



Integrating Predictive Models and Microsoft BI

A New Age in Analytics

Presented by **Curt Hertler, Partner Solutions Architect**

Models for Safe, Reliable, & Profitable Operations



E&P

Well Production Forecasting
Equipment/Asset/System Performance



Midstream

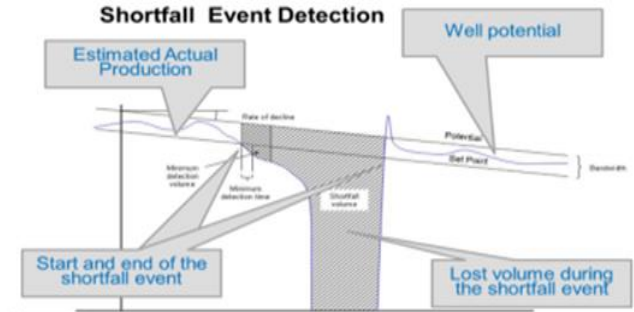
Equipment/Unit/System Performance
Reliability & Integrity



Hydrocarbon Processing

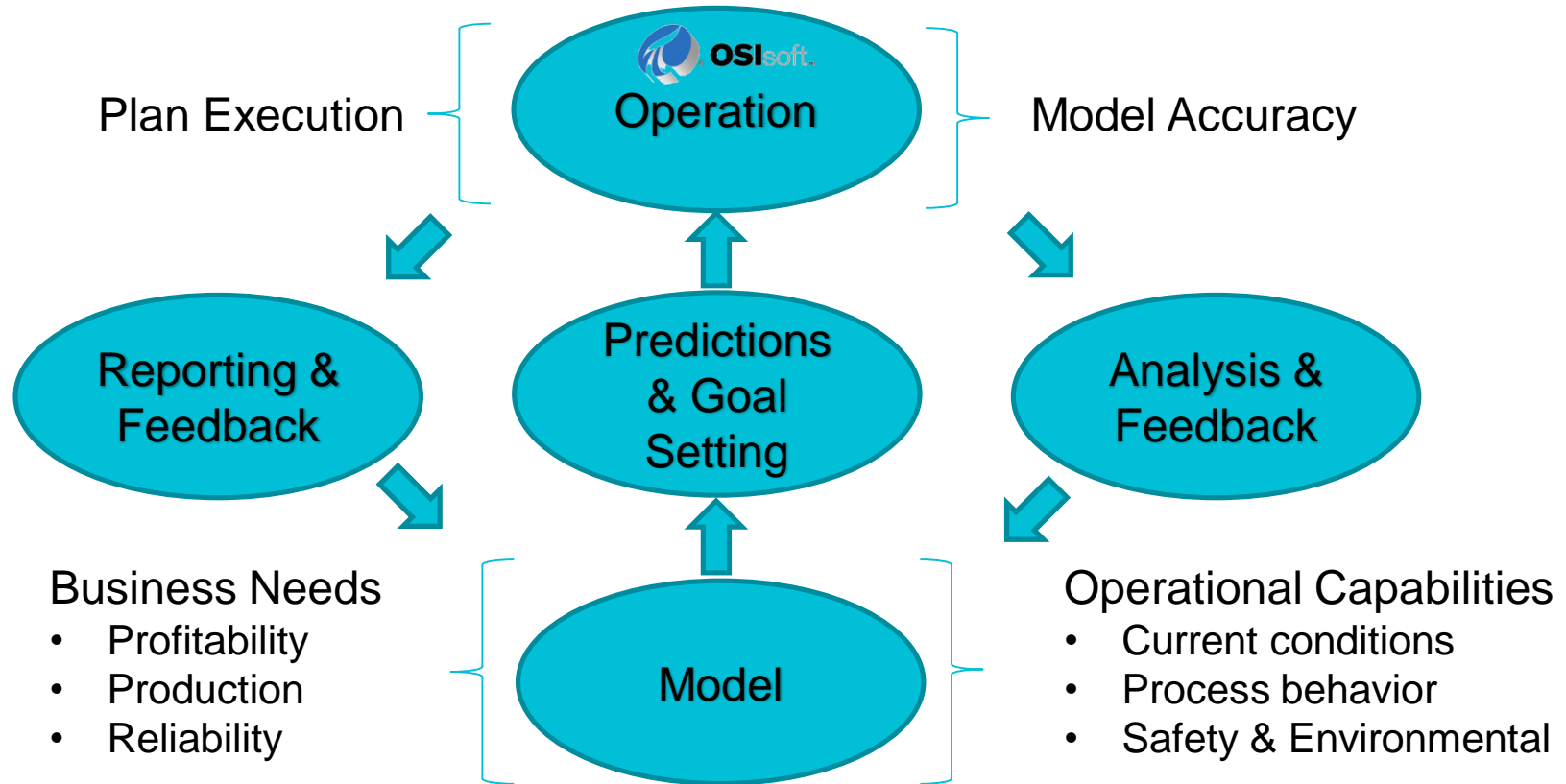
Planning & Forecasting
Equipment/Unit/System Performance

