

Power Market Analysis Near-Term (PMA -NT)

Offering an independent view of future
market prices and fuel consumption.

Also empowering your fundamental
understanding of gas, coal, and power
markets.

David K. Bellman



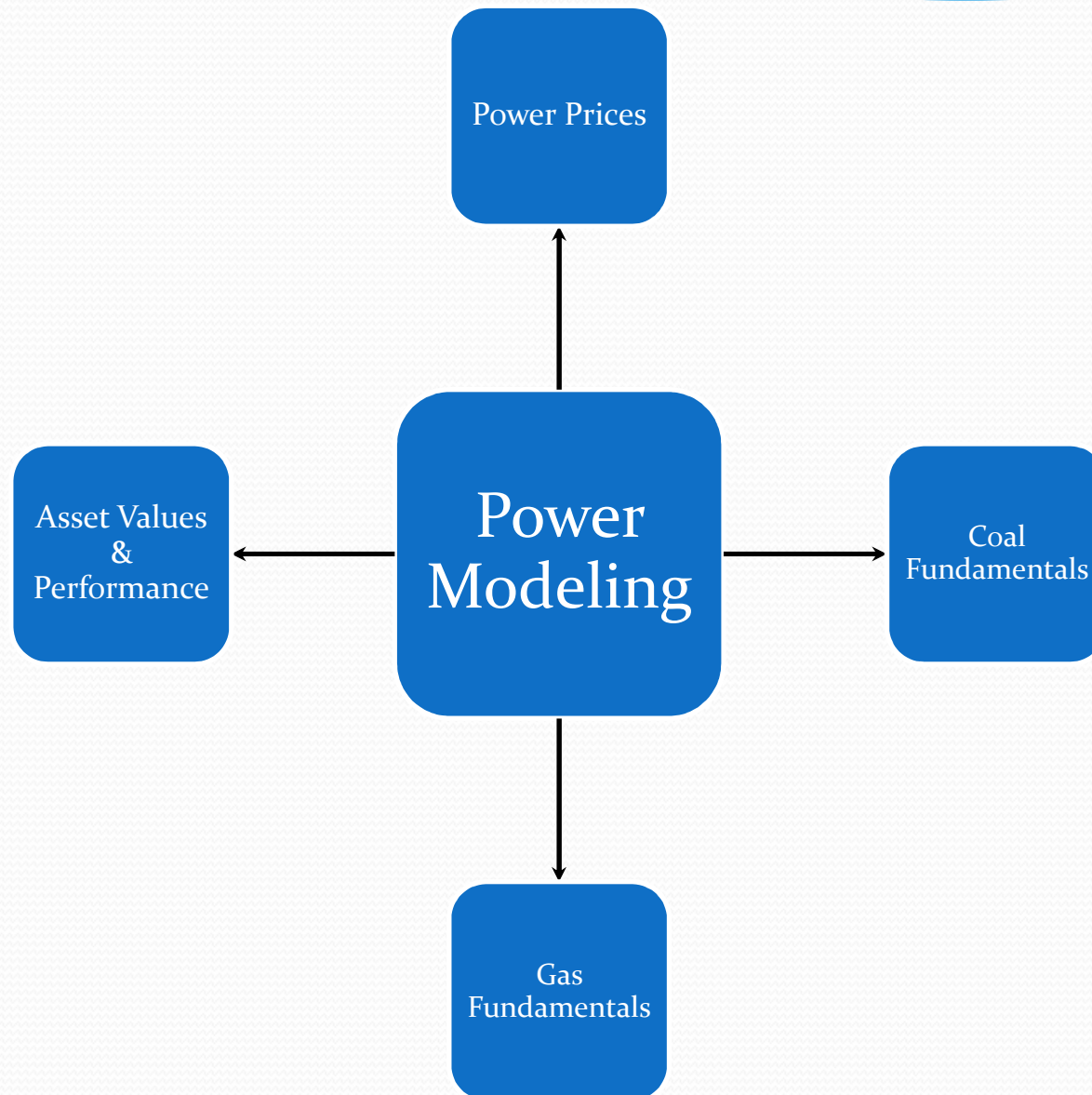
*"Know where to find the
information and how to use it -
that's the secret of success."*

Albert Einstein

PMA Background

- Purvin & Gertz Inc. (Now IHS)
 - Fundamental Analysis – Oil and petroleum products
- American Electric Power
 - Trading – Commodities (Oil & Gas)
 - Corporate Planning and Budgeting
 - Contract Evaluation
 - Retire / Retrofit Analysis
 - Policy Analysis
 - Strategic Planning / Resource Planning
- Hedge Fund – Trading Analytics
 - Trade Analysis – Spreads/ HR
 - Trade Recommendations





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Value of PMA

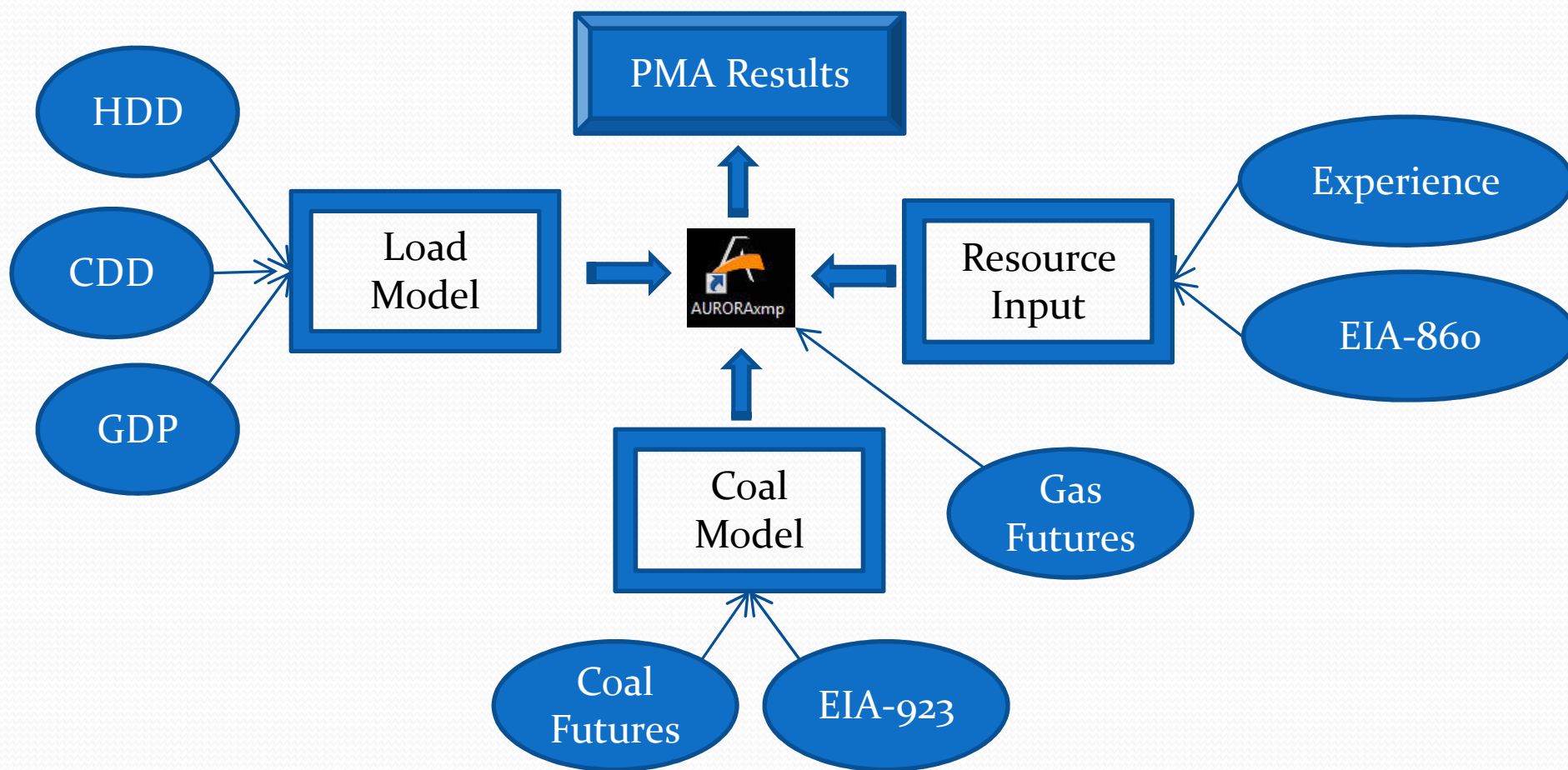
- Outsourcing/Enhancing your power analytics can be very cost effective given people and software requirements (\$200K+ - At least 1 FTE = \$120K + Benefits + \$80K Software License)
- Use of PMA: Trading, Risk, Fundamentals, Budgeting, Fuel Contracts, Policy Impact, Company Analysis
- PMA's model results will allow an understanding of ranges of fuel consumption and power prices to be expected in the power markets without perfect foresight.
- PMA's various runs will encompass the major variables using reasonable expectations of the future based on changes in weather, GDP, and gas prices.
- Upside and downside risks are not symmetrical all the time.
- Proven modeling success in finding arbitrages in power, gas and gas markets.
- Understanding performances of generation assets given various conditions.

