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INDUSTRY ANALYSIS

U.S. and Canadian Energy Markets

TAMID GROUP

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COMPANY OVERVIEW

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NSZ COMPANY OVERVIEW

Industry: Energy consulting.

Objective: “Market Advisory, Technology Analysis, Economic Evaluation, and Development Support” within the energy industry.

Primary Revenue: Cost analysis, energy storage solutions for major electricity companies. This includes helping to fulfill open procurement requests from independent systems operators or energy producers.

> “NSZ Energy is an expert in energy storage technologies and market opportunities. NSZ Energy’s technical expertise includes operational and performance knowledge of all advanced energy storage technologies.”

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PROJECT OVERVIEW

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PROJECT STAGES

1. General Industry Analysis

Find and detail the key players in the market.

2. Open Procurement Tracking

Find and detail open requests for energy storage procurement.

3. Energy and Demand Tariff Price Tracking

Find average energy and demand tariff prices.


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MARKET SEGMENTS
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ALASKA

Brit Stein

ALASKA ENERGY

Energy Source Used for Home Heating (share of households)	Alaska
Natural Gas	48.0 %
Fuel Oil	29.9 %
Electricity	12.4 %
Liquefied Petroleum Gases	1.1 %
Other/None	8.9 %

OVERVIEW:

Since Alaska has such a small population of only 700,000 (only 0.2% of the total U.S. population) it is a relatively small energy market. That being said, the total energy capacity is 0.9% share of the U.S and consumption reaches 603 trillion Btu. The larger share indicates the need to heat homes during harsh winter climates. Primary energy sources include Petroleum, Natural Gas, and Coal. Alternative energy sources include Hydropower, Biomass Fuels and Wood.

ALASKA'S CURRENT MARKET

The Electric Power Industry in Alaska is actually a **patchwork of unconnected grids**, where each generator operates independently of the other. These energy plants are gas fired. All electric, heating, and general utilities bills are **subsidized by the Alaskan government** that essentially controls the Energy Market. Only one of the five major utilities (Alaska Electric Light and Power) is investor owned and they solely operate in the Juneau area. The Regulatory Commission of Alaska sets price controls, so there is no energy competition amongst suppliers. Commission regulates utilities, rates and services of electricity, oil, gas and renewables.

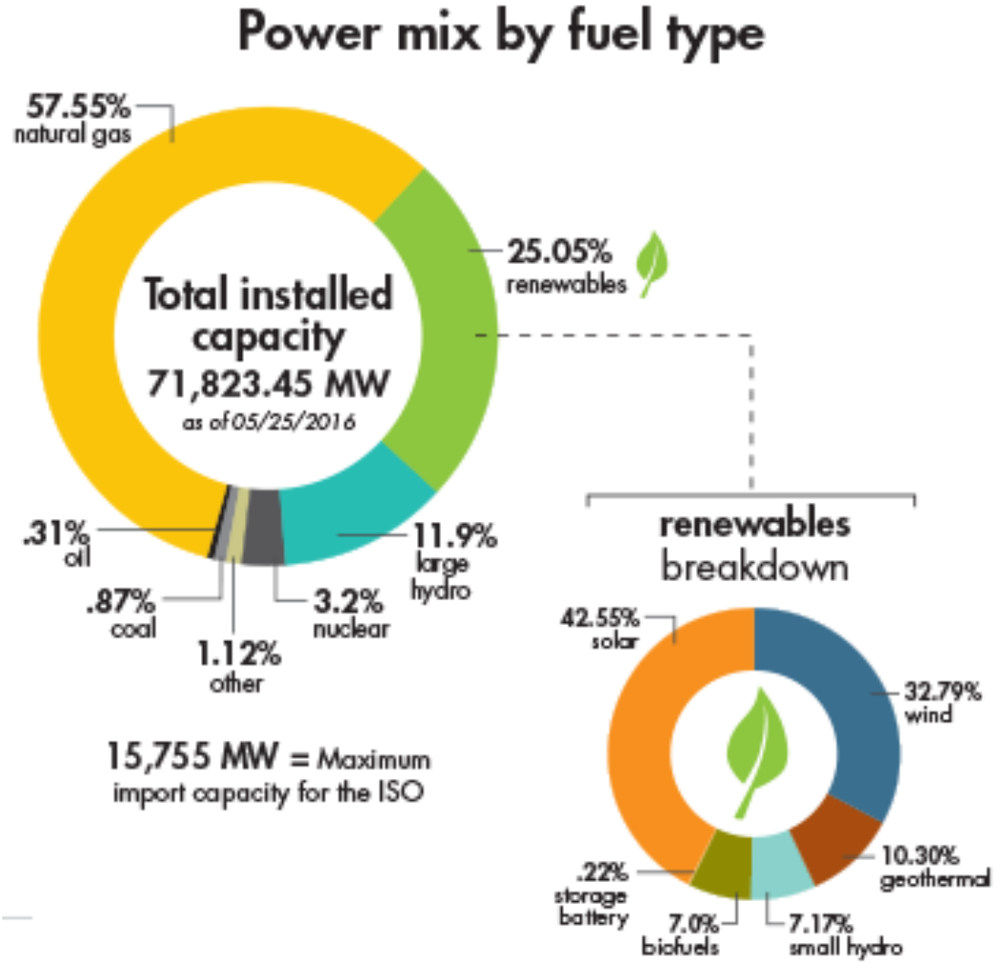
RECCOMENDATION

Alaska is a **relatively small market** – so while the average individual or household consumes a lot of energy as a result of low temperatures, there still is not much opportunity within the market. In fact, since the government sets the price regulations and rates for utilities and services of electricity, oil, gas, and renewables, there are most likely **no opportunities for NSZ** to enter the market.

CALIFORNIA

Jotham Sadan

CAISO ENERGY



GEOGRAPHICAL AREA: California, Oregon, Washington, Arizona, Nevada, and Utah

TOTAL ENERGY CAPACITY: 71,823.45 MW

AVERAGE DEMAND: 30,000 - 50,000 MW/day (S2016)

PRIMARY ENERGY SOURCES: Natural gas, renewables, and large hydro

RENEWABLES BREAKDOWN: Solar, wind, geothermal, hydro, and biofuels

CAISO DEMAND TARIFFS

District Name	Cost Per Unit Power ($/)
1. Los Angeles	Typically about $10/MWh above minimum
2. San Francisco	Typically about $7/MWh above minimum
3. San Diego	Typically about $5/MWh above minimum

HIGH TARIFFS IN CALIFORNIA AREA: LA, San Francisco, San Diego.

