Integrating the PI System with Third-Party Analytics

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Why Choose the PI System? Analytics

The PI System has the data – What's the next step?

- **Business intelligence:** optimizing production
- **Process control:** nominal trajectory
- **Data mining:** fault detection and prevention
- **Complex event processing:** notification

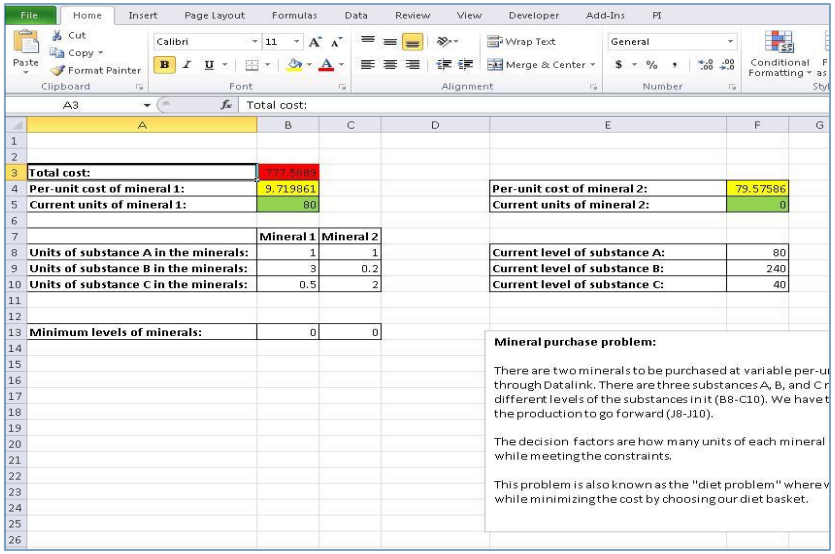
PI Analytics Subset

- Performance Equations
- Totalizers
- Alarm/Statistical Quality Control
- PI Advanced Calculation Engine
- PI for StreamInsight*
- AF-supported Analytics*

3rd-Party Analytics

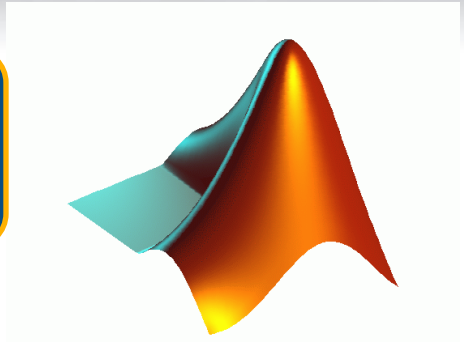
Excel Solver: Datalink, PI-SDK

- **Made by Frontline Systems**
- **Good for smaller setups**
- **Meshes well with PI-Datalink**



3rd-Party Analytics

MATLAB® by Mathworks



- ADO and PI OLEDB Provider
- OPC toolbox and PI OPC
- Database toolbox and PI JDBC Driver
- COM Automation Server referenced in codes using PI SDK or PI ACE