More than just a model run...



- 118 load zones statistically analyzed with 9 weather zones and 8 economic regions
- Gas price (Henry Hub and 36 basis)
- Coal price (6 major coal hubs with 1300 units)
- 22+K Power generation characteristics researched and optimized to produce accurate representation of fuel consumption and power prices for the past 4 years.
- Our model is based on 20 years of industry experience and took thousands of man-hours and hundreds of runs to develop and perfect.

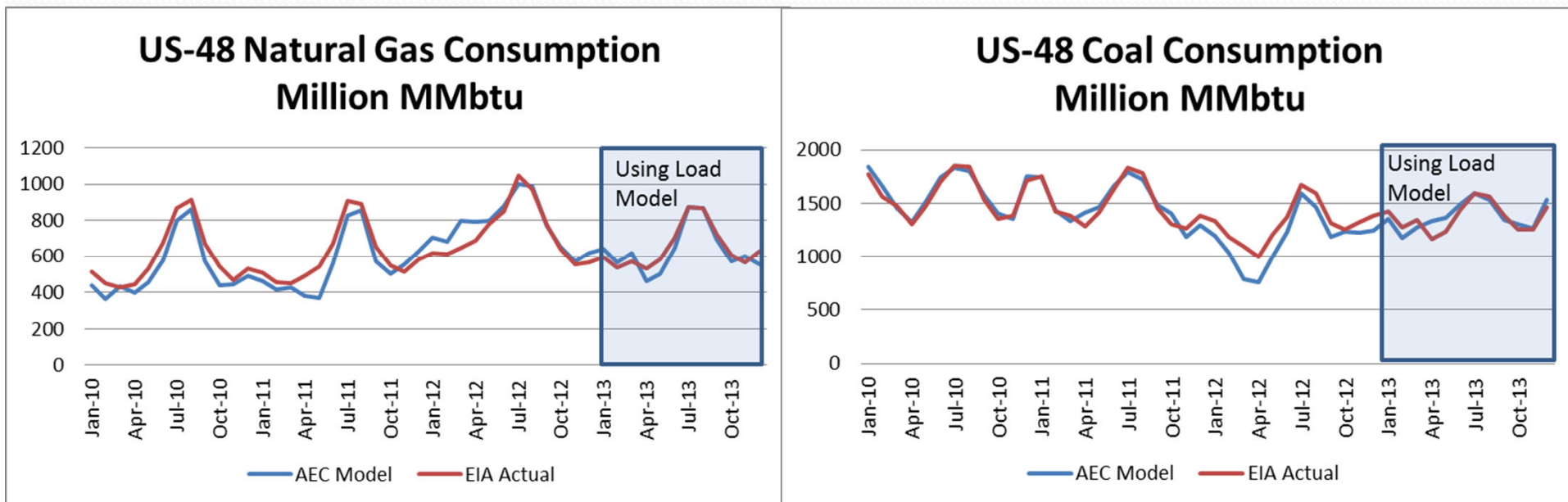
Process Flow



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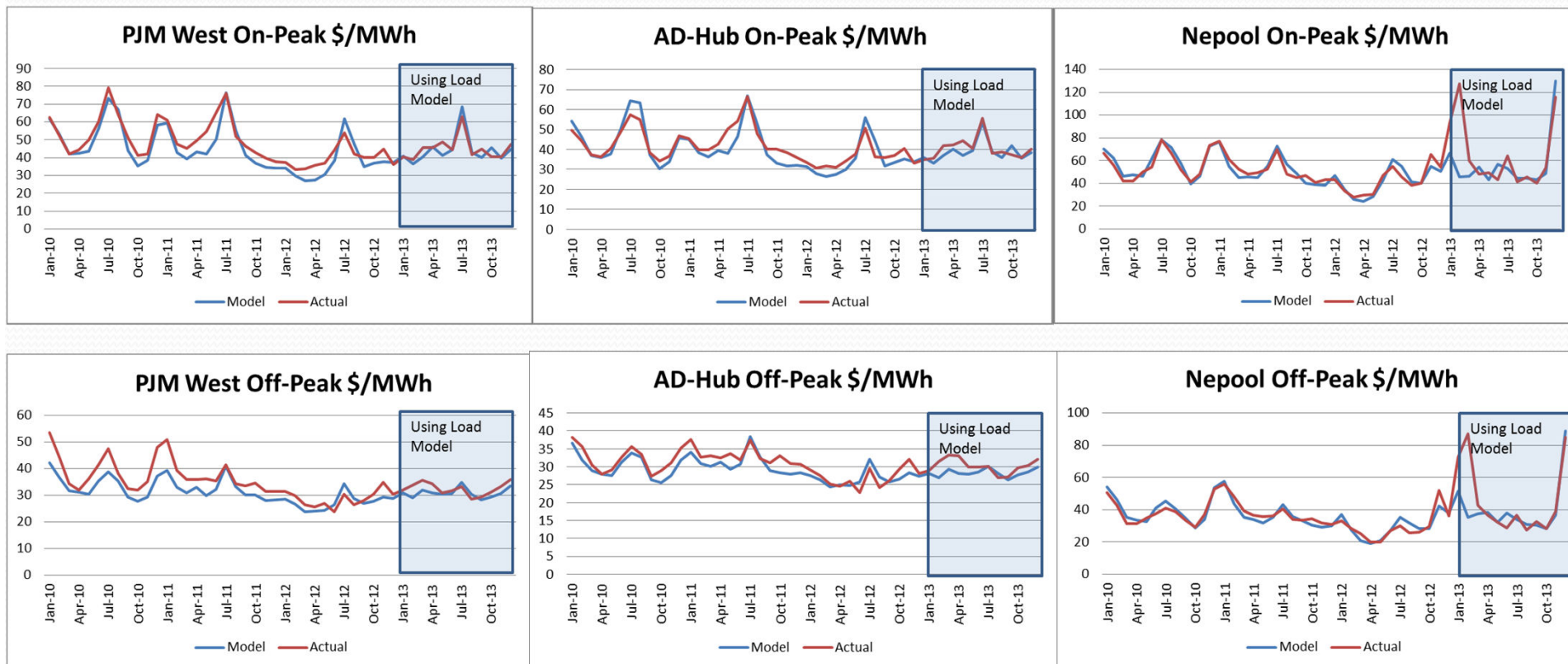
Fuel Consumption Validation