TARIFF ANALYSIS: May merit a deeper dive to see relative difference.

CAISO OBJECTIVES: Capacity expansion through grid size expansion outside large cities, continued shift towards renewables.

BUSINESS OPPORTUNITY

SMUD PLANS TO JOIN GRID: Sacramento Municipal Utilities District plans entrance to energy imbalance market.

- $6.5 million initial investment + $2.5 million annual costs.
- Redding, Roseville, Modesto Irrigation, and Trinity PUD may follow suit.

PORTLAND GE AND IDAHO POWER: To begin participating in energy imbalance market in Oct. 2017 and Apr. 2018 respectively.

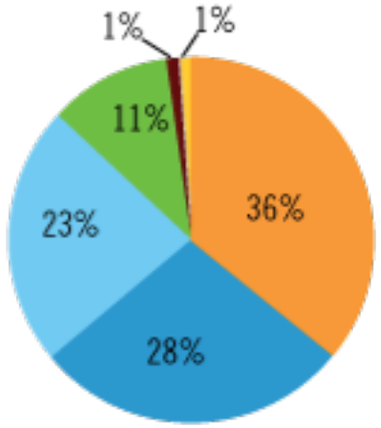
CENACE: Exploring expansion into CAISO grid. Terms not yet formalized.

ONTARIO

Danny Hoffman

ONTARIO ENERGY

Nuclear	12,978 MW
Gas	9,942 MW
Hydro	8,432 MW
Wind	3,923 MW
Biofuel	495 MW
Solar	280 MW



IESO.ca

POPULATION: 13.6 Million

TOTAL ENERGY CAPACITY: 36,050 MW

PRIMARY ENERGY SOURCES: Nuclear, Natural Gas, Hydropower.

RENEWABLE SOURCES: Wind, Biofuel.

10 YEAR ENERGY CAPACITY CHANGES

NET CHANGES TO INSTALLED GENERATION CAPACITY, 2005-2015

Installed Capacity (MW)	2005	2015
Nuclear	11,397	13,014
Coal	6,434	0
Natural Gas	4,976	9,852
Waterpower	7,910	8,768
Solar PV/Wind/Bioenergy	134	7,068
Demand Response	0	690

IESO.ca

EXPANDED: Nuclear, Natural Gas, Renewables

ELIMINATED: Coal

IESO NEWS – 2016

JANUARY 2016

- In a controversial decision, Ontario's government decided not to decommission their two aging nuclear plants (slated for 2020), instead opting for a 12.8 Billion dollar overhaul of the facilities

SEPTEMBER 2016

- Ontario suspends its large renewable procurement (LRP) process, halting procurement of over 1,000 MW of solar, wind, hydroelectric, and bioenergy projects.

- Cited savings of 3.8 Billion relative to their 2013 Long-Term Energy Plan forecast

POTENTIAL FOR RENEWABLE ENERGY DEMAND

Nuclear refurbishment has historically cost more and taken longer than expected, prompting the need for other energy expansion while that takes place.

TIME FRAME

- New Long Term Energy Plan in 2017
- New capacity contracts should be reached by 2019
- Construction of wind farms/other nuclear alternatives by early 2020's

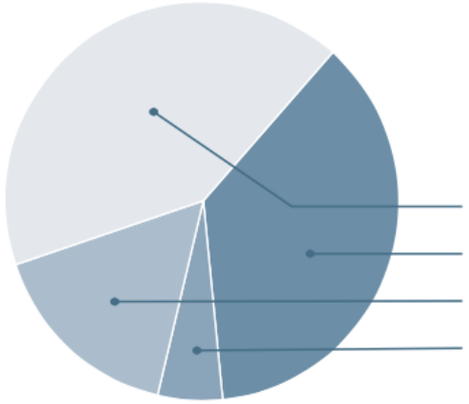
BOTTOM LINE: Definite potential for business while IESO undergoes a 12.8B overhaul of nuclear facilities, waiting for 2017 Long Term Energy Plan for updates.

ALBERTA

Jaunty Okhovat

ALBERTA'S MARKET

- Population: 4.15 million
- Total Energy Capacity: 16,315 MW
- Demand will grow by 2% every year over the next 20 years



SUPPLY:

OUR SOURCES OF ELECTRICITY (MEGAWATTS)

(2015 Data)

Natural gas 7,132 MW
Coal 6,271 MW
Renewables 2,756 MW
Interties 918 MW

- Primary Energy Sources: Natural Gas, Coal, Renewables
- Alternative Energy Sources: Wind, Hydroelectric

RENEWABLES EXPANSION

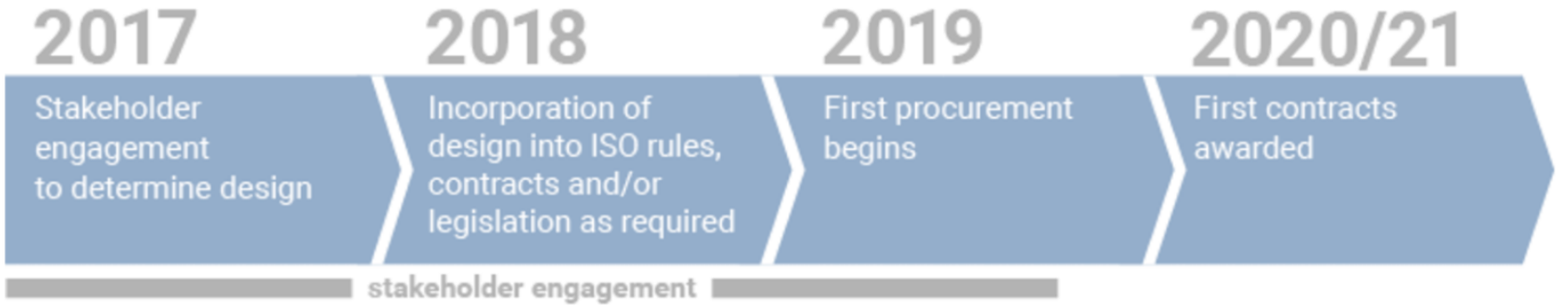
RENEWABLE ELECTRICITY PROGRAM: a series of competitions that will incentivize the development of renewable electricity generation projects - done through bidding process that will last through 2017.

