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EIG Idea Slide Pack

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Power went from a dead sector to a *Growth* Sector

Then

- The traditional Power and Utilities sector was largely a stagnant, dying sector from 1970 through 2015:
  - Power generation technology was largely the same with Nuclear, coal, and gas generation.
  - Alternative energy momentum came in 2008, but after the Great Recession all momentum died as technology was nowhere near cost effective.
    - The collapse in natural gas prices allowed lower carbon emitting CCGTs to naturally replace retiring coal plants allowing the proposed Waxman Markey carbon goals to be met through normal market actions.
  - Following 2008, integrated utilities (de-regulated power names and regulated Transmission & Distribution - T&D) sought to either divest their de-regulated generation or find a way to re-regulated it.
  - Independent power producers consolidated or went bankrupt leaving utilities to exhibit a simple strategy.
  - The IPP sector was in fact, a smaller E&P sector, that imploded 5 years prior.

Now

- Renewables, battery storage, hydrogen, microgrids, and EVs are all trending towards fossil fuel parity.
- The Green transformation has investor and government support.
- Unlike the previous era, utilities will need to partner with several players due to the sophistication and cost of electrifying the economy with intermittent resources.

Oil & Gas Expertise

- 2 years of formulating well-head to refiner oil marketing solutions + Director IR role at Concho allow me to integrate knowledge with general energy theme as well as evaluate detailed impact of EVs on oil demand and renewables on natural gas demand for power.

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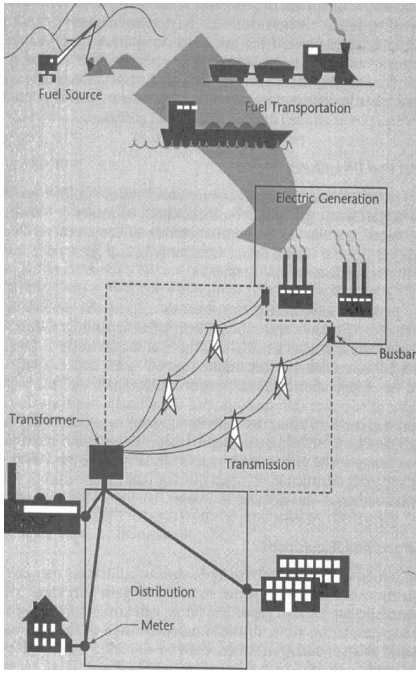
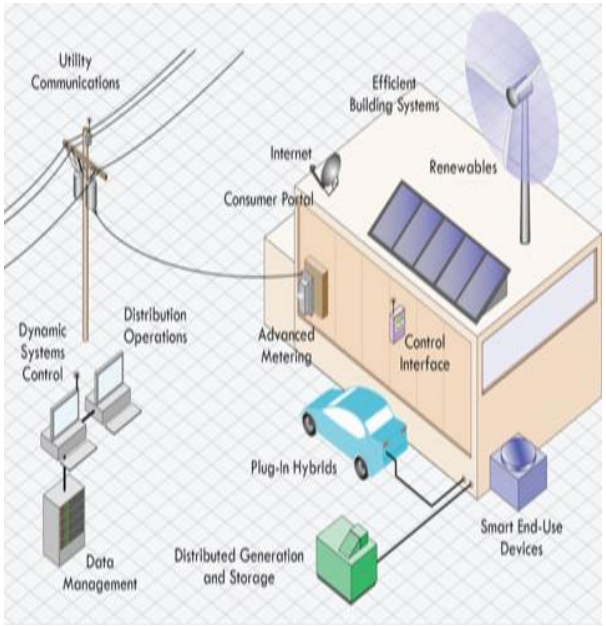
The Power Grid:From Outdated to Warp Speed Sophistication

Traditional electricity grid

Biden says the Corvette EV will "go 200 mph."