Late 2011 -early 2012 divergence as a result of coal running uneconomical due to coal plants large inventory.

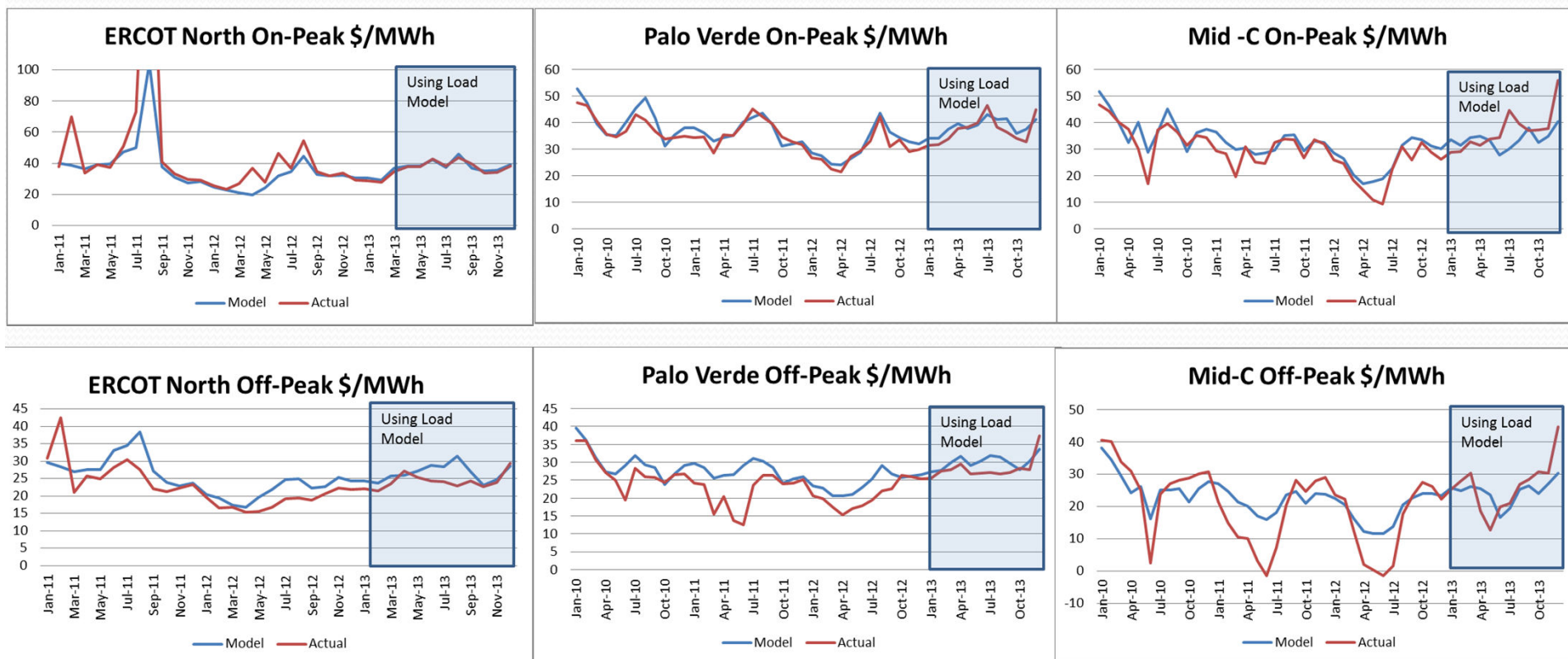
- Accounting for load and actual gas prices – still leaving other parameters subject to general assumption (outages – bidding factors – operations)
- 2013 is using the load forecasting model based on CDD & HDD and economic indicators.
- 2013 proves the methodology plus the efficacy of the load model.
 - 2013 Gas Deviation less than 3%
 - 2013 Coal Deviation less than 1.5%