- Alberta is Canada’s largest market for new wind energy investment
- Additional 5,000 MW of renewable energy by 2030: Wind, hydroelectric, biomass, solar
- $10.5 billion into Alberta economy; 7,200 jobs created
- Provide electricity at lowest possible price
- Coal phase-out

CAPACITY MARKET TRANSITION

TRANSITION FROM AN ENERGY MARKET TO A NEW FRAMEWORK THAT INCLUDES AN ENERGY MARKET AND A CAPACITY MARKET.

- Ensures reliability as Alberta's electricity system evolves
- Increases stability of prices
- Provides greater revenue certainty for generators
- Maintains competitive market forces and drives innovation and cost discipline



TEXAS

Ilia Dichev

ERCOT OVERVIEW

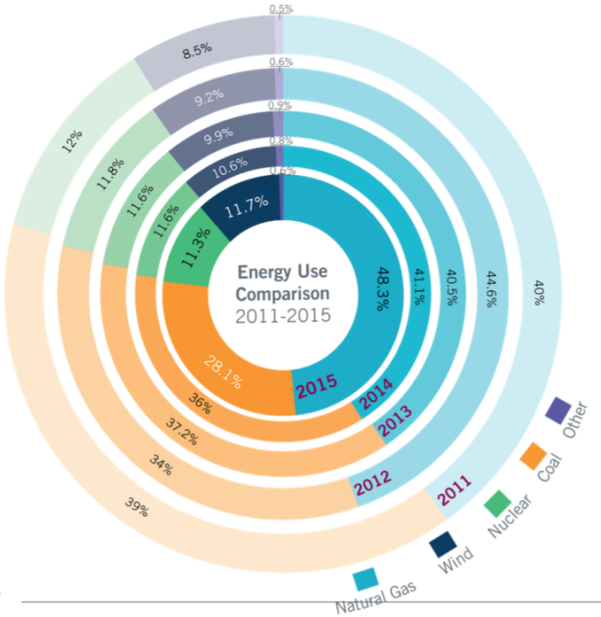
OVERVIEW

ERCOT serves **over 24 million customers**, which represents 90% of the Texas load and 75% of geographic area. At an **average price of $26 per megawatt hour**, ERCOT represents one of the **cheapest energy markets in the United States**, with some regions paying nearly $50 per megawatt hour. Moodys reported that Texas power **producers are struggling financially due to low energy prices**. However, due to the recent OPEC agreement for production cuts, the prices of oil have climbed to $50/bl. which could lead to higher electricity prices as Texas largely relies on natural gas for electricity.

ELECTRICITY SOURCES

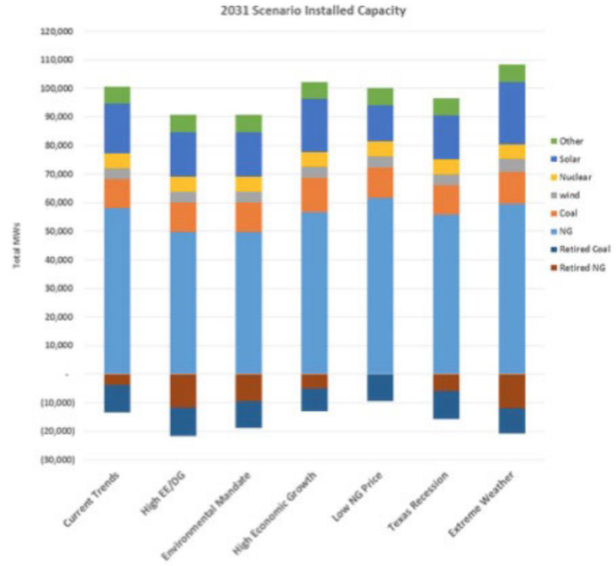
- As Texas is a **large petroleum producer**, the majority of the electricity within the region comes from natural gas.
- Although Texas relies largely on natural gas and coal for electricity, **ERCOT has implemented a wind energy initiative**, aiming to develop wind capacity to 19,000 MW by the end of the year and further in the future. Earlier this fall, ERCOT set a new record, with wind power accounting for 45% of all electricity used on a particular day.

Energy Use Comparison



2031 Capacity by Scenario

- Chart includes added and retired capacity
- Wind and solar capacity shown based on CDR capacity contributions



ERCOT CAPACITY

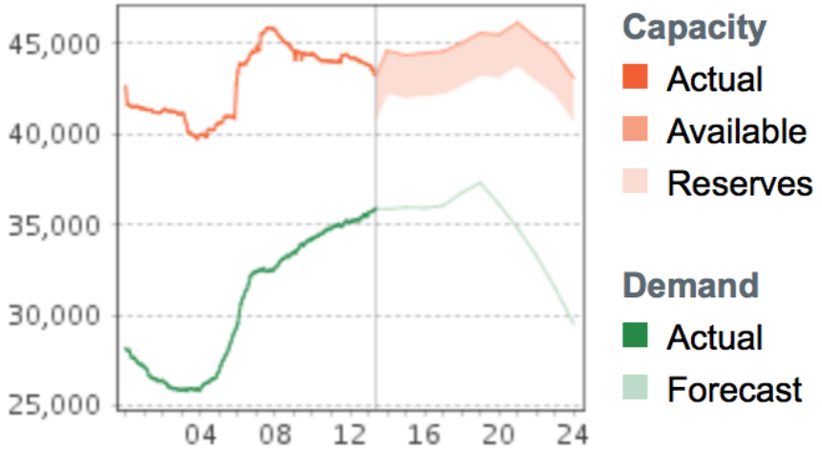
TOTAL CAPACITY: 82,000 MW

WINTER DEMAND: 58,000 MW

SUMMER DEMAND: 70,000 MW

OTHER INFORMATION:

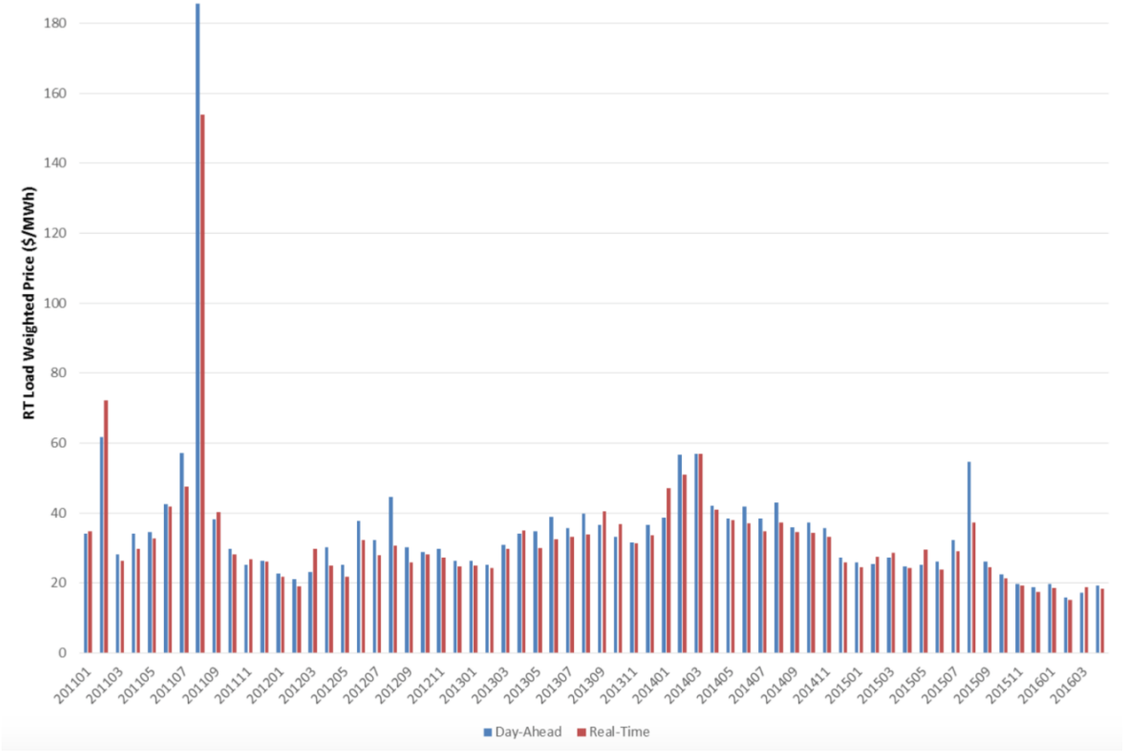
- Some concern ERCOT would not be able to meet supply due to coal plants being potentially shut down. However, with a Trump presidency, there is large upside for coal producers.
- Current minimum reserve margin set at 13.75%, however ERCOT aims to raise minimum to 20% in 2017 due to growth in solar and wind power



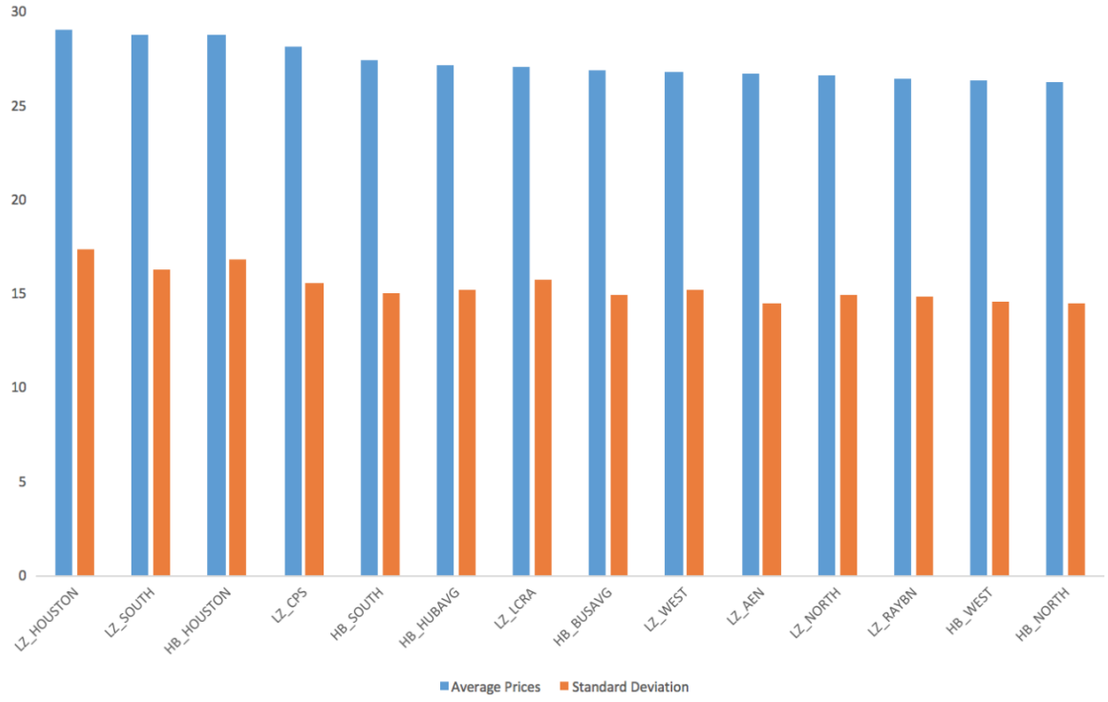
(November 11, 2016)

ERCOT MARKET PRICING

HISTORICAL MARKET PRICING



PRICING BY REGION (OCTOBER)



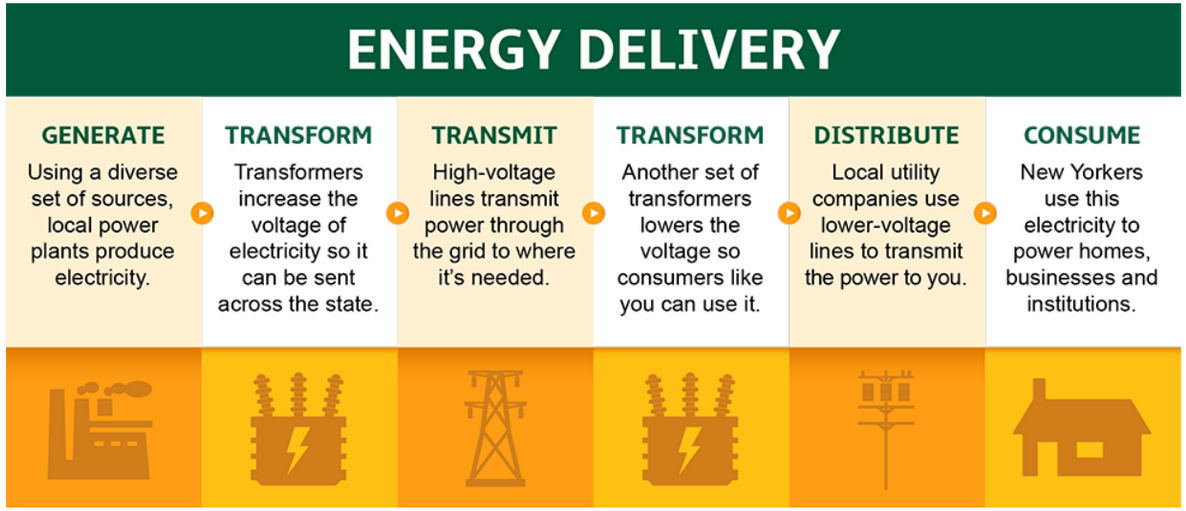
NEW YORK

Alexandre Breitbart

NEW YORK ENERGY

THE NYISO operates competitive wholesale markets and manages the flow of electricity throughout New York, reliably balancing consumer demand with sufficient supplies of power.