Evolving DER





Challenges

- Competing generation & storage from utility scale projects & microgrids
- Bi-directional distribution lines from competing front of the meter and behind the meter generation
- System planning for mostly competing intermittent resources & limited duration battery storage
- Capital allocation in a deflationary environment and when new technologies are constantly evolving.
- Utility funding when rates already high and a burden to ratepayers in a recessionary environment.

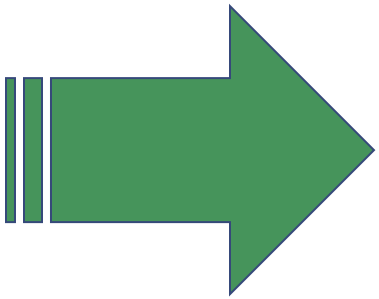
Customer options rapidly expanding

Broad Customer Wants

- Choice
- Control
- Convenience
- Communication

Emerging Electricity Ecosystem

- Decarbonization
- Decentralization
- Distributed Generation
- Digitalization



Customer wallet will be redefined to include:

- Tracking usage and time of use (TOU):
  - AMI
- Hardware
  - Distributed Generation (DG) / Rooftop Solar
  - Microgrids
  - Community Solar
- Reliability:
  - Battery storage
  - Backup generation
- Grid Interaction:
  - Net Metering
    - Access to utility scale generation
    - Ability to sell excess electricity to grid

The opportunity for non-utility players

- Vertically integrated utilities have historically been able to exclude IPPs and smaller developers from infringing on their territory. Integrated resource plans (IRPs) have been relatively simple in that generation technology had not changed in 30 years and all generation was dispatchable. Predicting load, building new CCGTs, and the intermediate T&D needed was a risk-free way to grow 4 to 6% per year. Adding new generation instead of signing up for LT PPAs with IPPs in the region offer a better risk adjusted return.

However, this utility generation monopoly is soon to change for the following reasons:

- Renewables/batteries costs are continuing to decline, but RPS/ESG requirements are requiring them to be a larger part of the generation mix moving forward.
- Utilities are particularly risk adverse and hesitant to be first movers in fear of being in regulatory purgatory. The risk-reward favors following the trend rather than innovation. Most recent examples of utilities taking risk and failing are Southern and SCANA deciding to build the Vogtle and Summer.
- Utility employees are lacking talent necessary to plan for a grid that runs on intermittent generation due unpredictably around deflation, necessary amount of redundant generation for reliability, and planning around existing infrastructure. The notable exception is NextEra which upgraded its data science and tech. teams years ago.

This means more opportunities/partnerships for developers as:

- **All utilities – some more than others – will sign PPAs for solar, wind, and storage to diversify risk. While PPAs still keep ratepayers under contract for 10-20 years, it will be at a 6% ROE to the counterparty vs. a 10% ROE in ratebase.**
- **Utilities focus more on upgrading/building out Transmission as well as upgrading distribution grid to handle 2 way power flows. Maintaining appropriate grid frequency is key.**
- **Utilities partner with private entities for both utility scale renewables/batteries and behind the meter technology to dilute risk. Next slide is a case study explaining a utility-BTM partnership.**

Emerging companies will create a new ecoystem

Traditional Utilities
IOUs
Munis
Coops
IPPs

System Connections
Honeywell
Emerson
United Elements
Johnson Controls

Battery/Storage Manufacturers
Panasonic
Bosch
BVP
LG Chem
Samsung

Platform Cos.
Facebook
Google
Apple
Amazon
Netflix

Rooftop Solar
SunRun
Sunnova
Vivint
SolarCity
Spurce Finance
SunPower

DR/EE
Comverge
EnerNOC
Honeywell
Cooper Power Systems
Oracle

Inverter Manufacturers
Schneider
Enphase
Omron
Sineng
GE

EV Integrated Storage
Tesla

Hydrogen
PLUG Power
Bloom Energy
Ballard Power Systems

New business relationships will be formed to create a new energy ecosystem.

Competition is the incumbent utility.

