

# New Age Energy Markets

## Challenges for Utilities, IPPs and Traders



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# The New Age Energy Markets

The North American power and gas markets are undergoing an accelerating evolution driven by increasing regulation, new and emergent technologies, and a persistent surplus of natural gas brought about by the “shale revolution.” The transformation from a coal-centric power market to one reliant upon renewables and natural gas for baseload power generation has had profound operational and commercial implications for both the electricity and natural gas markets.

Much of the change that has emerged has been catalyzed by regulation at the federal, regional and state levels, including emissions/greenhouse gas regulation and renewable portfolio standards. These regulatory mandates have been largely answered by technology – cheaper and more efficient solar and wind generation, abundant sources of natural gas from long-reach lateral drilling and massive hydraulic fracturing, smart grid technologies that improve grid efficiency and reliability, and more efficient industrial and consumer appliances that reduce system load. In aggregate, these changes have had massive and ongoing impacts across the energy industry in the US, increasing complexity of operations and affecting the business models of many of its participants.

For power utilities, IPP's and traders, this New Age Energy Market presents a number of challenges that must be addressed to operate profitably.

# THE EXIT OF COAL MARKS THE BEGINNING OF THE NEW AGE

US federal energy policies over the last couple of decades have been a stick and carrot affair – a mix of regulations and mandates that have sought to punish coal-fired generation and to encourage development and use of renewable energy resources. As early as 1992, the US federal government has supported the growth of renewable energy sources via a number of financial incentives, including investment and production tax credits. These incentives, coupled with federally funded research and development projects made available to industry, have encouraged massive investment and deployment of many forms of renewables, but particularly wind and solar generation. Simultaneously with stimulating investments in renewables, the Environmental Protection Agency (EPA), leveraging the Clean Air Act of 1970, began mandating reductions in particulates, pollutants, and greenhouse gas emissions associated with burning hydrocarbons for power generation. Through a series of increasingly costly regulations and mandates over the last decade, including the most recent Mercury and Air Toxics Standards (MATS), EPA rule-making has driven up the costs of building and operating new coal-fired generation facilities to prohibitive levels and forced expensive upgrades to otherwise modern plants. For many older plants, those beyond 35 years, these new regulations are forcing early retirements as these plants become unprofitable to operate given the costs of upgrades necessary to be compliant. In 2015 alone, 15 gigawatts of coal fired capacity was retired, amounting to about 4.6% of the nation's coal capacity at the beginning of that year; and through 2017, the FERC estimates as much as 64 gigawatts of coal fired capacity will be retired.

Beyond the regulatory pressures bearing down on coal generation, the advent of the shale gas revolution is further exacerbating the movement away from coal and to natural gas. Leveraging long reach lateral drilling and massive hydraulic fracturing, US drillers have opened vast shale deposits to production and in the process have created a surplus of supply that has driven down prices making natural gas the cheapest fuel for power generation in virtually all markets. With natural gas prices trading consistently around \$2.00MMBTU at Henry Hub, and little hope they will rise above \$2.50 in the near

term, cheap gas has effectively put at least a temporary nail in the coffin for new coal plant development, and has reduced the utilization of many of the existing plants. Though natural gas had a significant role in the generation mix since the 1970's when gas fired generators were typically employed as peaking facilities, as older coal plants are retired and replaced by with combined cycle or gas turbine facilities, and with fuel switching from coal to gas at a number of other facilities, natural gas generators are increasingly being pressed into service for base-load capacity.

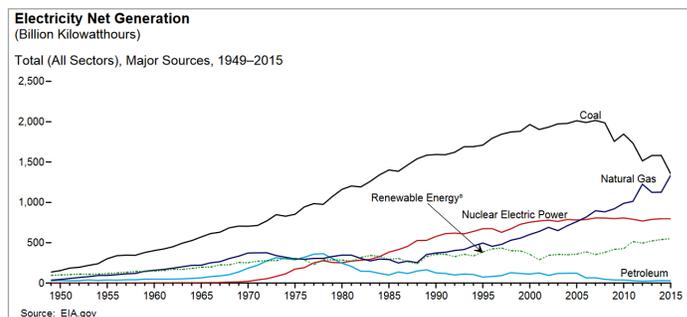
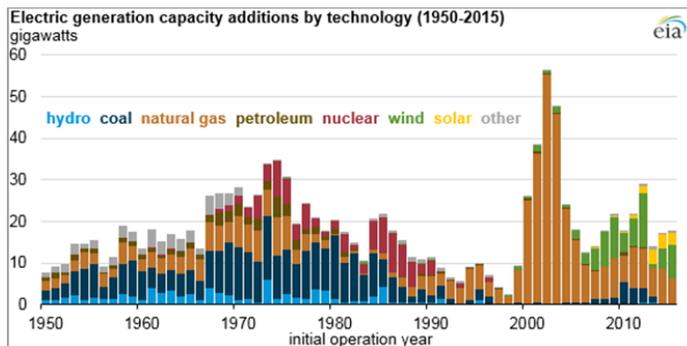
## RENEWABLES ON THE RISE