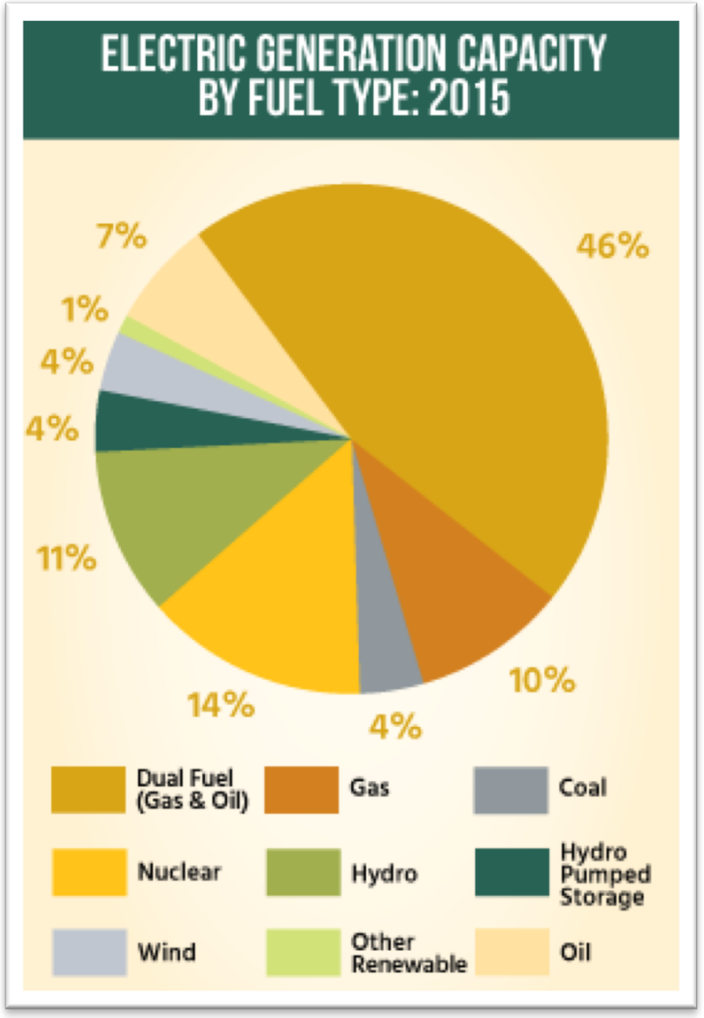
- Facilitates the energy delivery to some of the 19 Million NY State consumers.
- Currently they are expanding their wind power production and are planning for future expansion.



PRIMARY ENERGY SOURCES

- The generating capacity of wind-powered projects grew from 48MW in 2005 to 1,746MW in 2015. Currently there are more than 2,300MW of wind-powered proposed for development.

- Actual generation of electricity by wind-powered facilities has grown from little more than 100 gigawatt-hours in 2005 to nearly 4,000 gigawatt-hours in 2014.



NYISO PRICING

DISTRICT NAME	LBMP ($/MWHr) on 11/03/2016
1. Zone A - West	$19.96083
2. Zone B - Genesee	$19.34833
3. Zone C - Central	$19.85292
4. Zone D - North	$18.6025
5. Zone E - Mohawk Valley	$20.3275
6. Zone F - Capital	$21.68783
7. Zone G - Hudson Valley	$23.98583
8. Zone H - Milwood	$24.36208
9. Zone I - Dunwoodle	$24.38667
10. Zone J - New York City	$24.58042
11. Zone K - Long Island	$25.9975

MIDWESTERN U.S.

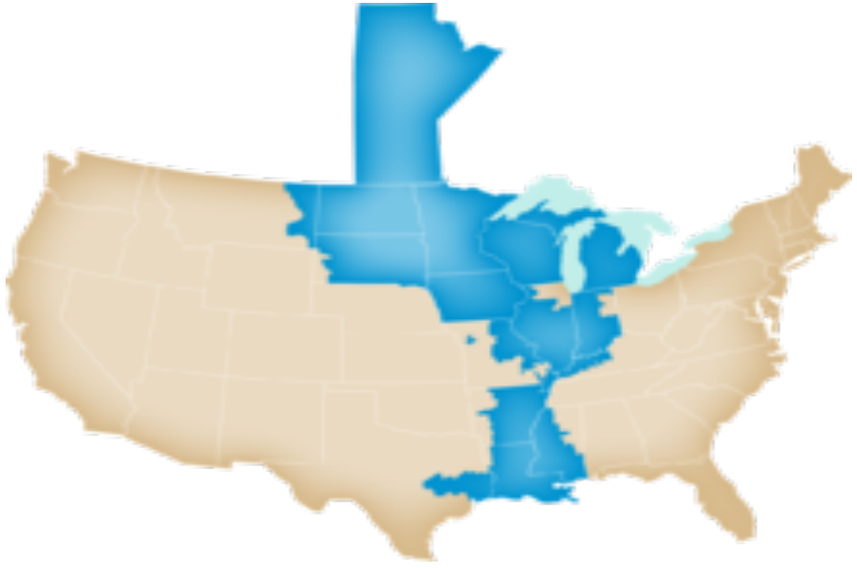
Tommy Cheng

MIDWEST ENERGY MARKET

GEOGRAPHIES: Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, Nebraska, North Dakota, South Dakota, and Wisconsin) and South (Arkansas, Mississippi, and Louisiana). Canada: Manitoba

TOTAL CAPACITY: 176,559MW

HISTORIC LOADS:
Historic Summer Peak Load in MW (set July 20, 2011): 127,125MW
Historic Winter Peak Load in MW (set Jan. 6, 2014): 109,307MW