Electricity IS now a storable commodity

- Until the last few years, electricity was not a storable commodity. This was the only non complex aspect of power. Now there are 3 distinct ways of storing power:

- Utility scale batteries – Typically attached to solar or wind facilities, batteries are trending upwards in capacity to 1 GW. However, this is a short term storage solution as the battery can only dispatch for 4 hours at a time. For context, CA has a peak period of 6 hrs of 3 to 9 PM which is non coincident with peak solar dispatch.

- Behind the meter (BTM) storage – Most common residential battery in the market is the Tesla Powerwall. Several utilities in CA, NY, and VT have partnered with residential customers to share the costs of the unit to manage peak load.

- Hydrogen – CA's recent round of rolling blackouts emphasizes the need for dispatchable generation. All available natural gas CCGTs and peakers were running all out. However, natural gas is being phased out globally due to aggressive decarbonization, and natural gas fired generation emits 4 to 6 tons per MWh.

  "Green hydrogen" produced from electrolyzing renewable energy can supply CCGTs with zero carbon emissions. However, this will require cost reduction and an infrastructure backbone and is at least 10 years away.

Case Study: Utility partnering with deregulated players BTM

Green Mountain Power and Tesla Powerwall

Background

Green Mountain Power – largest vertically integrated utility in Vermont. While utility does own generation, primary business is T&D with generation primarily supplied through PPAs (power purchase agreements).

GMP has a financial interest in lower PPA costs so it can invest more into its T&D rate base.

Tesla Powerwall – Stationary energy storage released in 2015 that uses lithium-ion batteries. Primarily for residential and commercial use.

Green Mountain's issue

GMP believes ratepayers are paying too much for capacity to ISO-NE for super peak insurance. GMP is paying an exorbitant amount to keep plants online that are at best used a few times a year.

The capacity payments increase GMP's purchased power costs limiting its ability to invest in earnings accreative T&D ratebase projects.

Partnership with TSLA Powerwall

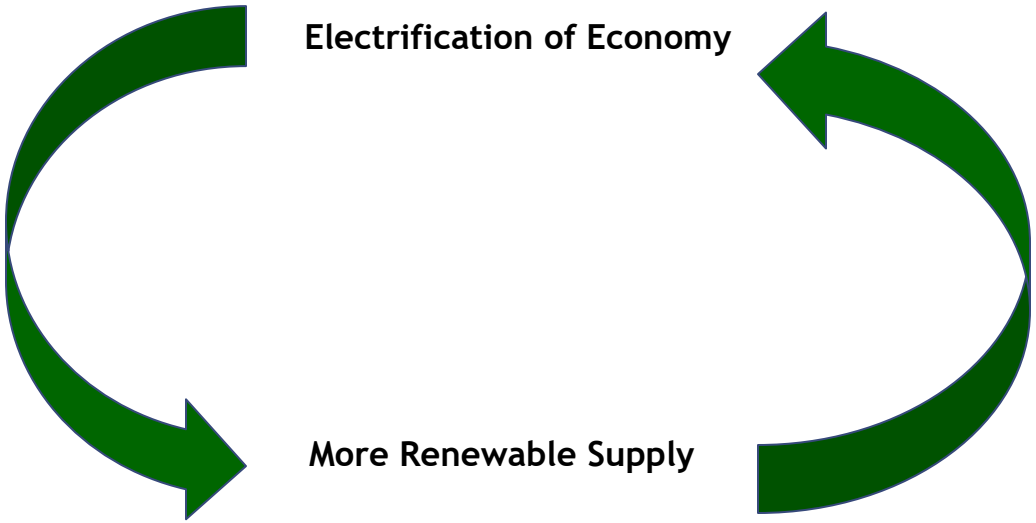
GMP will subsidize a portion of residential customers looking to install residential battery storage. Customers benefit from having more control of their electricity needs.

