Power Market Analysis
Near-Term (PMA - NT)
Power Trading/Hedging Advisory Service

David K. Bellman
dkb@allenergyconsulting.com
www.allenergyconsulting.com
614-356-0484

All Energy Consulting
Adding insights to energy markets for your success.
PMA commitment to you

✓ Quantifying risk to empower effective decision making.

✓ Converting variability into certainty.

✓ Adding insights to energy markets today and for years to come for your success.
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
Value of PMA

- 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.

- Default runs encompass the major variables using reasonable expectations of 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 and gas markets.

- PMA can be used for asset evaluation.

- PMA is designed for customization. You can create your own cases. e.g. a case using your own fundamental outlook on commodities.
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.
Effective Power Modeling Pieces

- **Data**
  - Generation Attributes
  - Commodities and Relationship
  - Constraints
  - Load

- **Analytics**
  - Load Forecasting
  - Coal Modeling
  - Gas Modeling
  - Risk Analysis

- **IT**
  - Database Management – Data scraper, Quality control
  - Interface – PHP, SQL, Excel

---

CONFIDENTIAL
No portion of this presentation may be reproduced, reused or otherwise distributed in any form without prior written consent.

All Energy Consulting
Adding insights to energy markets for your success.
Process Flow

- HDD
- CDD
- GDP

Load Model

PMA Results

Resource Input

Experience
- EIA-860

Coal Model

Gas Futures

Coal Futures

EIA-923
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.
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.

CONFIDENTIAL: No portion of this presentation may be reproduced, reused or otherwise distributed in any form without prior written consent.
Power Price Validation

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

CONFIDENTIAL: No portion of this presentation may be reproduced, reused or otherwise distributed in any form without prior written consent.
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
Default 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 decrease d 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

- **High Gas Consumption Case Assumptions**
  - Forward Curve Gas Henry adjusted 50 cents lower

All Cases Can Be Customized to Your Liking
Power Views

Forward Price Comparison

Note: The chart shows model prices vs. forwards.

Run ID 1: Base10-042914  ▼  Hub: PJM - West  ▼  Condition: On-Peak  ▼  Chart Data

Base10-042914: PJM - West On-Peak Prices ($/MWh)
## Trade Screener

- **Run ID**: 06-06-2014
- **Screener Type**: Custom Value
- **Condition**: X2

<table>
<thead>
<tr>
<th>Type</th>
<th>Hub</th>
<th>Condition</th>
<th>Month</th>
<th>Year</th>
<th>Gain</th>
<th>Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>On-Peak</td>
<td>Oct</td>
<td>2014</td>
<td>1.4</td>
<td>-0.59</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>Off-Peak</td>
<td>Feb</td>
<td>2015</td>
<td>11.81</td>
<td>3.98</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>On-Peak</td>
<td>Feb</td>
<td>2015</td>
<td>22.11</td>
<td>5.36</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>On-Peak</td>
<td>Mar</td>
<td>2015</td>
<td>12.8</td>
<td>4.95</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>Off-Peak</td>
<td>Mar</td>
<td>2015</td>
<td>4.81</td>
<td>0.99</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>On-Peak</td>
<td>Apr</td>
<td>2015</td>
<td>5.13</td>
<td>1.83</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>On-Peak</td>
<td>Feb</td>
<td>2016</td>
<td>24.77</td>
<td>-2.95</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>Off-Peak</td>
<td>Feb</td>
<td>2016</td>
<td>15.67</td>
<td>4.04</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>On-Peak</td>
<td>Mar</td>
<td>2016</td>
<td>10.07</td>
<td>-3.25</td>
</tr>
<tr>
<td>Sell</td>
<td>AEP_Dayton</td>
<td>Off-Peak</td>
<td>Mar</td>
<td>2016</td>
<td>4.83</td>
<td>-0.83</td>
</tr>
</tbody>
</table>

Showing 1 to 10 of 381 entries

Previous 1 2 3 4 5 ... 39 Next
## Gas Storage

### Input Controls

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analog Year</th>
<th>Adj Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Dry Natural Gas Production (Bcf)</td>
<td>2013</td>
<td>3.7</td>
</tr>
<tr>
<td>U.S. Supplemental Gaseous Fuels (Bcf)</td>
<td>2013</td>
<td>0.0</td>
</tr>
<tr>
<td>U.S. Natural Gas Net Imports (Bcf)</td>
<td>2013</td>
<td>2.7</td>
</tr>
<tr>
<td>Balancing Item (Bcf)</td>
<td>2013</td>
<td>0.0</td>
</tr>
<tr>
<td>U.S. Natural Gas Total Consumption ExPower (Bcf)</td>
<td>2013</td>
<td>2.1</td>
</tr>
</tbody>
</table>

### Power Demand Controls

<table>
<thead>
<tr>
<th>Weather Year</th>
<th>Month</th>
<th>Monthly Henry Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-2013</td>
<td>May</td>
<td>4.57</td>
</tr>
<tr>
<td></td>
<td>June</td>
<td>4.57</td>
</tr>
<tr>
<td></td>
<td>July</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>August</td>
<td>4.65</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>4.54</td>
</tr>
<tr>
<td></td>
<td>October</td>
<td>4.53</td>
</tr>
</tbody>
</table>
Gas Views

May 2, 2014 Storage: 1,055

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

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

Estimated coal consumption by basin.

Impact of changing forward curve on coal consumption.
All data presented online are also available daily in excel files.
• 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.
  - Historical power price screener
  - Layered screener capabilities – adding multiple screeners together
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…
  - Consulting service to setup the appropriate risk cases for your region.
- Subscription Path
  - Cost per customization
  - Limited data control – generic to all subscribers.
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
Contact Information

David K. Bellman

dkb@allenergyconsulting.com

www.allenergyconsulting.com

614-356-0484