April 12, 2017

SPP Wholesale Markets and Retail Markets

Carl Monroe, Executive Vice President and COO

Bruce Rew, Vice President, Operations

Our Mission

Helping our members work together to keep the lights on …
today and in the future.

THE SPP DIFFERENCE

- Relationship-based
- Member-driven
- Independence Through Diversity
- Evolutionary vs. Revolutionary
- Reliability and Economics Inseparable

CURRENT SPP FOOTPRINT: MEMBERS IN 14 STATES

- **Arkansas**
- **Kansas**
- **Iowa**
- **Louisiana**
- **Minnesota**
- **Missouri**
- **Montana**
- **Nebraska**
- **New Mexico**
- **North Dakota**
- **Oklahoma**
- **South Dakota**
- **Texas**
- **Wyoming**

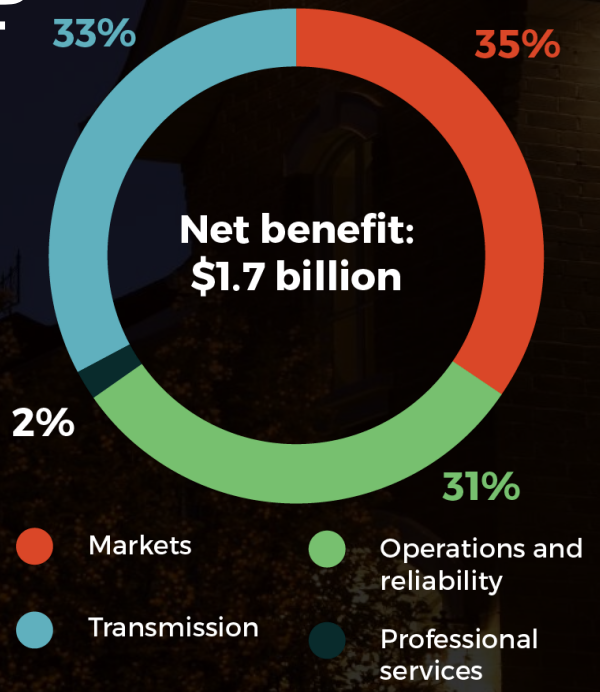
RTO REQUIREMENTS

8 Functions outlined in FERC Order 2000:

- Tariff administration and design
- Congestion management
- Parallel path flow
- Ancillary services (including energy imbalance, regulation, and operating reserves)
- OASIS administration and TTC/ATC calculation
- Market monitoring
- Planning and expansion
- Interregional coordination

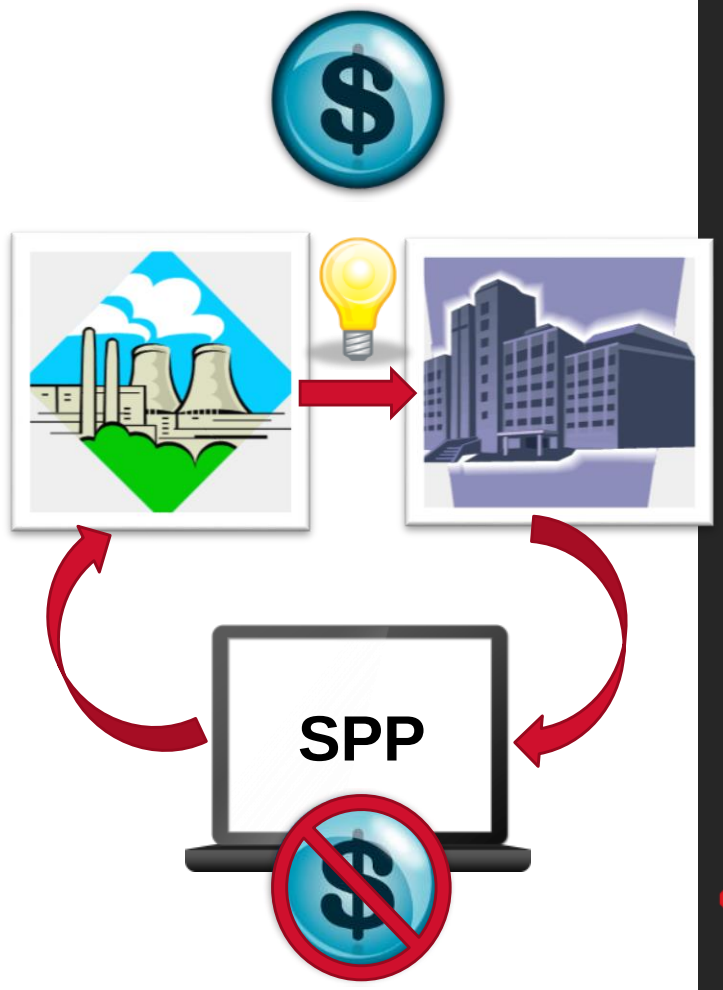
THE VALUE OF SPP

- Transmission planning, market administration, reliability coordination, and other services provide net benefits to SPP's members in excess of more than $1.7 billion annually at a benefit-to-cost ratio of 11-to-1.
- A typical residential customer using 1,000 kWh saves $5.71/month because of the services SPP provides.



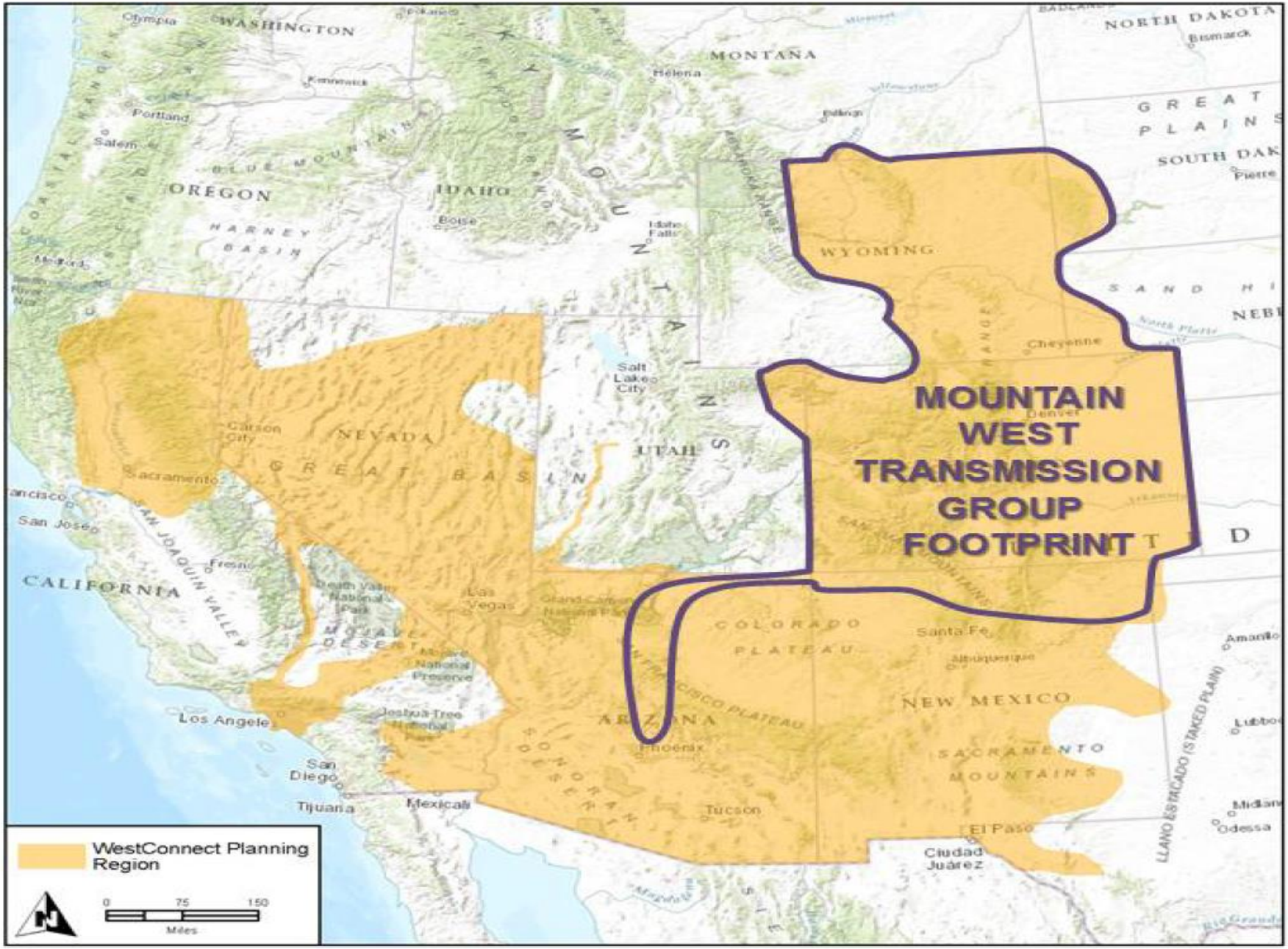
SPP'S ENERGY MARKET: INTEGRATED MARKETPLACE

- Similar to other competitive regional electric markets
- Matches buyers and sellers of energy
- Day-Ahead market includes unit commitment
- Real-Time spot market for energy
- Procures necessary ancillary services
- Consolidated Balancing Authority for reliability and optimized dispatch
- SPP does not have a Capacity Market
  - Reserve Margin at 30%+
  - Extensive renewable penetration

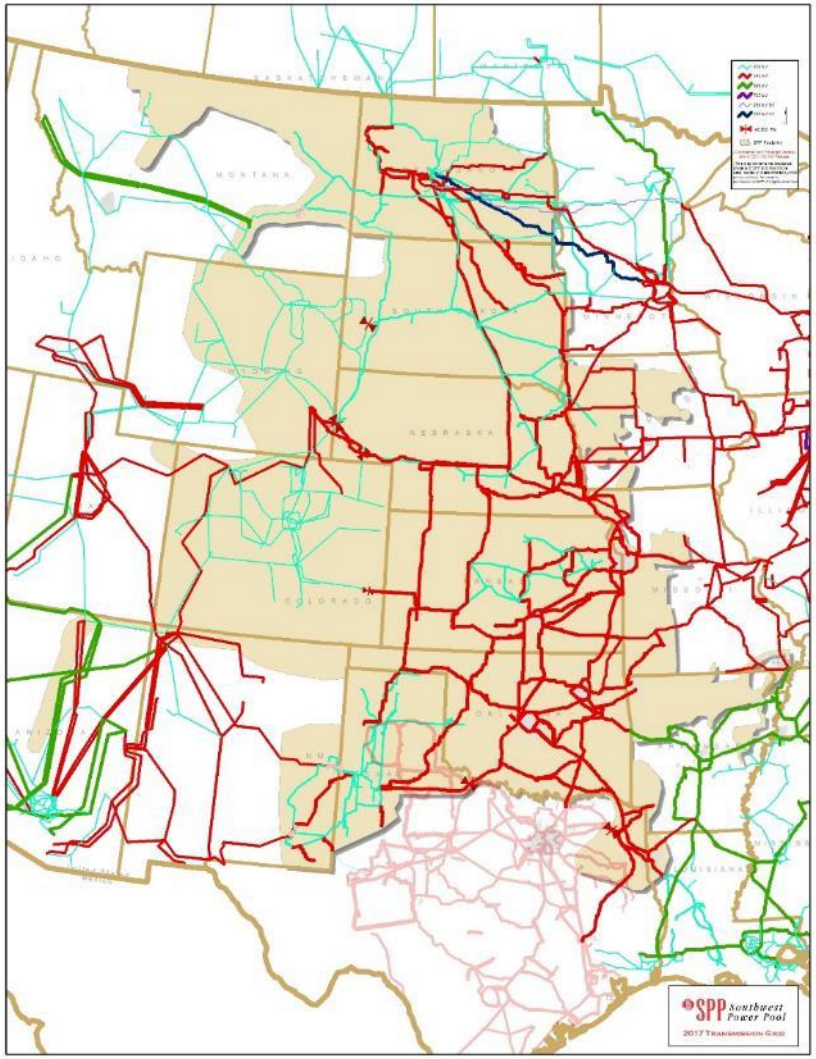


SPP IN THE WEST

- SPP is currently in discussions with the Mountain West Transmission Group to join SPP including the Integrated Marketplace
- MWTG will use SPP's market systems and experience to provide a lower cost and lower risk market implementation
- SPP and MWTG are interconnected through four DC Ties
- Market implementation will consider possible expansion
- MWTG is in the WestConnect Planning region which includes portions of Nevada



SPP AND MOUNTAIN WEST TRANSMISSION GROUP (MWTG)



REGULATORY CONSIDERATIONS

- A multi-state market requires Federal Energy Regulatory Commission approvals regarding RTO requirements
- Demand-side management (e.g., Orders 719 and 745)
- Load aggregation, which is important where there is a retail market underlying a wholesale market
- Qualifying Facility requirements
- Operating in compliance with NERC and NAESB standards

COST/BENEFIT CONSIDERATIONS

- Benefits
  - Optimized unit commitment provides substantial savings over the market area
  - Consolidated Balancing Authority reduces generation dispatch costs
  - Improves reliability by having bigger picture and more options to relieve transmission congestion
  - Enables higher renewable penetration levels at a lower cost
  - Regional Transmission Planning optimizes grid allowing lower cost generation to be delivered to a wider market
- Costs
  - SPP uses a scheduling fee to recover administrative costs of the market and is charged on a per MWh basis
  - Regional transmission planning includes cost sharing and a rate schedule is used to recover expansion costs

NEVADA AND SPP PARTNERSHIP

- **SPP Integrated Marketplace expanded to include Nevada**
  - SPP business model setup to accept expansion
  - Connection with SPP market could be accomplished through contractual arrangement
  - Leverage existing systems and market experience for low cost implementation
  - Market rules would allow for Nevada retail choice
  - Greater value with access to large diverse market
- **SPP develop stand alone Nevada Market**
  - More costly and time consuming to implement
  - Market rules would need to be defined but could be specific to Nevada needs
  - Could use existing market rules as starting point but review process 2-3 years to design and receive approvals
  - Limited access to generation resources

Updated April 12, 2017

Updated March 23, 2017

SPP Southwest Power Pool

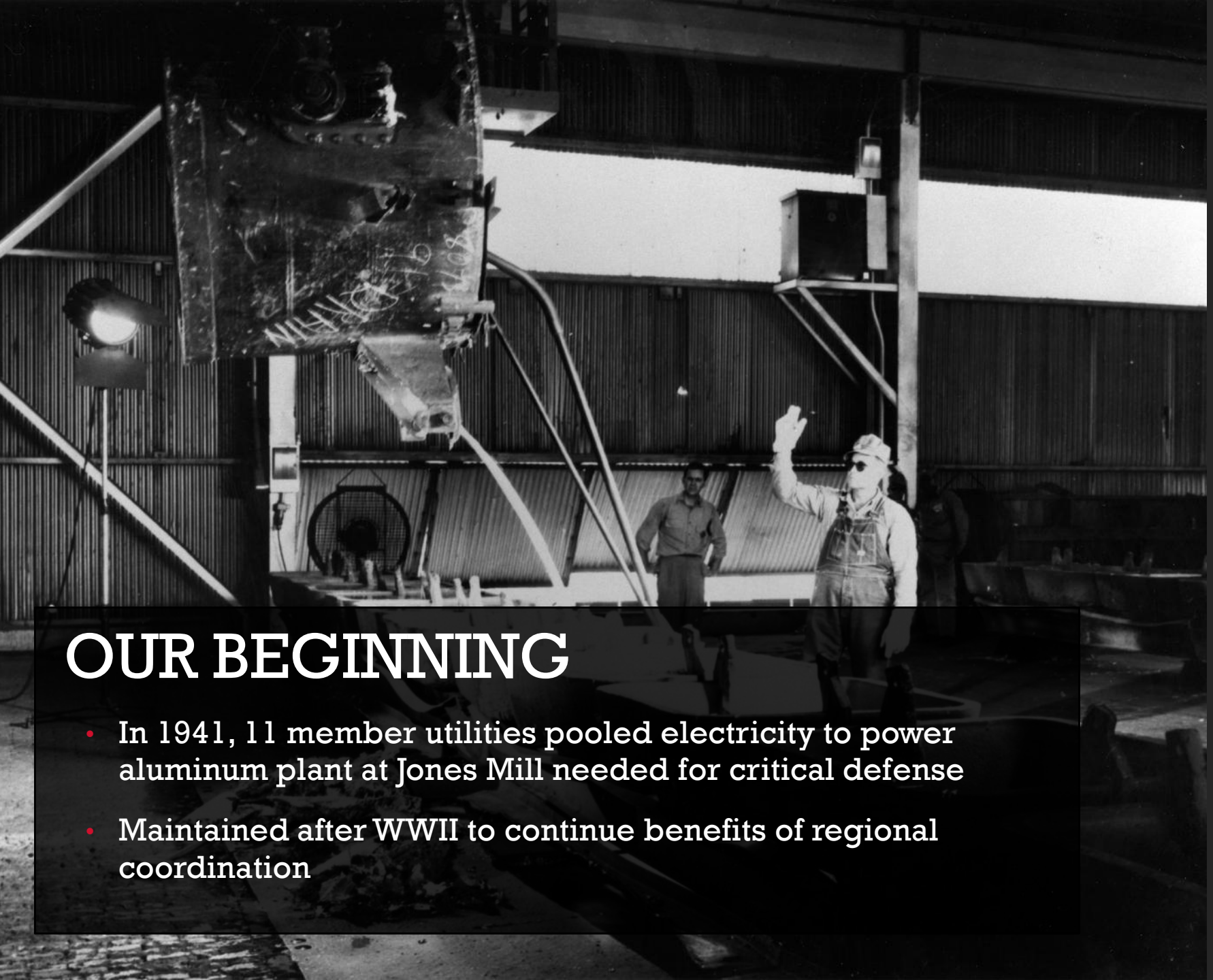
SPP101

An Introduction to Southwest Power Pool

SouthwestPowerPool SPPorg southwest-power-pool

Our Mission

Helping our members work together to keep the lights on …
today and in the future.



OUR BEGINNING

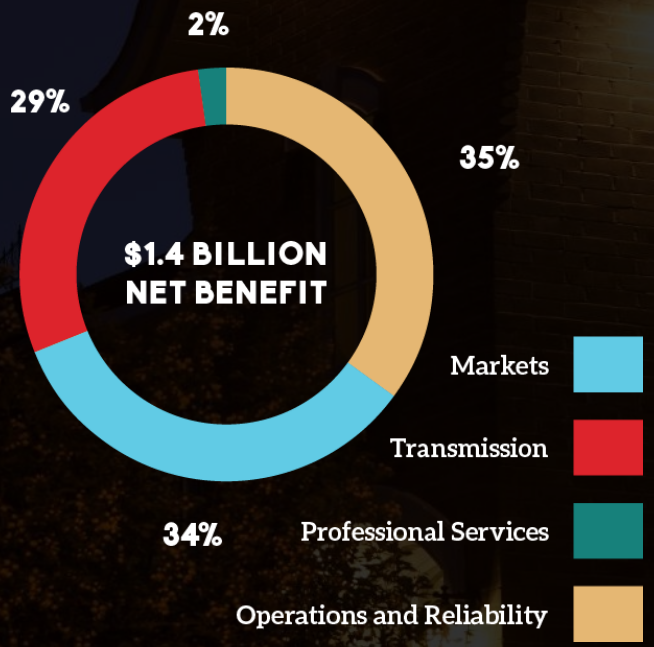
- In 1941, 11 member utilities pooled electricity to power aluminum plant at Jones Mill needed for critical defense
- Maintained after WWII to continue benefits of regional coordination

THE SPP DIFFERENCE

- Relationship-based
- Member-driven
- Independence Through Diversity
- Evolutionary vs. Revolutionary
- Reliability and Economics Inseparable

THE VALUE OF SPP

- Transmission planning, market administration, reliability coordination, and other services provide net benefits to SPP's members in excess of more than $1.4 billion annually at a benefit-to-cost ratio of more than 10-to-1.
- For the typical end-use customer using 1,000 kWh per month, a monthly electric utility bill of $100 would be $105.65 without the services SPP provides.



