



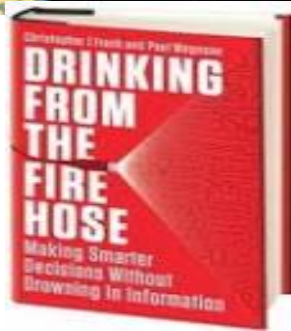
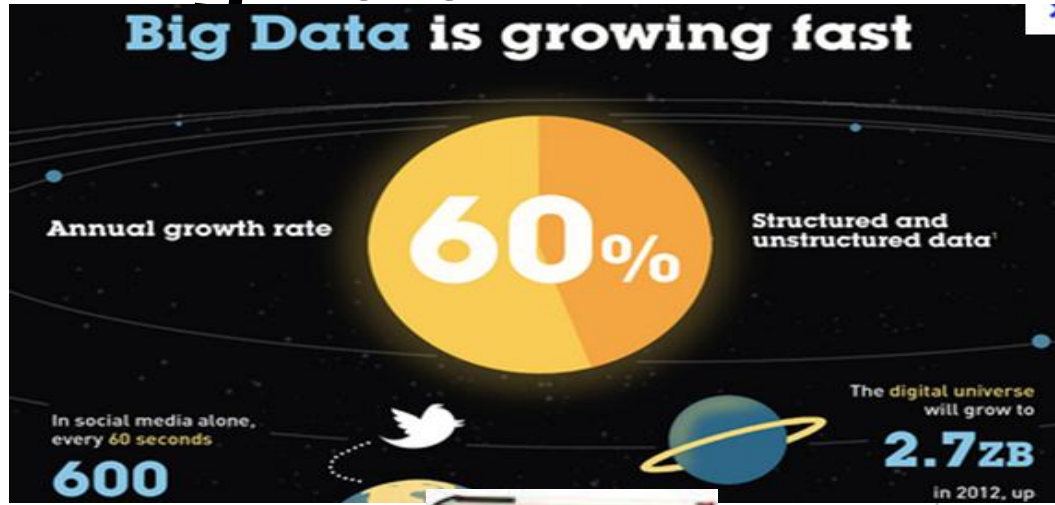
OSIsoft®  
**REGIONAL**  
**SEMINARS** 2013  
The **Power** of **Data**



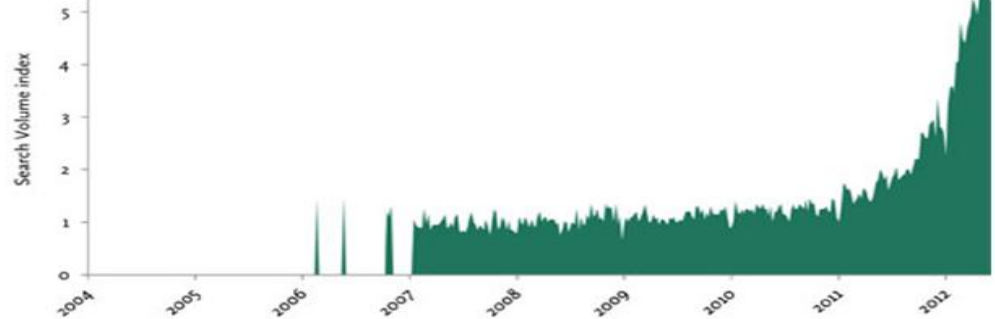
# Operational Insight: Using Self-Service Technologies to Do More with the PI System

Presented by **Martin Bryant & Ales Soudek, OSIsoft**

# Big Data



Google Search Weekly Volume for "Big Data"  
1/1/04 to 6/3/12



# The Super Bowl indicator...

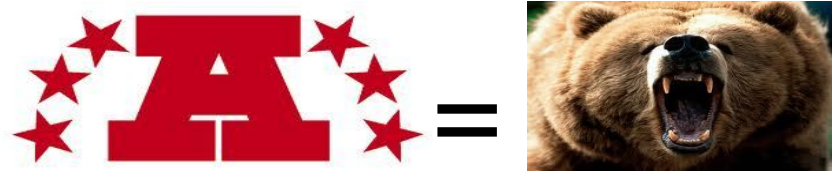
A correlation recognized by a sportswriter in the 70s when it had never failed that

If a team from the old American Football League (current AFC) wins the Super Bowl – this foretells a decline in the overall value of the stock market in the coming year (as measured by the Dow Jones Ind Avg)

However if a team from the old NFL (current NFC division) wins – the stock market overall value will rise.