3rd-Party Analytics

JMP Statistical discovery by SAS

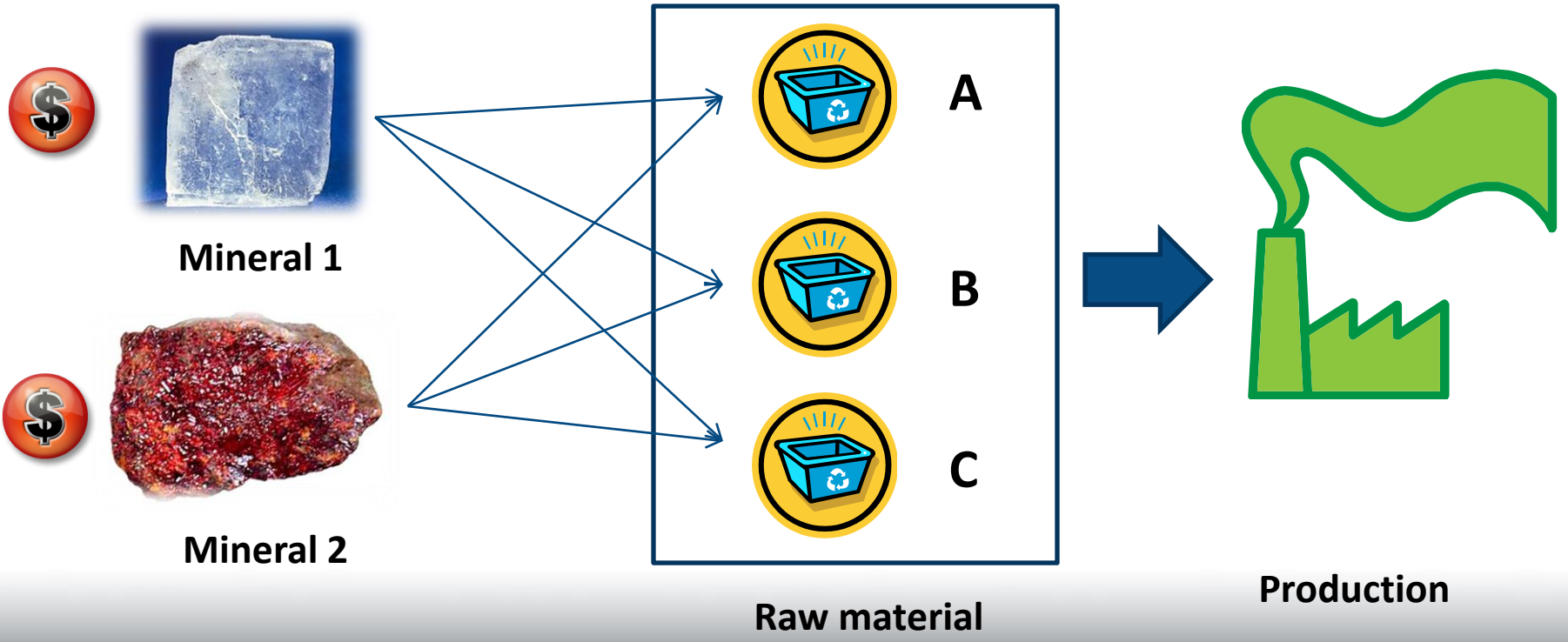
- Provides visual statistical data on the desktop
- MS Excel and PI DataLink
- ODBC and PI ODBC Client
- Flat text files and `piconfig` utility

Use Case: Mathematical Optimization

Business Intelligence	Process Control	Data Mining and Curve Fitting
• Minimizing production cost	• Verification of a process controller/DCS against nominal trajectory	• Preemptive fault detection and forecasting