Prior to 2000, new generation capacity in any year was almost exclusively a mix of coal, gas, hydro and nuclear; however, with coal being effectively regulated and priced out of the market and federal subsidization via various tax credits supporting investments in renewables, the mix of new generation shifted dramatically over the last decade and a half, with gas, wind and solar forming the bulk of new capacity additions. Though coal still maintains a dominate position with as much as 70% of US total capacity, gas-fired plants are now operating at near parity with coal, with nuclear, wind, solar and hydro adding about 30% on an “average” day.

Renewables now account for about 13% of the total US installed capacity; however, the majority of that capacity is concentrated in a few states and regions, and particularly in California, Texas and the Southeast Power Pool (SPP). In these state and regional markets, power from renewables (particularly wind in Texas and the SPP, and solar in CAISO), can reach a third or more of the power generated in a day. With the highly variable nature of these energy sources, grid operators are challenged in managing grid stability as a significant portion of their capacity rises or falls with the winds or during periods of cloud cover on any given day.

For California's grid operator, the CAISO, that state's promotion of solar energy via incentives and tax credits has created a two-tiered solar infrastructure – utility-scale concentrating solar plants (CSP) and distributed roof-top (or behind-the-meter) solar. While the CSPs are operationally visible to the grid operator and are dispatchable, the roof top systems now common in the state are essentially invisible and unmeasurable on the system. Without that visibility into a growing source of generation, the grid operator has difficulty predicting market demand, leading to significant locational marginal pricing (LMP) volatility and increased transmission congestion as the load changes unexpectedly during the day and throughout the year, particularly during the summer months when system loads are at their highest and the state's wind generation tends to be at its lowest.

Texas too has experienced difficulties integrating the massive influx of renewables, as power from new wind generation farms in West Texas have occasionally swamped the states transmission lines and driven out other competing sources. With almost 18,000 MW in wind capacity at the end of 2015, wind accounted for 9% of Texas's total generated power for the year. However, given the price advantage wind enjoys with



production subsidies, wind farms have at times accounted for as much as 50% of the total energy generated at any given time, creating negative prices in the real-time markets. With a significant financial advantage, wind can continue to operate profitably in negative prices, forcing other sources, such as gas and coal, to quickly ramp down production or “pay to run”.

California is also seeing increasing periods of negative pricing as solar continues to invade that market region. In 2015, the CAISO saw about a dozen days of negative prices, reaching a low of (\$23.87) MWH. In all these and other markets (like the Northwest region which is dominated by cheap-to-run hydro), the further integration of financially advantaged renewables such as wind and solar, despite their rather unpredictable nature, will result in increasingly frequent periods of negative pricing.

# NATURAL GAS IN THE NEW AGE OF ENERGY

**Though renewables share of the generation mix is increasing, natural gas continues to be the marginal source of power in most markets. Given that wind and solar have a limited operating window on any given day, gas-fired generation provides the most flexible source of on-demand power, particularly turbine driven generators which can be brought on-line on very short notice. Given that flexibility, gas-fired generation now sets the marginal price in most markets in the US, creating an ever-tightening linkage and correlation between power and natural gas prices. Though that correlation may vary across markets depending on the mix of assets, the ongoing switch from coal to natural gas has reduced wholesale power prices and volatility to a large degree in all markets. In 2015, wholesale power prices in the US were down 27-35% compared to 2014 as natural gas prices fell throughout the year.**

The Northeast US, in particular, has seen significant switching from coal to natural gas given the vast resources opened in the last 5 years in the Marcellus and Utica shales, whose combined production has increased from less than 5 bcf/day to almost 20 bcf/day. Given this significant and cheap fuel source, non-gas generation retirements have accelerated (such as the coal-fired Salem Harbor plant and the Vermont Yankee nuclear facility in New England) and the region has seen development of number of new, but relatively smaller power plants that are being constructed across the area. However, given difficulties in developing new power transmission lines and pipelines in that region due to political, environmental and landowner objections, these new generation facilities continue to encounter recurring periods of transmission and pipeline congestion that have plagued the area for decades.

The Southeast region has also been impacted by the increased gas production from the Marcellus and Utica, as gas

from the mid-continent and Gulf Coast that once supplied the New England markets is left stranded in the south. Over the past 3 years, the Southeast added approximately 6.5 GW of gas-fired generating capacity and total natural gas demand in the region during 2015 increased 5.2 percent over 2014 levels. The EIA estimates that an additional 17 GW of gas-fired capacity will be added in the Southeast over the next 3 years.