Power Price Validation



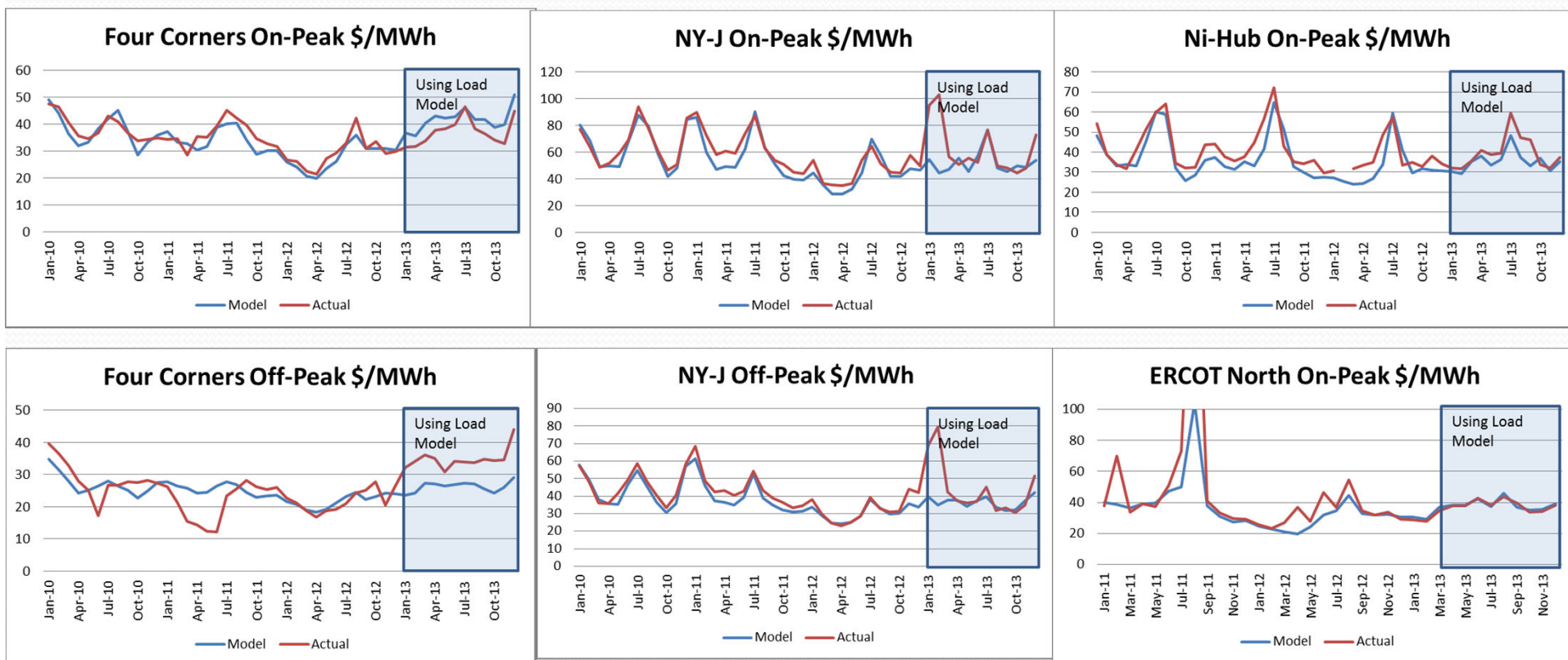
- Accounting for load and actual gas prices – still leaving other parameters subject to general assumption (outages – bidding factors – operations)
- 2013 is using the load forecasting model based on CDD & HDD and economic indicators.

Power Price Validation



- More experience in the East, but we're now spending more time improving the West.
- 2013 is using the load forecasting model based on CDD & HDD and economic indicators

Power Price Validation



- Adding region validation graphs upon request.
- 2013 is using the load forecasting model based on CDD & HDD and economic indicators

Output

- Power
 - Sensitivity view - Daily power price changes from gas and coal forward curves changes, Special Case Impact (e.g. basis study)
 - Power Hub comparison to forward curve to identify risk and reward for trades.
 - Heat rate comparison to forward curve to identify risk and reward for trades.
 - Power Hub Spread comparison to forward curve to identify risk and reward for trades.
 - Trade screeners help quickly identify power, heat rate, and spread trades.
- Gas
 - Sensitivity view - Daily consumption changes due to gas and coal forward curves changes, Special Case Impact (e.g. basis study)
 - Comparing changes of gas forward curves over time.
 - Gas storage model empowers users to create and produce gas forecast and see the impact of changes to consumption. Variable controls include weather, henry hub, and basis changes.
- Coal
 - Sensitivity view - Daily consumption changes due to gas and coal forward curves changes, Special Case Impact (e.g. basis study)
 - Regional coal consumption breakdown.
- Plant
 - Specific plant performance

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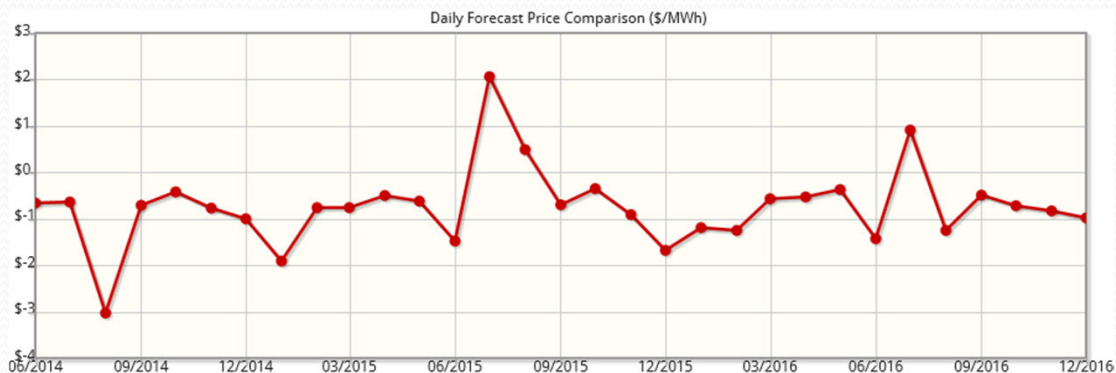
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Cases

- Base Price Case Assumptions
 - Forward Curve Gas Prices and Basis
 - Forward Curve Adjusted to Coal Prices
 - Normal Weather
 - GDP Outlook 2014 2.8% 2015 3% 2016 3%
 - Average Forced Outage Rates
- High Price Case Assumptions
 - Forward Curve Gas Henry adjusted 50 cents higher
 - 2010 CDD & HDD
 - GDP Outlook Increased by 0.5%
 - Shift New Builds Out 1 Year
 - Double Forced Outage Rates
- Low Price Case Assumptions
 - Forward Curve Gas Henry adjusted 50 cents lower
 - 2009 CDD & HDD
 - GDP Outlook decreased by 0.5%
 - Shift Retirements Out 1 Year
 - Half Forced Outage Rate
- Low Gas Consumption Case Assumptions
 - Forward Curve Gas Henry adjusted 50 cents higher
 - Weather CDD and HDD Jan-2006, Feb-2005, Mar-2012, Apr-2010, May-2009, Jun-2003, Jul-2009, Aug-2004, Sep-2003, Oct-2010, Nov-2009, Dec-2011
- High Gas Consumption Case Assumptions
 - Forward Curve Gas Henry adjusted 50 cents lower
 - Weather CDD and HDD Jan-2010, Feb-2007, Mar-2013, Apr-2011, May-2004, Jun-2010, Jul-2012, Aug-2007, Sep-2007, Oct-2005, Nov-2008, Dec-2010

