

Determining Plant Capacity for a Combined Cycle Power Plant Using PEPSE

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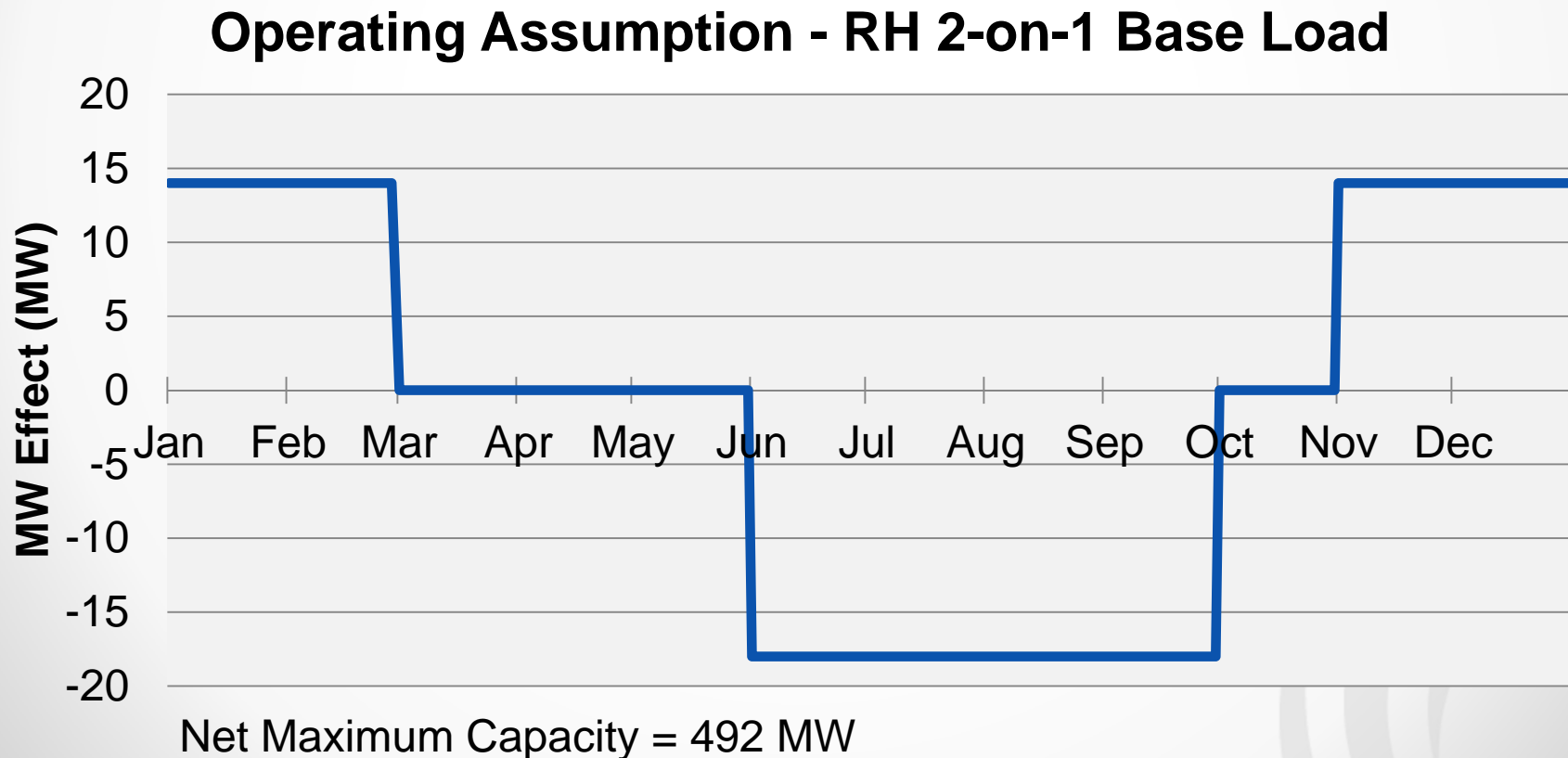
EPRI Heat Rate Improvement Conference
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Redhawk Power Station


- Two 2-on-1 Combined Cycles
- 492 MW Net Base Load
- General Electric 7FA gas turbines (~150 MW each)
- Supplemental firing in the HRSG
- Alstom Power steam turbines (~200 MW each)
- Located in Arlington, Arizona
- Began operating in mid-2002

Problem

- Current Operating Assumptions (OAs)
- Current OA at 2-on-1 base load conditions