By 1997 – the “Super Bowl indicator” was 90% accurate. The indicator went 0-4 in the years 1998-2001, and 4 for 5 in the years 2002-2007. Those who bet on the New York Giants win in 2008 took a big time bath as the market suffered it’s greatest downturn since the great depression.

Currently it is 80% accurate.



# Unstructured Data



**Tag Search**

Basic Search | Advanced Search | Alias Search

PI Server: MBryantE6410 Point Type: Point Class:

Tag Mask: \*RX\*T\*57\* Point Source: Engineering Units:

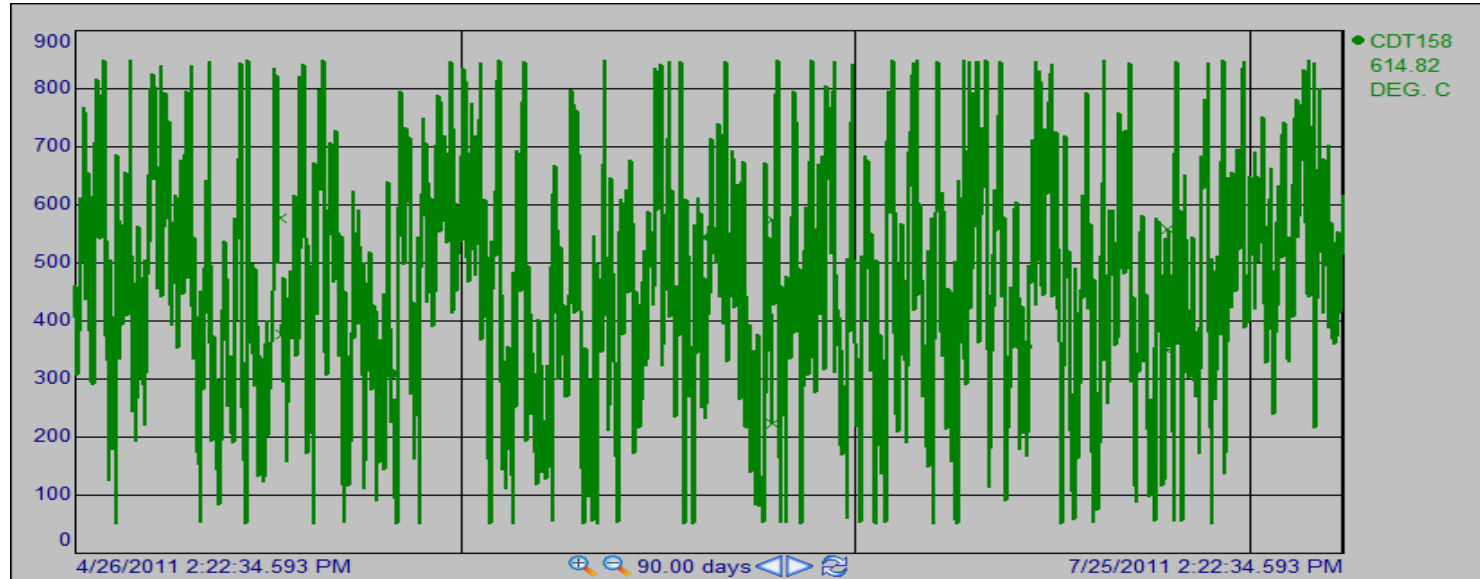
Descriptor: Value:

Server: Tag: Descriptor:

Favorites  
Connections...  
Search  
Abort  
Reset  
Select All  
Pt. Attr...

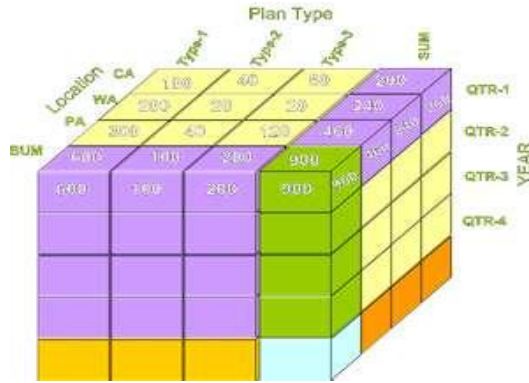
# PI Data more ready for decision making and reporting

Most people are used to thinking of PI like this  
- data over time....