Given the increasing reliance on natural gas for the US power supply, the Federal Energy Regulatory Commission (FERC) has been taking action to better coordinate the operations of the two markets, most recently (as of April 1) realigning pipeline nomination deadlines to better match day-ahead generation scheduling and adding an additional nomination cycle during the day. Most market observers feel this will be but the first step and the FERC will continue to make additional rule changes in order to ensure system stability as gas' role in the power mix continues to grow.

## TRANSMISSION REMAINS AN ISSUE

**While the ongoing construction of smaller but more numerous gas generators closer to load centers does promise to relieve some the transmission congestion issues that have plagued many areas of the country, the simultaneous influx of renewables, particularly wind is creating additional transmission congestion issues in others. Given that wind generation is generally sited in remote, less populated areas, existing transmission lines are generally inadequate to handle loads during periods of peak production. Despite recent investments in new and upgraded lines, some of these market regions, such as ERCOT and SPP, continue to experience significant trans-**

**-mission congestion during peak days. These conditions are likely to continue as investments in new transmission capacity is forecast to lag new wind and solar capacity added in the US.**

With the addition of roof-top solar and other distributed generation sources, encouraged by the increasing adoption of net-metering schemes in a number of markets, transmission planning becomes even more difficult. The growth of these

programs across the country has resulted in a 500% growth in power sold back to utilities since 2011, and that volume will undoubtedly continue to grow creating additional operational issues for grid operators and utility-scale generation owners.

## ADDRESSING CHALLENGES OF THE NEW AGE

**For traders, IPP and utilities, this “New Age Market” offers any number of challenges. With the rapidly changing mix of generation and increasing reliance on renewables and natural gas, what were once largely one-dimensional markets, governed primarily by weather driven demand, have become increasingly multi-dimensional. In this market, the nature of the power supply and associated fuel costs (if any) must also be more thoroughly considered, analyzed and forecasted. Transmission issues will continue to plague regional markets, though historical congestion conditions will be an increasingly less accurate indicator with the growth of distributed generation and utility scale renewables. The increasing reliance on natural gas continues to operationally and financially link those two markets, leading to a tight correlation and reducing arbitrage opportunities between the two. Regulatory mandates at the federal, regional and state levels will certainly continue to reshape the “rules of the road”, though political influences will undoubtedly make forecasting those regulations increasingly difficult.**

These rapid changes and growing uncertainties are increasing risks. As regulations reshape the mix of the generation fleet and impact the trading of power, gas and financial products, trading volumes are declining and day-to-day activi-

ties have become more operationally centric. Traders, market-ers and merchants are reducing activity to adjust to these new market conditions...and for the trades that are occurring, more analysis, investigation and due diligence is required.

## ALLEGRO AT THE CENTER OF THE NEW AGE MARKET

**For traders, utilities and IPPs, profitability in this complex and evolving market requires a full and complete picture of assets, operations, positions and risk exposures. Operating profitably will require the latest technology – sophisticated systems that quickly aggregate, optimize, forecast and value the multitude of variables that make up the New Age Market. Allegro Horizon is uniquely positioned to address the complexities faced by asset holders and traders in any market region.**

With APIs for rapid integration of a multitude of data sources, including market data and bespoke or vendor supplied generation optimization, load forecasting, and transmission scheduling solutions, Horizon functions as the data-driven analytic and decision support center of your operations. It provides rapid insights, valuations and control in trading, tracking and risk management of physical and financial positions spanning power, fuel, transmission, ancillary services, swaps, options and structured transactions.

Built upon the latest technology infrastructure without proprietary code, Horizon provides real-time insights into positions, valuations, volumes, risk metrics, exposures and other key performance indicators. With Allegro, decision-makers gain a holistic and transparent view of their portfolios, capturing every detail of their diverse operations for an accurate view of current and future value. As data volumes and velocities accelerate with increasingly granular markets, both in terms

of time and nodes, the Horizon platform is continuously fine-tuned to ensure customers keep pace with market data and demand.

IPP's and utilities with gas generation assets are able to utilize Horizon to optimize gas purchases, gas storage positions, and pipeline contracts and capacity, including optionality, with full visibility into positions across commodities. For power traders, Horizon provides users a fully aggregated view of bids & offers and positions from across all markets and regions, providing a consolidated view of enterprise positions and exposures.

Allegro's Horizon addresses the critical needs of all power-related enterprises in the New Age Energy Market, providing operational and trading insights and support across the complete lifecycle of power, reducing risk and helping to ensure profitability.

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