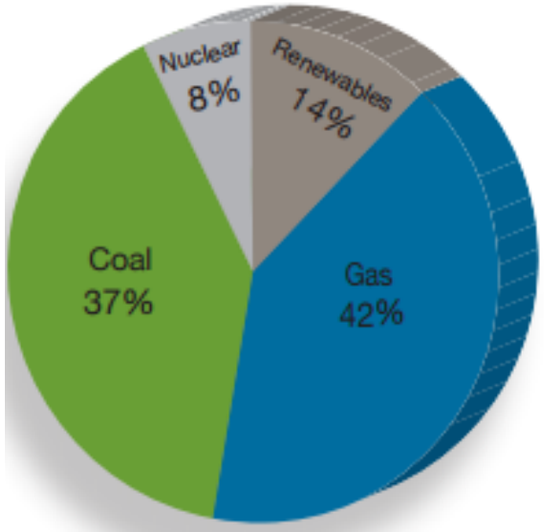


MIDWEST ENERGY SOURCES

SOURCES: Gas (42%) and Coal (37%).

RENEWABLES: represents the most abundant clean energy fuel source in the Midwest.

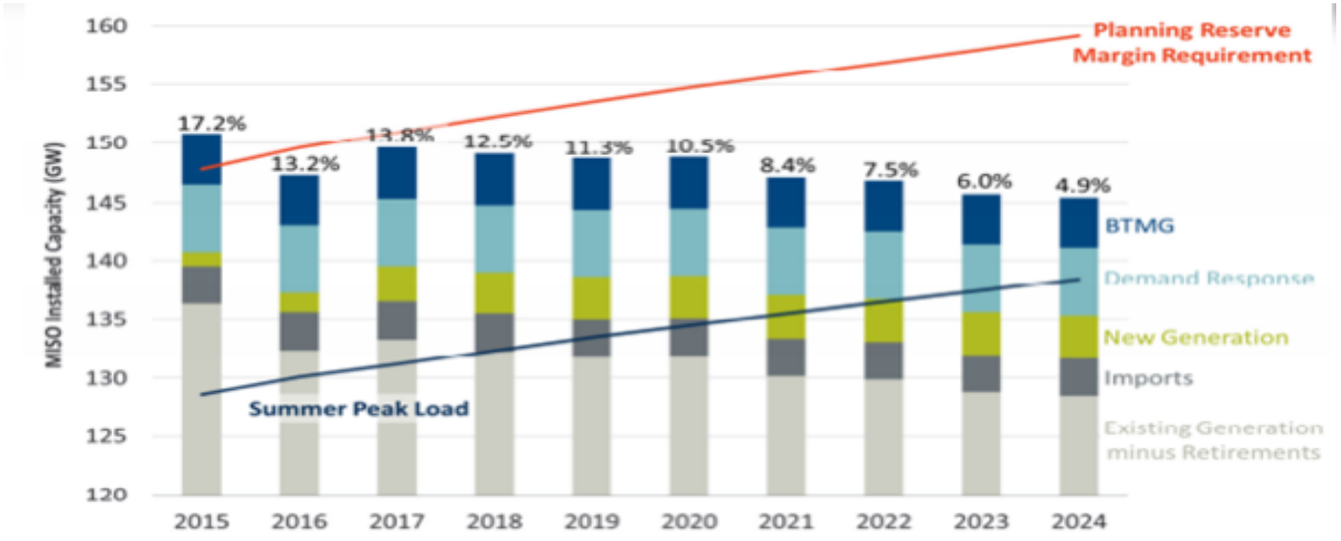
- Total wind capacity in the MISO footprint has grown dramatically since 2006



Fuel Mix

DEMAND VS. CAPACITY

- Historically, the MISO region has maintained capacity levels in excess of the Planning Reserve Margin.
- Coal-fired resources in MISO are expected to decrease from 46% of total installed capacity in 2013 to 36% in 2020. In the near term, not every coal unit is being immediately replaced.
- MISO footprint is forecasted to drop below its target Planning Reserve Margin Requirement.
- However, capacity is still greater than peak load in future forecasts.
- MISO has developed five Resource Adequacy Guiding Principle → on track to maintaining its high capacity over peak load.



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CAISO DEEP DIVE

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CAISO AVERAGE ENERGY PRICES

MONTH OF HIGHEST DEMAND: October (~$6/MWh higher)

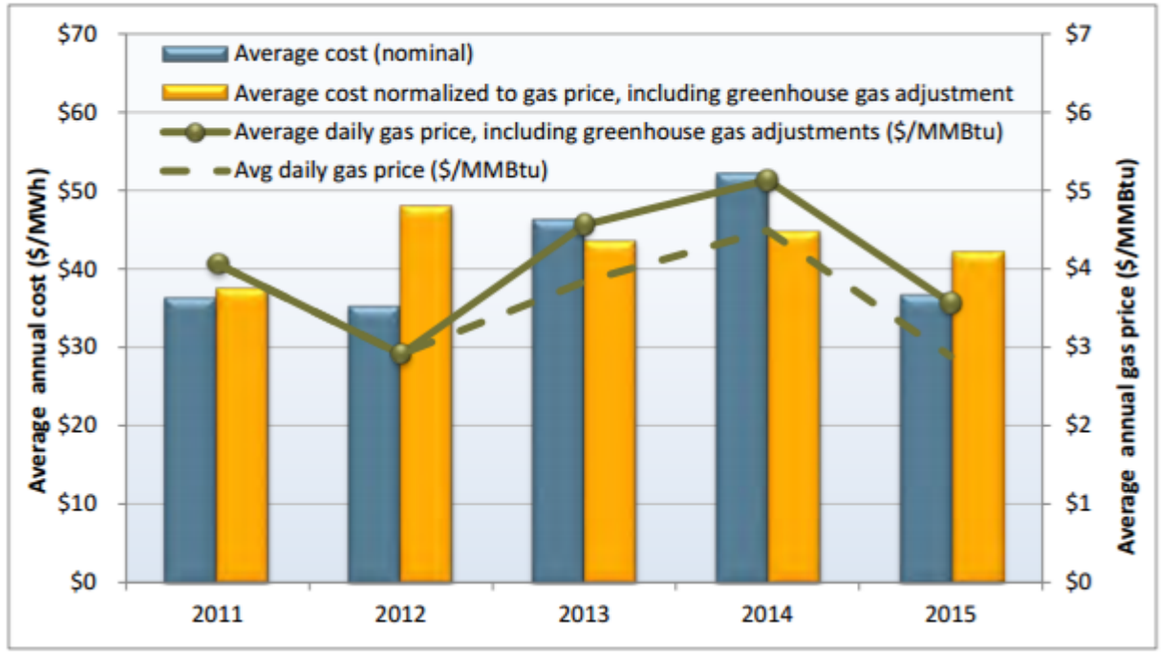
MONTHS OF LOWEST DEMAND: May and August (~$3.50/MWh lower)