Example: Solver add-in to Microsoft Excel

- Minimizing cost of raw material

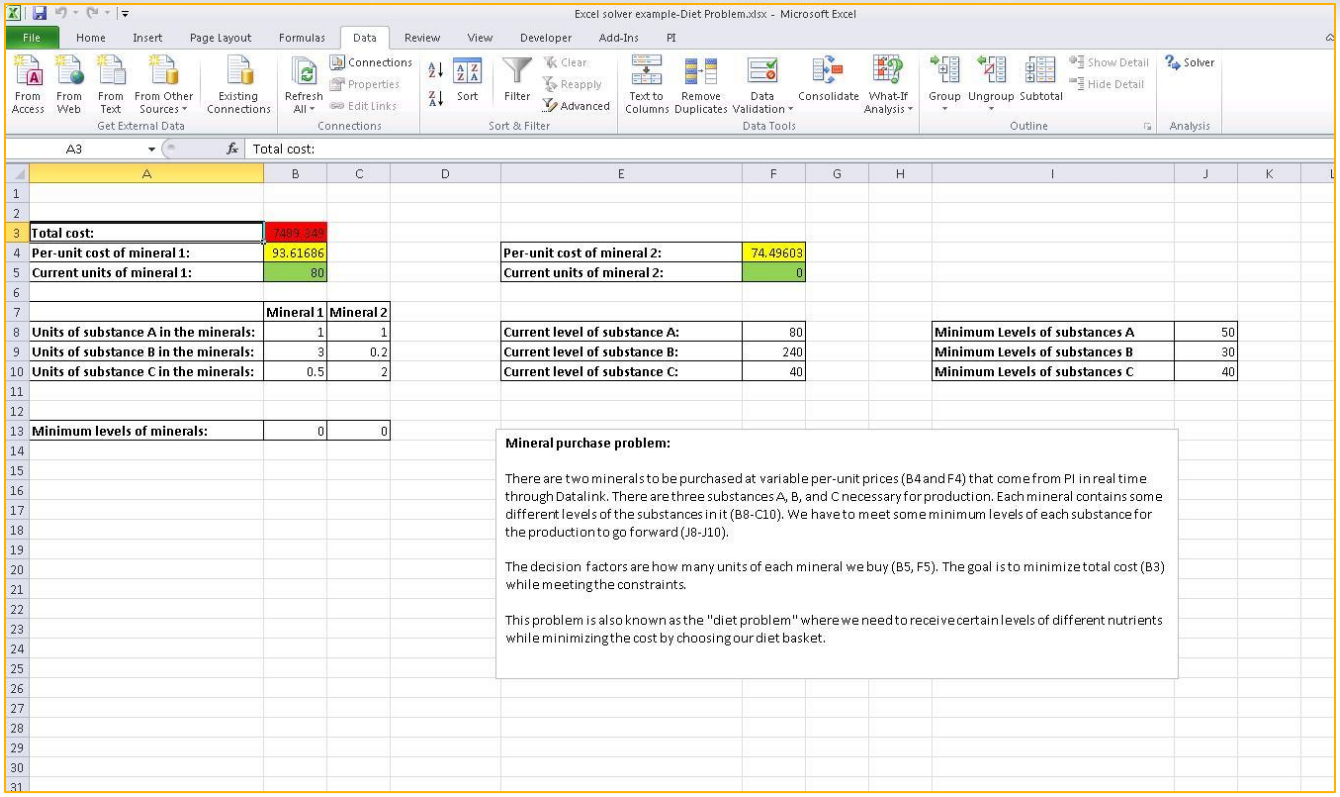


Example: Solver add-in to Microsoft Excel

- **Objective**: minimize the cost of minerals
- **Constraints**: minimum levels of each material

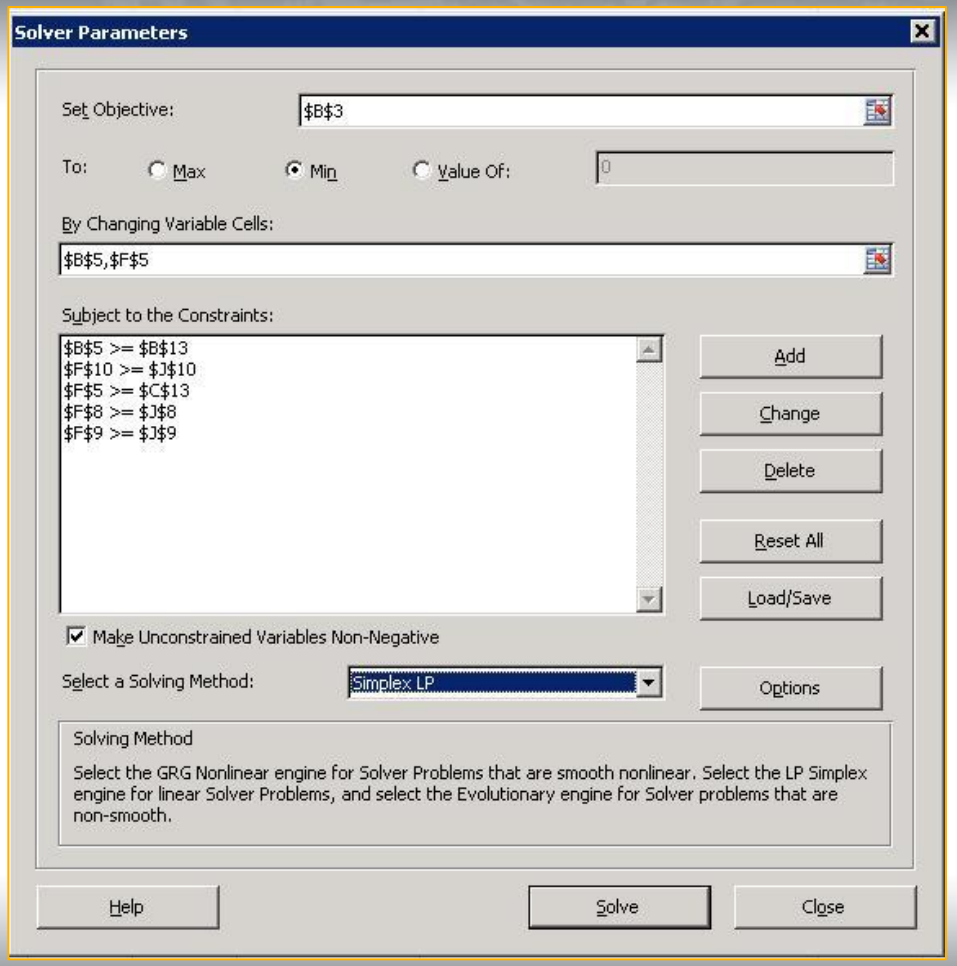
- **The PI System**: different parameters come through PI DataLink in real-time
- **Excel Solver**: optimization