Solution Needs

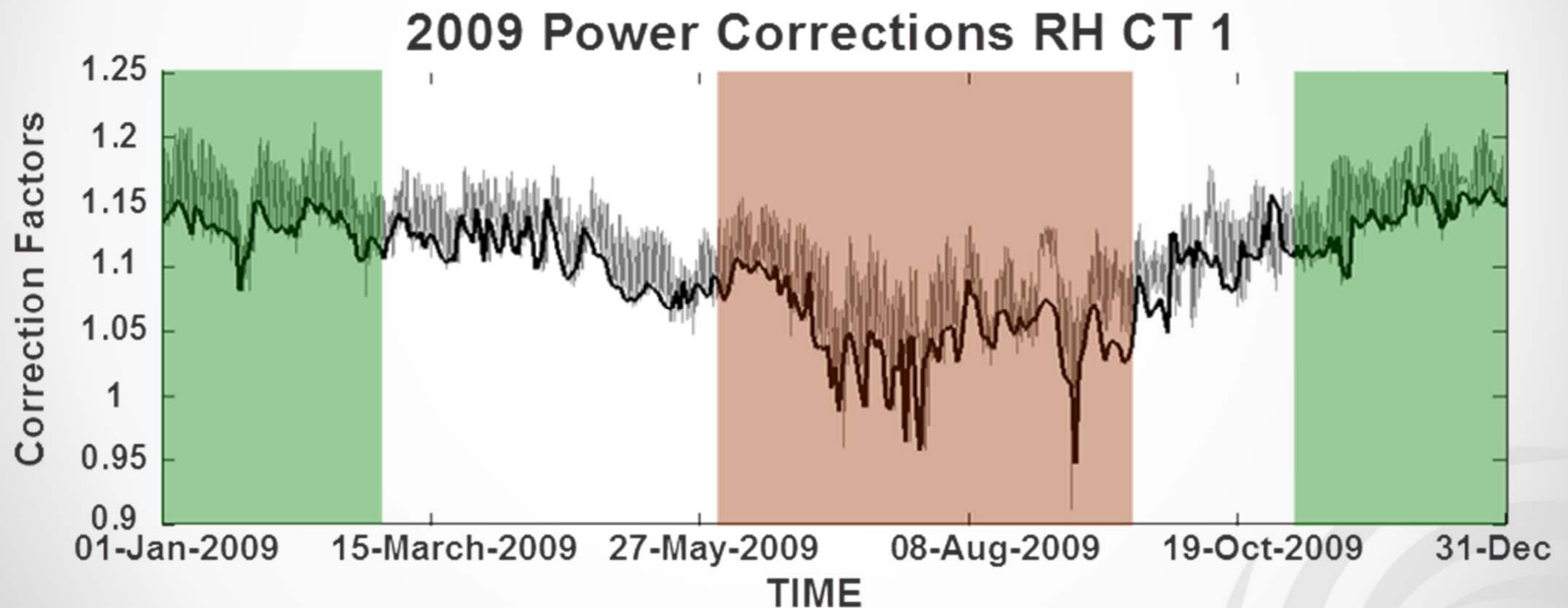
- Use Ambient Conditions
 - Monthly
 - Accurate
 - Documented
 - Repeatable
 - Day-ahead and/or Real-time
 - Performance Monitoring
- 

Background

- Operating Assumptions used for dispatch
 - Max Output
 - Heat Rate
- Current Performance up to date
 - Degradation and/or Repairs
 - Ambient Conditions

Power Correction

- Power Correction Factor for Temperature and Humidity



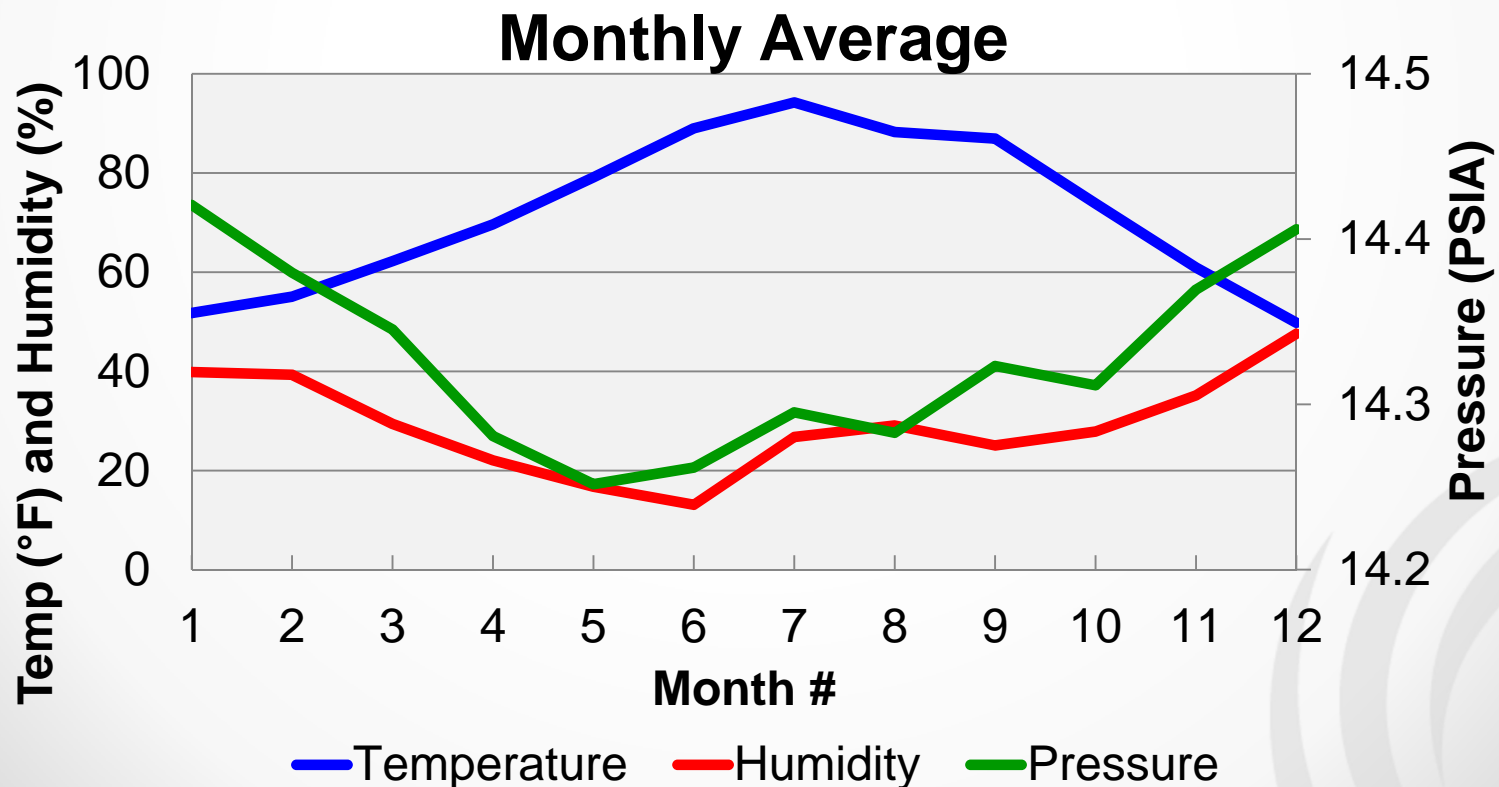
Data Collection

- PI Data for Ambient Conditions
 - Temperature
 - Humidity
 - Pressure
- Collection Intervals and Time
- Data Collection Schemes
 - Monthly Average
 - Peak Time Monthly Average
 - Conservative Monthly Outlook
 - Hybrid Outlook