In return, GMP will have access to residential battery storage during peak periods allowing the utility to rely less on generation during peak periods. This would lower GMP's peak demand needs, which are calculated in front of the meter (explained in slide 4) and lower capacity payments.

VMT approved the partnership program in late May 2020.

The Chicken and Egg Game

Which will come first - Supply or Demand. Ideally, both develop simultaneously.



There is a global shift to decarbonize both for environmental reason but also to inject a green stimulus in to the economy.

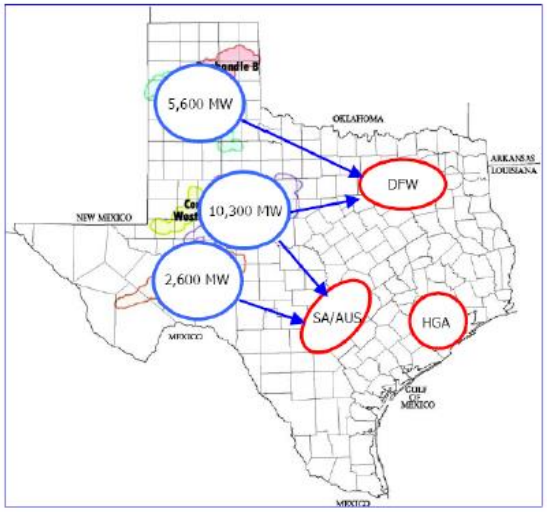
However, the pace of clean electrification depends on if:

1) Potential demand sources such as Evs/shifting natural gas use for industry/heating develop alongside renewables to create balanced S/D fundamentals
2) If demand sinks attempt to wait for renewable assets to build first without an offtake agreement, the pace of electrification will be slower as equity owners will hesitate to underwrite merchant risk.

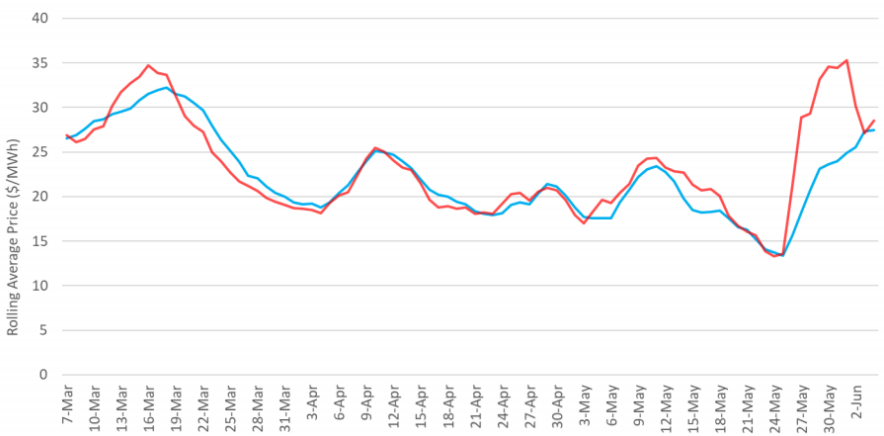
Forecasting and Tracking Renewable Generation and Load

Learning some new things

- Since early March, have high graded skills to model with Python, Matplotlib, SQL, and Powerpivot.
- The tools allow me to automatically create databases continuously tracking renewable generation from ISO websites as well as tracking load forecasting error. The table in the bottom right is an easy trackable database for TX wind that can be expanded.
- Currently further high grading coding skills to be able to predict load and gen given a set of variables.
- Given variability of renewables (generation) and increasing behind the meter generation makes it harder to calculate load.
- *Given increasing gen (renewables) + load (BTM) forecasting error, this creates increased opportunities to realize value from diverging real time and day ahead prices.*



CALISO RT Pricing vs. Day Ahead (Load Forecasting Error)