Example: Solver add-in to Microsoft Excel



Example: Solver add-in to Microsoft Excel

Set up of the problem:



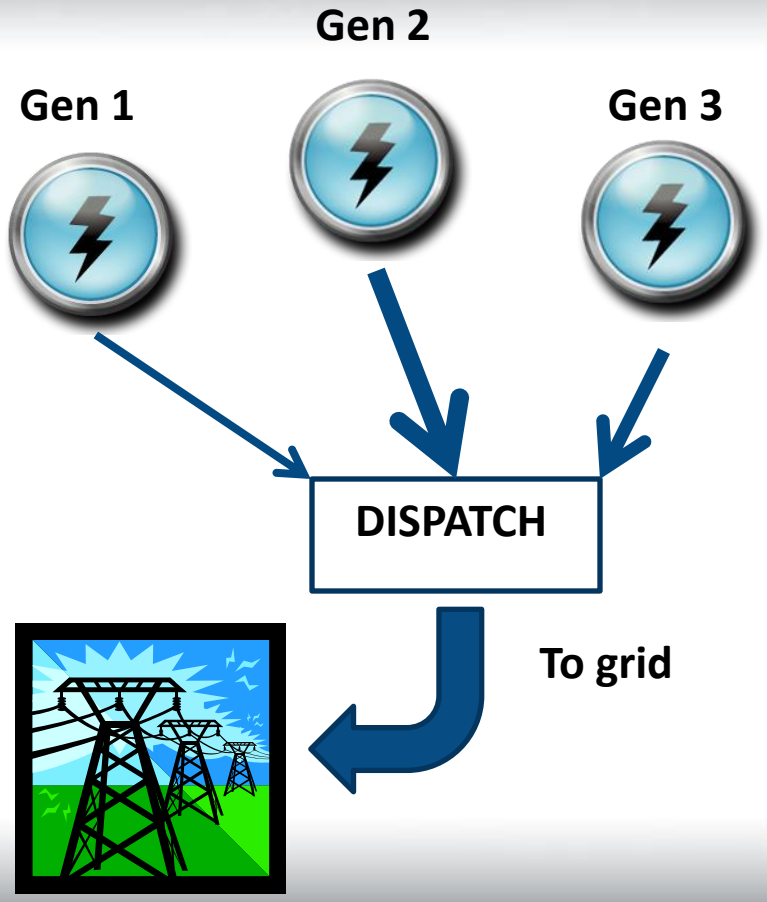
Mathworks MATLAB®

The PI System	MATLAB
• Provides historical data	• Performs analysis

- Data analysis and modeling, application and algorithm development

Example: Economic Dispatch

- Several production units, variable costs
- Given: power demand
- Question: How to allocate the production