TREND: Rising prices until 2014, when storage procurements were made

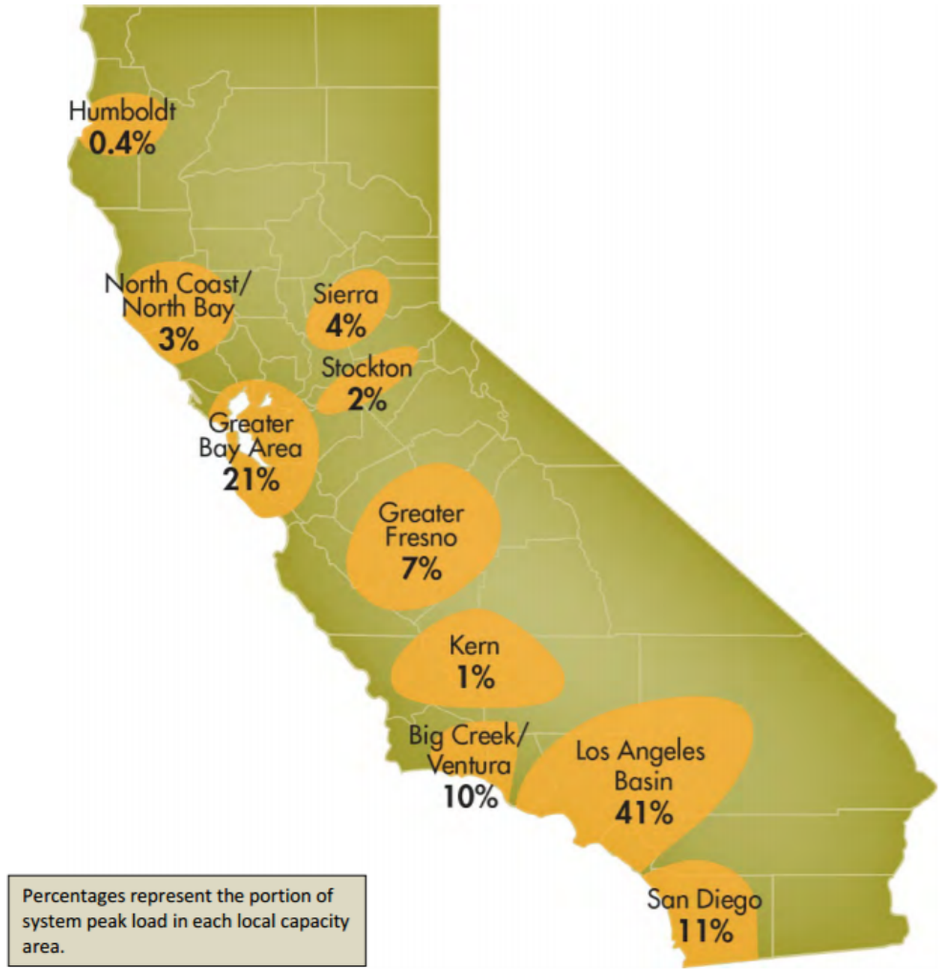
CURRENT PRICES: In October and November, ranged from $27 in the mornings to $36 in the afternoon to $46 in the evening

MARKET PREDICTION: Based on Q3/Q4 trends, average energy prices likely will not change much

Figure E.1 Total annual wholesale costs per MWh of load (2011-2015)



DEMAND TARIFFS



DEFINITION: Extra charge added on at the end of the month based on peak usage.

IMPORTANCE: Often makes up over 30% of customer's' energy bill.

TARGET: Regions with highest demand tariffs.

DIFFICULTY: Rates not openly advertised, easily readable.

LIKELY CANDIDATES: LA, SD, SF, Ventura, Fresno.

CONGESTION AS A WORKAROUND

FROM THE REPORT, CAISO board stated that congestion costs had, overall, a very low impact on total prices of energy (typically between .5 and 2.5 percent)

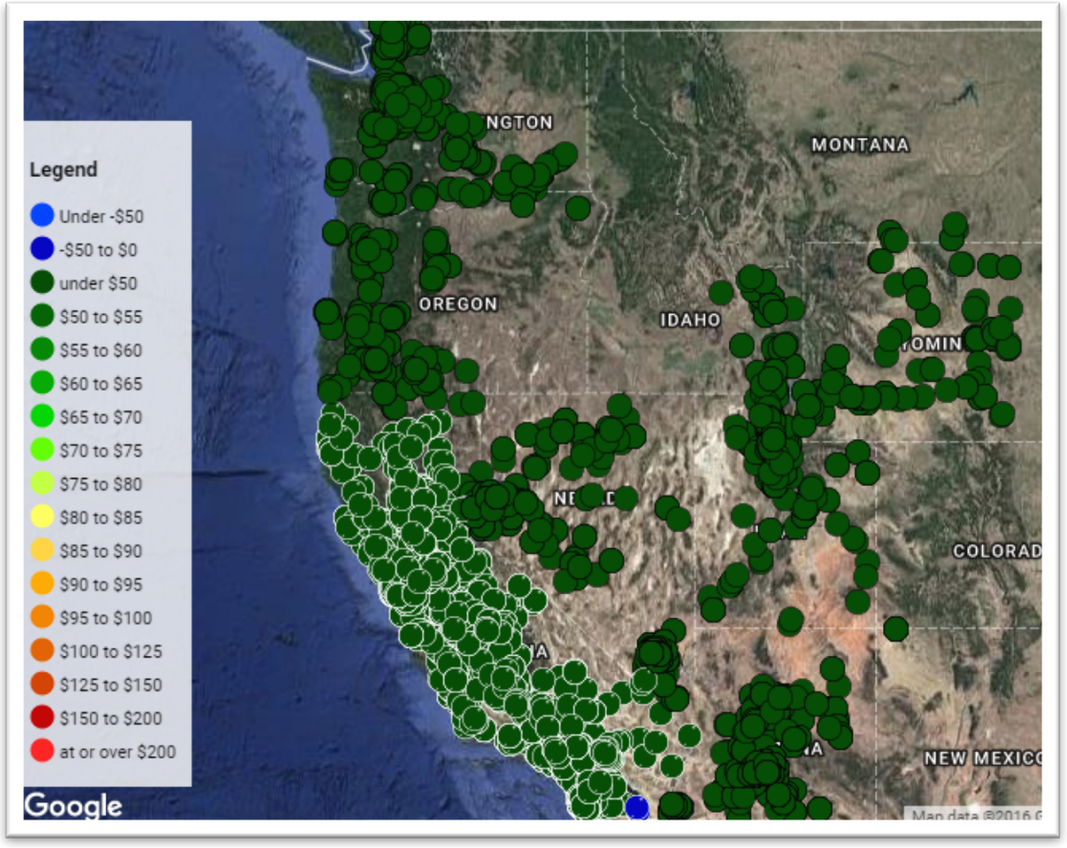
WHY IT'S IMPORTANT: Used as a tool to help identify most likely candidates for high demand tariffs