MILESTONES

1968 Became NERC Regional Council

1980 Implemented telecommunications network

1991 Implemented operating reserve sharing

1994 Incorporated as nonprofit

1997 Implemented reliability coordination

MILESTONES

1998 Implemented tariff administration

2004 Became FERC-approved Regional Transmission Organization

2007 Launched EIS market; became NERC Regional Entity

2009 Integrated Nebraska utilities

2010 FERC approved Highway/Byway cost allocation methodology and Integrated Transmission Planning Process

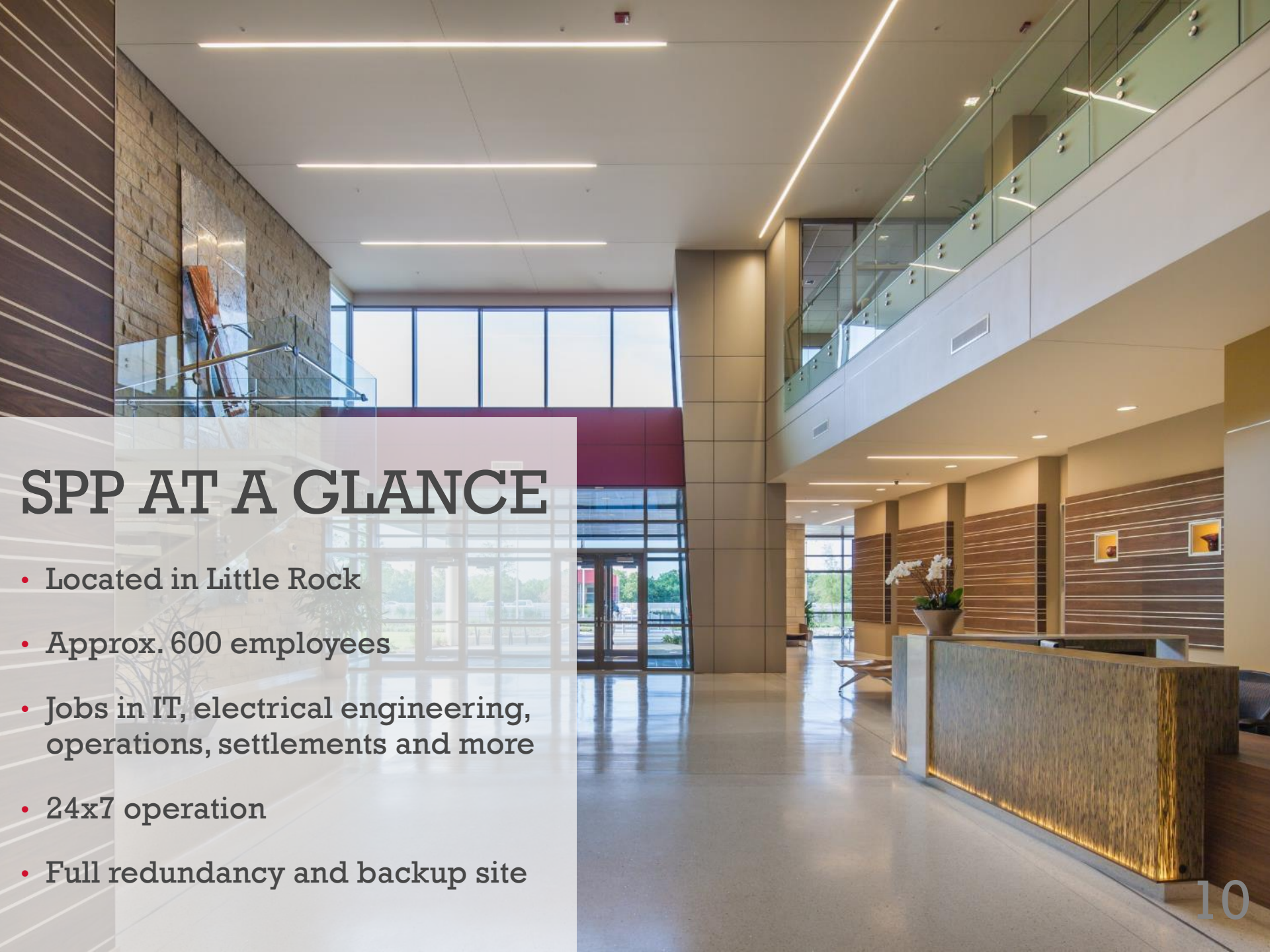
MILESTONES

2012 Moved to new Corporate Center

2014 Launched Integrated Marketplace

Became regional Balancing Authority

2015 Integrated System joins SPP



SPP AT A GLANCE

- Located in Little Rock
- Approx. 600 employees
- Jobs in IT, electrical engineering, operations, settlements and more
- 24x7 operation
- Full redundancy and backup site

SPP CORPORATE CENTER

COMMUNITY INVOLVEMENT AND RECOGNITION

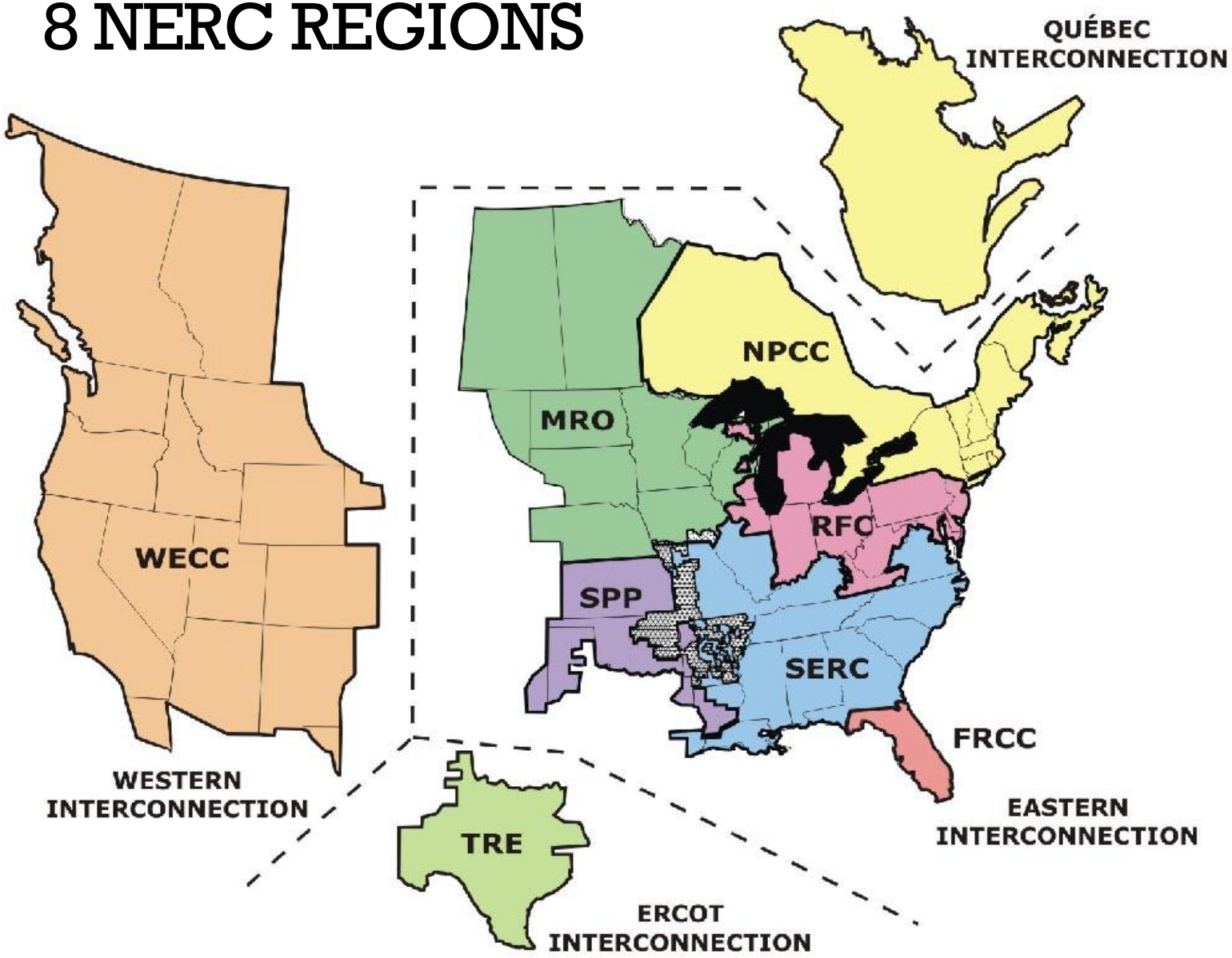
- Best Place to Work in Arkansas:
  2014 Benchmark Award Winner
  2013 Finalist
- Principal Financial Group "Top 10"
- SPP employees support more than 70 Central Arkansas charities including:
  - Arkansas Foodbank
  - Girls of Promise
  - Race for the Cure
  - Relay for Life
  - United Way
  - Youth Home

SPP

REGULATORY ENVIRONMENT

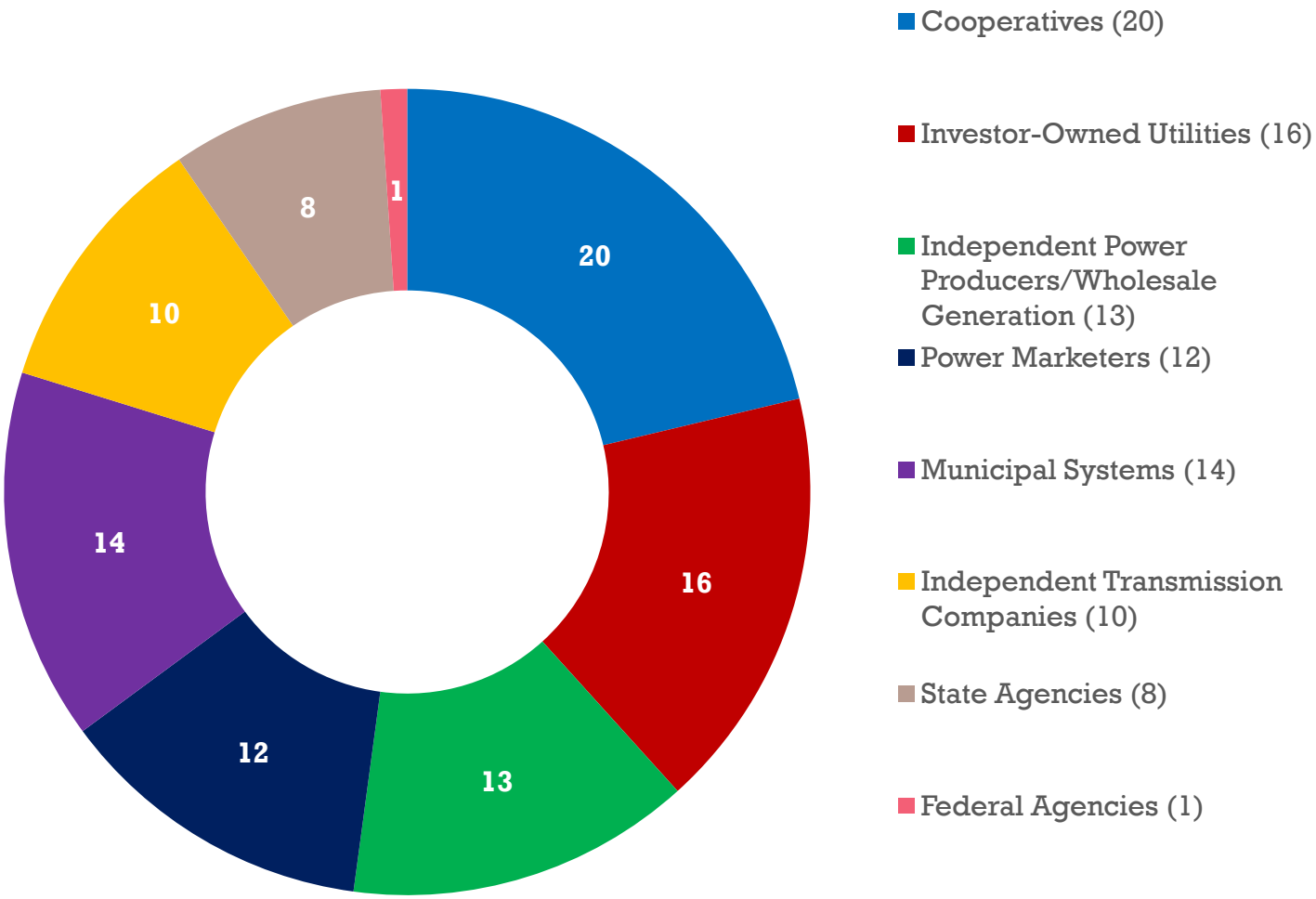
- Incorporated in Arkansas as 501(c)(6) nonprofit corporation
- Federal Energy Regulatory Commission (FERC)
  - Regulated public utility
  - Regional Transmission Organization
- North American Electric Reliability Corporation (NERC)
  - Founding member
  - Regional Entity

3 ELECTRIC INTERCONNECTIONS
8 NERC REGIONS



NORTH AMERICAN INDEPENDENT SYSTEM OPERATORS (ISO) AND REGIONAL TRANSMISSION ORGANIZATIONS (RTO)

SPP'S 94 MEMBERS: INDEPENDENCE THROUGH DIVERSITY



As of August 11, 2016

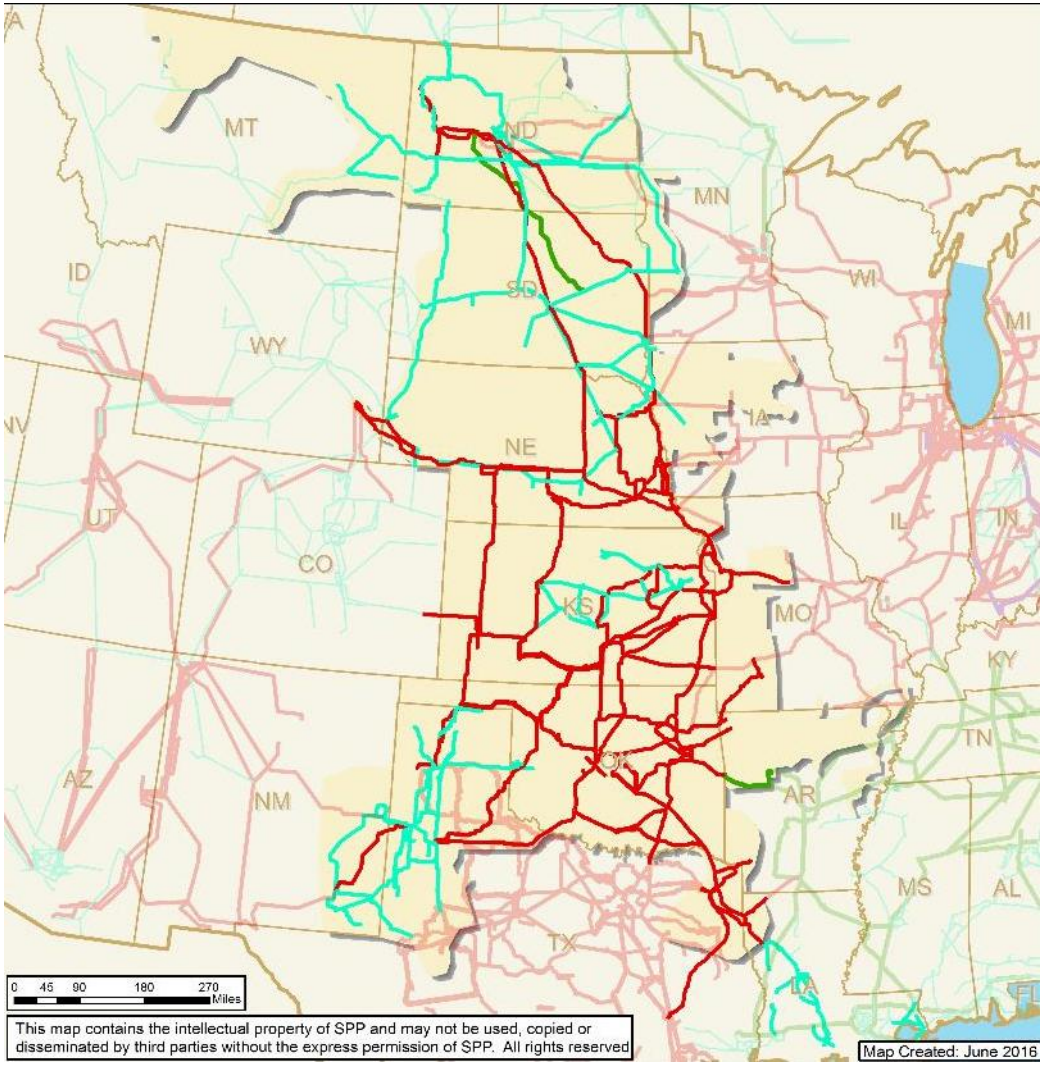
THE SPP FOOTPRINT: MEMBERS IN 14 STATES

- **Arkansas**
- **Kansas**
- **Iowa**
- **Louisiana**
- **Minnesota**
- **Missouri**
- **Montana**
- **Nebraska**
- **New Mexico**
- **North Dakota**
- **Oklahoma**
- **South Dakota**
- **Texas**
- **Wyoming**

SPP MANAGES THE GRID IN 5 OF THE TOP 100 CITIES IN AMERICA:

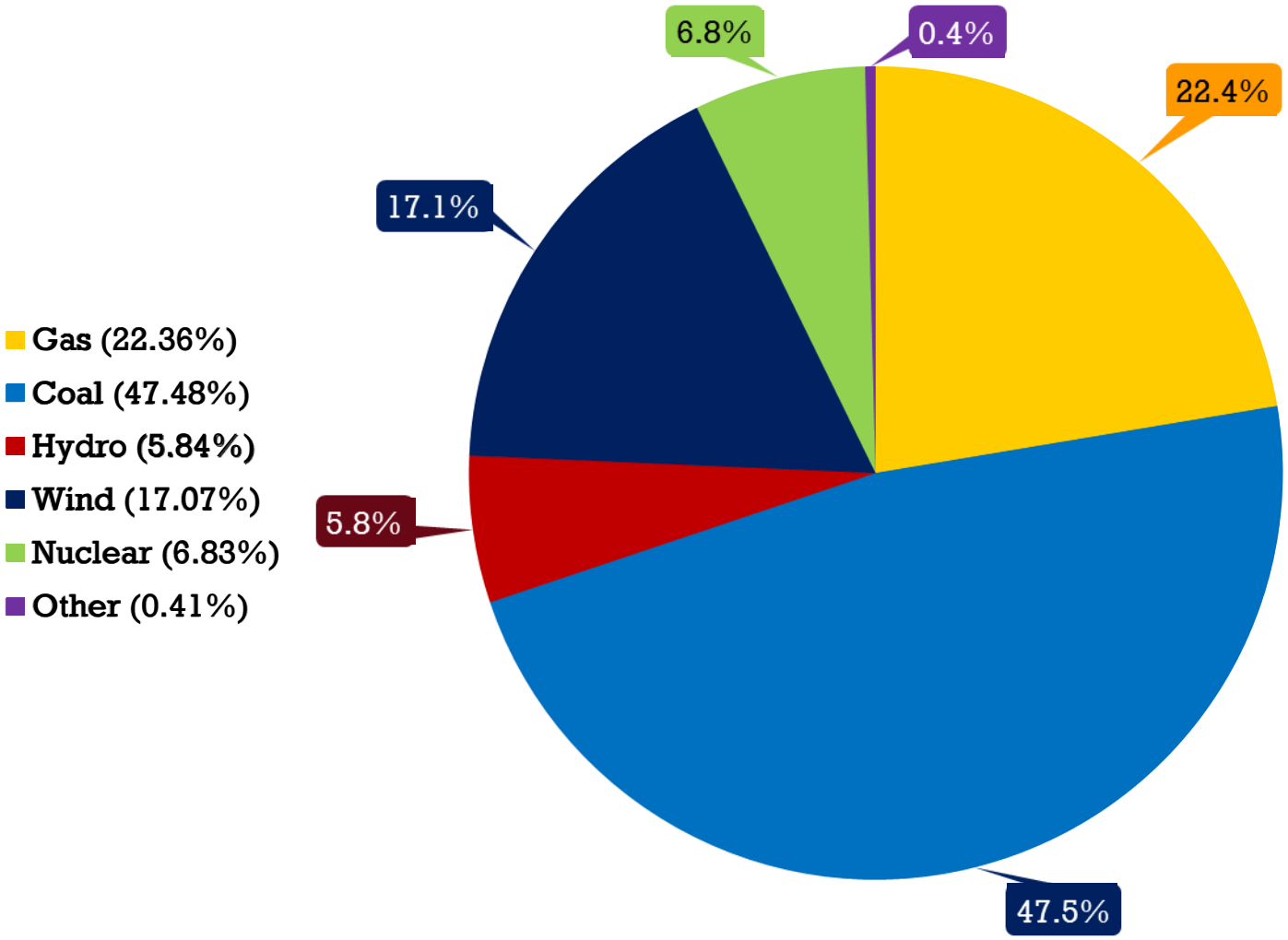
Kansas City, Oklahoma City, Tulsa, Omaha, and Wichita

OPERATING REGION

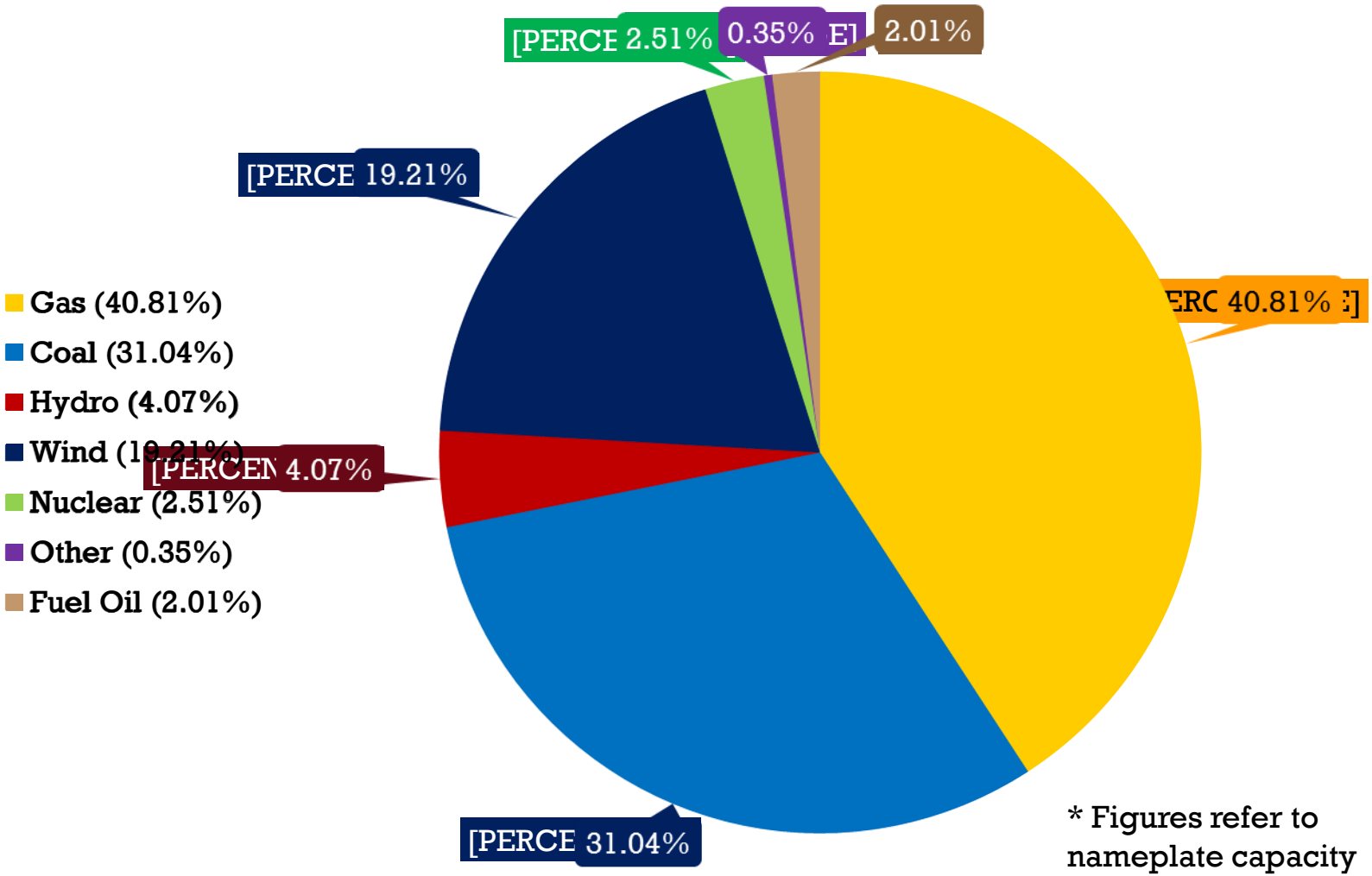


- Miles of service territory: 546,000
- Population served: 17.5M
- Generating Plants: 790
- Substations: 4,835
- Miles of transmission: 65,755
  - 69 kV 16,808
  - 115 kV 15,512
  - 138 kV 9,471
  - 161 kV 5,596
  - 230 kV 7,518
  - 345 kV 10,758
  - 500kV 92

2016 ENERGY CONSUMPTION BY FUEL TYPE (266,442 GWH TOTAL)



ENERGY CAPACITY* BY FUEL TYPE



* Figures refer to nameplate capacity as of 1/1/17

MARKET FACTS

- 185 participants
- 726 generating resources
- 2016 Marketplace Settlements = $15.8 billion
- 50,622 MW coincident peak load (7/21/16)
- Wind penetration record: 52.65% (3/6/17 @ 02:25)