Customized Cases Available

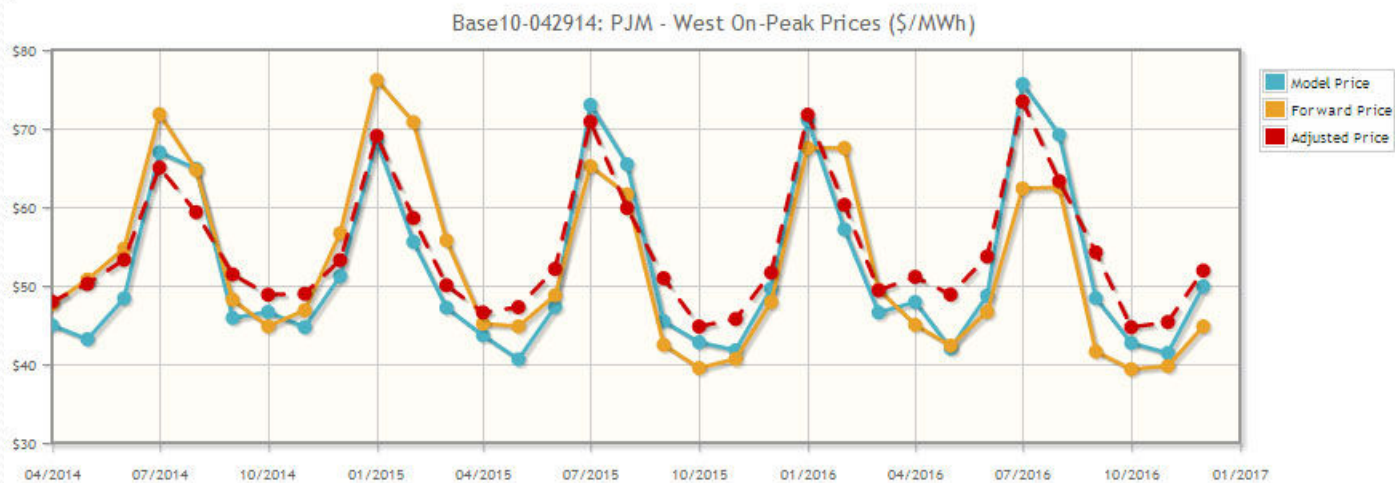
Power Views



Forward Price Comparison

Note: The chart is shows the model prices vs the forwards.

Run ID 1: Hub: Condition:



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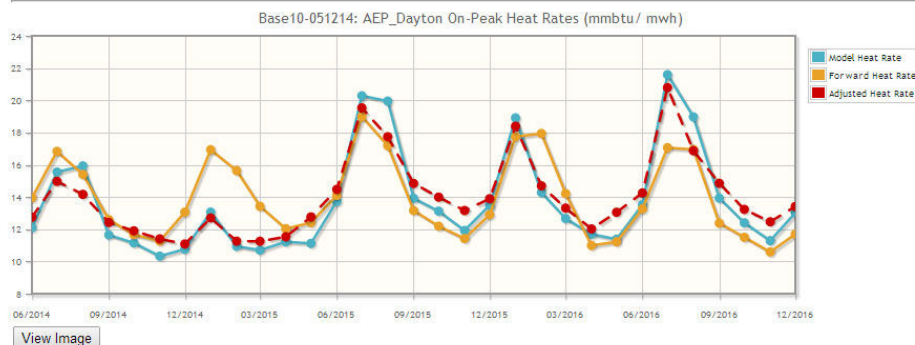
Power Views

Forward Heat Rate Comparison

Note: The chart is shows the model prices vs the forwards.

Run ID 1: Hub: Condition:

Fuel Name:

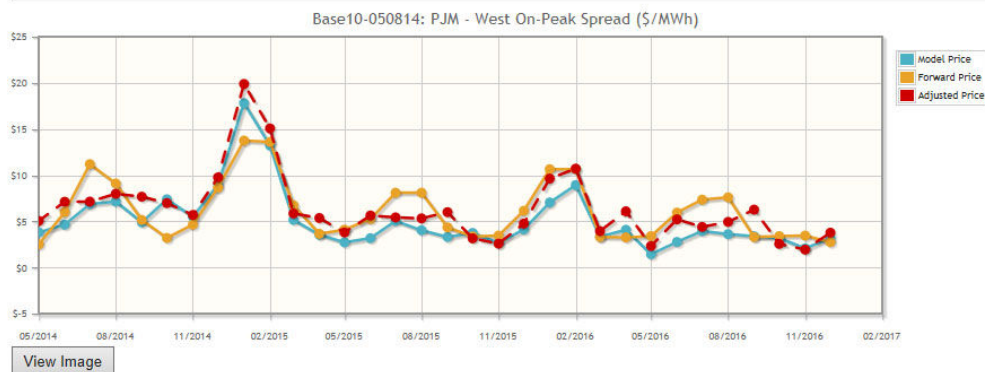


Forward Price Spread

Note: The chart is shows the model prices vs the forwards.

Run ID 1: Hub 1:

Hub 2: Condition:



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Power Views

Trade Screener

Run ID 1: 05-29-2014 ▼ Trade Screener

Show 10 ▼ entries

Search: 2014 ✕

Type	Hub	Condition	Month	Year	Max Gain	Min Gain
Sell	ERCOT-North	On-Peak	Jul	2014	43.42	25.21
Sell	NEPOOL	On-Peak	Dec	2014	17.55	13.57
Sell	ERCOT-North	Off-Peak	Jul	2014	14.42	8.5
Sell	Mid-Columbia	Off-Peak	Jul	2014	11.24	7.84
Sell	Palo Verde	On-Peak	Sep	2014	18.01	6.87
Sell	NEPOOL	Off-Peak	Dec	2014	25.72	6.58
Sell	NEPOOL	On-Peak	Aug	2014	19.62	6.08
Sell	Indiana Hub	Off-Peak	Sep	2014	8.58	5.99
Sell	ERCOT-North	Off-Peak	Sep	2014	11.1	5.73
Sell	NY-J	Off-Peak	Dec	2014	20.18	5.63