Overview of Situation

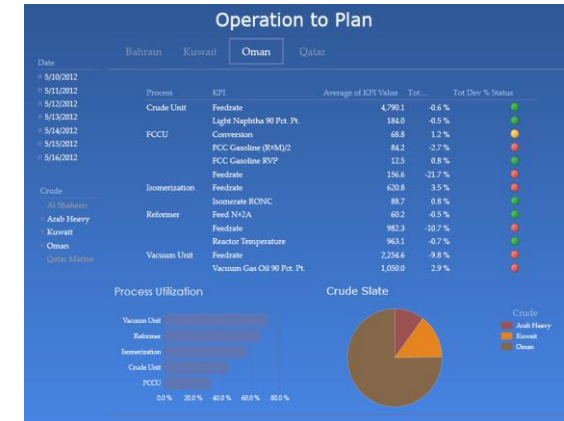
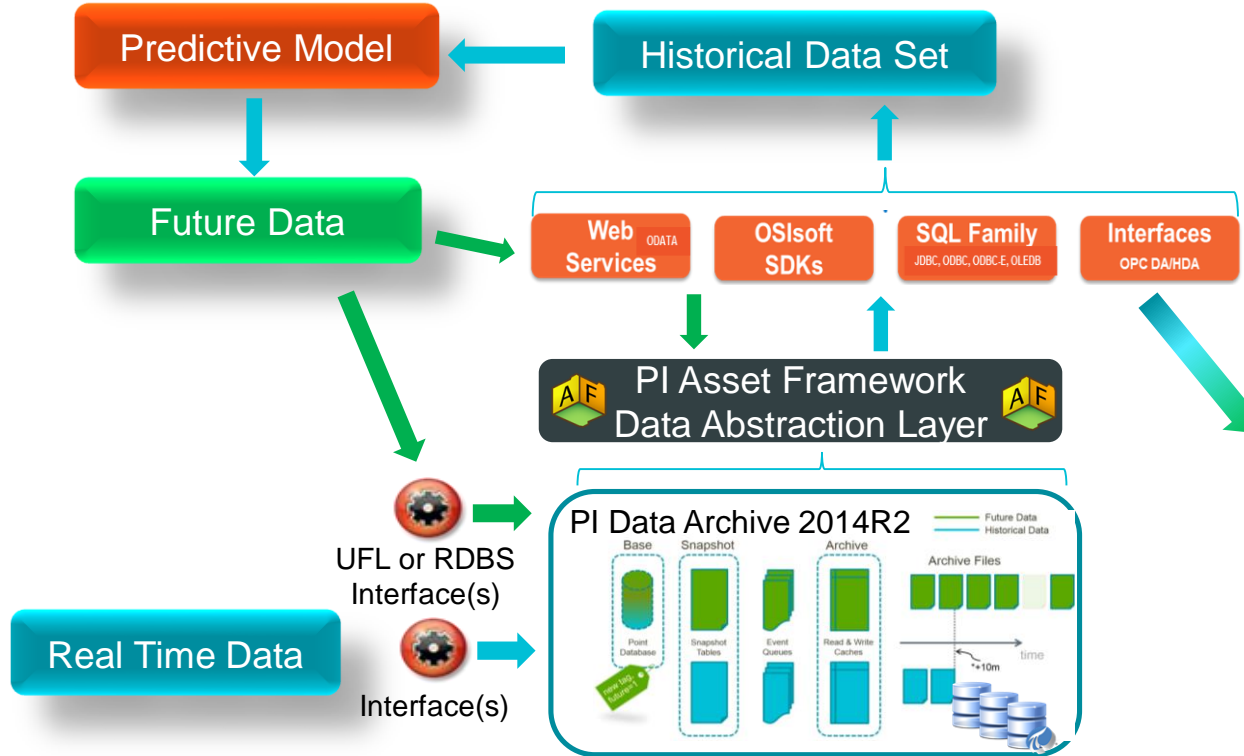