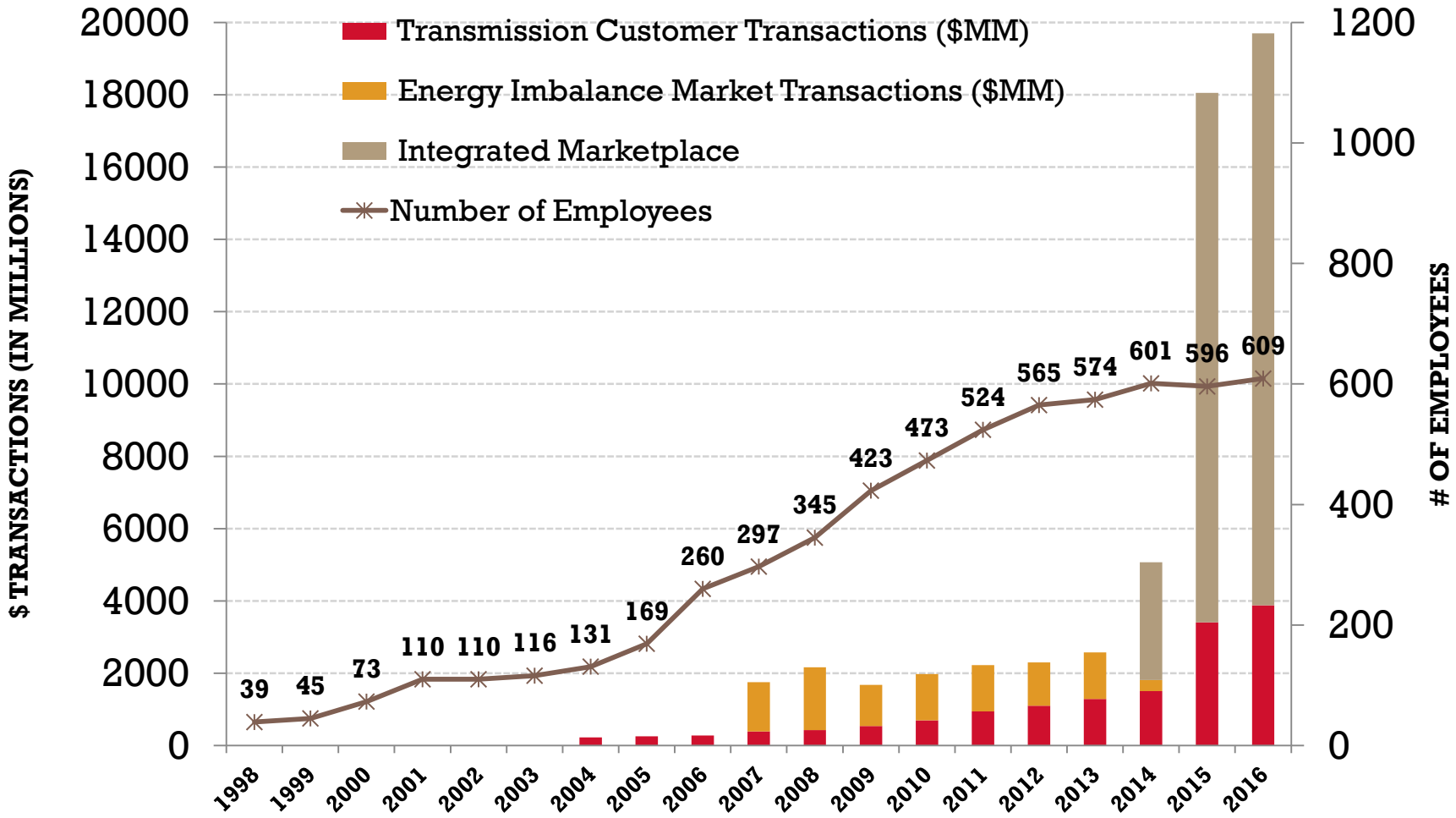
TRANSMISSION IN SPP

- In 2016, SPP members completed 78 transmission projects totaling more than $939 million.
- More than $9.7 billion in transmission upgrades were planned and approved from 2004-2016.
- 65,755 miles of transmission lines in SPP's footprint would circle the earth more than twice!

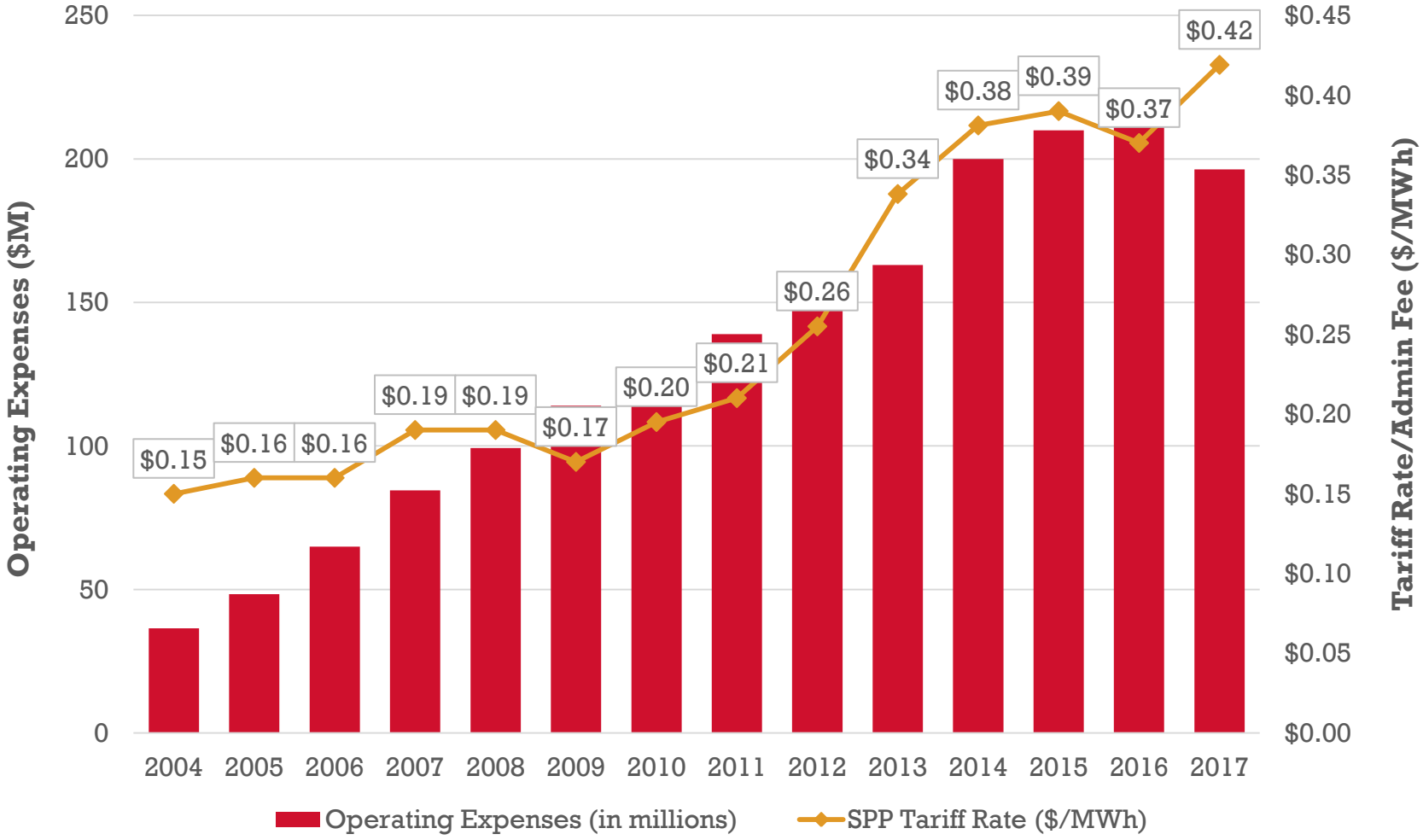
SPP'S IT INFRASTRUCTURE

- 166,000+ data points updated every 2-30 seconds
- Operations model solves 47,150 x 80,548 matrix every two minutes
- Approx. 2,000 servers
- More than 2.14 petabytes of storage

GROWTH IN RESPONSIBILITIES



SPP EXPENSES: 2004-2017



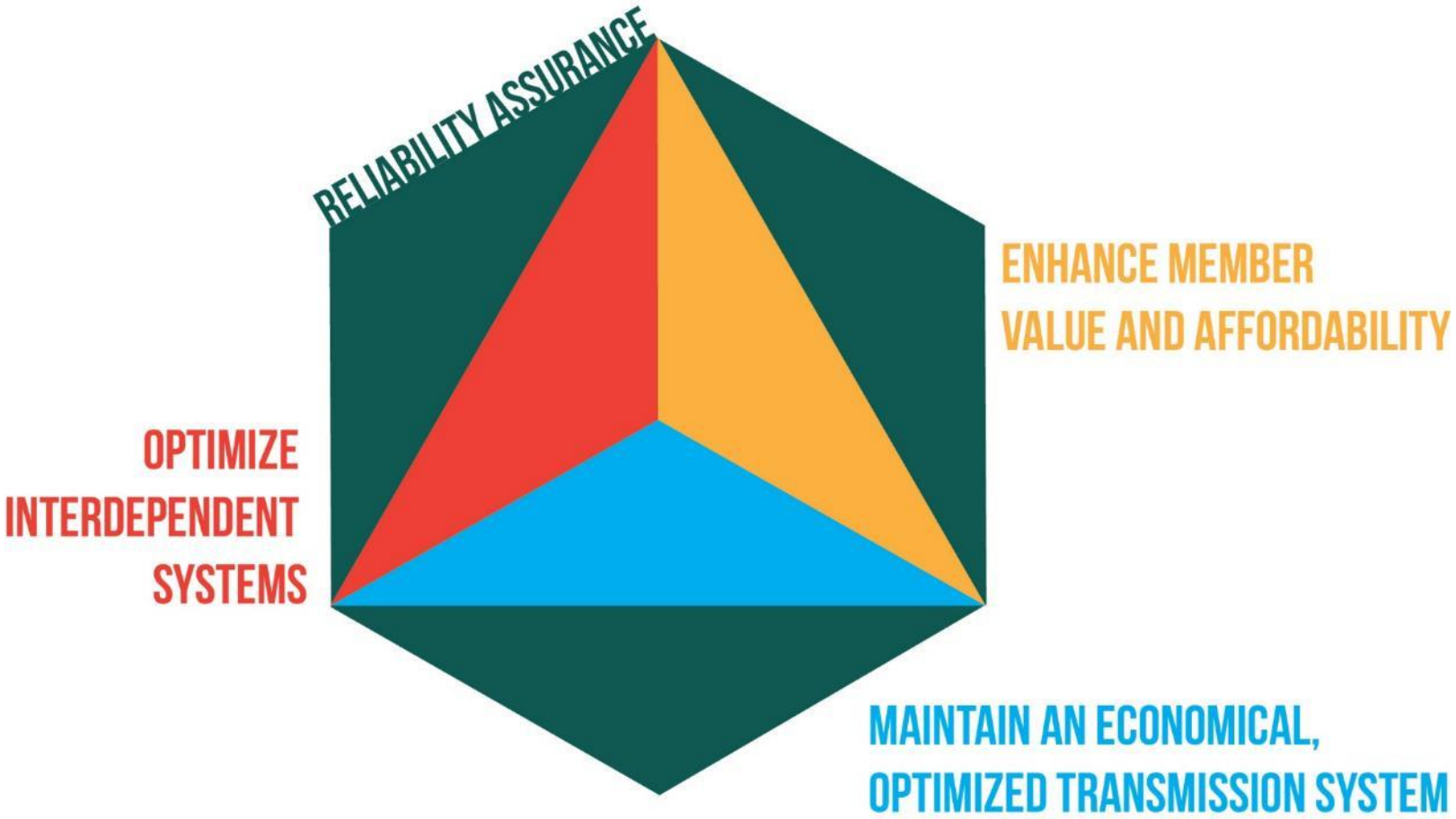
INTERREGIONAL COORDINATION

- ISO-RTO Council
- Interregional planning efforts
- North American Energy Standards Board (NAESB)
- National Association of Regulatory Utility Commissioners

CONTRACT SERVICES

- Alternative to RTO membership for Transmission Owners
- Oversight of Transmission Owners' system operations:
  - Reliability Coordination
  - Transmission Planning
  - Tariff Administration
  - Interregional Coordination
- Provides process for assigning cost responsibility for transmission upgrades

OUR STRATEGY



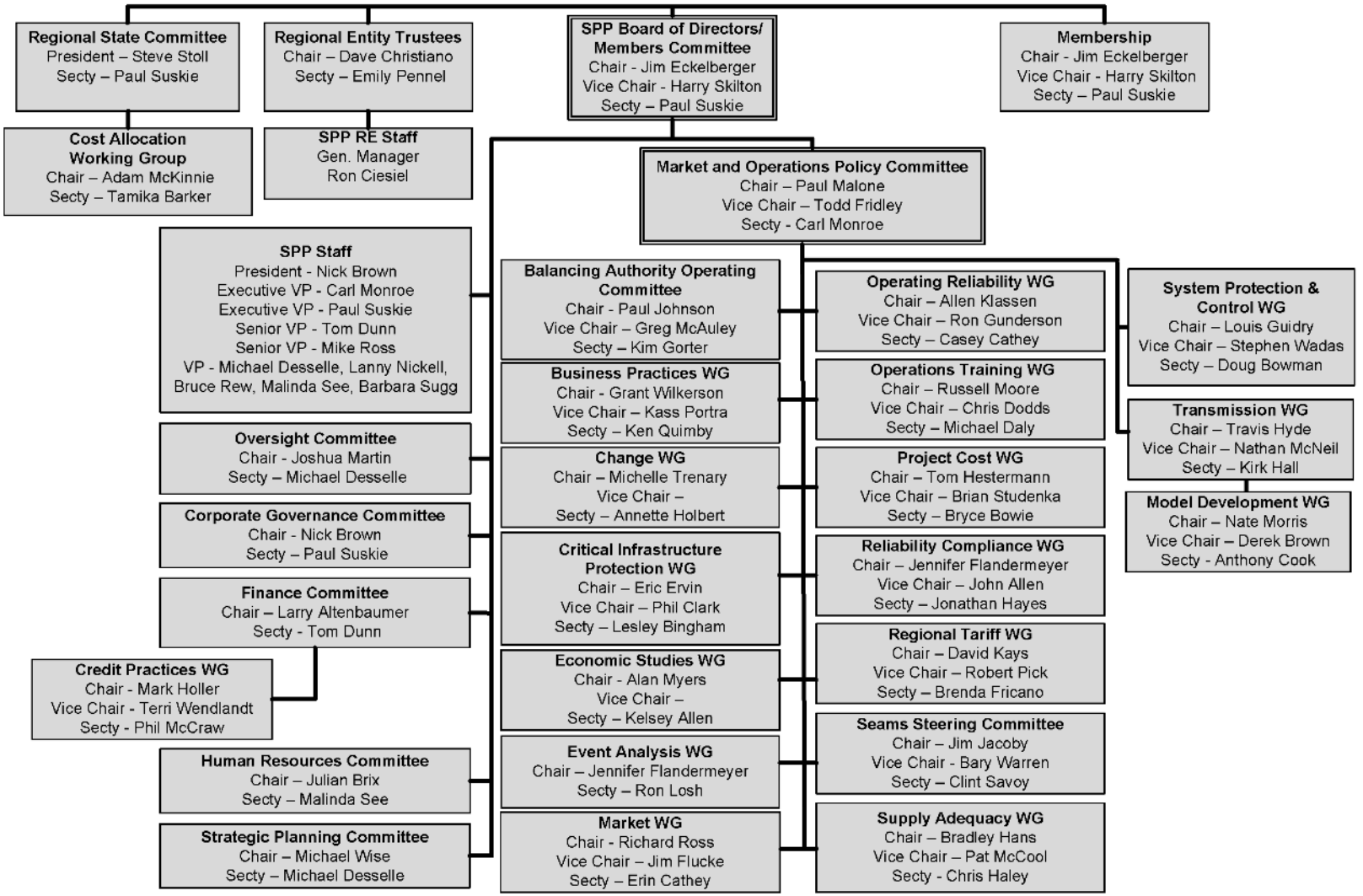
SERVICES

OUR MAJOR SERVICES

- Facilitation
- Reliability Coordination
- Balancing Authority
- Transmission Service/Tariff Administration
- Market Operation
- Transmission Planning
- Training
- Standards Setting
- Compliance Enforcement

OUR APPROACH:
Regional, Independent, Cost-Effective and Focused on Reliability

FACILITATION



Updated 3/7/17

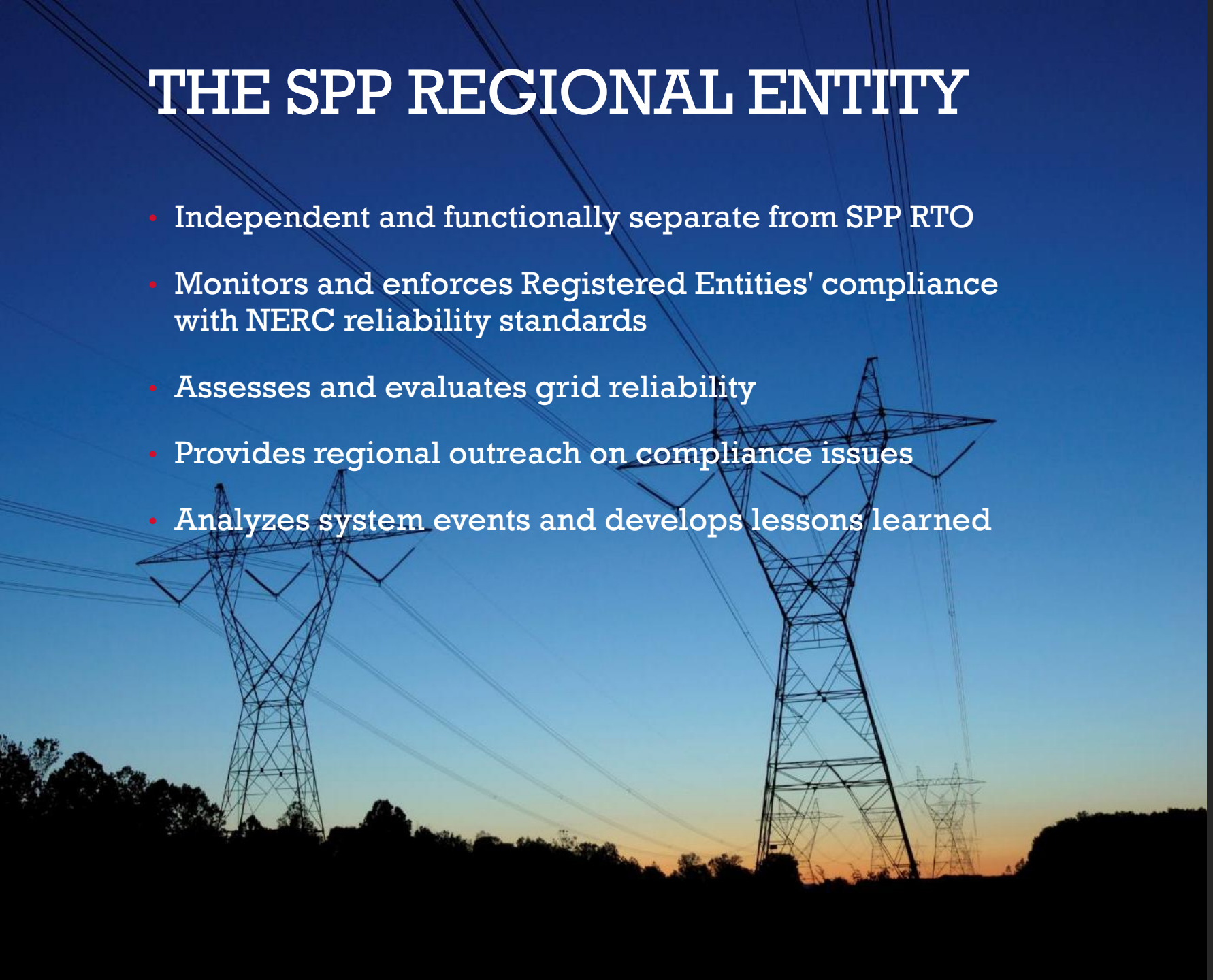
RELIABILITY COORDINATION: AIR TRAFFIC CONTROLLERS OF THE BULK POWER GRID

- Monitor grid 24 x 365
- Anticipate problems
- Take preemptive action
- Coordinate regional response
- Independent
- Comply with more than 5,500 pages of reliability standards and criteria

TRAINING

- In 2016 SPP's training programs delivered 28,046 training hours to 46 member companies, including instructor-led, virtual-led and self-study, computer-based training.
- SPP offers:
  - Regional System restoration drills
  - Integrated Marketplace training
  - Regional Emergency Operations sessions
  - Train-the-Trainer classes

THE SPP REGIONAL ENTITY



- Independent and functionally separate from SPP RTO
- Monitors and enforces Registered Entities' compliance with NERC reliability standards
- Assesses and evaluates grid reliability
- Provides regional outreach on compliance issues
- Analyzes system events and develops lessons learned

WHAT KIND OF MARKETS DOES SPP OPERATE?

- Transmission Service: Participants buy and sell use of regional transmission lines that are owned by different parties.
- Integrated Marketplace: Participants buy and sell wholesale electricity in day-ahead and real-time.
  - Day-Ahead Market commits the most cost-effective and reliable mix of generation for the region.
  - Real-Time Balancing Market economically dispatches generation to balance real-time generation and load, while ensuring system reliability.

WHAT IS A MARKET?