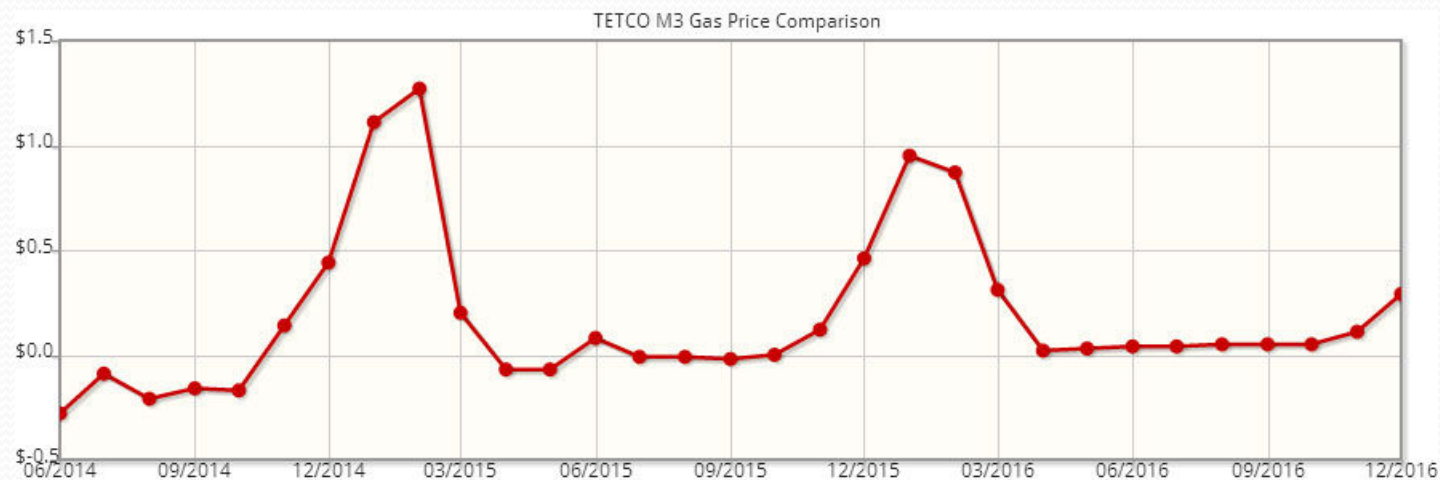
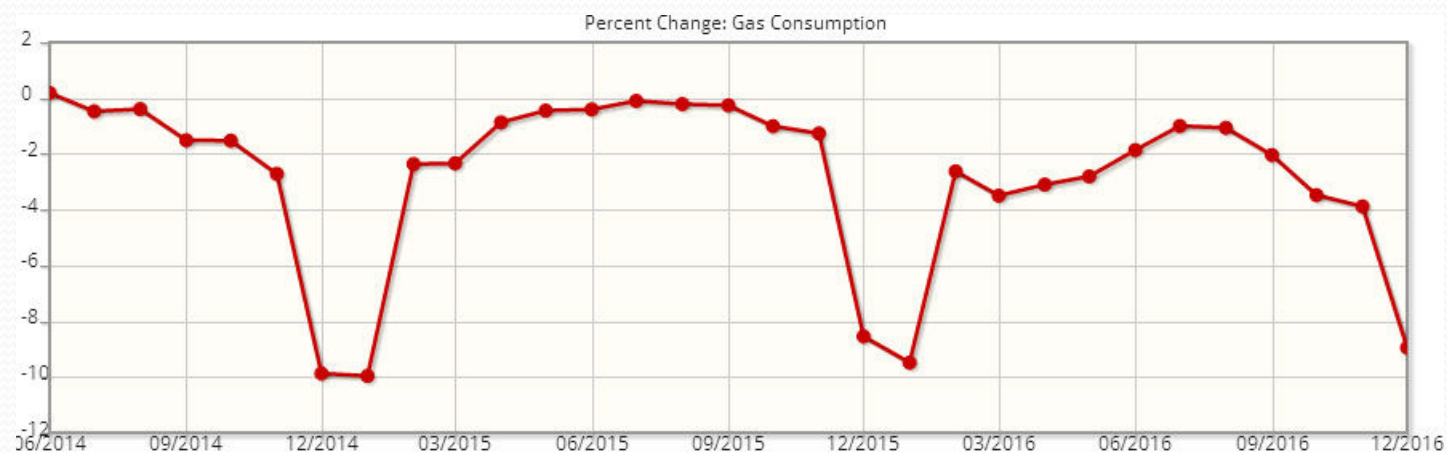
Showing 1 to 10 of 33 entries (filtered from 206 total entries)

Previous 1 2 3 4 Next

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Gas Views



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Gas Views

Gas Storage

Input Controls

U.S. Dry Natural Gas Production (Bcf)	Analog Year: 2013 ▼	Adj Growth Rate: 3
U.S. Supplemental Gaseous Fuels (Bcf)	Analog Year: 2013 ▼	Adj Growth Rate: 0
U.S. Natural Gas Net Imports (Bcf)	Analog Year: 2013 ▼	Adj Growth Rate: 2.7
Balancing Item (Bcf)	Analog Year: 2013 ▼	Adj Growth Rate: 0
U.S. Natural Gas Total Consumption ExPower (Bcf)	Analog Year: 2013 ▼	Adj Growth Rate: 2.1

Power Demand Controls

Weather Year: 2003-2013 ▼	Month	Monthly Henry Price
	May	4.57
	June	4.57
	July	4.6
	August	4.55
	September	4.54
	October	4.53

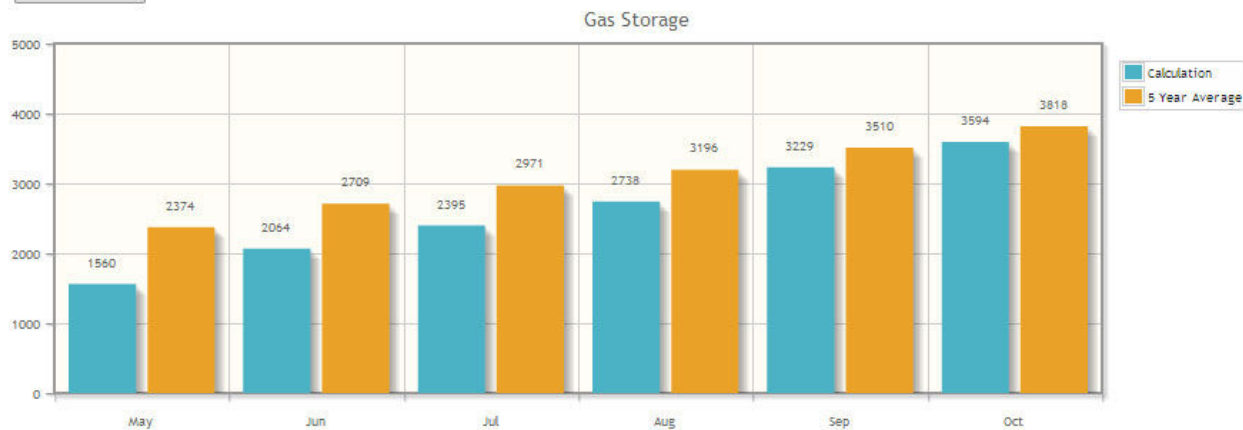
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Gas Views

[View Results](#)



[View Image](#)