SIMSCI

Continuous Improvement Process



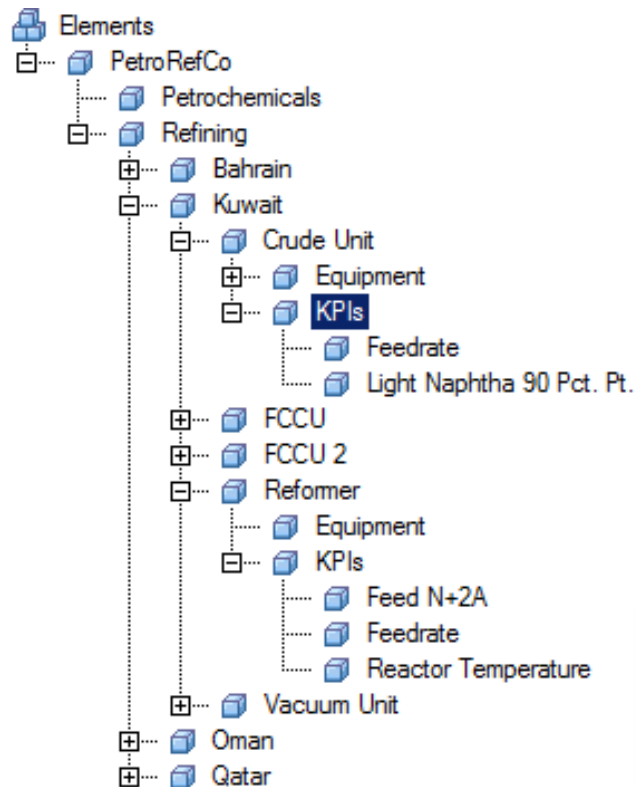
Conceptual Data Flow



Reporting to Scale – *PI AF*

Asset Hierarchy

- Plant
- Process
- KPI



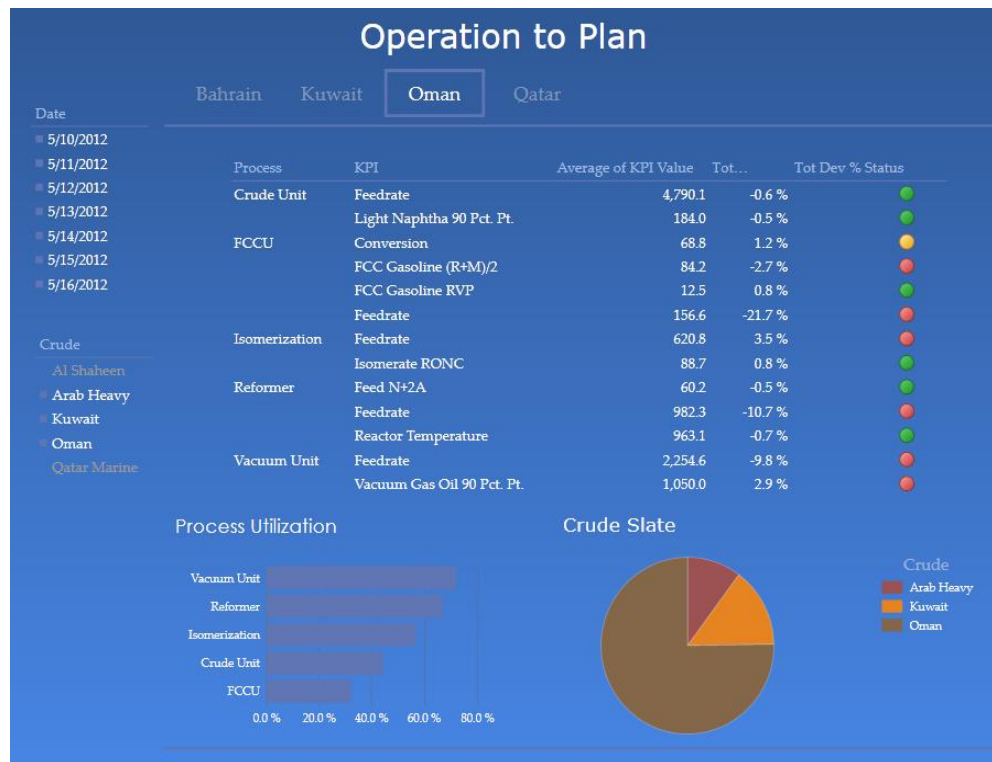
“KPI Total” Template

	Name	Value
Category:	Operating Plan Data	
	Operating Plan Target	16700 bbl
Category:	Process Data	
	Hourly Throughput	16761.332951708042
	Process Value	401676.21875 bbl/d

“KPI Laboratory” Template

	Name	Value
Category:	Operating Plan Data	
	Operating Plan Target	175 °F
Category:	Process Data	
	Laboratory Value	177.199996948242 °F