General Concepts:

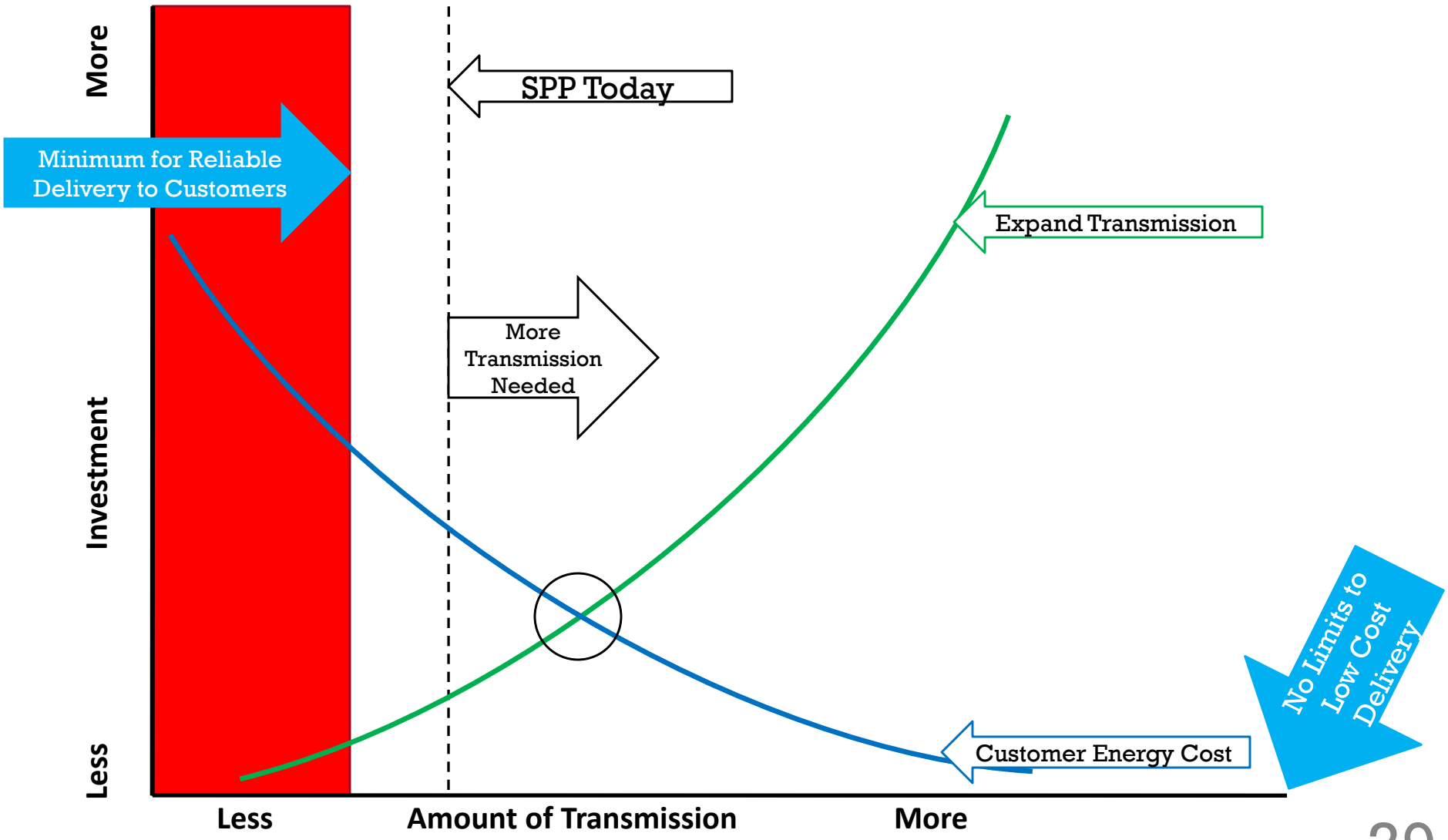
Buyers/Sellers OR Producers/Consumers

Prices driven by Supply and Demand

Products

TRANSMISSION MARKET

FINDING BALANCE



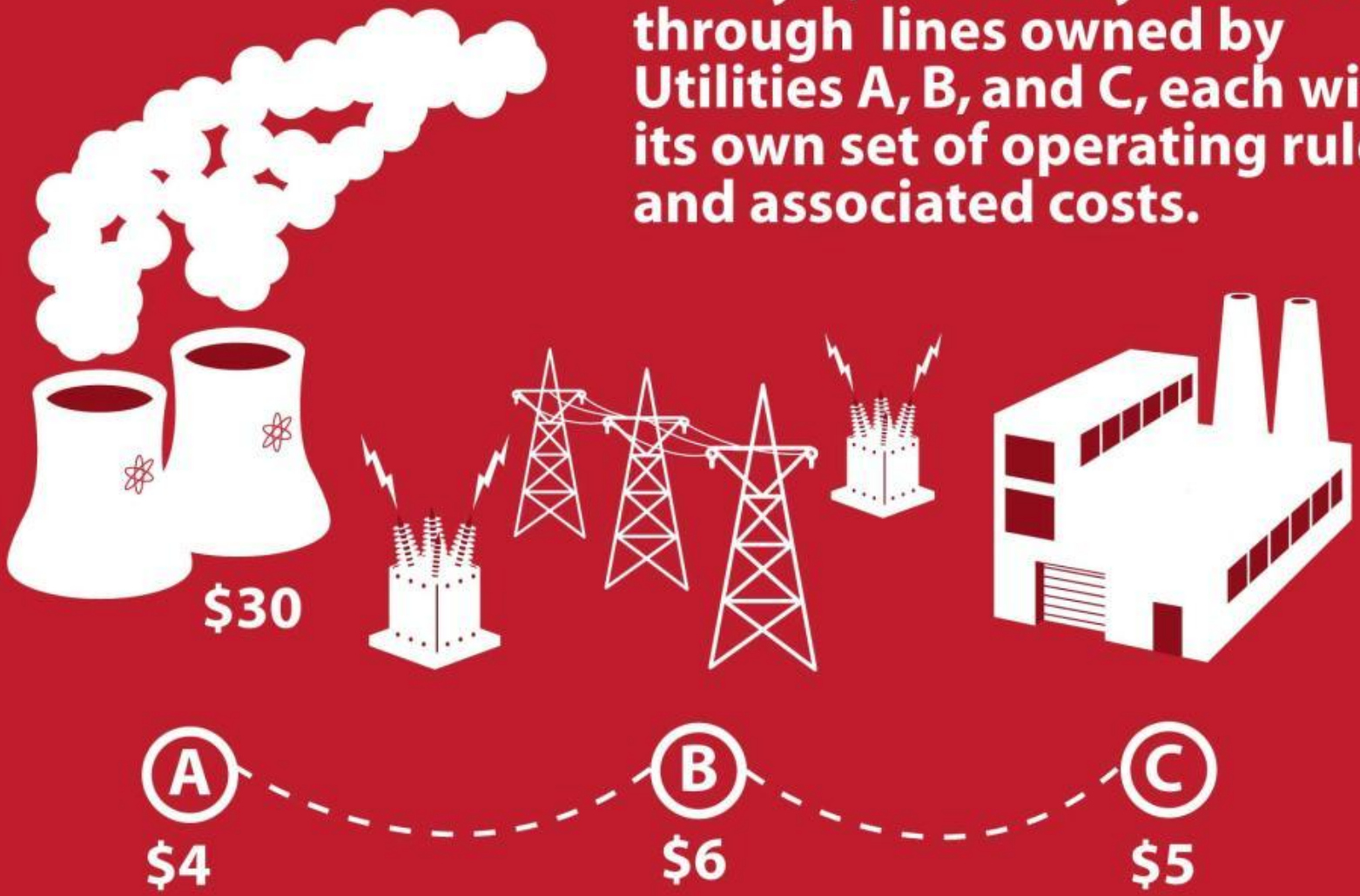
TRANSMISSION MARKET

- Provides "one-stop shopping" for use of regional transmission lines
- Consistent rates, terms, conditions for all users
- Independent
- More than 4,700 transactions per month on average
- 2016 transmission customer transactions = $3.879 billion

As a "sales agent," SPP administers a transmission tariff greater than 5,500 pages in length on behalf of its members and customers.

Without SPP

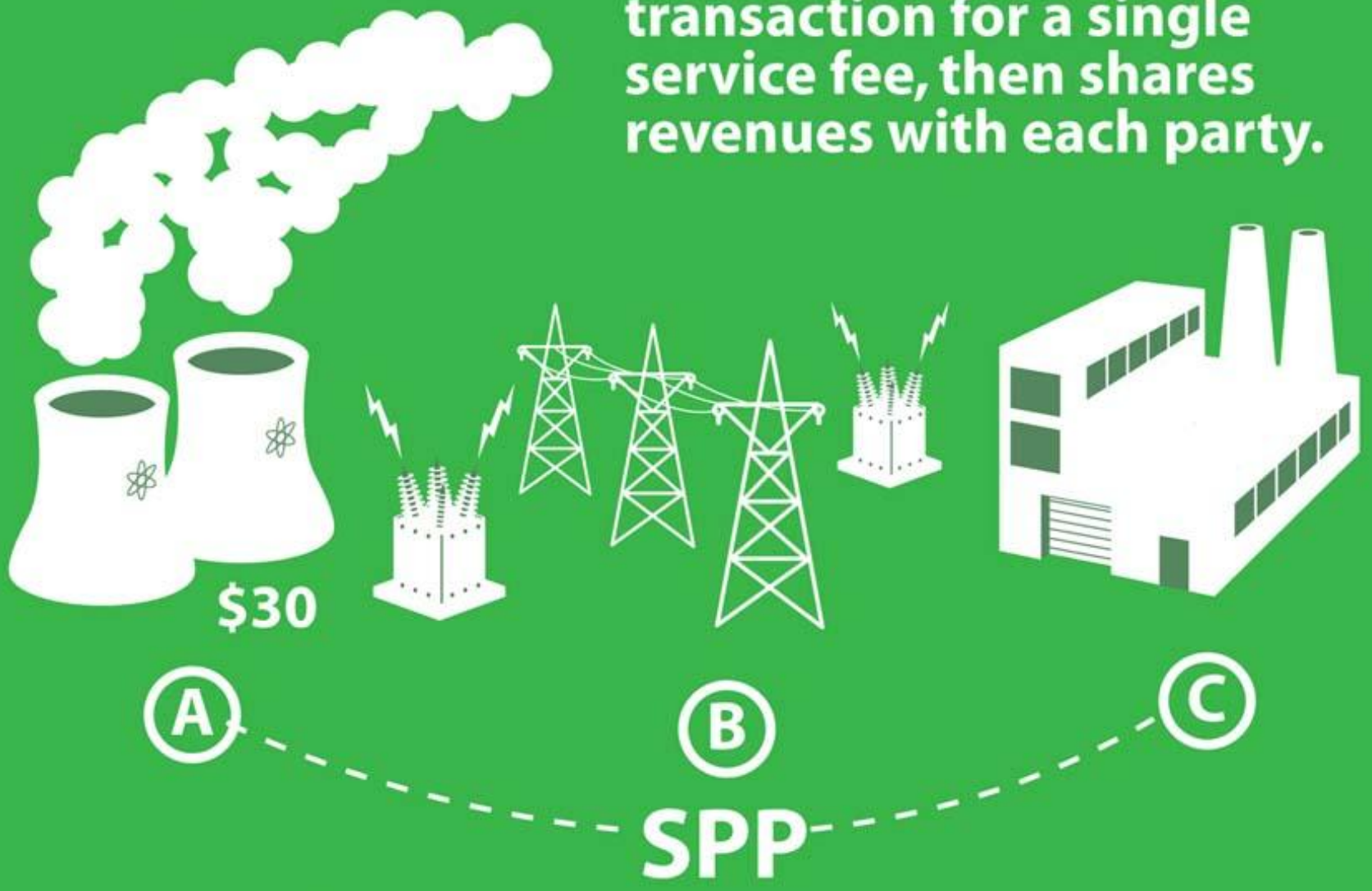
To get from a generator in Utility A to a customer in Utility C, electricity must flow through lines owned by Utilities A, B, and C, each with its own set of operating rules and associated costs.



$15 transmission service + $30 energy = $45

With SPP

SPP moves electricity across Utilities A, B, and C in one transaction for a single service fee, then shares revenues with each party.



$5 transmission service + $30 energy = $35

HOW TRANSMISSION SERVICE WORKS

- Reserving transmission service = reserving a seat on a plane
  - Customer specifies priority, time, source/sink, capacity
  - Tariff administrator approves if capacity exists

- Issuance of NERC Tag = receiving boarding pass
  - Won't be approved if improper use of reservation

- Creation of schedule from tag = sitting on the plane
  - Generators ramp to provide energy for transaction
  - May be curtailed if transmission system overloaded

WHOLESALE ENERGY MARKET

WHAT IS A WHOLESALE ENERGY MARKET?

Sellers/ Producers	Buyers/ Consumers	Locational Prices	Products
• Utilities • Municipals • Independent Power Producers • Generators • Power Marketers	• Utilities • Municipals • Load Serving Entities (LSEs) • Power Marketers	• Driven by Supply and Demand at defined locations	• Energy • Operating Reserves • Congestion Rights

SPP'S ENERGY MARKET: INTEGRATED MARKETPLACE

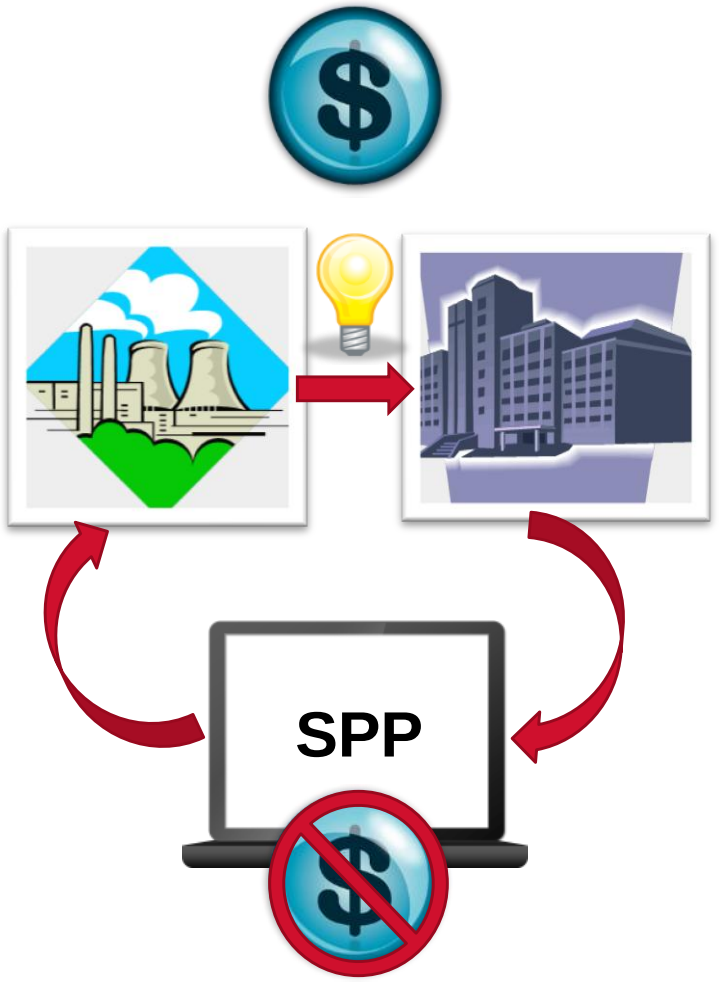
1. SPP facilitates the Marketplace

- ✓ Provides the infrastructure and systems
- ✓ Maintains and follows 900+ pages of Marketplace protocols
- ✓ 24/7 market operations

SPP'S ENERGY MARKET: INTEGRATED MARKETPLACE

2. SPP financially settles the Marketplace
   - Calculates prices
   - Captures wholesale energy production and consumption
   - Collects from market participants (MPs) who owe the market
   - Pays MPs who are owed by the market
   - Remains revenue neutral

3. SPP has an independent Market Monitor



MARKET MONITORING UNIT (MMU) ENSURES MARKET'S RELIABILITY, EFFECTIVENESS

- SPP's internal MMU reports directly to the Board and Oversight Committee
- Independent from SPP RTO
- FERC Order 719 allows ISO/RTO markets to be overseen by internal, external or hybrid monitor
  - Three ISOs/RTOs have an external monitor, two have an internal monitor, and one has a hybrid
  - Order 719 authorizes RTO Board of Directors to decide on the monitor structure and the SPP Board has decided an internal form to be most appropriate for SPP
- MMU reviews real-time/historic data and reports any issues to FERC for investigation

INTEGRATED MARKETPLACE OVERVIEW

KEY COMPONENTS

- Day-Ahead Market
- Centralized Unit Commitment
- Real-Time Balancing Market
- Transmission Congestion Rights Market

PRODUCTS

- Energy
- Operating Reserve (Regulation Up, Regulation Down, Spinning, Supplemental)
- Congestion Rights

MARKETPLACE BENEFITS

- SPP's markets provide participants $422M in net savings annually
- Reduce total energy costs through centralized unit commitment while maintaining reliable operations
- Day-Ahead Market allows additional price assurance capability prior to real-time
- Operating Reserve products support implementation of the SPP Balancing Authority and facilitate reserve sharing

DAY-AHEAD MARKET

- Determines least-cost solution to meet energy bids and reserve requirements
- Participants submit offers and bids to purchase and/or sell energy and operating reserve:
  - Energy
  - Regulation-Up
  - Regulation-Down
  - Spinning Reserve
  - Supplemental Reserve

REAL-TIME BALANCING MARKET (RTBM)

- Balances real-time load and generation committed by the Day-Ahead Market and Reliability Commitment processes
- Operates on continuous 5-minute basis
  - Calculates dispatch instructions for energy and clears operating reserve by resource
- Energy and operating reserve are co-optimized
- Settlements based on difference between results of RTBM process and Day-Ahead Market clearing
- Charges imposed on market participants for failure to deploy energy and operating reserve as instructed

TRANSMISSION CONGESTION RIGHTS (TCR) MARKET

- In the DA Market, price separation of MP's resource to load may occur due to congestion leaving the MP exposed to high prices
- A TCR can be used as hedge against congestion that allows MPs to reduce their exposure to high market prices and potentially receive lower priced deliverable energy
- TCR Market has Annual and Monthly Auction processes related to two products:
  - Auction Revenue Rights (ARRs)
  - Transmission Congestion Rights (TCRs)

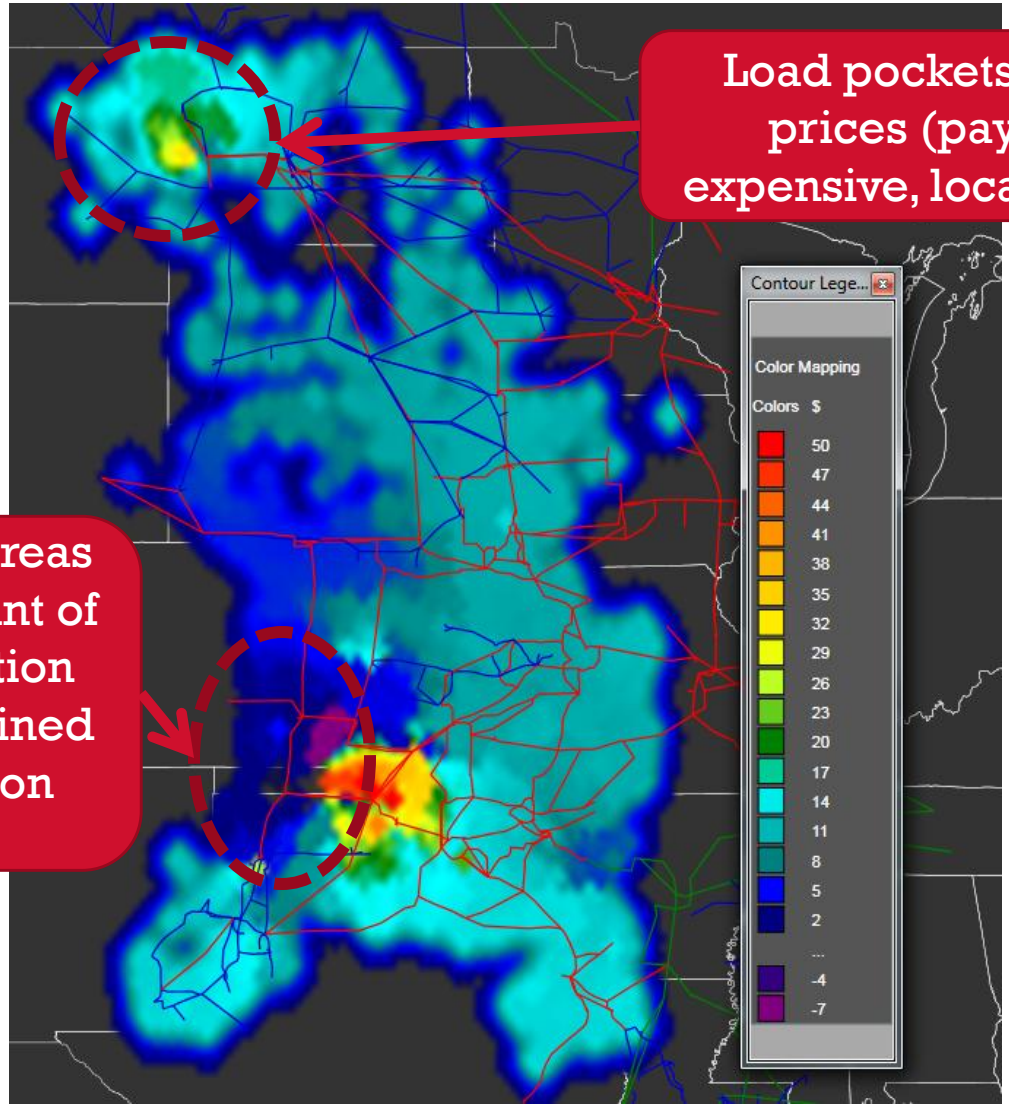
GRID CONGESTION

Impacts markets and transmission planning

WHAT IS CONGESTION?