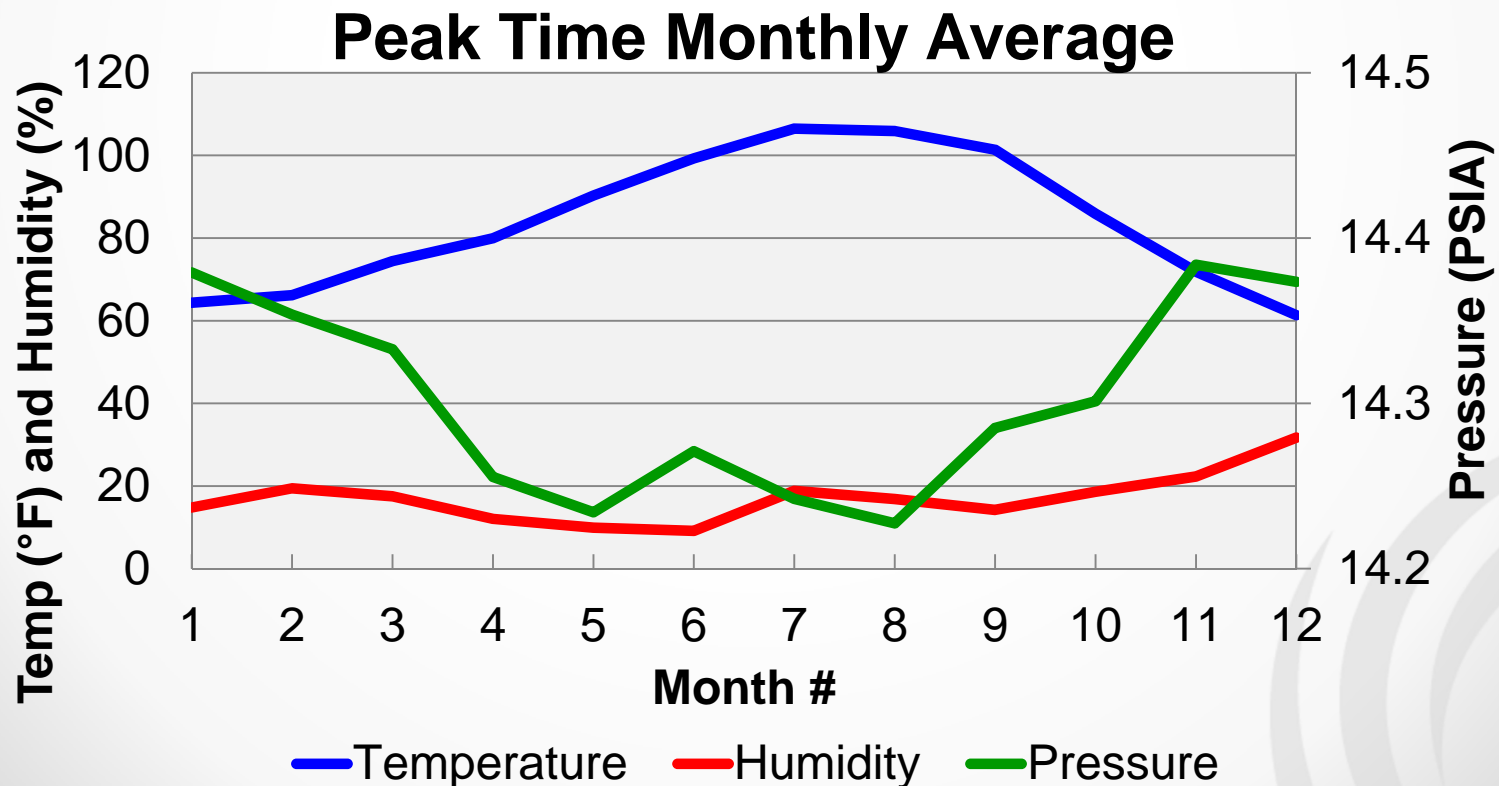
Ambient Conditions

- **Monthly Average** – average over each month at 4-hour intervals from PI. Similar to current OAs.