Plan Execution Reporting



Model Accuracy Analysis

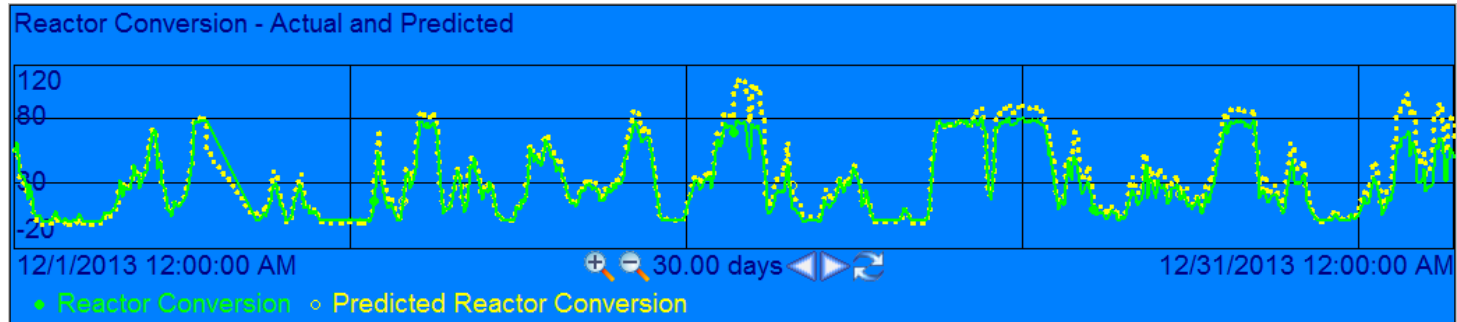
PI Data Archive 2014 R2



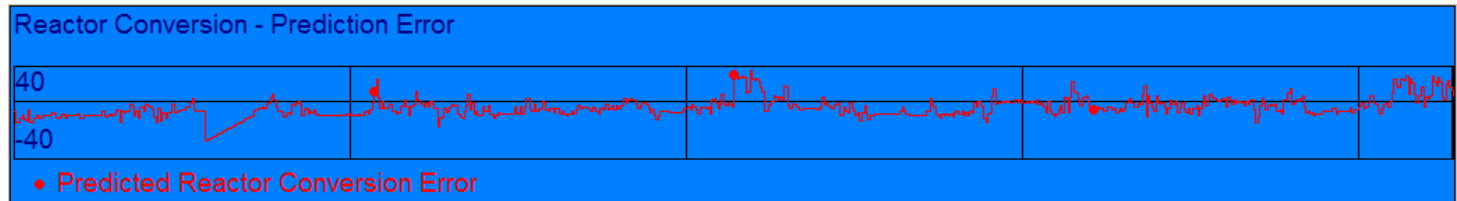
Model Improvement Opportunity

Leveraging Real Time Data for Prediction Improvement

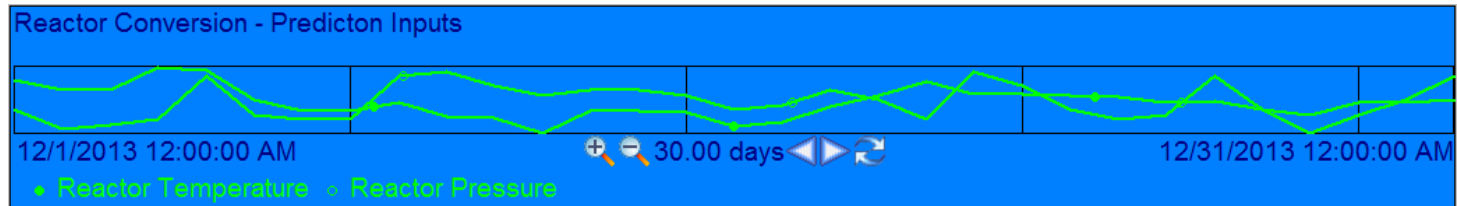
Actual
& Predicted



Prediction
Error



Affecting
Conditions



PI Analytics 2014

FCCU

General Child Elements Attributes Ports Analyses Version

Name Backfilling

Prediction Error

Name: Prediction Error

Description:

Categories:

Analysis Type: ☒ Expression ☐ Rollup ☐ Event Frame Generation

↑ ↓ Evaluate

Name	Expression	Value	Output Attribute
Calculation	<code>TagVal('Conversion','*')-TagVal('Predicted Conversion','*')</code>	31.53993	Predicted Conversion Error

`TagVal('Conversion','*')-TagVal('Predicted Conversion','*')`

Evaluated at 3/19/2014 7:47:37 AM

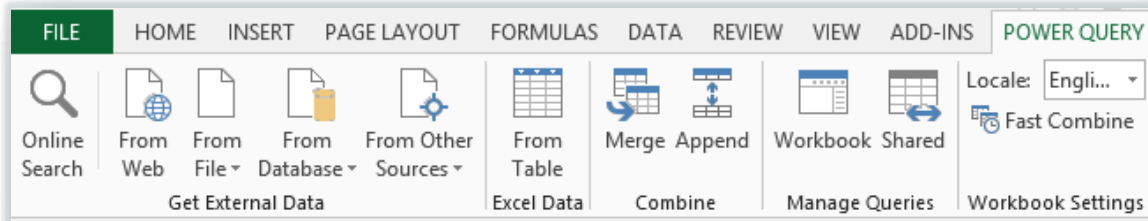
Scheduling: ☐ Event-Triggered ☒ Periodic