- Congestion or "bottlenecks" happen when you can't get energy to customers along a certain path
  - Desired electricity flows exceed physical capability
- Congestion caused by:
  - Lack of transmission, often due to load growth
  - Line and generator maintenance outages
  - Unplanned outages such as storms or trees on lines
  - Too much generation pushed to grid in a particular location
  - Preferred energy source located far from customers
- Results in inability to use least-cost electricity to meet demand

CONGESTION PREVENTS ACCESS TO GENERATION



Load pockets see higher prices (pay for more expensive, local generation)

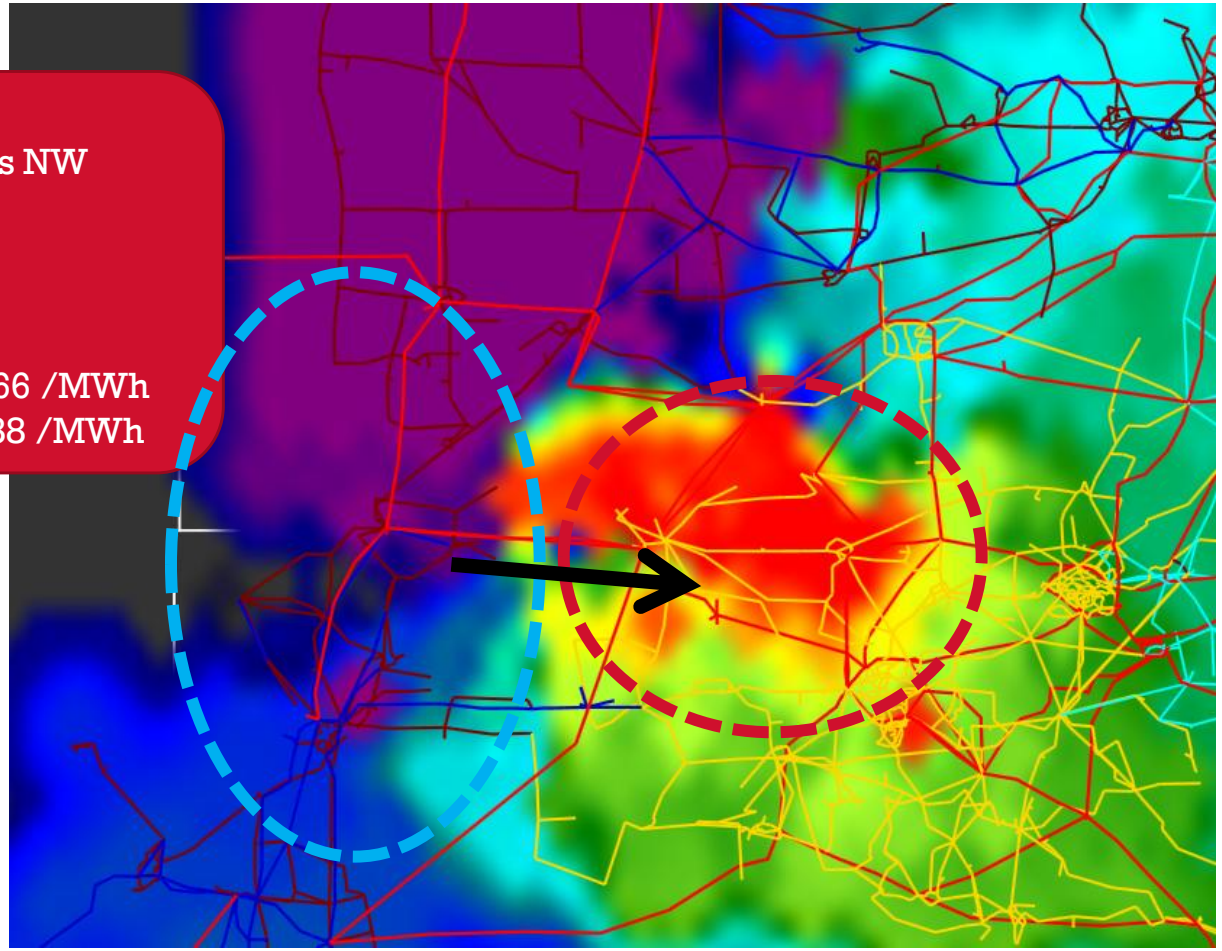
Low prices in areas with high amount of cheap generation (wind), constrained by transmission outlets

CONGESTION'S IMPACT ON MARKET PRICES

WDWFPLTATNOW
West → East flow across NW Oklahoma

MEC: $29.36/MWh

West of constraint: $-9.66 /MWh
East of constraint: $86.88 /MWh



WDWFPLTATNOW: Woodward – FPL Switching Station 138kV for the loss of Tatonga – Northwest 345kV

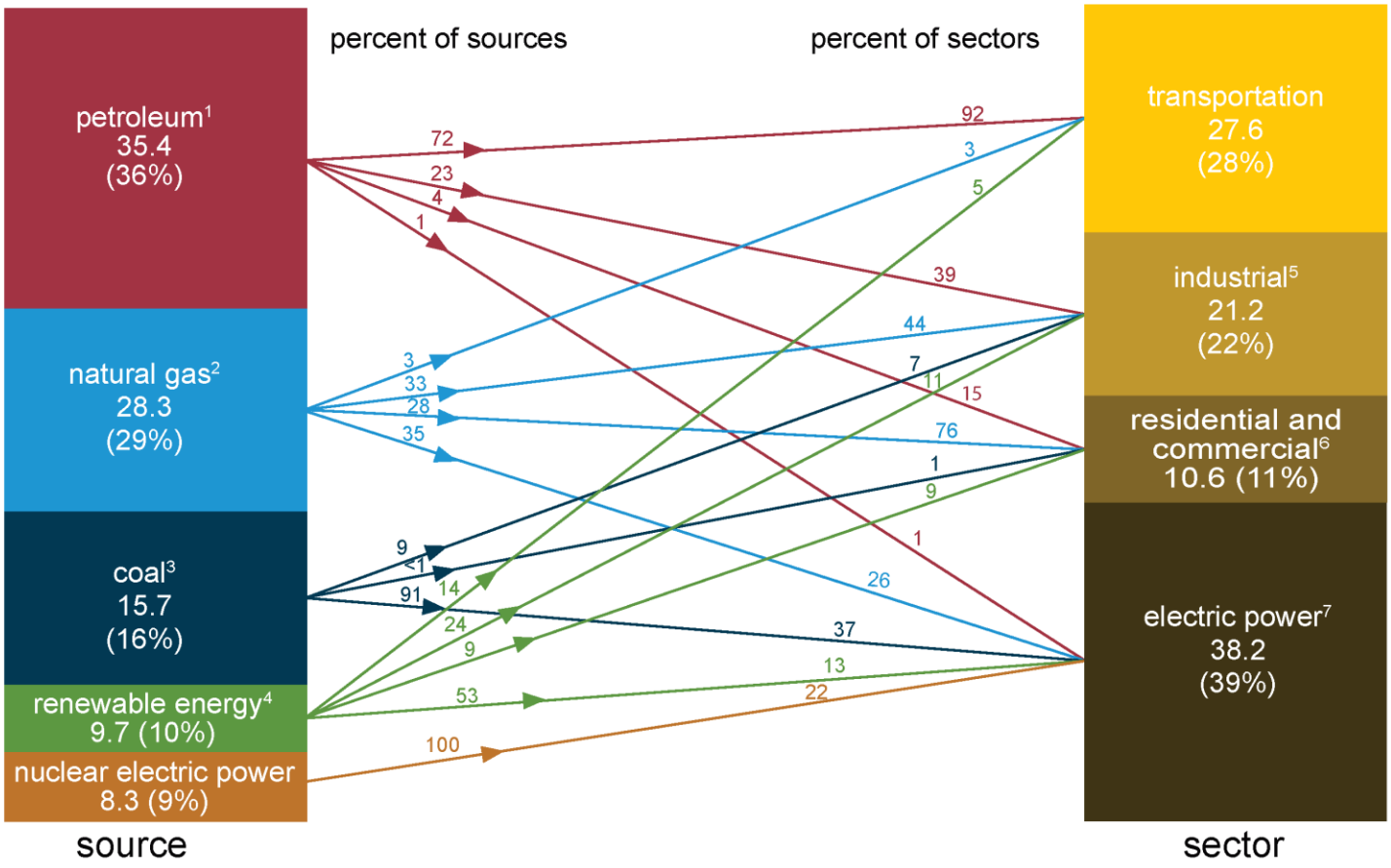
TRANSMISSION PLANNING: BASIC CONCEPTS

Services

U.S. ENERGY CONSUMPTION

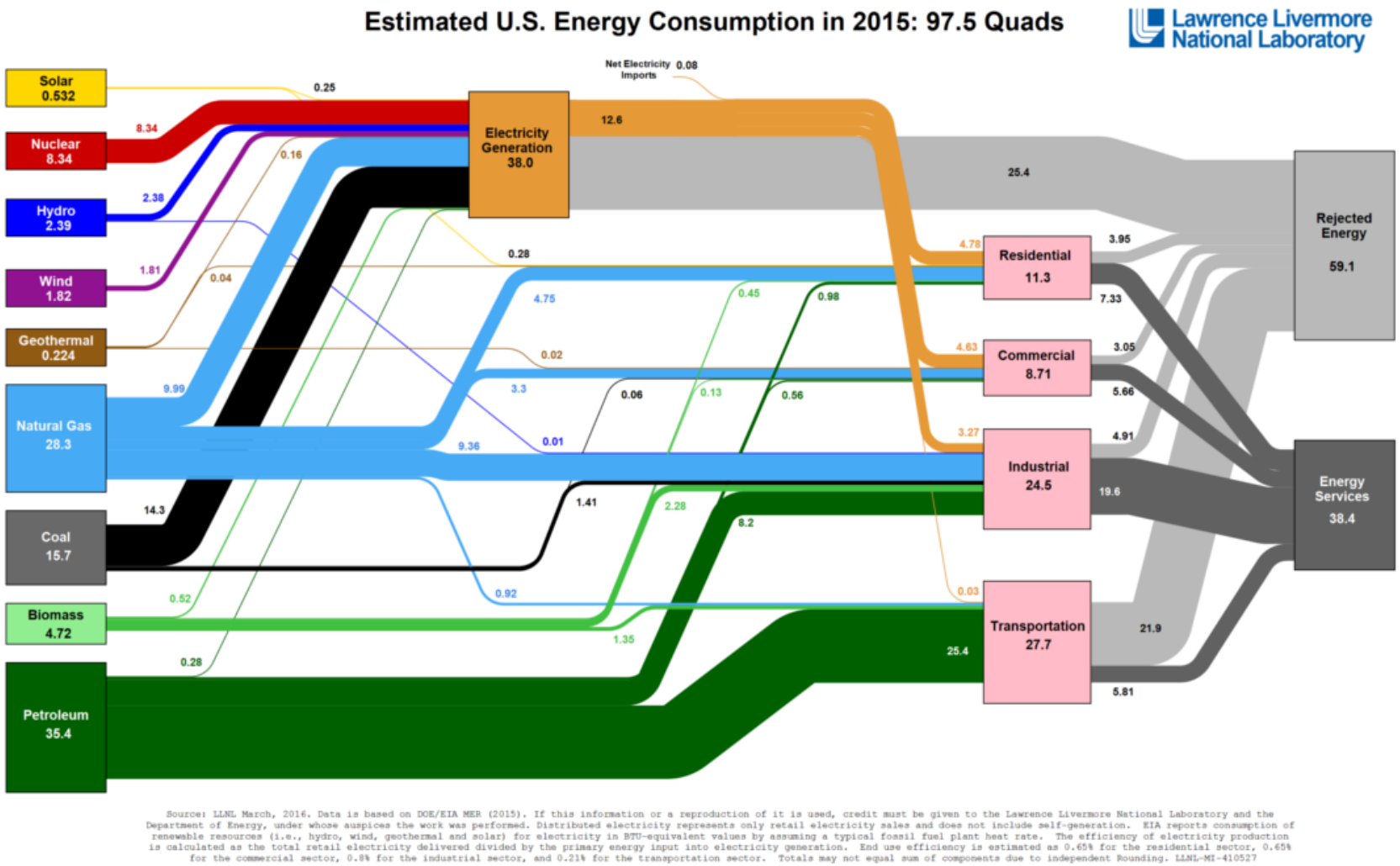
U.S. primary energy consumption by source and sector, 2015

Total = 97.7 quadrillion British thermal units (Btu)



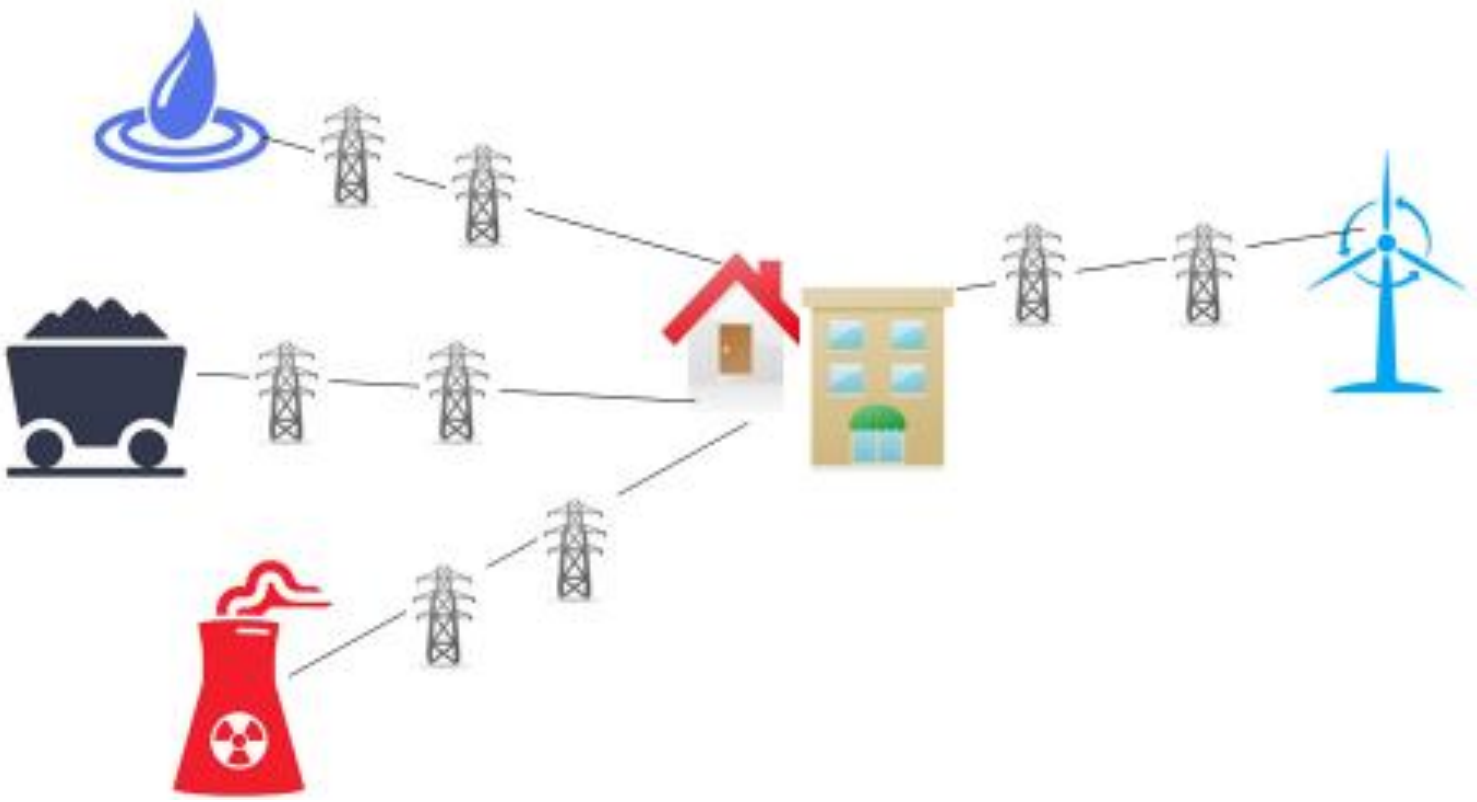
https://www.eia.gov/totalenergy/data/monthly/pdf/flow/css_2015_energy.pdf

U.S. ENERGY CONSUMPTION



https://flowcharts.llnl.gov/content/assets/images/charts/Energy/Energy_2015_United-States.png

ENERGY CONSUMED WHEN GENERATED



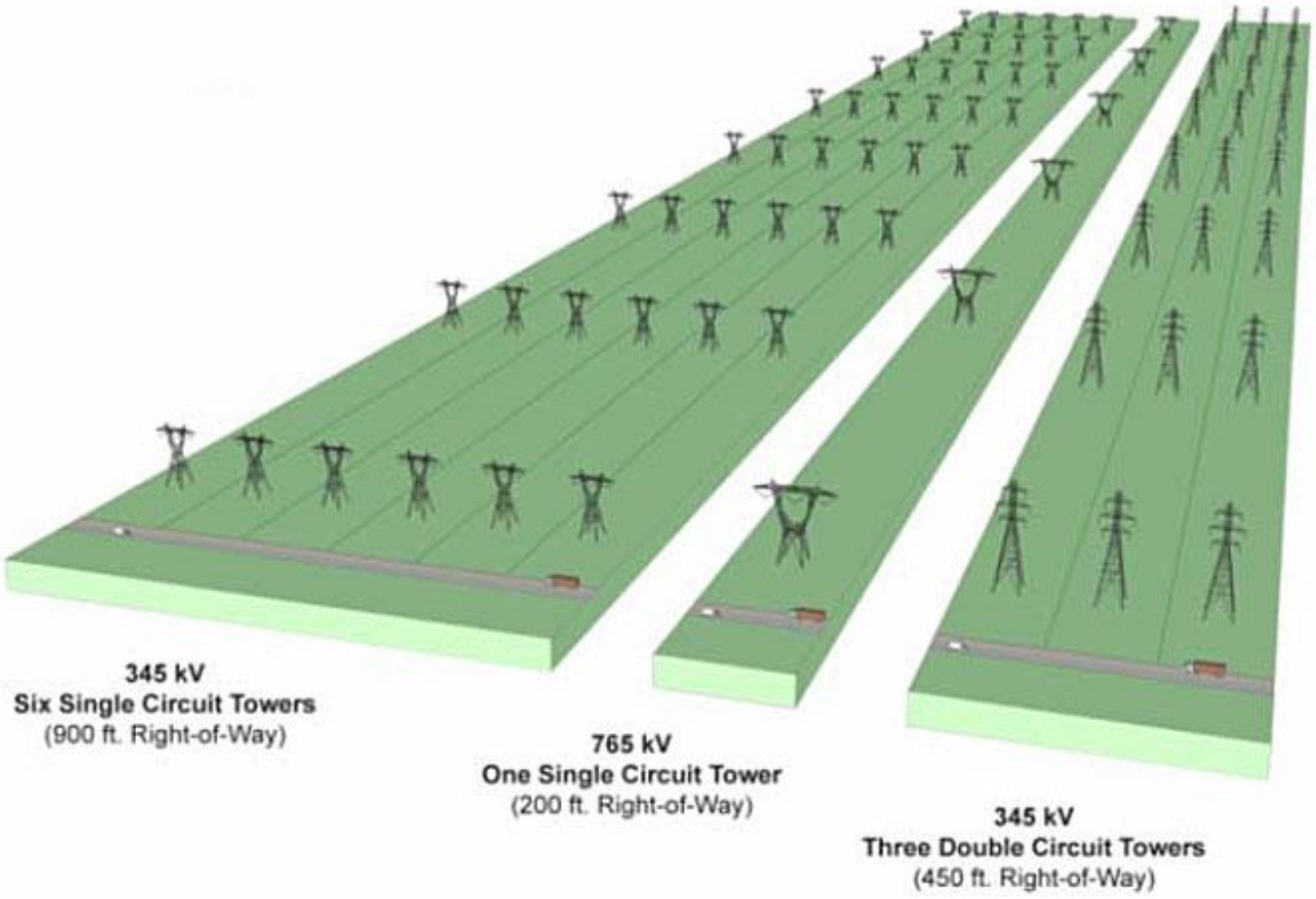
OTHER WAYS ELECTRIC INDUSTRY IS UNIQUE

- Location of "manufacturing" plants is limited
  - Wind farms must be in areas of high wind, solar farms in areas with strong sun, hydroelectric plants on a river
  - Coal and natural gas can only be extracted where fuel is
    - Coal mine may be far from coal-fired power plants – Expensive to transport coal long distances
    - Location of coal and gas plants have limitations
- Manufacturing plants may be far from people, and "roads" may not exist to deliver product to consumers
- Some products are only available at certain times

TRANSMISSION PLANNING CONSIDERATIONS

- What parts of grid need strengthening to "keep the lights on?"
  - Redundancies necessary to account for a line being out
- Where are current and future generations located?
- Where are electricity consumers located?
- Where on the grid do we frequently see congestion (more traffic than roads can accommodate)?
- Will laws mandating more renewable energy or a carbon tax impact traffic?
- How do coal/gas prices impact traffic?
  - People will use more coal if gas prices rise, and vice versa
- How do regional temperatures impact traffic?
  - If temperature differs across region, one area may need more energy

LARGER TRANSMISSION REDUCES RIGHT OF WAY

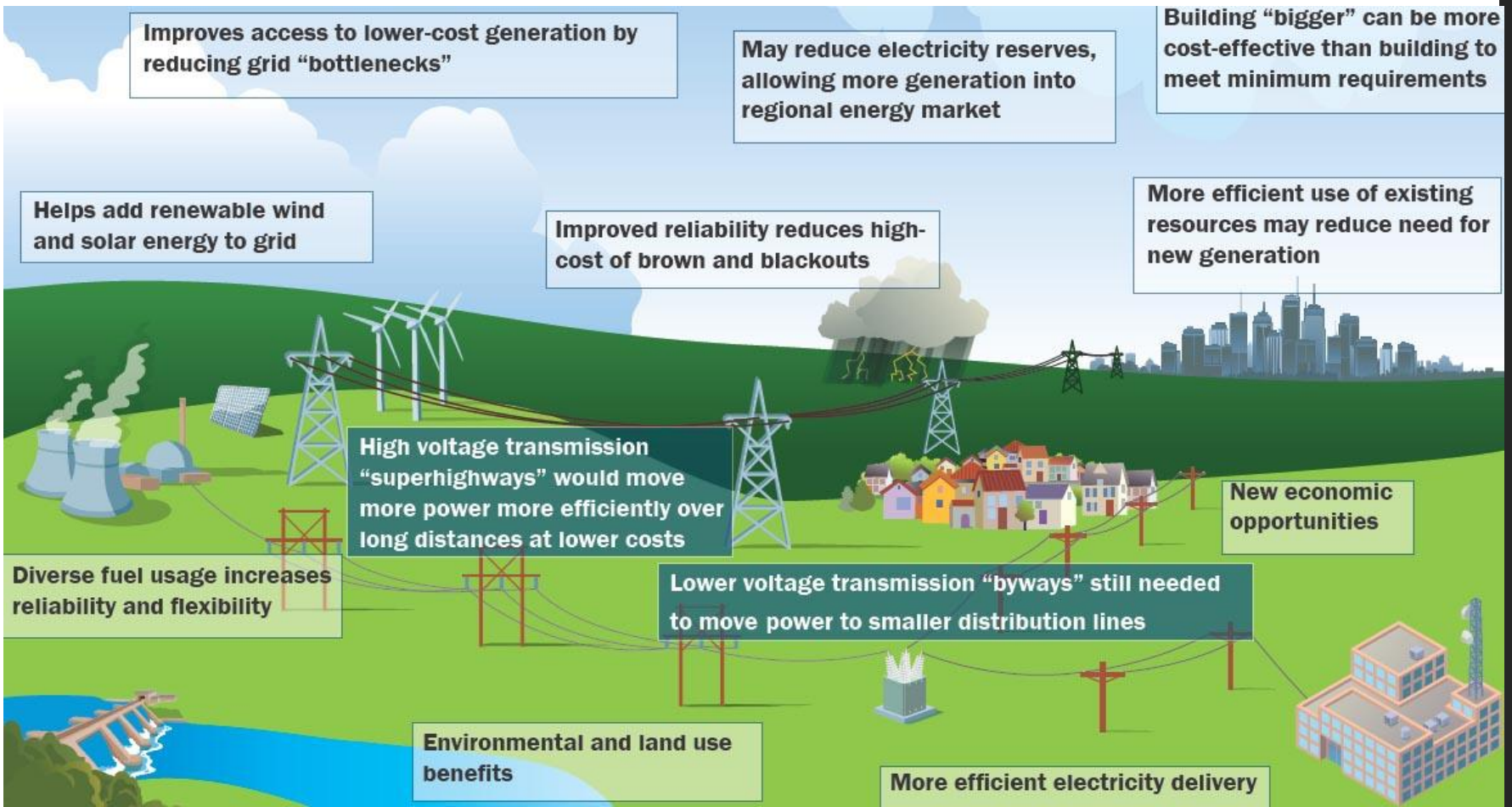


TRANSMISSION PLANNING AT SPP

Services

WHY WE NEED MORE TRANSMISSION?