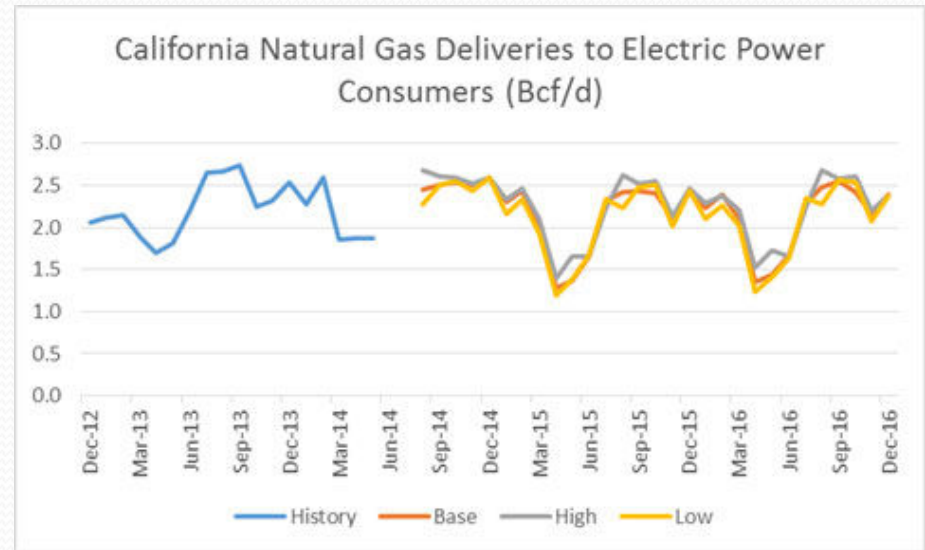
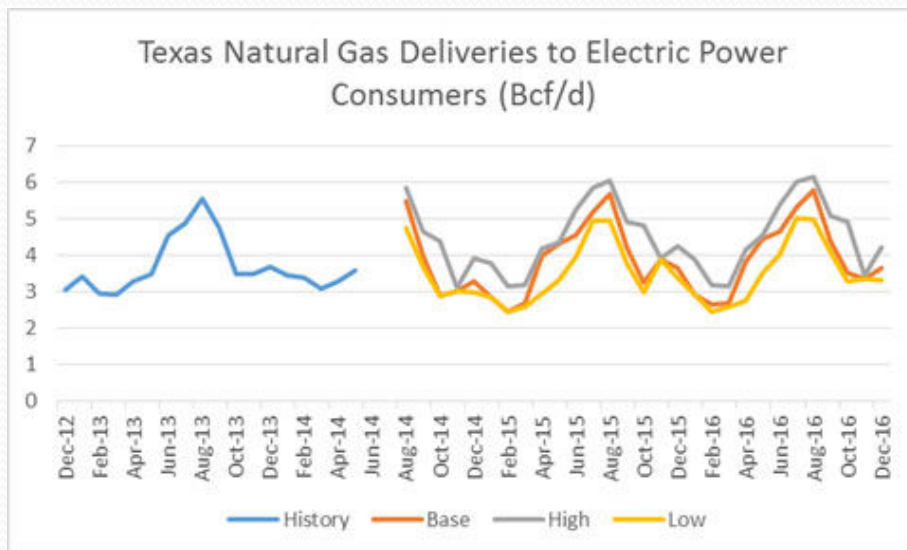
May 2, 2014 Storage: 1,055

Type	May	Jun	Jul	Aug	Sep	Oct
Storage Calculation	1560	2064	2395	2738	3229	3594
5 Year Average	2374	2709	2971	3196	3510	3818
U.S. Dry Natural Gas Production (Bcf)	2118	2050	2138	2138	2050	2144
U.S. Supplemental Gaseous Fuels (Bcf)	5	3	3	5	5	4
U.S. Natural Gas Net Imports (Bcf)	94	106	111	109	124	101
Balancing Item (Bcf)	8	8	7	0	-7	-69
U.S. Natural Gas Total Consumption ExPower (Bcf)	1154	1019	1033	1039	1027	1250
U.S. Natural Gas Net Withdrawals from Storage (Bcf)	-505	-504	-331	-342	-491	-365

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Gas View



- State by state gas demand available.
- Demand can be used to feed into GPCM model.

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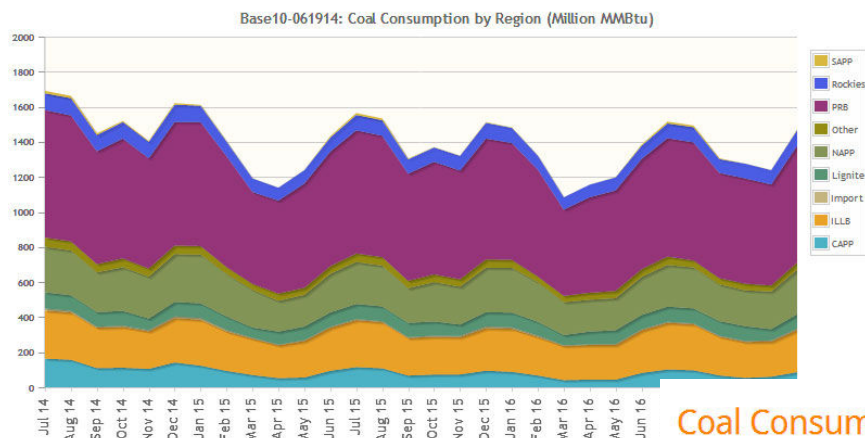
Coal View

Coal Consumption By Region

Note: The chart displays coal usage by region

Run ID: Base10-061914

Chart Data



Estimated coal consumption by basin.

Impact of changing forward curve on coal consumption.

Coal Consumption

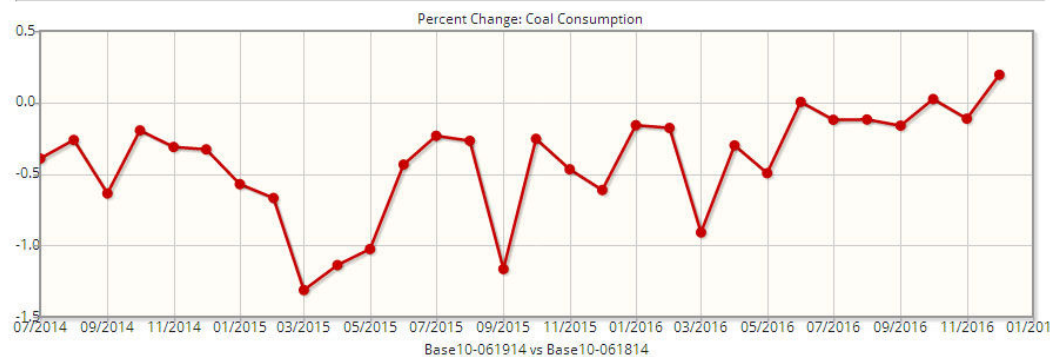
Note: The chart is the difference between RunID 1 & RunID 2

Run ID 1: Base10-061914

Run ID 2: Base10-061814

Percent Change

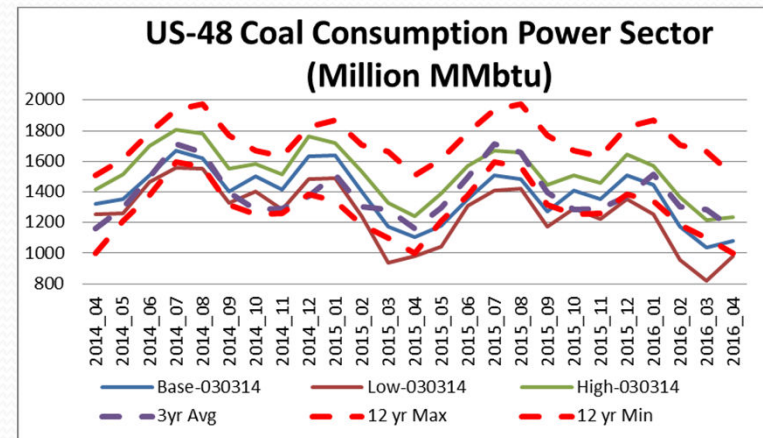
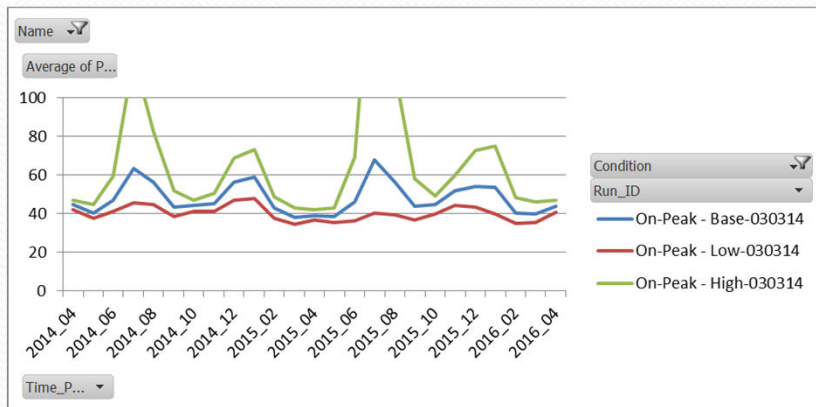
Chart Data