Period: 00h 01m 00s [Configure](#)

Attributes

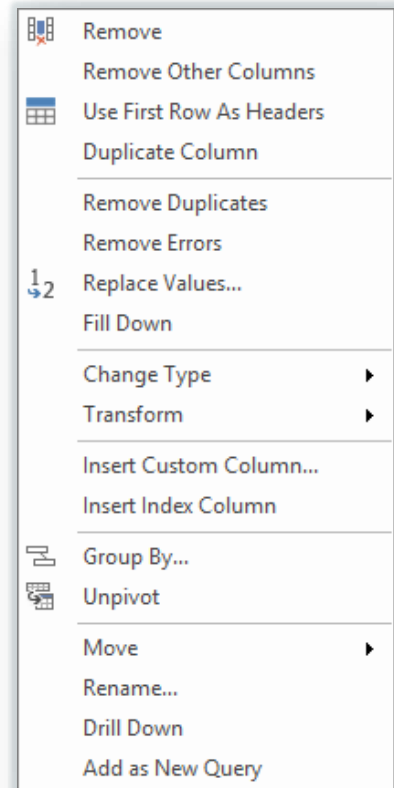
Connected to the PI Analysis Service.

Power Query for Excel 2013



Free Add-In for Excel 2010 or 2013

- Access to useful data sources
 - OData Feeds, like the PI OData feature of the PI Web API
- Shape datasets for Power View analysis
 - Remove columns and filter rows
 - Insert calculated columns
 - Reformat text and numeric data
 - Append and merge



PI Web API's OData Feature

CTP available on vCampus

- Connect to PI AF by URL
- Easy navigation to AF attribute data by element template
- Dataset types
 - Snapshot
 - Archive
 - Interpolated
 - Summaries

<http://localhost/PIOData/WindFarms/T>

The screenshot displays the PI Web API OData interface. A table titled "SiteInterpolations" is shown, containing data for various time intervals. The table has four columns: Time, GenerationPrediction, Generation, and Humidity. The data is for the date 2/23/2014, ranging from 12:00:00 AM to 8:00:00 AM. The GenerationPrediction values range from 93.036072 to 9.522457, and the Humidity values range from 92 to 94.

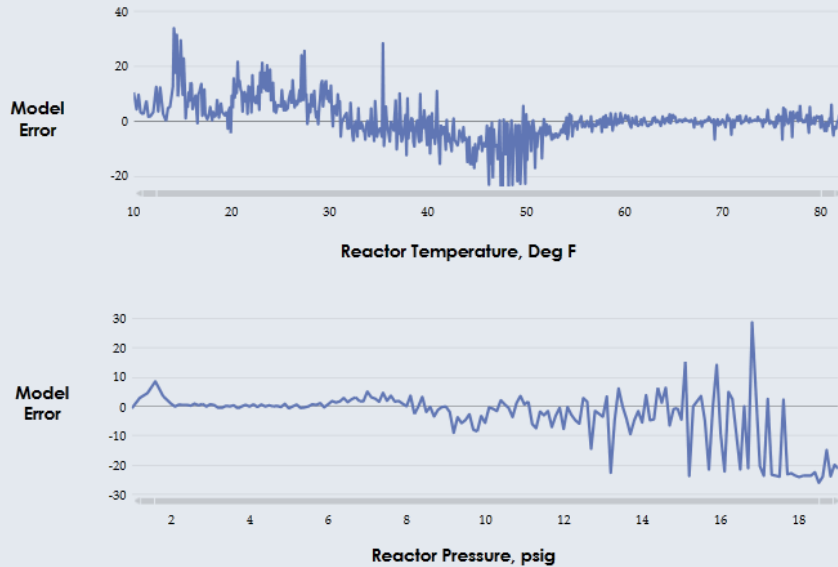
Time	GenerationPrediction	Generation	Humidity
2/23/2014 12:00:00 AM	93.036072	14.408216	92
2/23/2014 1:00:00 AM	90.036072	14.143168	92
2/23/2014 2:00:00 AM	74.036072	13.878119	92
2/23/2014 3:00:00 AM	55.536076	13.613071	92
2/23/2014 4:00:00 AM	39.036076	13.348023	92
2/23/2014 5:00:00 AM	26.036074	13.082975	94
2/23/2014 6:00:00 AM	13.022457	12.817926	94
2/23/2014 7:00:00 AM	8.022457	12.552878	94
2/23/2014 8:00:00 AM	9.522457	12.28783	94

Below the table, the columns are listed: Columns [17] StartTime, EndTime, TimeStep, SiteID, SiteName, Time, GenerationPrediction, Generation, Humidity, Latitude, Longitude, Temperature, WindDegrees, WindSpeed, WindDirection, Capacity, Site.