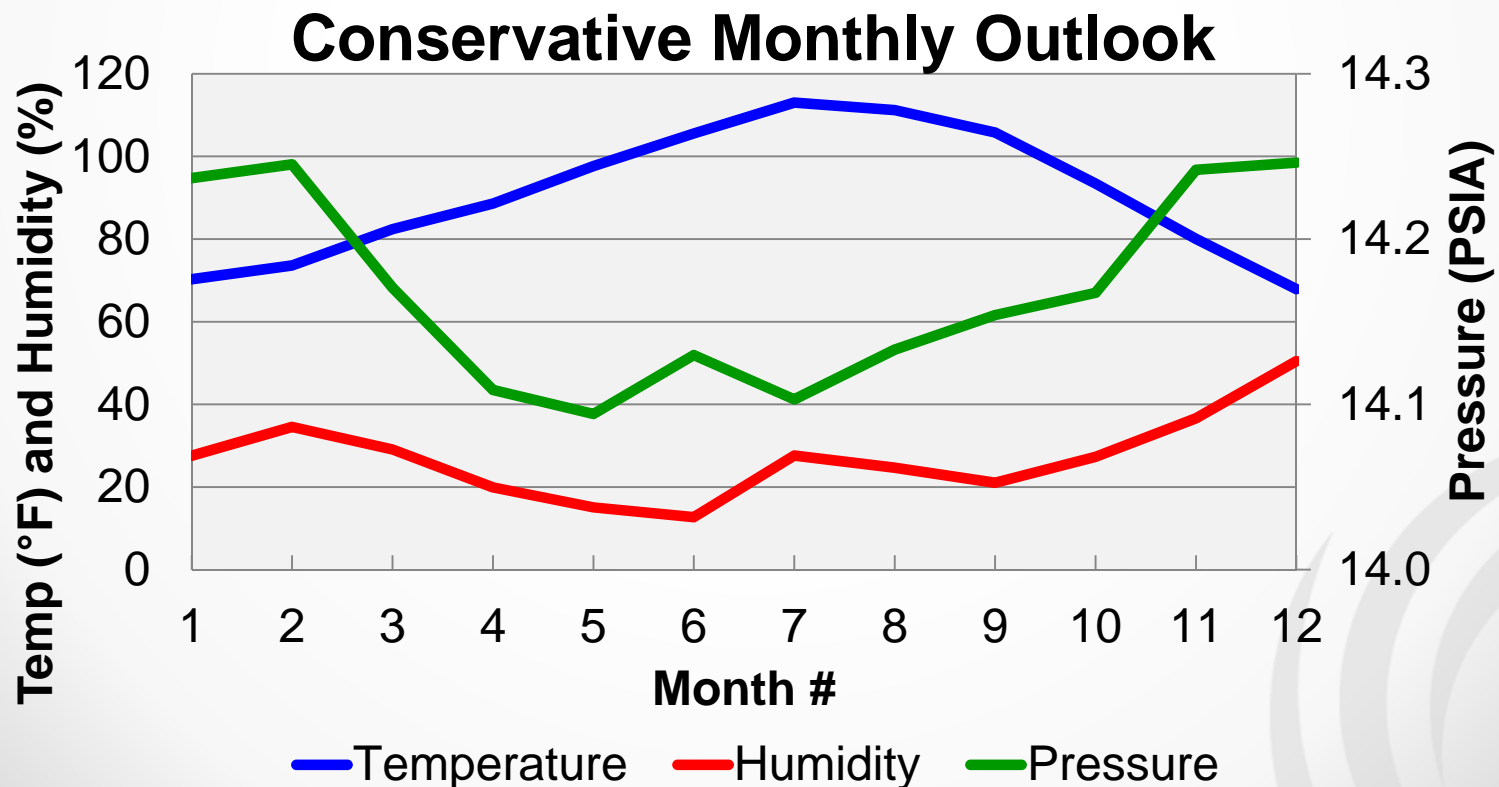
Ambient Conditions

- **Peak Time Monthly Average** – average over each month using data at 5 PM each day. Peak time scenario.



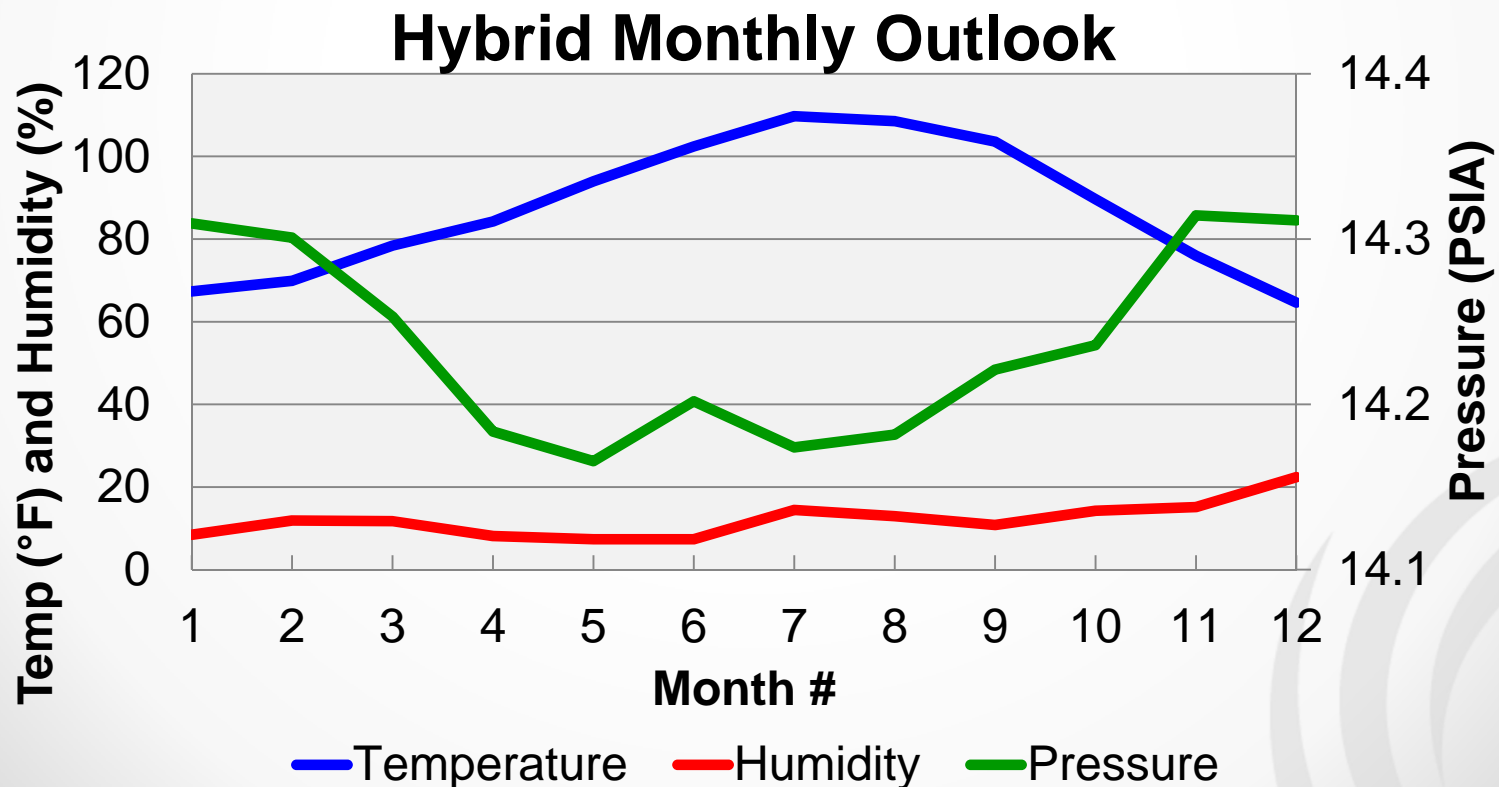
Ambient Conditions

- **Conservative Monthly Outlook** – Peak Time Average adding (Temperature) or subtracting (humidity and pressure) the average standard deviation of the peak time condition for those months to it. Worst case scenario.