- In the past, built least-cost transmission to meet local needs
- Today, proactively building "highways" to benefit region



HOW SPP MAKES TRANSMISSION DECISIONS

- Integrated Transmission Planning process
- Generation Interconnection Studies
  - Determines transmission upgrades needed to connect new generation to electric grid
- Aggregate Transmission Service Studies
  - Determines transmission upgrades needed to transmit energy from new generation to load
  - Shares costs of studies and new transmission
- Specific transmission studies

ITP: ECONOMICS AND RELIABILITY ANALYSIS

- Develops 345 kV+ backbone for 20-year horizon
- Studies broad range of possible futures

- Analyzes transmission system for 10-year horizon
- Establishes timing of ITP20 projects

- Annual Near-Term plan
- Reliability is primary focus
- Identifies potential problems and needed upgrades
- Coordinates with ITP10, ITP20, Aggregate and Generation Interconnection study processes

WHO PAYS FOR TRANSMISSION PROJECTS?

- Sponsored: Project owner builds and receives credit for use of transmission lines
- Directly-assigned: Project owner builds and is responsible for cost recovery and receives credit for use of transmission lines
- Highway/Byway: Most SPP projects paid for under this methodology

Voltage	Region Pays	Local Zone Pays
300 kV and above	100%	0%
above 100 kV and below 300 kV	33%	67%
100 kV and below	0%	100%

TRANSMISSION OWNER SELECTION: ORDER 1000

- SPP developed the Transmission Owner Selection Process (TOSP) to allow competitive bidding on certain transmission projects.
- Transmission Facilities that meet the criteria in the SPP Tariff and are approved for construction (or are endorsed by the SPP Board of Directors) are known as Competitive Upgrades.
- SPP will solicit proposals for Competitive Upgrades from Qualified RFP Participants (QRP) utilizing the TOSP.

STATE REGULATORS' ROLE

- Regional State Committee — Retail regulatory commissioners from:

Arkansas	Nebraska	South Dakota
Iowa	New Mexico	Texas
Kansas	North Dakota	
Missouri	Oklahoma	

Louisiana maintains active observer status

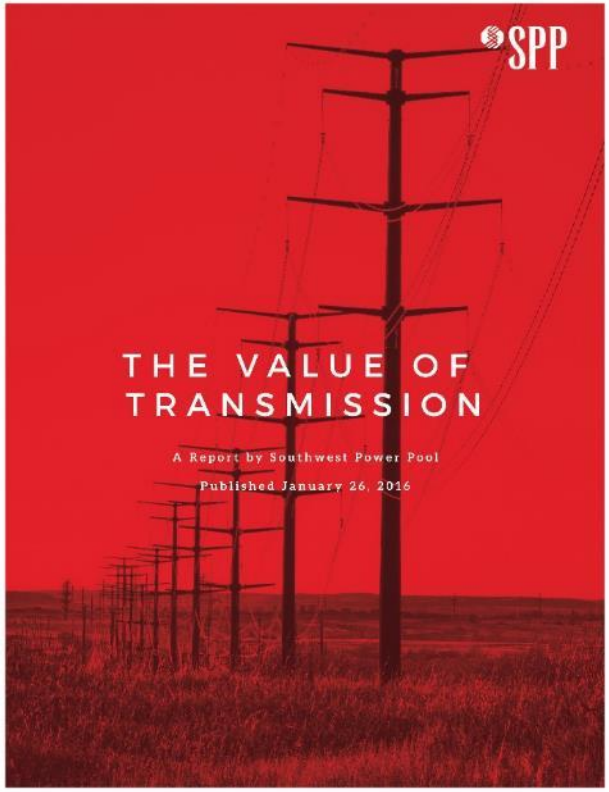
- Primary responsibility for:
- Cost allocation for transmission upgrades
- Approach for regional resource adequacy
- Allocation of transmission rights in SPP's markets

THE VALUE OF TRANSMISSION

SPP'S 2015 VALUE OF TRANSMISSION STUDY

Study Scope:

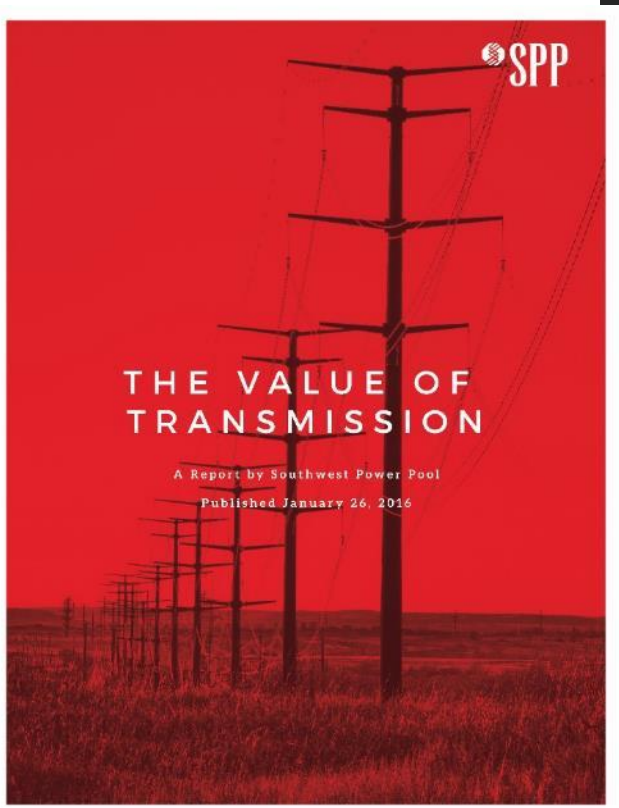
- Assessed 348 projects from 2012-14, representing $3.4B of transmission investment
- Based on the first year of operation of Integrated Marketplace from March 2014 through February 2015



STUDY RESULTS

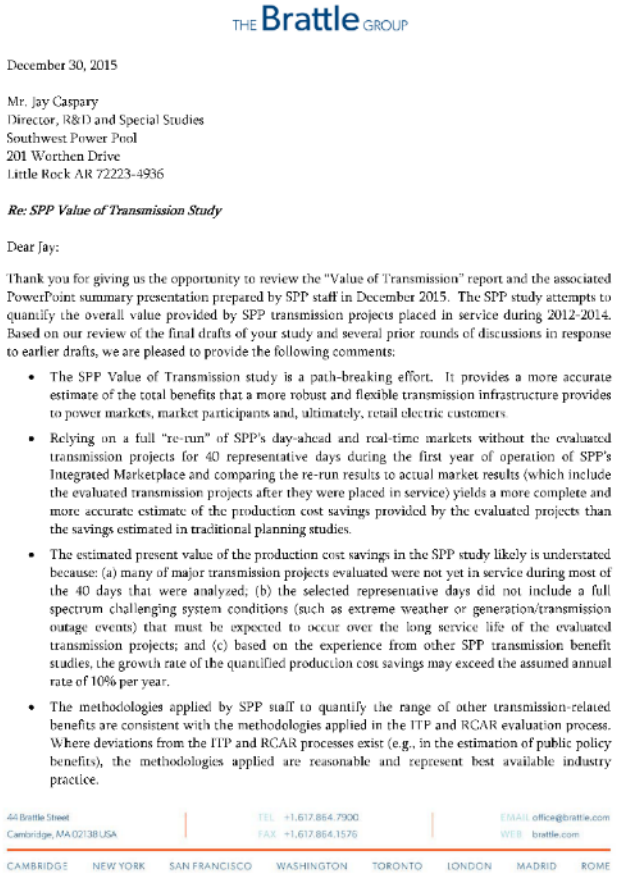
- APC Savings calculated at more than $660k/day, or $240M/year.
- Overall NPV of all benefits for considered projects are expected to exceed $16.6B over 40 years.

BENEFIT-COST RATIO OF 3.5 TO 1



BRATTLE GROUP REVIEW

- "The SPP Value of Transmission study is a path-breaking effort…"
- "… A more accurate estimate of the total benefits that a more robust and flexible transmission infrastructure provides to power markets, market participants and, ultimately, retail electric customers."
- "Estimated present value of the production cost savings in the SPP study likely is understated…"



THE Brattle GROUP

December 30, 2015

Mr. Jay Caspary
Director, R&D and Special Studies
Southwest Power Pool
201 Worthen Drive
Little Rock AR 72223-4936

Re: SPP Value of Transmission Study

Dear Jay:

Thank you for giving us the opportunity to review the "Value of Transmission" report and the associated PowerPoint summary presentation prepared by SPP staff in December 2015. The SPP study attempts to quantify the overall value provided by SPP transmission projects placed in service during 2012-2014. Based on our review of the final drafts of your study and several prior rounds of discussions in response to earlier drafts, we are pleased to provide the following comments:

- The SPP Value of Transmission study is a path-breaking effort. It provides a more accurate estimate of the total benefits that a more robust and flexible transmission infrastructure provides to power markets, market participants and, ultimately, retail electric customers.
- Relying on a full "re-run" of SPP's day-ahead and real-time markets without the evaluated transmission projects for 40 representative days during the first year of operation of SPP's Integrated Marketplace and comparing the re-run results to actual market results (which include the evaluated transmission projects after they were placed in service) yields a more complete and more accurate estimate of the production cost savings provided by the evaluated projects than the savings estimated in traditional planning studies.
- The estimated present value of the production cost savings in the SPP study likely is understated because: (a) many of major transmission projects evaluated were not yet in service during most of the 40 days that were analyzed; (b) the selected representative days did not include a full spectrum challenging system conditions (such as extreme weather or generation/transmission outage events) that must be expected to occur over the long service life of the evaluated transmission projects; and (c) based on the experience from other SPP transmission benefit studies, the growth rate of the quantified production cost savings may exceed the assumed annual rate of 10% per year.
- The methodologies applied by SPP staff to quantify the range of other transmission-related benefits are consistent with the methodologies applied in the ITP and RCAR evaluation process. Where deviations from the ITP and RCAR processes exist (e.g., in the estimation of public policy benefits), the methodologies applied are reasonable and represent best available industry practice.

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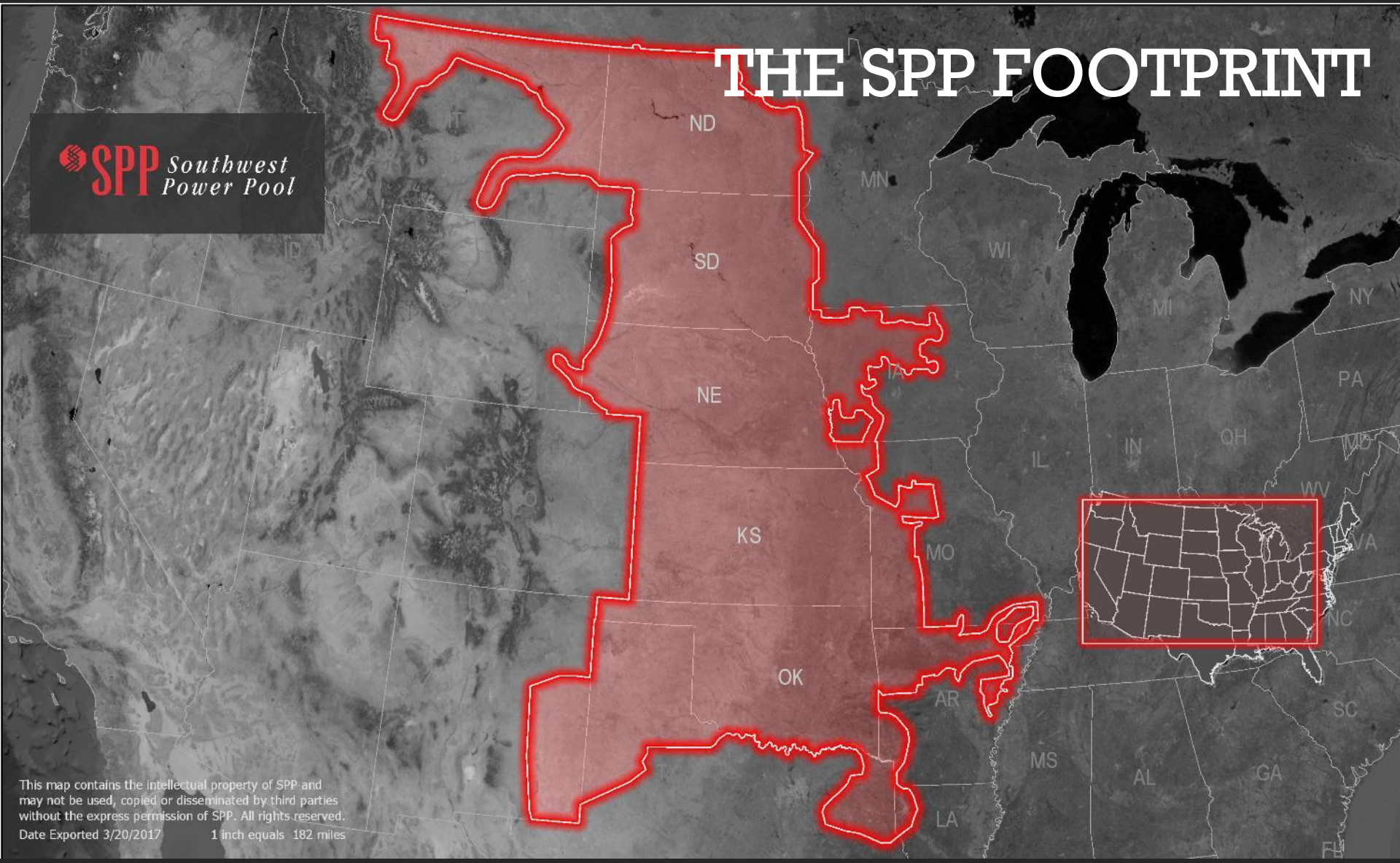
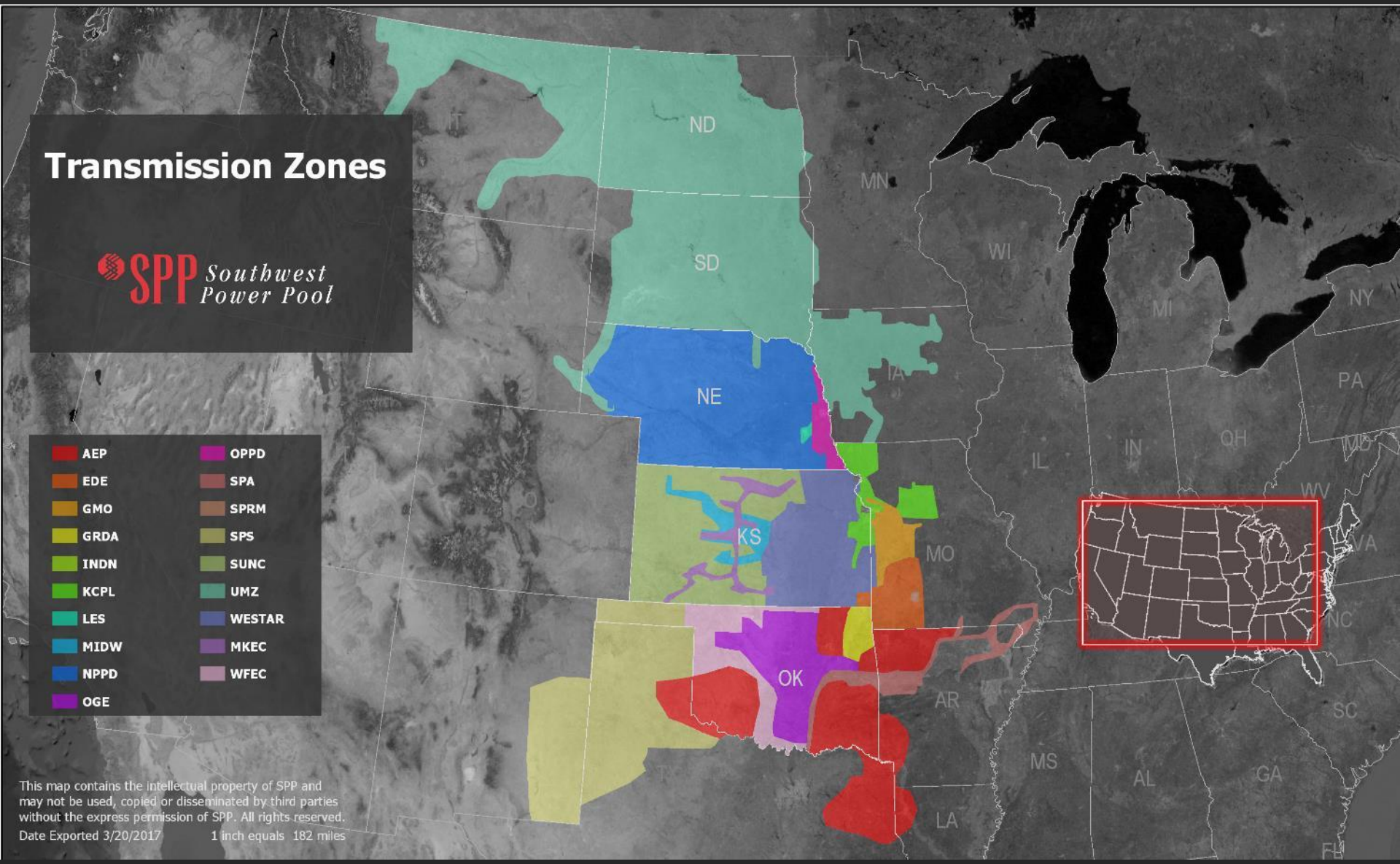
TRANSMISSION PLANNING MAPS

THE SPP FOOTPRINT




Transmission Zones
SPP Southwest Power Pool
AEP
EDE
GMO
GRDA
INDN
KCPL
LES
MIDW
NPPD
OGE
OPPD
SPA
SPRM
SPS
SUNC
UMZ
WESTAR
MKEC
WFEC
ND
SD
NE
KS
OK
MN
WI
MI
NY
PA
IA
IL
IN
OH
WV
MO
AR
MS
AL
GA
LA
SC
NC
VA
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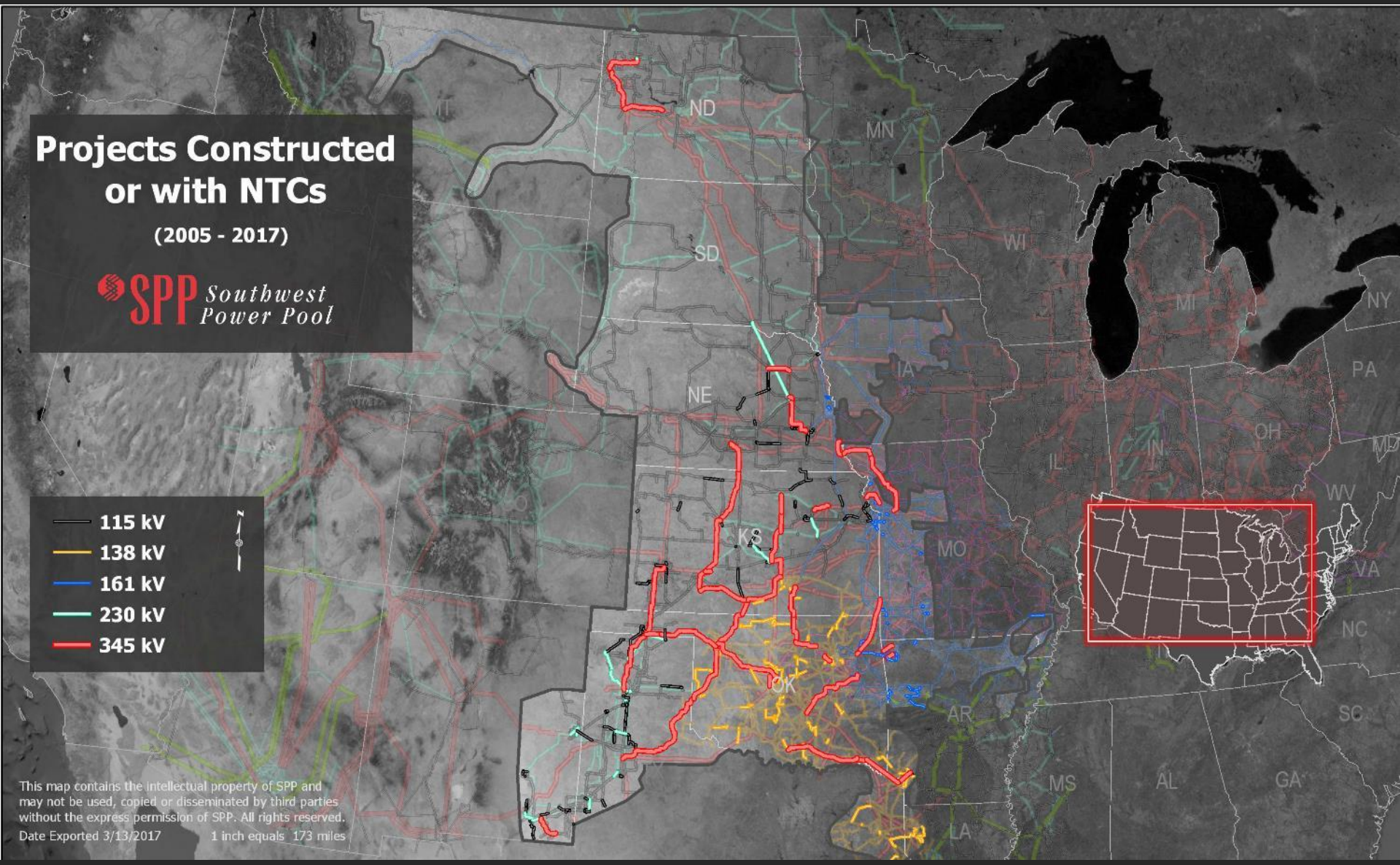
Date Exported 3/20/2017
1 inch equals 182 miles