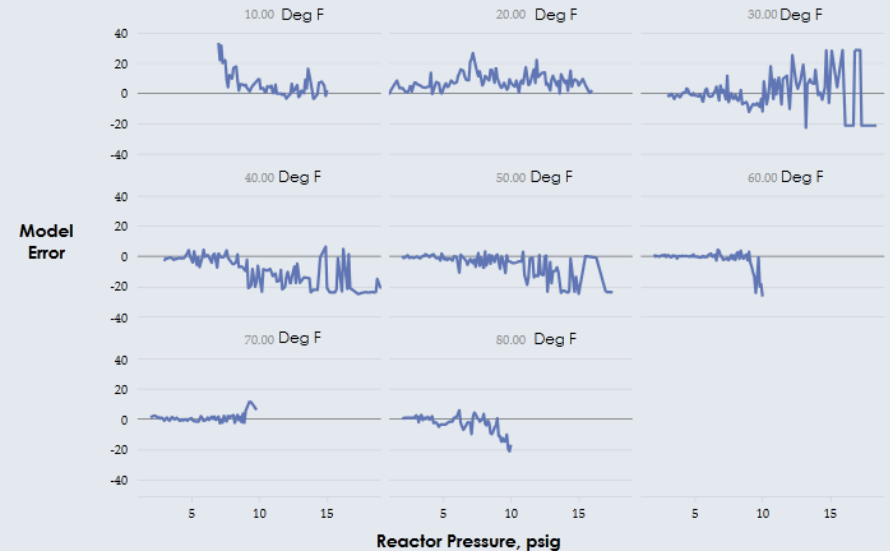
The sidebar on the right shows a "Navigator" with a list of data sources. The selected source is "http://localhost/piodata/windfarms/t". The list includes: RegionArchive, RegionInterpolations, Regions, RegionSnapshots, RegionSummaries, SiteArchive, SiteInterpolations (selected), Sites, SiteSnapshots, and SiteSummaries.

Analyzing Model Accuracy

Affecting Variables vs. Prediction Error



Model Error vs. Pressure by Temperature Range

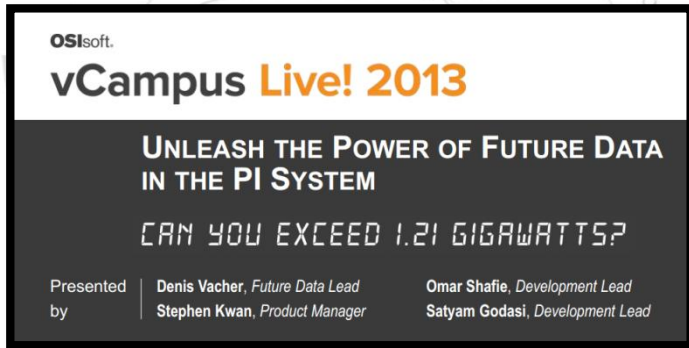


PI Data Archive 2014 R2 “DeLorean”



September 2013

⇒ Sneak peak, user validation

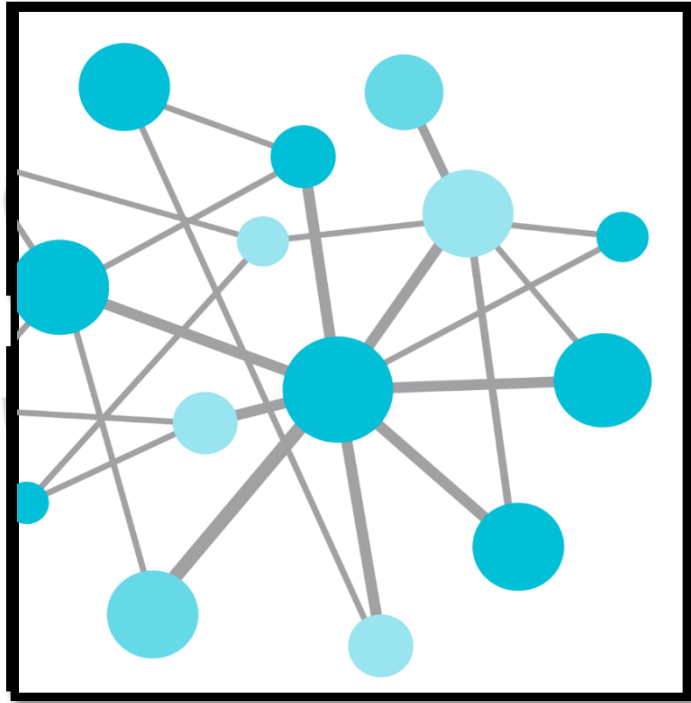


December 2013

⇒ Programming Hackathon

⇒ Demos & developer feedback

PI Data Archive 2014 R2 “DeLorean”