Example: Economic Dispatch

Objective: minimize total production cost

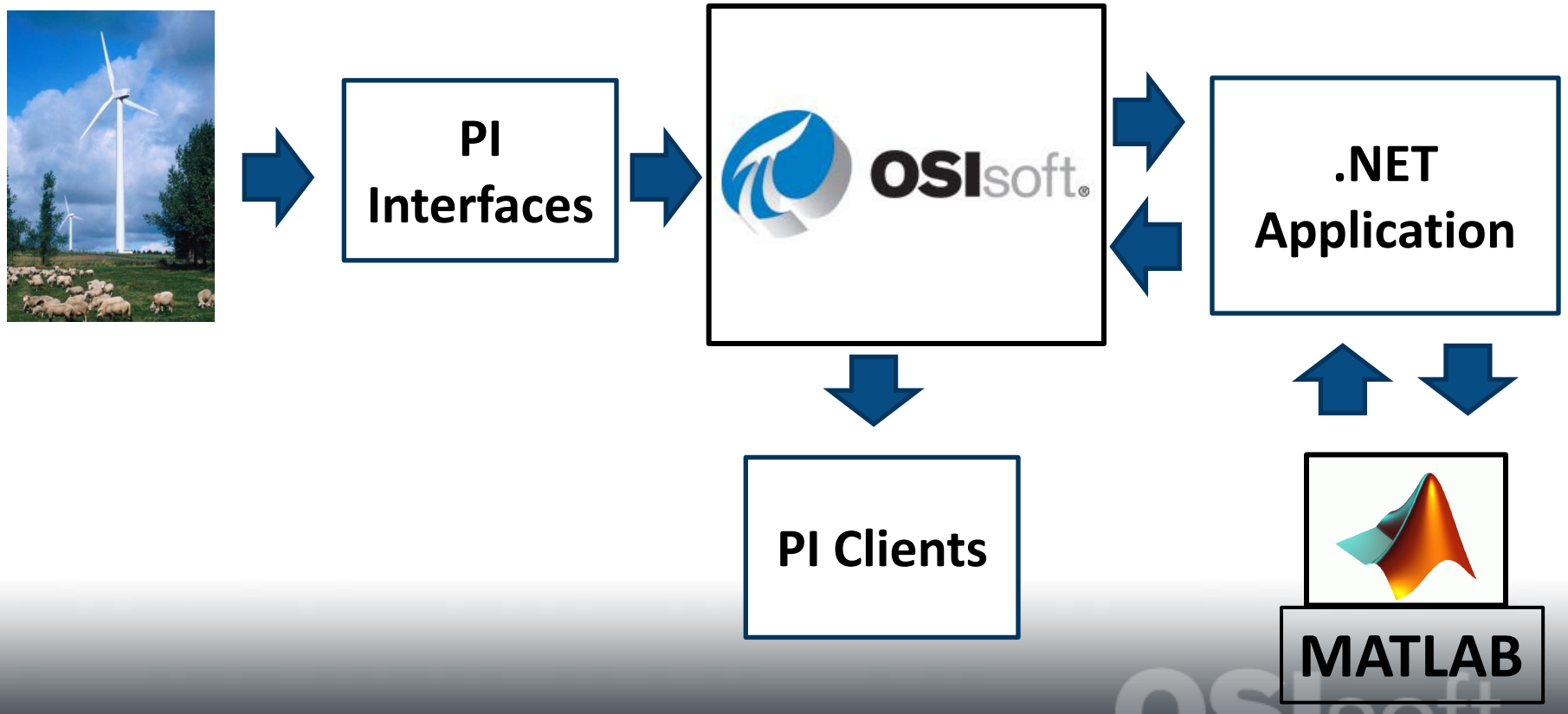
Constraints:

- Total generation less than demand
- Individual production cap
- Other constraints

Decision: how much each unit generates

Example: Economic Dispatch

Data flow:



Example: Economic Dispatch

- Cost: $\sum_i c_i {P_i}^2 + b_i P_i + a_i - \pi P_i$
- Subject to: $0 \leq P_i \leq {P_i}^{max}$

$$\sum P_i \leq P_d$$

P_i	Production at generator *i*
P_d	Demand
π	Going price at the market
a_i, b_i, c_i	Cost coefficients (from PI)

Example: Economic Dispatch

A `server` object in PI-SDK to access PI points (`Data.Snapshot.Value`)