Projects Constructed or with NTCs
(2005 - 2017)
SPP Southwest Power Pool
115 kV
138 kV
161 kV
230 kV
345 kV
ND
MN
SD
WI
MI
NY
NE
IA
PA
IL
IN
OH
WV
KS
MO
VA
NC
OK
AR
SC
MS
AL
GA
LA
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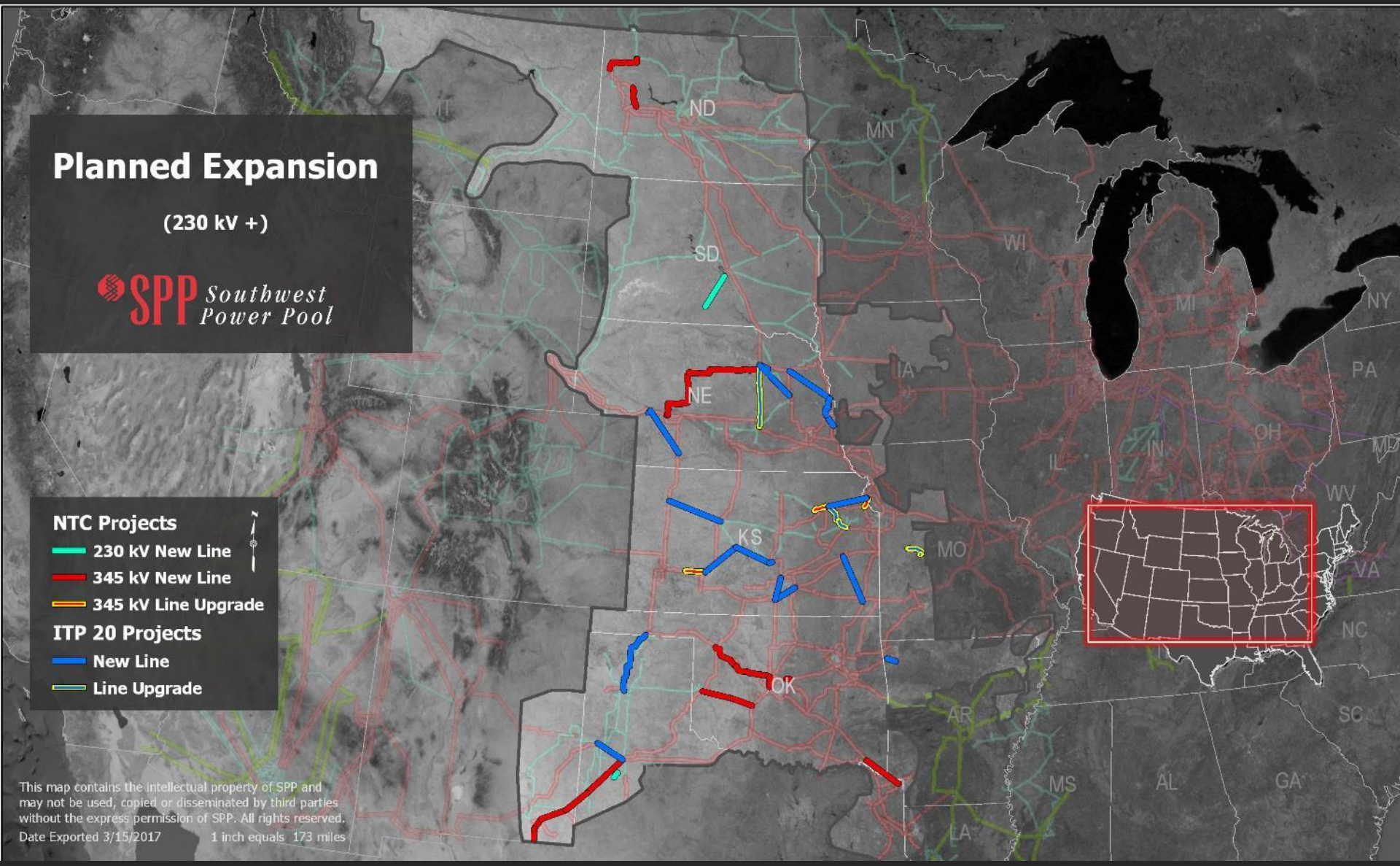
Planned Expansion
(230 kV +)
SPP Southwest Power Pool
NTC Projects
230 kV New Line
345 kV New Line
345 kV Line Upgrade
ITP 20 Projects
New Line
Line Upgrade
ND
MN
SD
WI
MI
NY
NE
IA
PA
OH
IN
IL
MD
WV
KS
MO
VA
NC
OK
AR
SC
MS
AL
GA
LA
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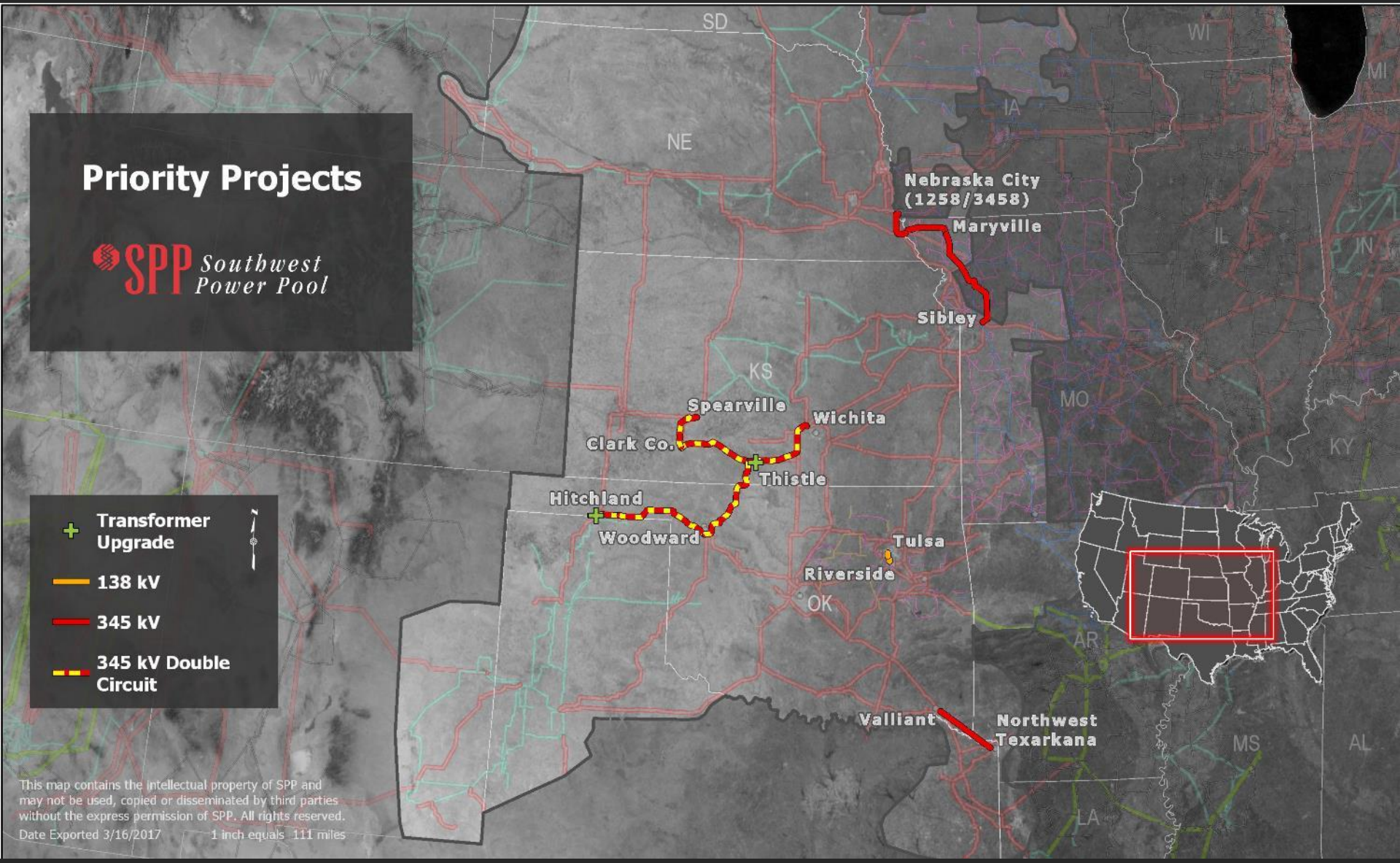
Priority Projects
SPP Southwest Power Pool
Transformer Upgrade
138 kV
345 kV
345 kV Double Circuit
Nebraska City (1258/3458)
Maryville
Sibley
Spearville
Wichita
Clark Co.
Thistle
Hitchland
Woodward
Tulsa
Riverside
Valliant
Northwest Texarkana
SD
NE
KS
OK
IA
MO
AR
LA
MS
AL
KY
IL
IN
WI
MI
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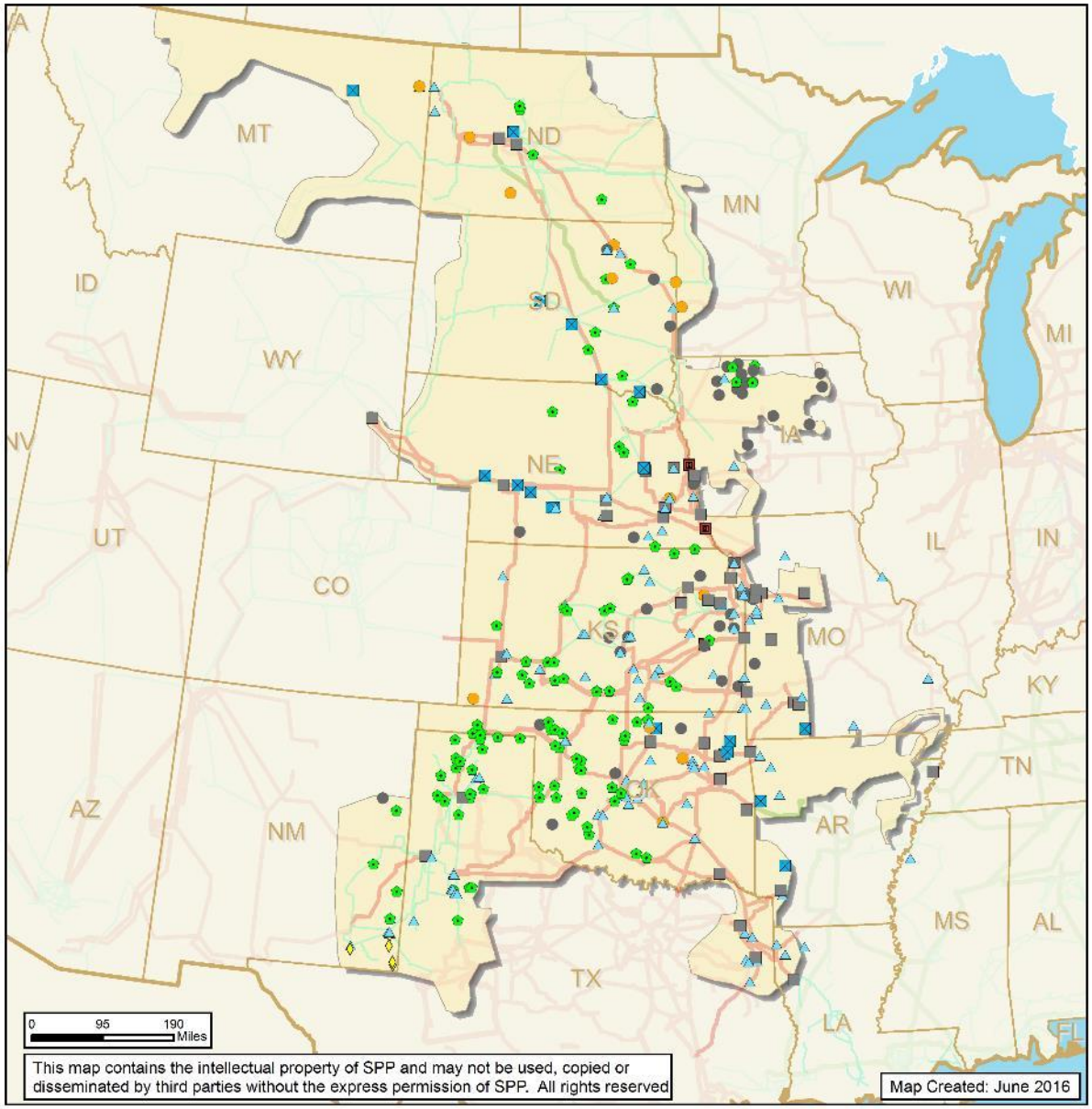
1 inch equals 111 miles



Map Created: June 2016

SPP 75th Anniversary 75

Distribution of Generation

(June 2016)

Fuel Type	Voltage
Coal	230 kV
Fuel Oil	345 kV
Natural Gas	500 kV
Nuclear	
Solar	
Water	
Wind	
Other	

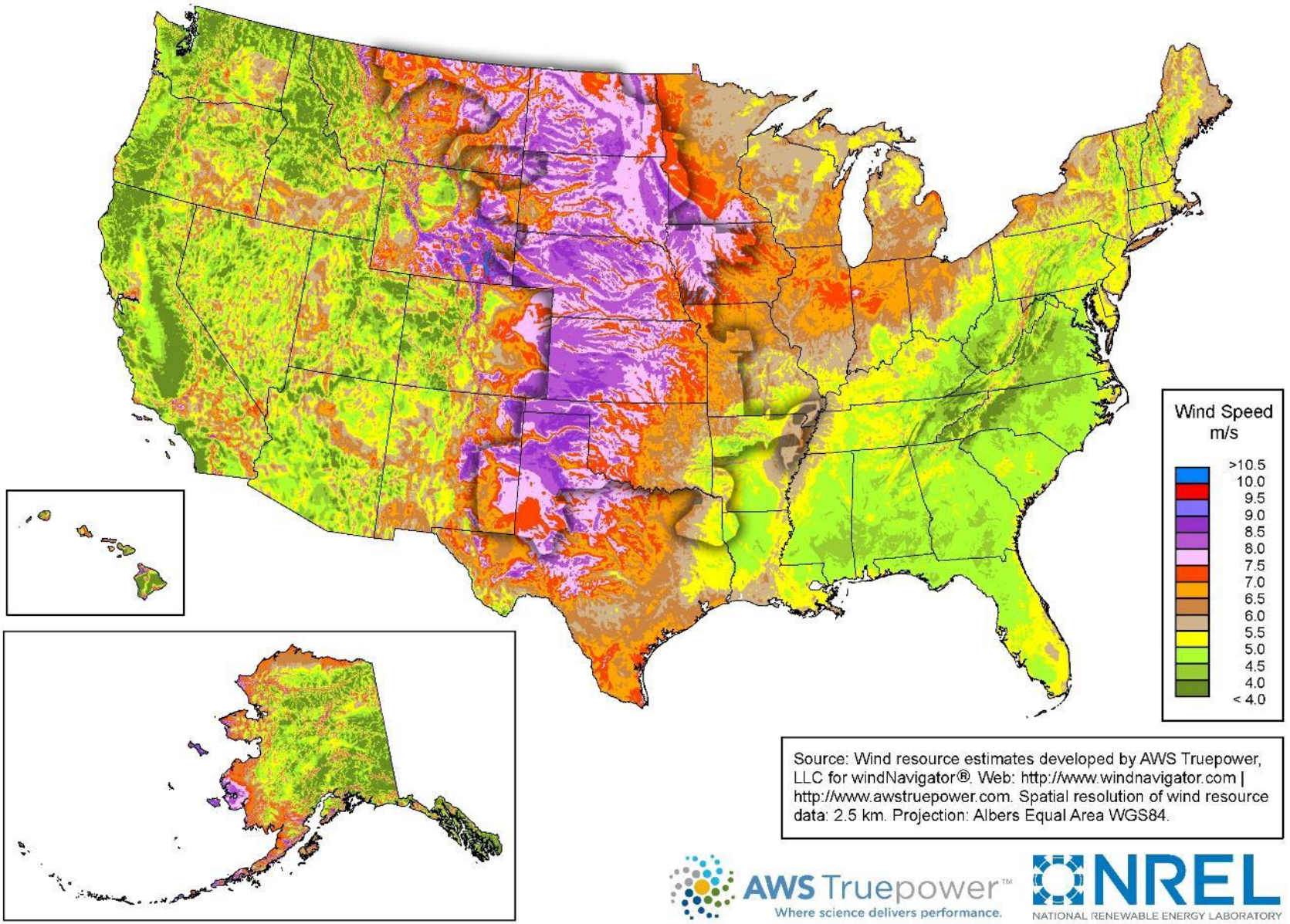
SPP

WIND ENERGY

WIND ENERGY DEVELOPMENT

- SPP's "Saudi Arabia" of wind: Kansas, Oklahoma, Nebraska, Texas Panhandle, and New Mexico
  - 60,000-90,000 MW potential
  - More wind energy than SPP uses during peak demand
- 16,114 MW capacity of in-service wind
- 55,573 MW wind in all stages of development
  - Includes Generation Interconnection queue and executed Interconnection Agreements

ANNUAL AVERAGE WIND SPEEDS



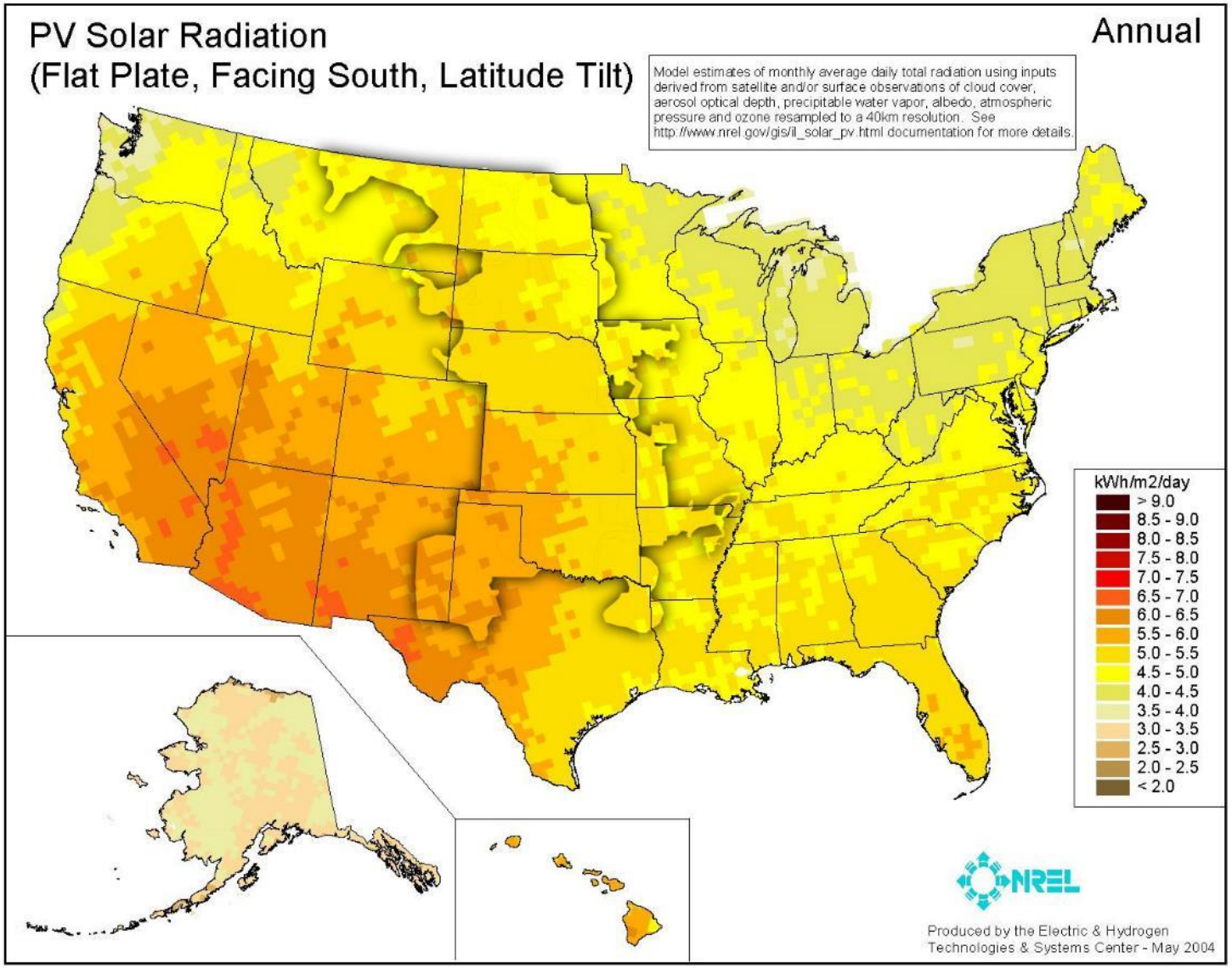
Source: Wind resource estimates developed by AWS Truepower, LLC for windNavigator®. Web: http://www.windnavigator.com | http://www.awstruepower.com. Spatial resolution of wind resource data: 2.5 km. Projection: Albers Equal Area WGS84.

AWS Truepower™
Where science delivers performance.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

SPP

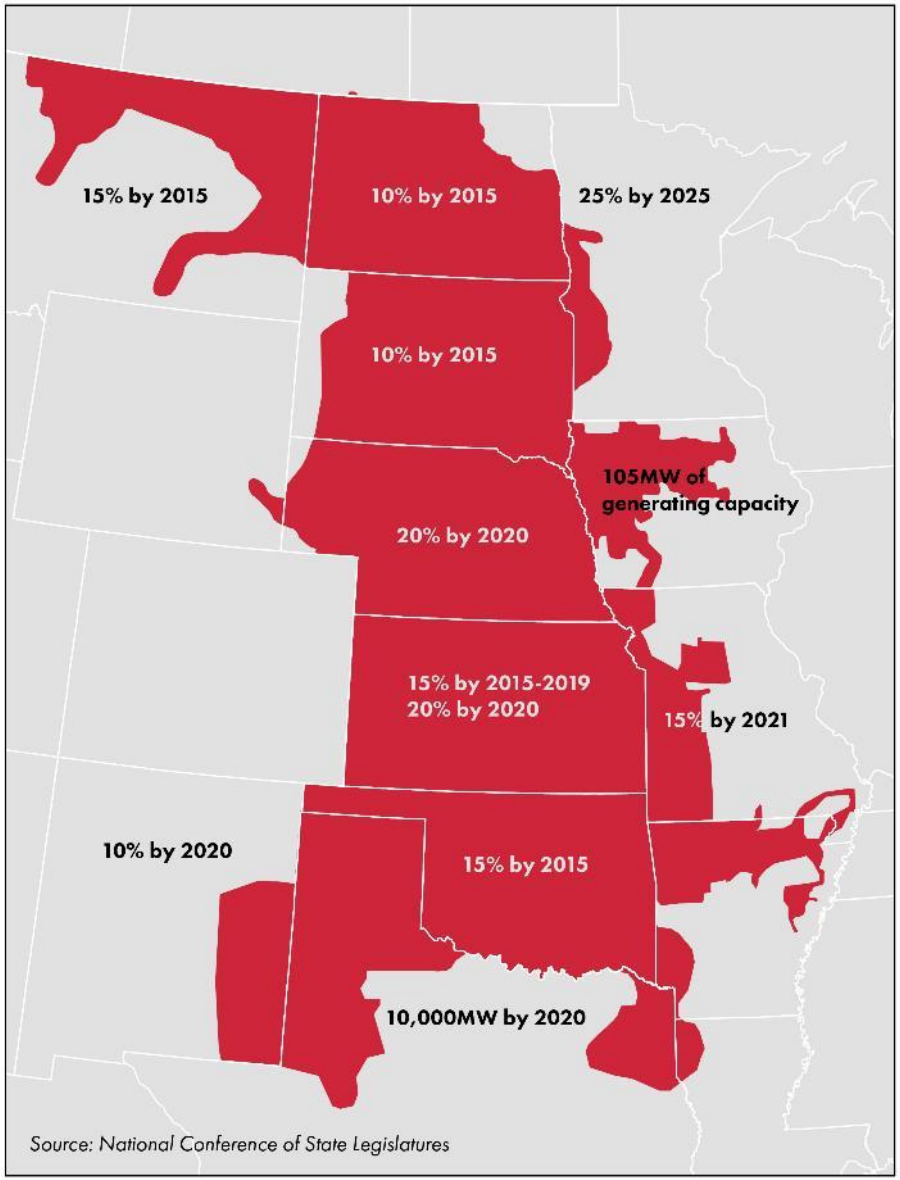
SOLAR IN THE U.S.