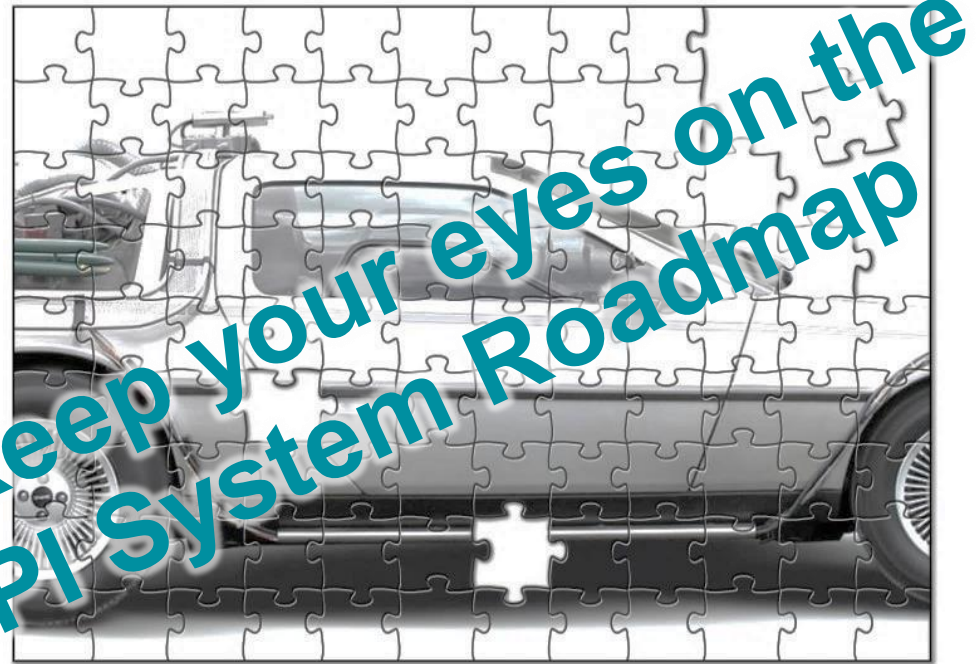


2014

- ⇒ Q2: vCampus CTP
 - storage preview
- ⇒ Q3: Beta Program
 - storage feature complete
- ⇒ Release

System-Wide Future Data

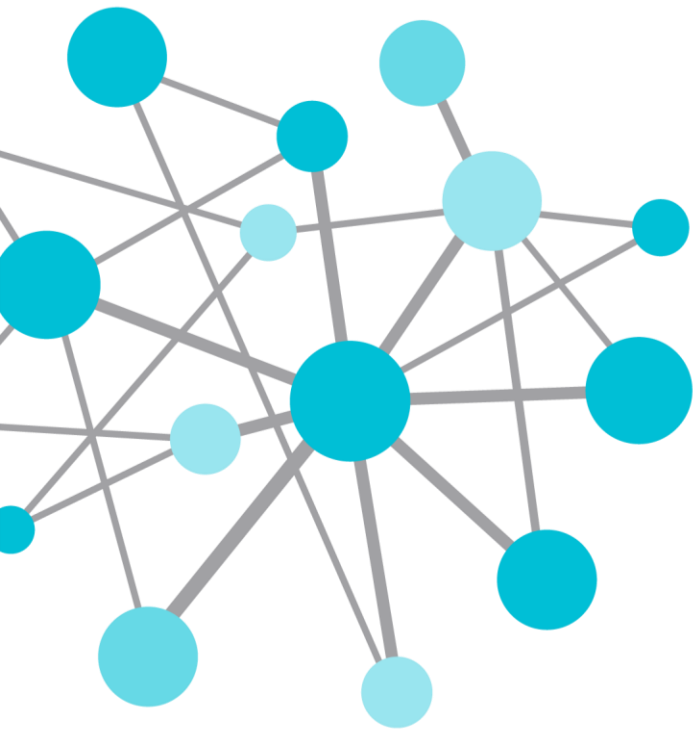
- PI Interfaces/Connectors
 - Data In/Out
- PI Server
 - AF and Analytics
- Programmatic Access
 - PI AF SDK, Web API, ...
- Clients
 - PI DataLink, PI Coresight, ...