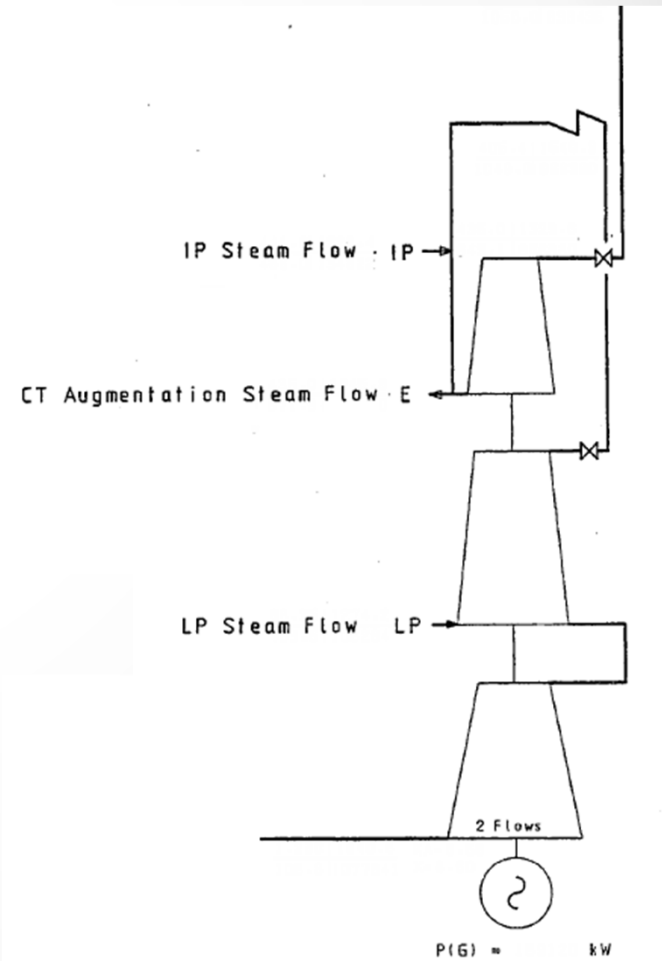
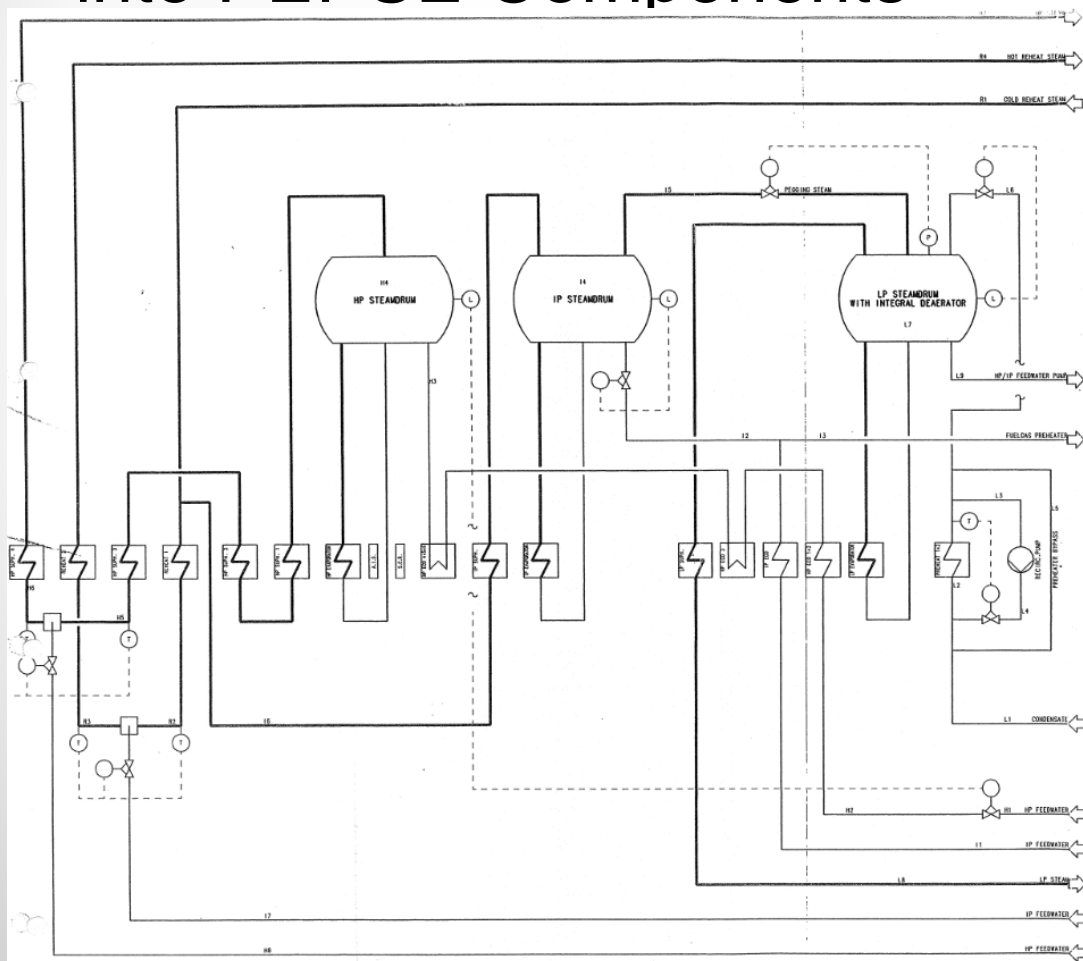
Ambient Conditions

- **Hybrid Outlook** – average of Peak Time Monthly Average and the Conservative Monthly Outlook. A different level of conservatism.