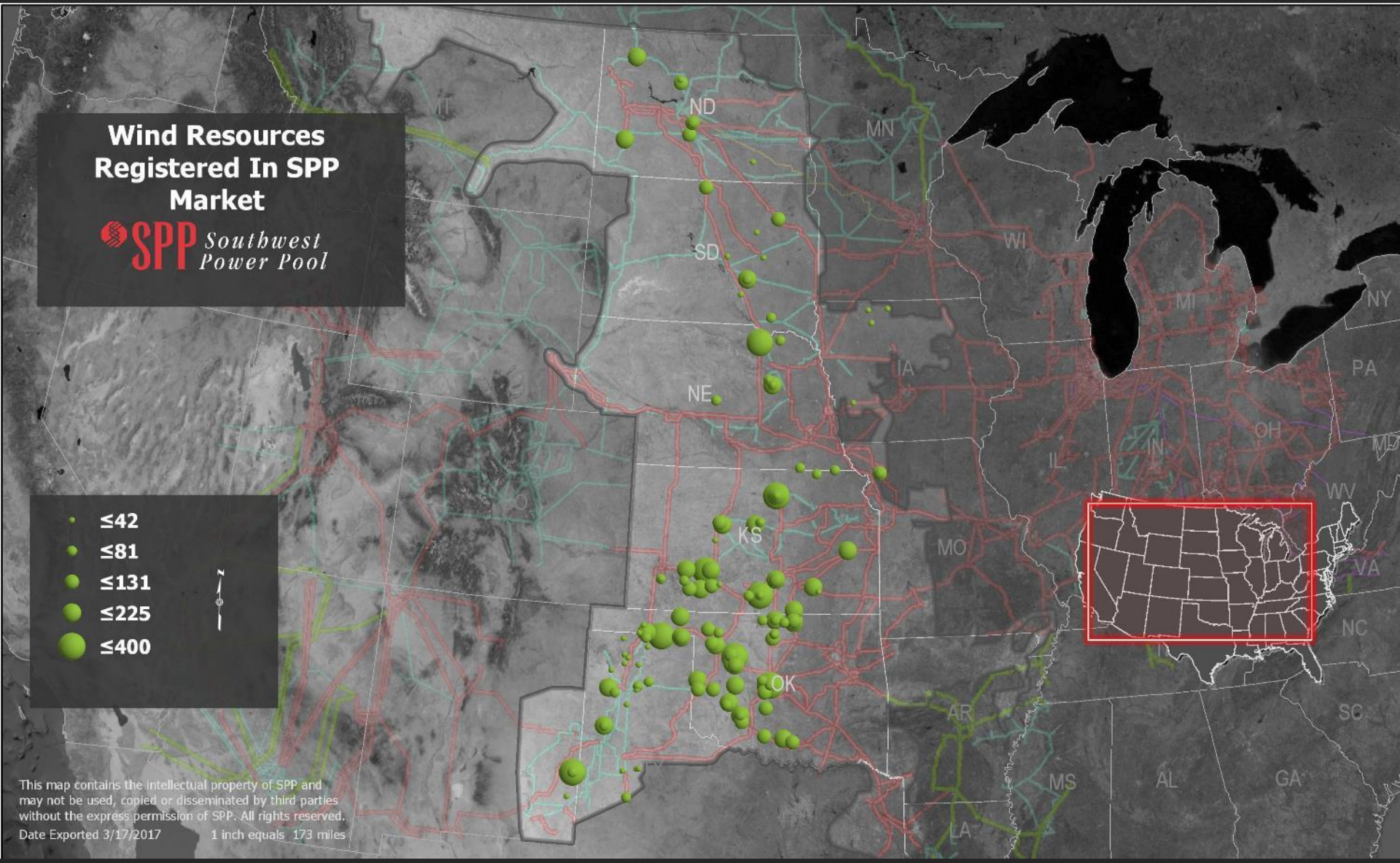


WIND DEVELOPMENT CHALLENGES

- Intermittent
- Must be supplemented with constant generating sources
- Wind in remote areas
- Expensive new transmission needed
- "Not in my backyard" siting issues
- Seams agreements
- Renewable Energy Standards

RENEWABLE PORTFOLIO STANDARDS




Wind Resources Registered In SPP Market
SPP Southwest Power Pool
≤42
≤81
≤131
≤225
≤400
ND
MN
SD
WI
MI
NY
IA
PA
NE
OH
IN
IL
WV
KS
MO
VA
NC
OK
AR
SC
MS
AL
GA
LA
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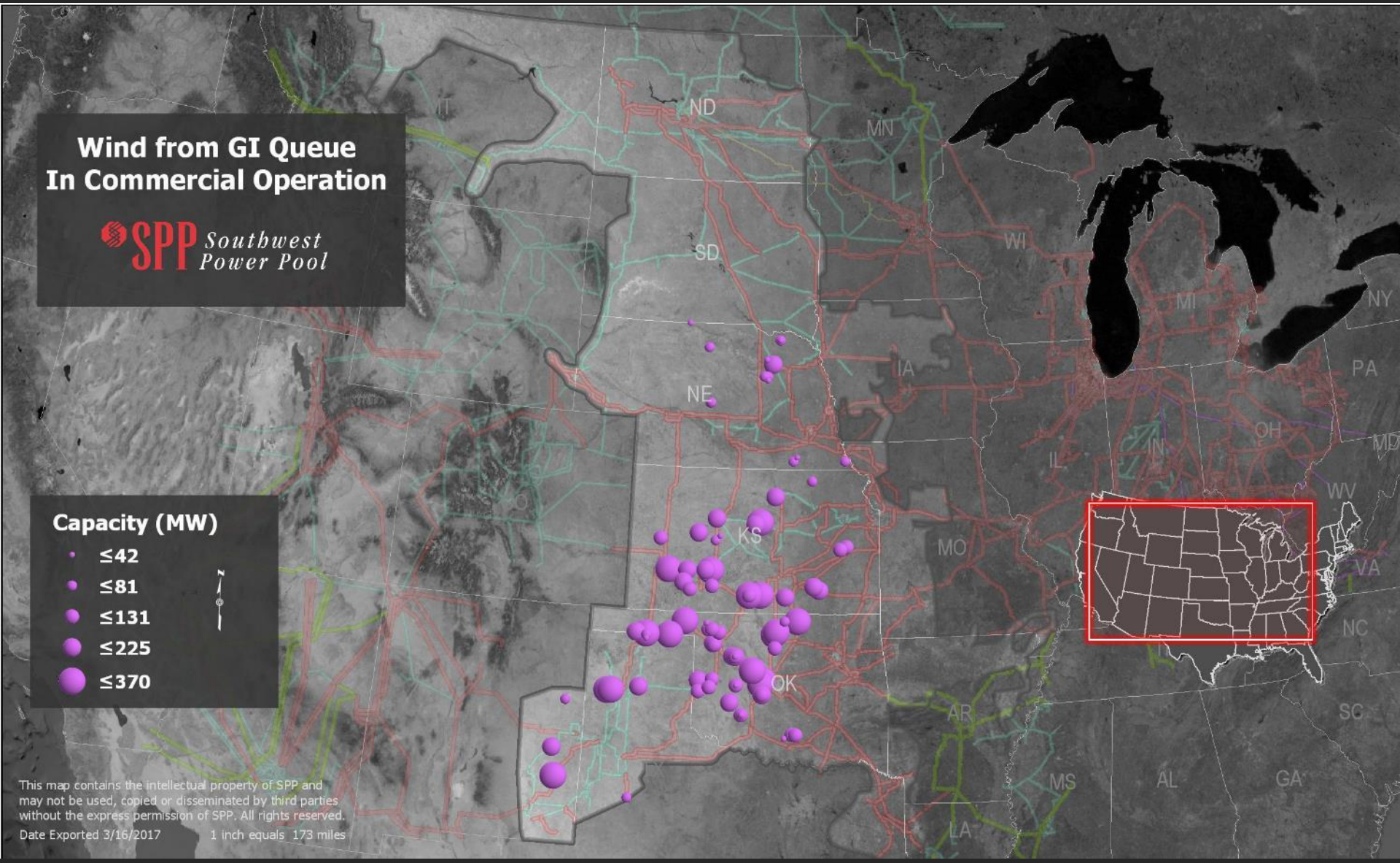
Wind from GI Queue
In Commercial Operation
SPP Southwest Power Pool
Capacity (MW)
≤42
≤81
≤131
≤225
≤370
ND
MN
SD
WI
MI
NY
NE
IA
PA
OH
IN
IL
MD
WV
KS
MO
VA
NC
OK
AR
SC
MS
AL
GA
LA
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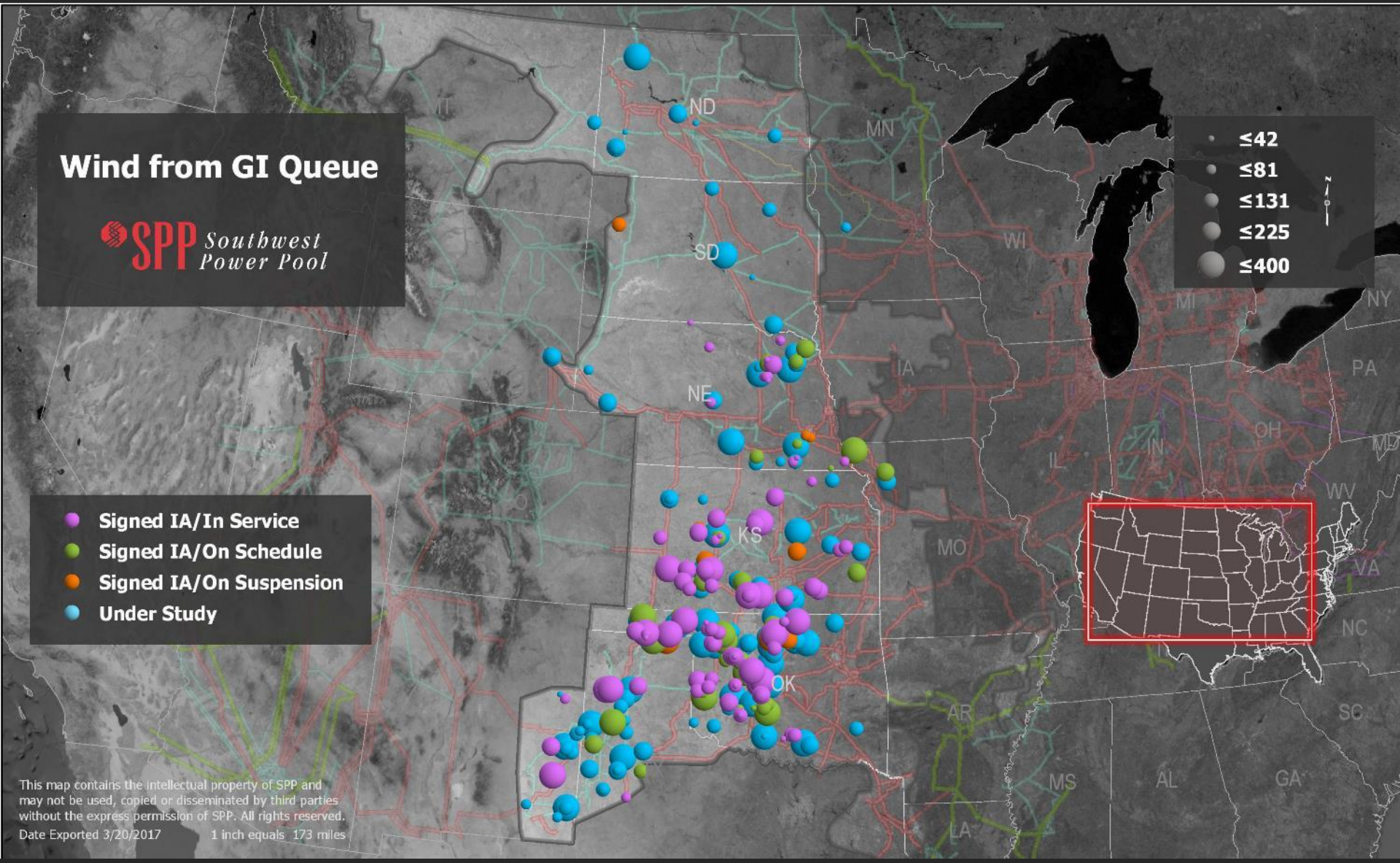
Wind from GI Queue
SPP Southwest Power Pool
≤42
≤81
≤131
≤225
≤400
Signed IA/In Service
Signed IA/On Schedule
Signed IA/On Suspension
Under Study
ND
MN
SD
WI
MI
NY
NE
IA
PA
OH
IN
IL
WV
KS
MO
VA
NC
OK
AR
SC
MS
AL
GA
LA
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NEVADA RURAL ELECTRIC ASSOCIATION

Representing Nevada's Rural Electric Cooperatives, Power Districts, and Municipal Utilities.

Prepared for the Governor's Committee on Energy Choice Workgroup

Open Energy Market Design & Policy: Commercial and Residential

August 8, 2017

Presented By:

Richard "Hank" James
Executive Director
NREA

NEVADA RURAL ELECTRIC ASSOCIATION

- Founded in 1974 to represent the collective interests of Nevada's rural electric distribution systems providing service to rural Nevadans not being served by the I.O.U.

- NREA Advocates for owner-member/consumers with national and state legislators, agencies, local governments, and like-minded organizations about the importance of the services our utility members provide.

- NREA members are not-for-profit associations of persons who procure and distribute electric service on behalf of their owner-members:
  - One municipal utility
  - Six rural electric cooperatives
  - Two power districts.

Governance

- Each NREA member is an individual association of people with a common purpose to acquire and distribute electricity (aggregated load) solely for the members of their Association.

- Local, democratically elected boards are at the center of each member's electric distribution system with a common mission to provide:
  - safe, reliable, and low-cost electric service for their owner-member/consumers.

- PUCN oversight is limited as prescribed in various NRS enabling statutes relative to the Association's entities:

  Electric Cooperatives --- Power Districts --- Municipalities.

NREA Utility Members Do Not Have "Customers"

NEVADA RURAL ELECTRIC ASSOCIATION

- Net revenues are allocated back to the Owner/Members as *capital credits…* Either refunded by check or utility bill credit on a pro-rata basis. *(Cooperatives)*

- For Public Utility Districts and Municipalities, net revenues are returned to the consumer manifested in lower rates or lower taxes.

Total Utility Plant Investment	Total Annual Revenue	Total Employees	Total Annual Payroll
$293,852,330	$184,353,076	266	$12,345,678

“Fundamentals” of
NEVADA’S RURAL ELECTRIC DISTRIBUTION SYSTEMS

NEVADA RURAL ELECTRIC ASSOCIATION

- **The democratic structure** of NREA member Boards
  - Enable each utility system Board to make progressive changes to their own energy policies… only if their owner-members/consumers want change.
  - All owner-members have one vote regardless of the amount of energy purchased.

- NREA utility members have **no excess margin component** when setting rates**.**
  - Rate components = Energy + Demand + Cost of Business

- Provide electricity over ~50% of the land and serve ~10% of the Nevada’s population.

- NREA utility members serve an average **5.2 consumers per mile** of distribution power line, compared to over 34 consumers per mile.

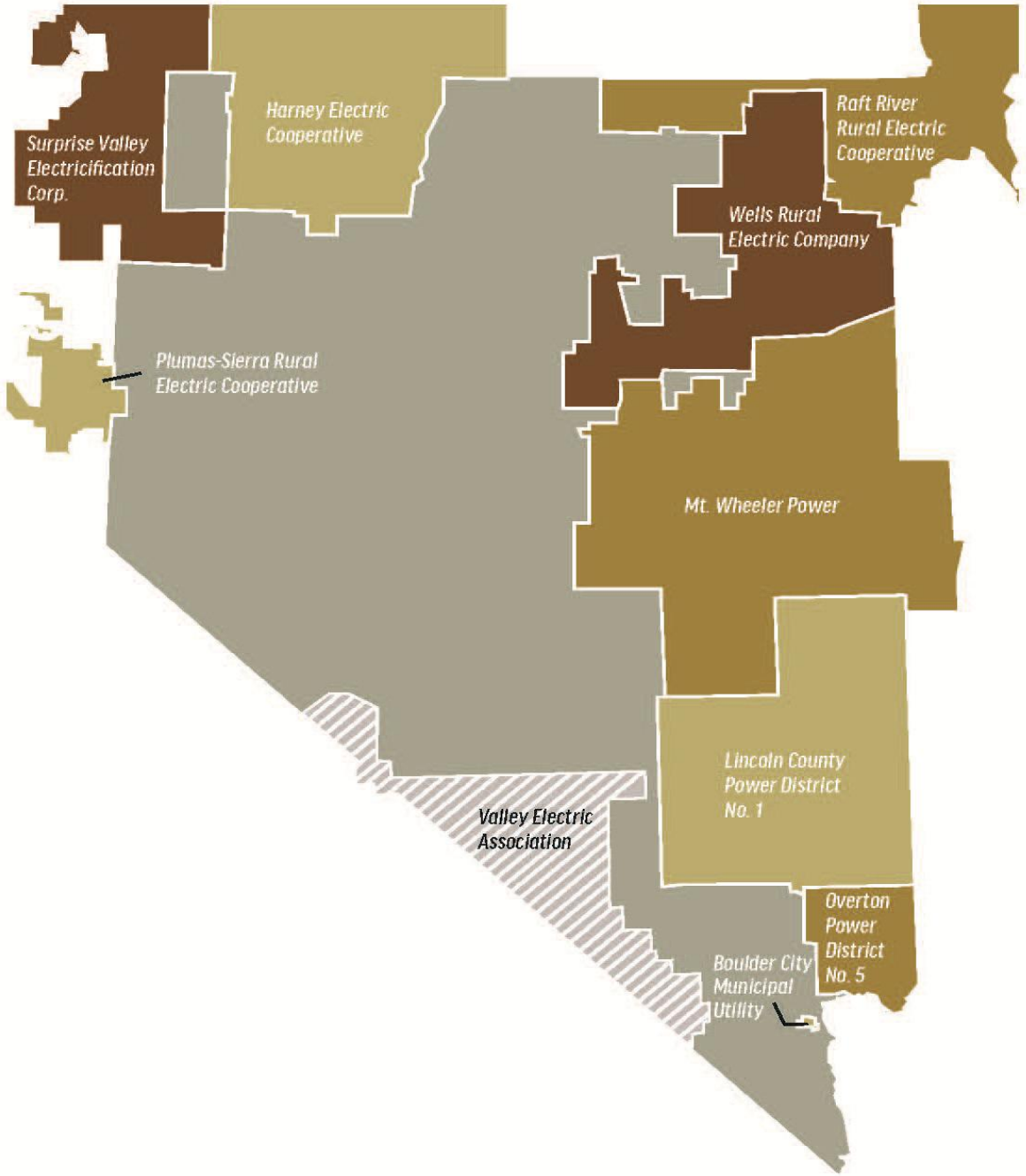
- Nevada’s rural distribution systems seek to acquire and distribute least-cost renewable/carbon-free generation resources with high reliability (99.99%) to meet **native demand** as they arise.

NREA UTILITY MEMBERS

NEVADA RURAL ELECTRIC ASSOCIATION

- Harney Electric Cooperative, *Hines, OR*
- Lincoln County Power District No. 1, *Pioche, NV*
- Mt. Wheeler Power, *Ely, NV*
- Overton Power District #5, *Overton, NV*
- Raft River Rural Electric, *Malta, ID*
- Wells Rural Electric Company, *Wells, NV*
- Boulder City Electric Utility, *Boulder City, NV*
- Surprise Valley Electrification Corp, *Alturas, CA*
- Plumas-Sierra Rural Electric Co-op, *Portola, CA*

LOCATION OF NEVADA'S RURAL ELECTRIC UTILITIES



NEVADA RURAL ELECTRIC ASSOCIATION

Summary by the Numbers

NEVADA RURAL ELECTRIC ASSOCIATION

- **Utility Members:** 9
- **Renewable/Carbon-Free Portfolio**: ~65%
- **Nevada Consumers:** 41,562
- **Distribution -** 12,248 Miles – **Transmission** 1,664 Miles (Local)
- **Owner-Member/Consumers per mile of distribution line :** 5.2
- **Nevada Service Territory:** 48,216 square miles
- **Employees:** 266
- **Combined Load:** 2,731,475 MWh - **Peak Load:** 502 MW (CY2015)
- **Elected Owner-Member/Consumer Directors:** 68

NREA & ENERGY CHOICE

- NREA Members have always provided “Choice” to their member/consumers…
  - In their power supply options, their rates, and in the make-up of their Boards’.
  - All owner-members have one vote regardless of the amount of energy purchased.
- 14 other (Deregulated) States exclude, or, provide an opt-out/in mechanism for not-for-profit Public Power because:
  - Long-term, low-cost energy PPA’s discourage profit-motivated retail providers from entering the market
  - Transmission capacity constraints within NREA member service areas for external resources.

NREA & ENERGY CHOICE

NEVADA RURAL ELECTRIC ASSOCIATION

- Additional Energy Costs for NREA owner-members in an Open Energy Market Structure would include:
  - Alternative Power Providers' profit margin (10-15%)
  - Transmission and retail wheeling costs (TBD)
  - NREA's existing PPA Divestiture/Liquidation costs (~$1 Billion)
  - Additional Transition costs (~$1 Billion)
    - Including, but not limited to:
      - Automated Meter Infrastructure (if possible)
      - Billing software
      - New regulatory oversight/compliance

The Future:

NEVADA RURAL ELECTRIC ASSOCIATION

- NREA's electric distribution system members:

  A. Create and administer policies to achieve equitable, environmentally responsible, sustainable livelihood for all owner-member/consumers.

  - We stand together as an Association of independent not-for-profit Associations of people who operate cooperatively… their own electric distribution systems.
  - We also stand ready, willing, and able to assist the Governor's CEC to develop recommendations that ensure NREA members continue retain access to energy supply resources of their choosing in Nevada's new open energy market.

  B. Ensure the availability of safe, reliable, low-cost electric service to rural Nevadans.

  - Technical advisors and Energy Industry Experts are available through NREA utility members to partner with the GCEC to facilitate and contribute to responsible on-going wholesale and retail market research and data collection.

NEVADA RURAL ELECTRIC ASSOCIATION

Nevada Rural Electric Association
Richard “Hank” James
Executive Director

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