Wind Generation tracking by Zone

Hour	DELIVERY_DATE	South	West	South % on 7/14	South % on 7/13	Difference
12	2020-07-14	3280.0	10929.0	23.0	10.0	13.0
13	2020-07-14	3313.0	10260.0	24.0	10.0	14.0
14	2020-07-14	3428.0	9409.0	27.0	12.0	15.0
15	2020-07-14	3735.0	8090.0	32.0	16.0	15.0
16	2020-07-14	3991.0	6913.0	37.0	21.0	16.0
17	2020-07-14	4169.0	6668.0	38.0	25.0	13.0
18	2020-07-14	4431.0	6672.0	40.0	31.0	9.0
19	2020-07-14	4856.0	7712.0	39.0	33.0	6.0

Oil and Gas: With expertise in the Permian

Hydrocarbon marketing &Upstream: Macquarie & Concho

Macquarie

- Primary midstream analyst on 6 person commodity strategy/analytics team which provided fundamental analysis on crude, natural gas, power and NGLs for trading desk, corporate clients, and institutional investors.
- Team named "Commodity Research House of the Year" in 2019 by corporate clients where:
  - 2 reports I led were cited by clients:

    1) Detailed Corpus Christi export infrastructure analysis arguing for adequate supply to move Permian crude and a narrowing WTI-Brent Spread

    2) A detailed analysis of West Texas Light (WTL) arguing that the Gross Refining Value (GRV) was higher than what was initially priced in the market (-$2/Bbl discount to WTI Midland)
  - I also worked with corporate clients to implement/revise their hydrocarbon marketing strategies as a consultant.

Concho Resources

- My best relationship was Concho Resources headquartered in Midland, TX. The pure-play producer kept all of its crude in basin except for an underwater contract with Trafigura for 50KBD with a $4 marketing fee + all applicable gathering, pipe (Cactus II), and dock fees. Pitched a marketing strategy to involve Houston for more optionality.
- Company created a Director of Investor Relations/Fundamentals Role (top 2% role) for me in 2019 out of the Houston office and flew me to the Midland headquarters every week through 2019 and early 2020.
- Position was eliminated in March given change in world events and my presence in Houston vs. Midland headquarters.

What I learned “in House” in the Permian

Peer Oil Marketing Contracts (Specific Terms)
(from Non-Op Interests)

Apache
Chevron
Diamondback
Endeavor
Exxon Mobil
Parsley
Pioneer

*EPD has a near monopoly on NGLs in the region

Commodity Observations

- The fastest growing grade of crude is West Texas Light (API > 44) in the Delaware basin.
- Delaware heavy producers like CXO are continuing to look to Oryx/Plains to build blending facilities to mix Midland and Delaware crude to meet WTI Midland spec.
- Gas Oil Ratios continue to trend up. CC Stage 3 LNG was relied on many as a demand sink for WAHA gas, which will now be delayed indefinitely until global gas prices move up.
- NGLs are still misunderstood but companies are now exploring hedging propane and natural gasoline.
- Based on pre-Covid pricing (~$50/Bbl), the majors / CXO / PXD were only companies with material drilling program and >10 years of inventory measured by rig years.

Permian operating assumptions

- Majority of CXO projects were underperforming type curve projections due to aggressive downspacing.
- Vertical interference was as important an issue in the Delaware as horizontal interference. There are far fewer landing zones than initially advertised. For example, the 3BS and WCA are not distinct landing zones.
- Parent-child continues to be a major issue from
  - Aggressive downspacing
  - Lack of Co-development where infill wells perform significantly worse when completed 30 days after parent well.
- Optimal horizontal spacing to maximize well RoRs varies between 660’ (Lower Spraberry) in Midland to as high as 1,200’ in the Wolfcamp A in Lea County, Delaware Basin.

References

References

- Dave Pursell, EVP Apache, David.Pursell@apachecorp.com, (Former boss at TPH)
- Thad Hill, CEO of Calpine, Thad.Hill@calpine.com
- Jack Fusco, CEO of Cheniere, Jack.Fusco@cheniere.com
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