"MATLAB COM automation sever" is referenced

Arrays (matrices) are passed "`MATLAB.Application`" object

"`quadprog`" function in optimization toolbox

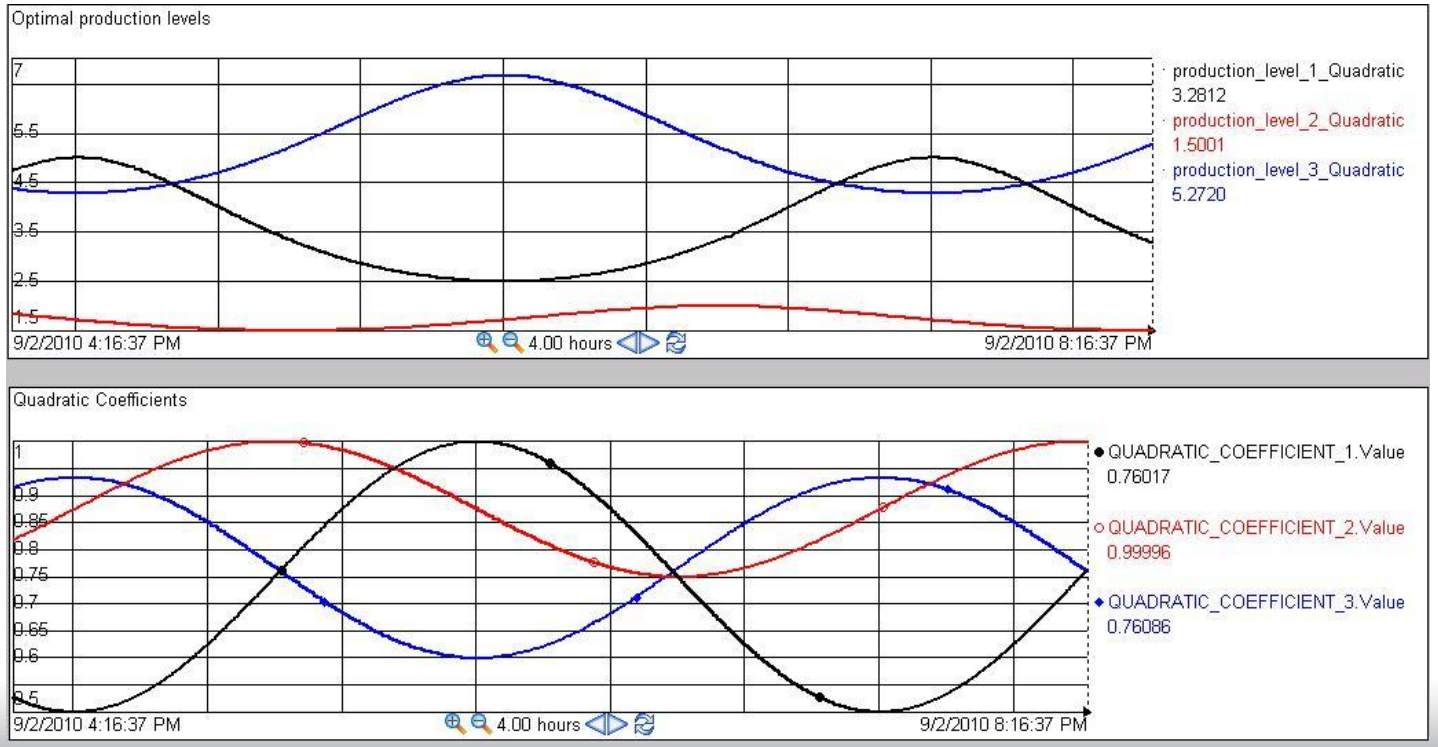
Example: Economic Dispatch

Benefits

- Convenient access to enterprise data in real-time
- Easy manipulation of complex analytics; suitable for large scale problems
- Having optimal results in real-time

Example: Economic Dispatch

Implementation results



Concluding Remarks

The PI System provides several analytical tools

The PI System could conveniently combine with 3rd party analytical tools as well

Optimization problems can boost the whole enterprise via complex optimal results in real-time

Thank You!

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