# PI Data more ready for decision making and reporting



















But for decision making – “BI” solutions recommend thinking of data as a cube:



Dimensions of data which are correlated on common values so that different perspectives can be found on the data when it is sorted and presented and analyzed

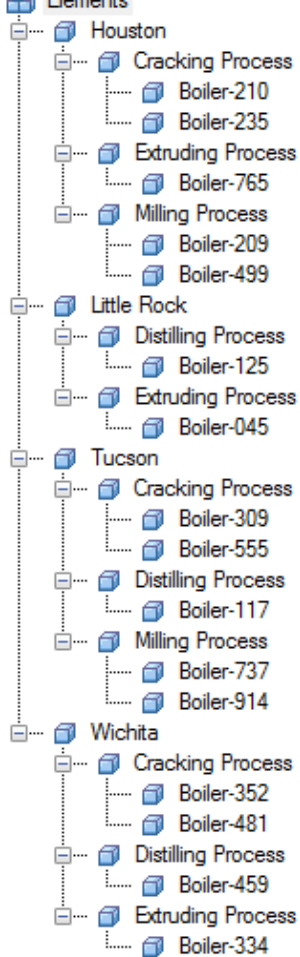
For this – a PI server provides a very valuable dimension – the historical or time based dimension – and it does it better than anything else, but a cube requires more dimensions than just time & tag...

For one dimension we can use our  
PI AF template...

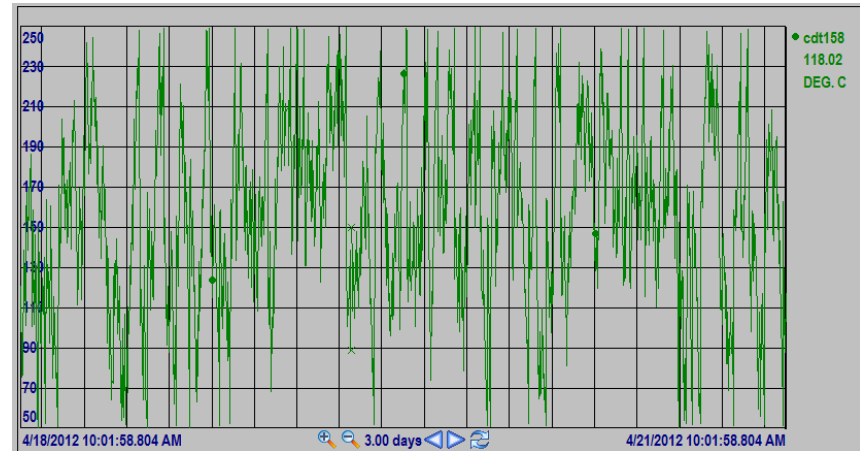
	 Burner	TZ-14
	 Equipment State	Manual
	 Fuel	861.01187173340145
	 Fuel Gas Flow	19.6521072387695 k sft...
	 Installation Date	4/6/1980 9:00:00 PM
	 Make-Up Water ...	2.09466862678528 bbl/d
	 Manufacturer	Swift Brothers
	 Model	STM-305
	 Water	91.77308738940863



**Some attributes are from PI Tags  
others may be from table lookups  
or other meta-data which give us  
context...**



**For another dimension we can use the collection of all of the assets which use that template...**



**And then we can bring in that deep history of PI Data...**

# Sustainability at Safeco Field

- Real-time Operational Awareness
  - Security Office
- Unplanned Event Notification
  - Water Leak
- Operational Systems Costs
  - Stadium Roof Open/Close
- Key Equipment Reliability
  - Stadium Roof Equipment
- Solar Panel Integration
  - Green Operations and Cost Reduction



# Real-time Visualization for Awareness

Now, how can we learn from our experience?

What affects game day power and water consumption?



# AF Structure Required

## Important Considerations

- Leverage structure used throughout the PI System Infrastructure
- Correct aggregation of real-time events
- Scalable, driven from PI AF Structure

The screenshot displays the PI System Explorer application. The left pane shows a tree view of the AF structure under 'Seattle Mariners', including 'Electricity' (with sub-elements F1HW\_H8026-1, F1HW\_H8026-2, F6HW\_H8026-1, F6HW\_H8026-2, F6HW\_H8026-3), 'Gas', 'PI Coresight Aliases', 'Water' (with sub-elements UNT82.CwF, UNT82.CwF\_South, VAV-79.CwF, VAV-79.CwF\_NW), and 'Weather Monitor'. The right pane shows the details for the selected element 'F1HW\_H8026-1', with tabs for 'General', 'Child Elements', 'Attributes', 'Ports', and 'Version'. The 'General' tab is active, showing a table of aggregated values and conversion constants.