HOW: Nodes of particularly high price for the area are likely to be charged more in demand tariffs relative to neighboring areas

WHAT TO LOOK FOR: breakdown by region (state, then rural vs. metropolitan), to identify how each region handles congestion

- The overall impact of congestion increased prices in the PG&E area above the system average by about $0.43/MWh (1.3 percent) in the day-ahead market and $0.86/MWh (2.6 percent) in the 15-minute market. Much of the impact in the PG&E area was related to Path 15 planned maintenance during most of the second quarter.
- Congestion decreased average day-ahead prices in the SCE area below the system average by about $0.28/MWh (0.9 percent), and decreased real-time prices by $0.55/MWh (1.8 percent).
- Prices in the SDG&E area were impacted the least overall by internal congestion. Average day-ahead prices in this area increased above the system average by about $0.20/MWh (0.6 percent) while real-time congestion decreased prices by about $0.19/MWh (0.6 percent).

CONGESTION PRICING (#1)



WYOMING: Difference in metropolitan vs. rural pricing ~$.40.

IDAHO: Very little difference between metropolitan and rural areas.

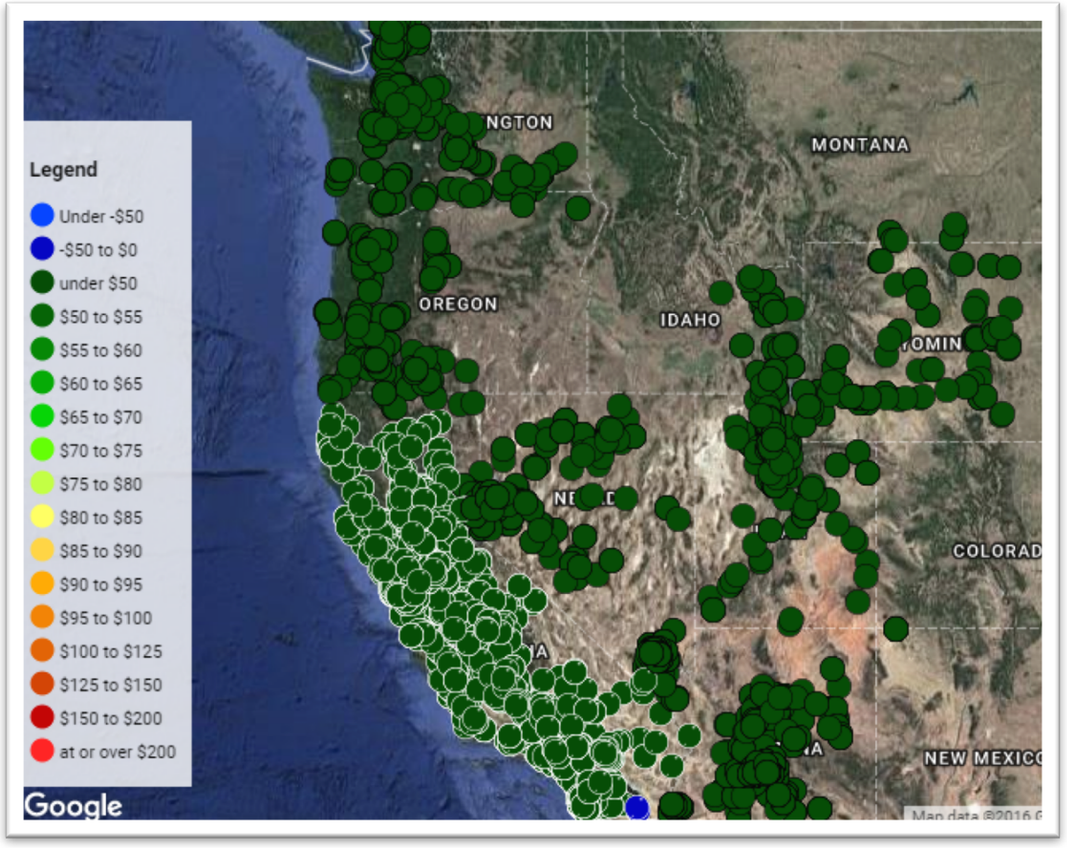
UTAH: Difference of $2 between.

NEVADA: Difference of $2.50 during peak hours.

ARIZONA: Negligible difference.

IMPORTANCE: Mostly export energy. Differences are not due to high congestion rates, but rather rates in the negatives.

CONGESTION PRICING (#2)



WASHINGTON: Difference of ~$1 - $1.50 between rural and metropolitan.

OREGON: Negligible difference in congestion pricing.

SOUTHERN CALIFORNIA: Congestion for metropolitan was $4.38, as compared to a rural congestion pricing of -$3.12.

NORTHERN CALIFORNIA: Typically around $3 difference between metropolitan and rural.

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MAJOR CONCLUSIONS

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ANALYSIS CONCLUSIONS

ALASKA
Unlikely source of business due to scattered grid and low population

ERCOT (TEXAS), MISO (MIDWEST)
Unlikely sources of business due to already high capacity

NYISO (NEW YORK), IESO (ONTARIO)
Potential source of business in the future due to changes in policy that will likely affect energy prices and storage

AESO (ALBERTA), CAISO (CALIFORNIA)
Markets with open procurement requests that could be sources of business right now

WITHIN CAISO (CALIFORNIA)
Overall, prices expected to stay the same, with Southern California, Northern California, Nevada having the biggest gap in congestion (and tariffs).