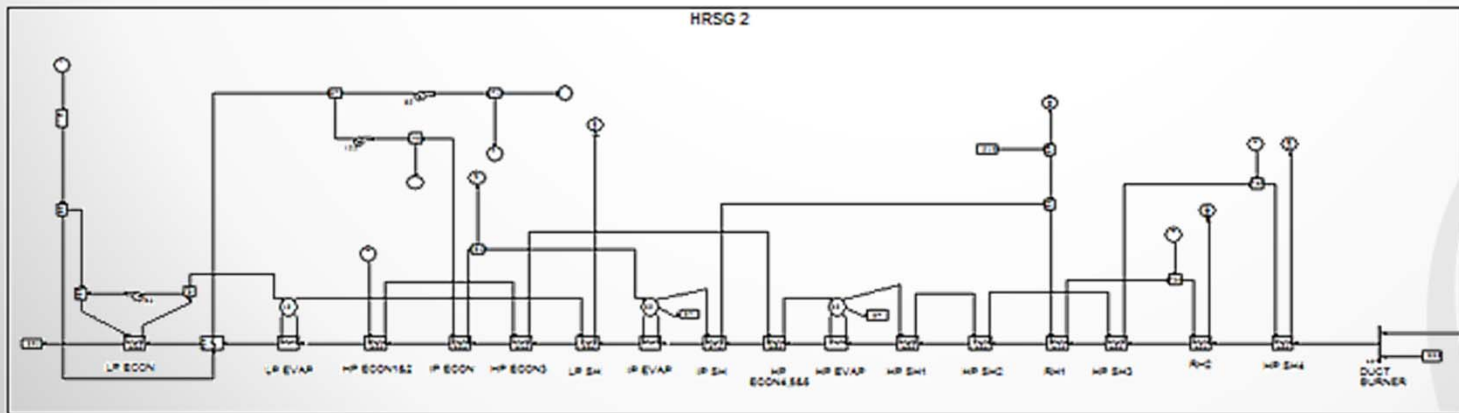
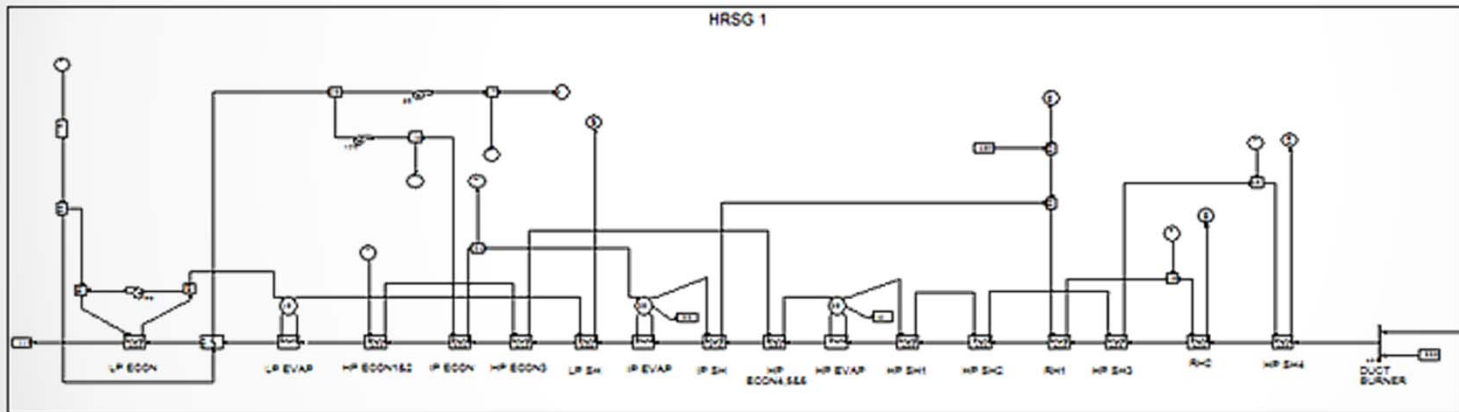
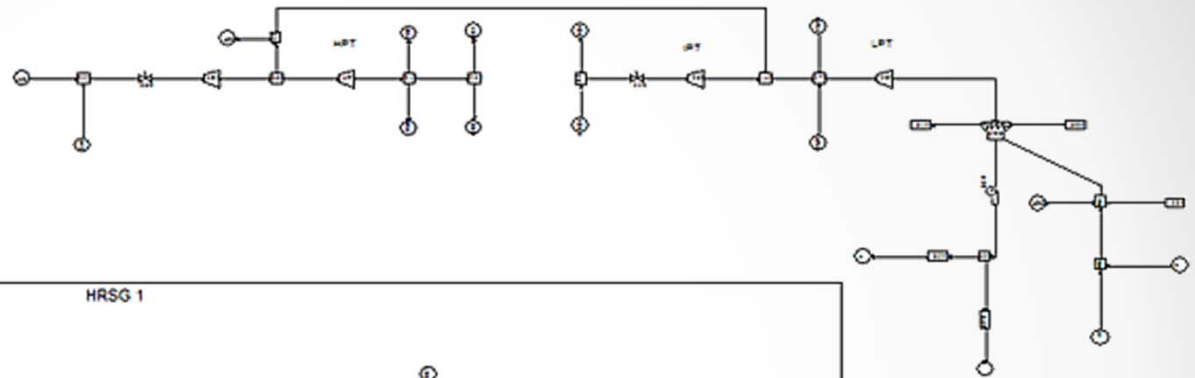