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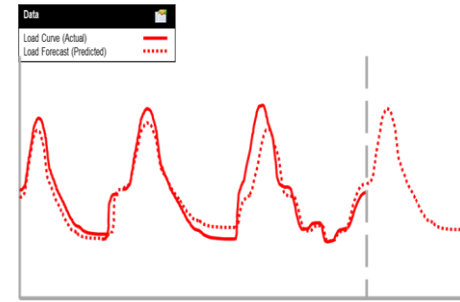


THANK
YOU

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Agenda

- The What and Why of Future Data?
- What are sources and uses of Future Data?
- Examples in Predictive Analytics
- Closing Comments
- Q&A

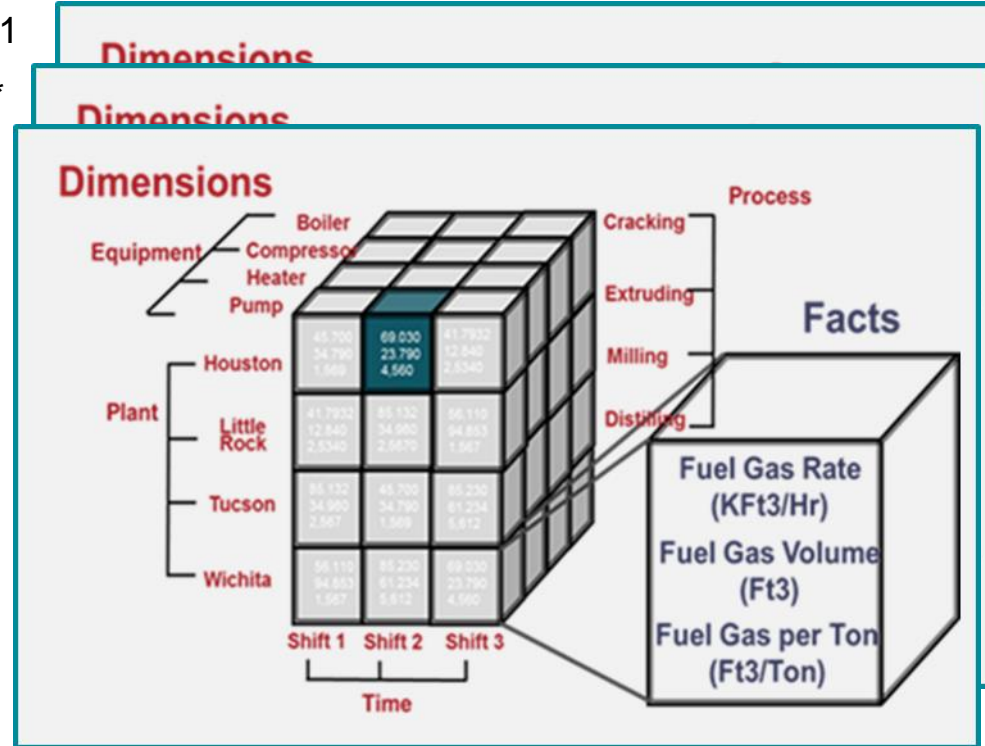
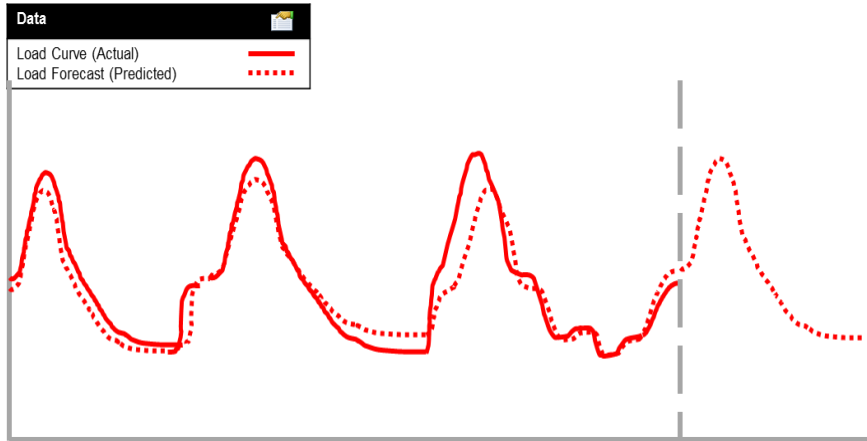


Adding the 4th Dimension to the Cube..

Time *-1

Time *

Future Time * +1



More Examples of PvA BI

Closing Comments

- Future Data Enabled Predictive Analytics
- Xxxx
- Xxxx
- Xxxx
- Participation in Beta Test – “opportunity to help shape the Future of Future Data”



FUTURE DATA

*"As a plant operator or manager,
I want to record and visualize forecast data with our PI System
so we can see how we are doing right now and
anticipate both risks and opportunities."*

BETTER DECISIONS

*"As a maintenance engineer,
I want to manage our equipment service schedule in our PI System
so that we operate our facility more efficiently
while minimizing equipment failures and downtimes."*

HIGHER EFFICIENCY

*"As a process or lab engineer,
I want to use predictive analytics with all data from our PI System
in order to generate and optimize production techniques
while researching future products and production techniques."*

DEEPER INSIGHTS

Conceptual Data Flow