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Output Files



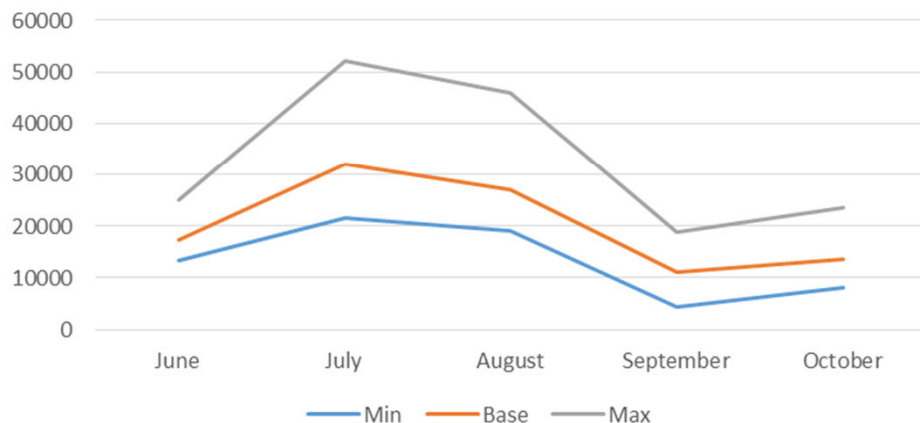
- All data are presented online are available daily in excel files.

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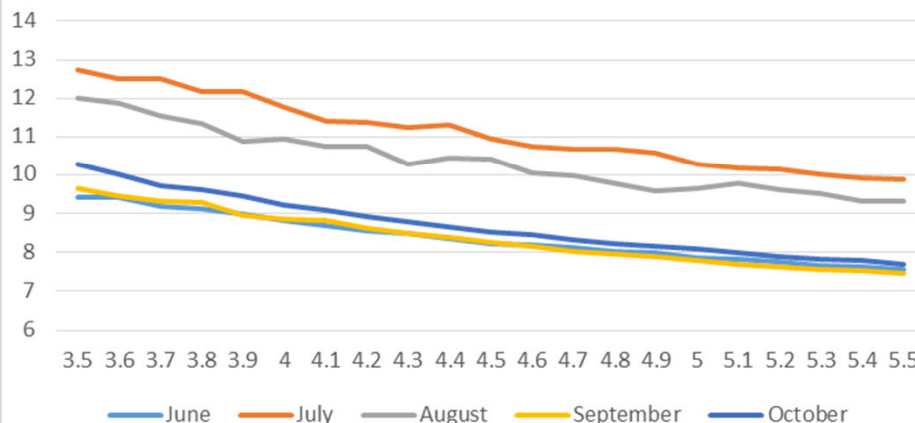
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Asset Focus

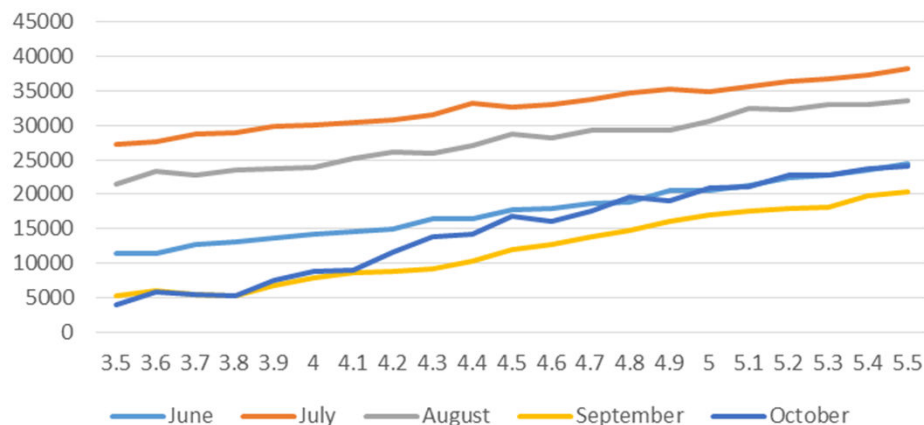
Brandon Shores Weather Revenue Risk/Reward
by Month \$000



Heat Rate mmbtu/MW (PJM-BGE/TCO) vs. Henry
Hub Price



Henry Hub Impact on Brandon Shores Revenue
by Month \$000



- Custom focused available for assets.
- Output range from revenue, cost, profit, local market information, sensitivities, etc...

Continued Progress

- Updates in queue:
 - Power Price Developer – Similar to Storage tool
 - Allows user to change the weather, henry hub, basis. Then select a power hub to create a power price forecast.
 - Potentially Changing High and Low cases to be more extreme
 - Adding basis risk
 - Change load setup from analog year to monthly maximums and minimums.

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Monthly “Special Topic” Studies

- Investigate the latest market developments resulting from outages, retirements, gas basis, coal pricing, weather anomalies, etc...
- Studies will include market commentary, written discussion, tables and graphs.
- Clients may suggest themes for special topic studies.
- Studies will help clients develop a well-rounded view of how various variables are impacting power markets from a price and a fuel consumption perspective.
- Mid Month Study – Run next month sensitivities changing Henry Hub from \$2-7/MMbtu in 50 cents increments.
- Summer and Winter Outlook

PMA-NT Subscription

- 2 paths – Custom Path – Subscription Path
- Custom Path gives complete customization – essentially creates an “outsource” model and modeler.
 - Unlimited changes and customization
 - Extensive data control given
 - Data feed integration e.g. IIR outage, Energy Velocity, etc...
- Subscription Path
 - Cost per customization
 - Limited data control – generic to all subscribers.

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Customization Input Items

- Changing gas and gas basis
- Changing Coal Major Prices
- Changing Load via GDP outlook Total and by BEA Regions
- Changing Load via CDD and HDD by US Census Region
- Changing Emission Prices
- One time run & Continuous runs available



Customization Output Items

- Customization output include:
 - A portfolio report of specified units can be produced showing fuel burn, fuel cost, generation, starts, etc...
 - A custom fuel burn view from particular region to fuel specific codes
- One time run & Continuous runs available