PEPSE - Modeling

- Translate Heat Balance and Plant Schematics into PEPSE Components



PEPSE –Schematic With Components



Study Modeling

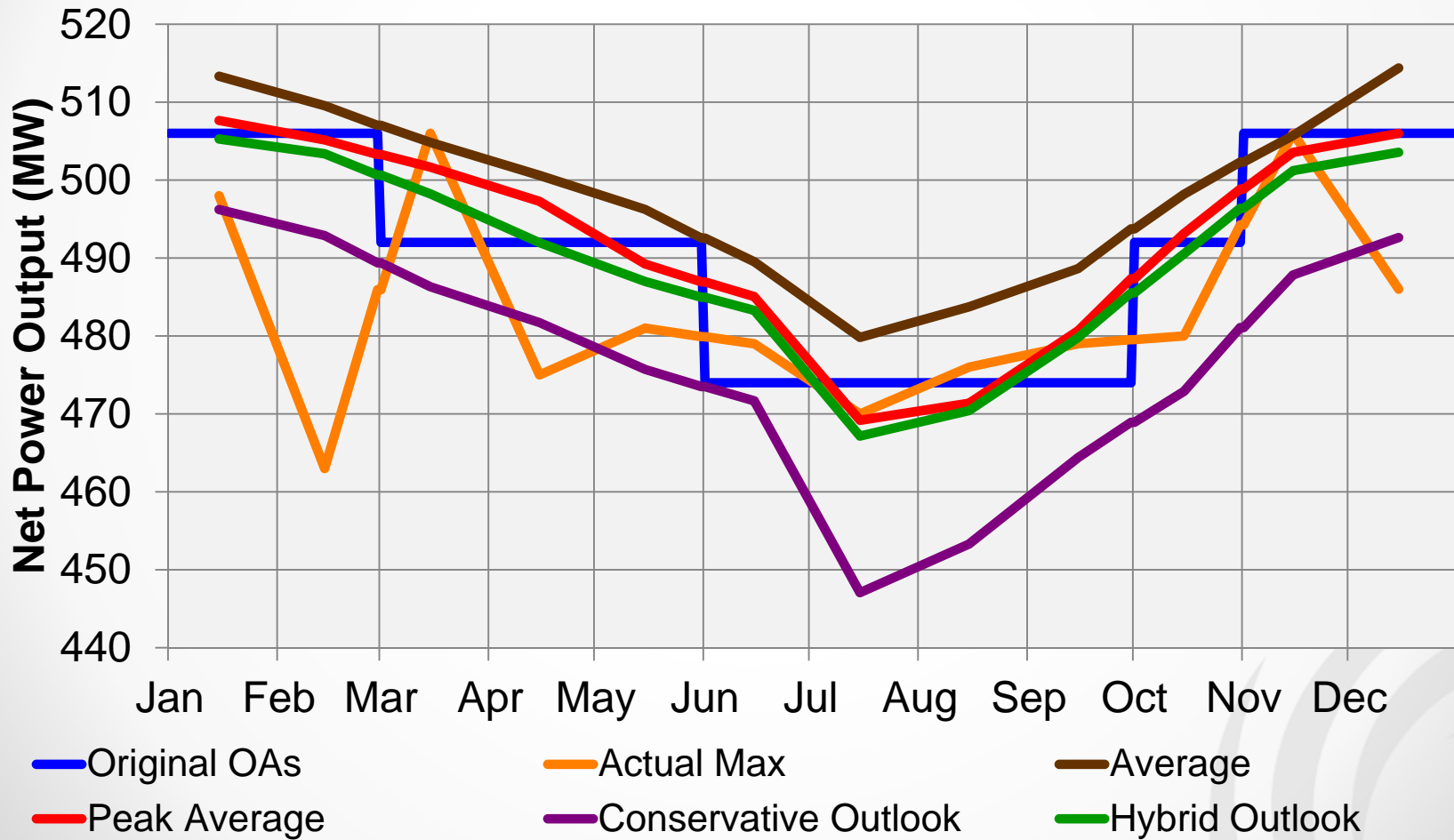
- Tuned PEPSE model to Heat Balances
- Three operating modes - each month
 - 2-on-1 base load
 - 2-on-1 with max supplemental firing
 - 1-on-1 base load
- Ambient Conditions – monthly for each average ambient condition

Other Modeling Assumptions

- Evaporative Cooler considerations
 - On above 75 °F
 - Off below 75 °F
- Condenser Pressure
- Pump Pressures
- Duct Firing – Max at 1198 °F
- Others

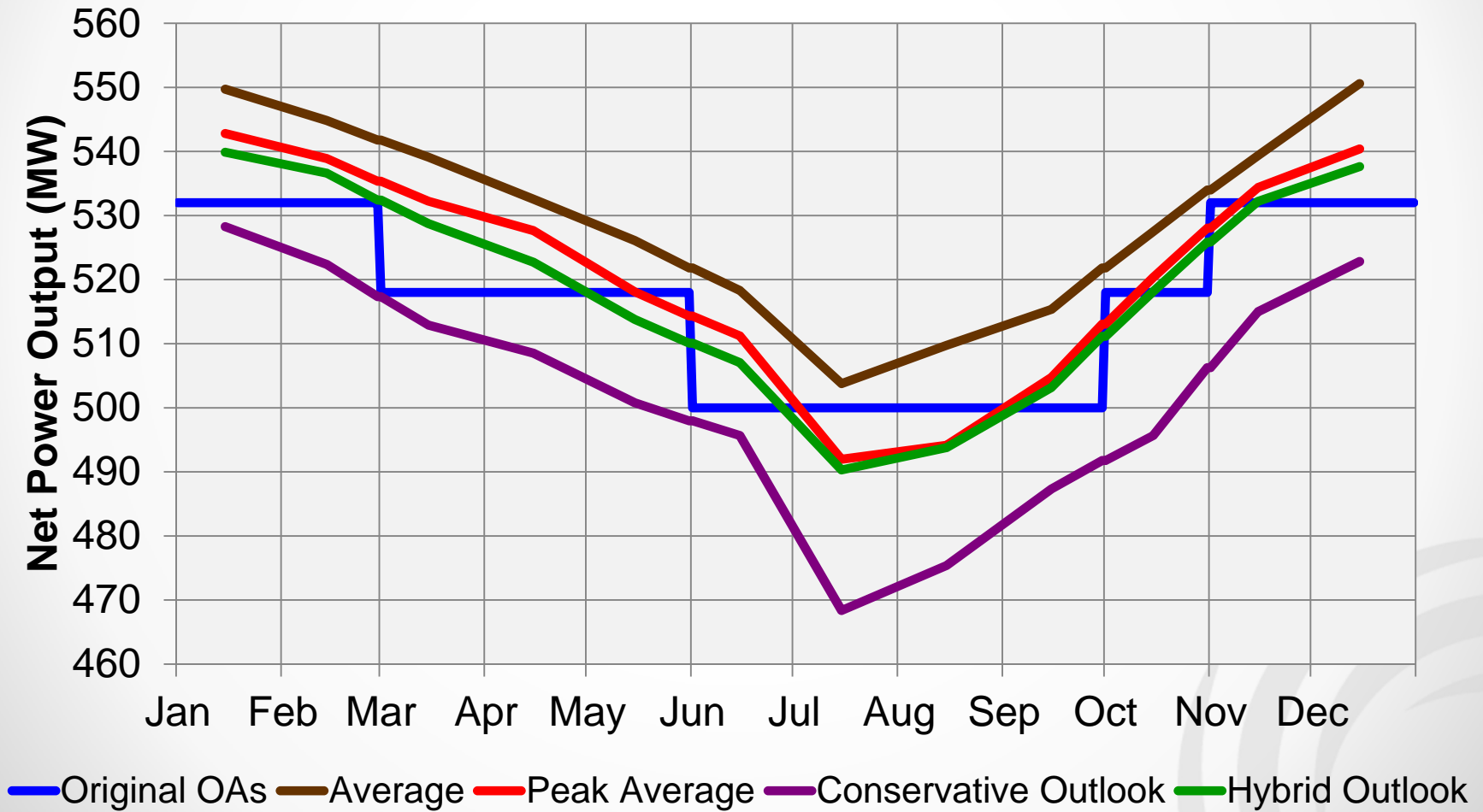
2-on-1 Base Load Comparison

Redhawk 2-on-1 Base Load Comparison



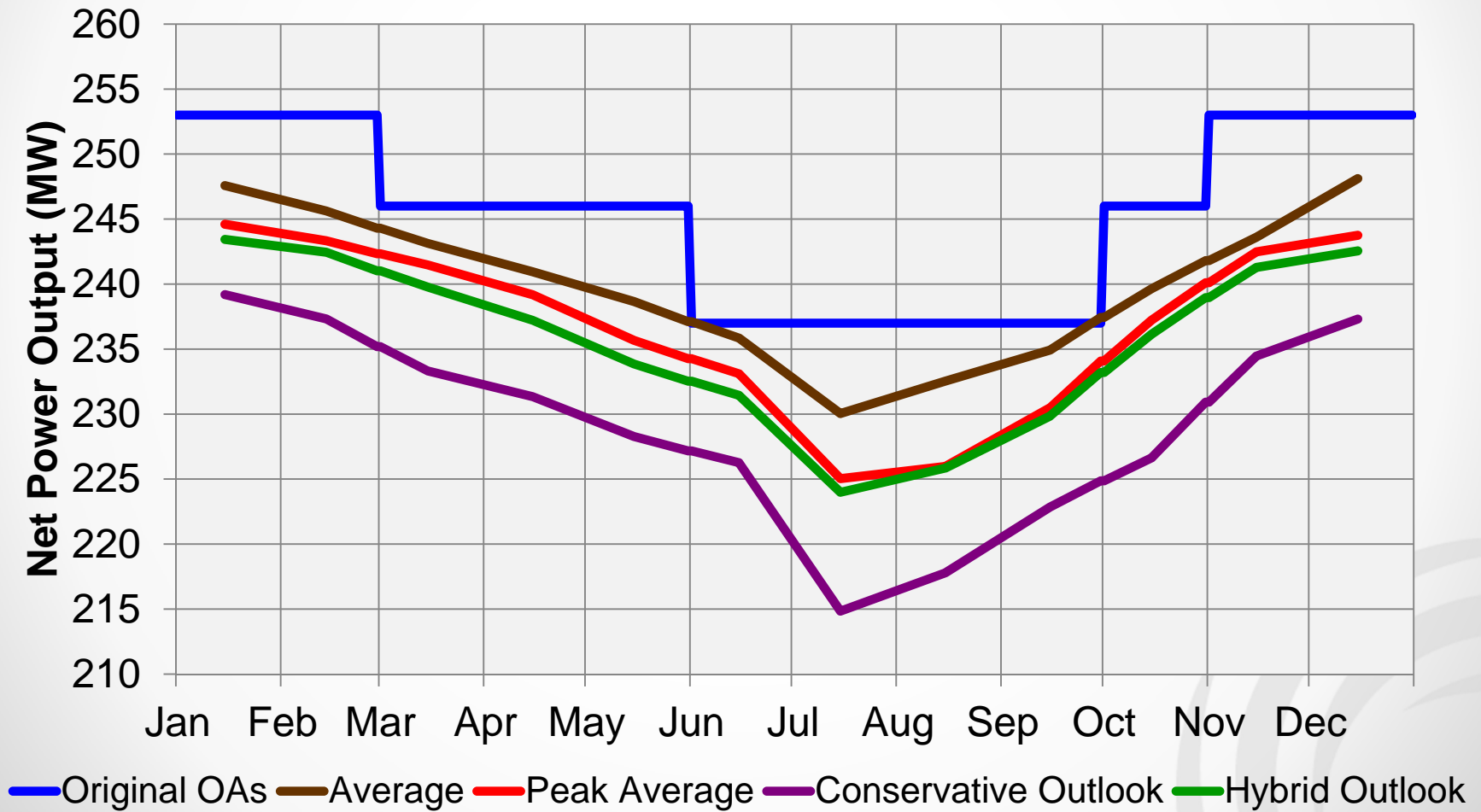
2-on-1 Max Duct Fired Comparison

Redhawk 2-on-1 Max Duct Fired Comparison



1-on-1 Base Load Comparison

Redhawk 1-on-1 Base Load Comparison



Recommended Solutions

- Which to use as the new OAs for 2-on-1 Base Load, 2-on-1 Max Duct Fired, and 1-on-1 Base Load?
 - Average
 - Peak Average
 - Conservative Outlook
 - Hybrid Outlook

Additional Work

- Next Steps?
 - Plant data at each Operating Mode
 - Marketing involvement
 - Implement Method(s) for OAs
 - Day-ahead and Real-time instead of Monthly
 - Performance Monitoring
- What could be done for better results?
 - More Data
 - Testing
 - Plant Data Tunes

Questions?