Name	Value
Category: Aggregated Values	
10 Minute Total Real Power	1.18896064269541 kWh
10 Minute Total Real Power ...	51.7154379572505 kWh
Average Real Power	7.25391006469727 kW
Consumption	218259 kWh
ConsumptionConv	9494266.5 kWh
Hourly Total Real Power	7.24968556471787 kWh
Hourly Total Real Power Conv	315.36132206522751
Category: Conversion Constants	
Conv	43.5
Category: Converted Power Values	

[illegible]

- Home or away
- Start time

2012 Seattle Mariners Schedule, Box Scores and Splits - Baseball-Reference.com - Windows Internet Explorer

http://www.baseball-reference.com/teams/SEA/2012-schedule-scores.shtml

2012 Seattle Mariners Schedule, Box Scores and Splits

Franchise Encyclopedia | 2012 | Stats | Payroll, Roster & Uniforms | Batting [+] | Pitching [+] | Fielding | **Schedule & Results**

Scoring | Other [+]

## Team Game-by-Game Schedule and Results

Glossary · SHARE · Embed · CSV · PRE · [LINK](#) · ?

Rk	Gm#	Date	boxscore	TEA	OPP	W	R	RA	IN	W-L	Rank	GB	Win	Loss	Save	Time	D/T	Attendance	
1	1	Wednesday, Mar 28	<a href="#">boxscore</a>	SEA	@ OAK	W	3	1	1	1	1	0	1	0.5	Wilhelmsen	Cargiano	3:04	N	44,227
2	2	Thursday, Mar 29	<a href="#">boxscore</a>	SEA	@ OAK	L	1	4	1	1	1	1	Tied	Colon	Kelley	Balfour	2:23	N	43,391
3	3	Friday, Apr 6	<a href="#">boxscore</a>	SEA	@ OAK	W	7	3	2	1	1	1	Tied	Vargas	McCarthy		3:06	N	35,067
4	4	Saturday, Apr 7	<a href="#">boxscore</a>	SEA	@ OAK	W	8	7	3	1	1	up 1.0	1	Hernandez	Colon	League	2:58	N	16,612
5	5	Monday, Apr 9	<a href="#">boxscore</a>	SEA	@ TEX	L	5	11	3	2	2	0.5	Darvish	Noesi		3:12	N	42,003	
6	6	Tuesday, Apr 10	<a href="#">boxscore</a>	SEA	@ TEX	L	0	1	3	3	2	1.5	Felix	Beavan	Nathan	2:23	N	25,753	
7	7	Wednesday, Apr 11	<a href="#">boxscore</a>	SEA	@ TEX	W	4	3	4	3	2	0.5	Luetge	Nathan	League	3:20	N	32,342	
8	8	Thursday, Apr 12	<a href="#">boxscore</a>	SEA	@ TEX	L	3	5	4	4	2	1.5	Holland	Vargas	Adams	2:33	D	31,513	
9	9	Friday, Apr 13	<a href="#">boxscore</a>	SEA	@ OAK	L	0	4	4	5	3	2.5	Colon	Hernandez		3:02	N	46,026	
10	10	Saturday, Apr 14	<a href="#">boxscore</a>	SEA	@ OAK	W	4	0	5	2	2.5	Noesi	Milone		2:29	N	21,071		
11	11	Sunday, Apr 15	<a href="#">boxscore</a>	SEA	@ OAK	W	5	3	6	5	2	2.5	Beavan	Godfrey	League	2:36	D	19,650	
12	12	Tuesday, Apr 17	<a href="#">boxscore</a>	SEA	@ CLE	L	8	9	6	6	2	3.5	Perez	Furbush	Perez	3:33	N	12,461	
13	13	Wednesday, Apr 18	<a href="#">boxscore</a>	SEA	@ CLE	W	4	1	7	6	2	3.5	Vargas	Lowie	League	2:47	N	11,343	
14	14	Thursday, Apr 19	<a href="#">boxscore</a>	SEA	@ CLE	L	1	2	7	7	2	4.5	Tomlin	League	Perez	2:29	N	12,942	
15	15	Friday, Apr 20	<a href="#">boxscore</a>	SEA	@ CHW	L	3	7	7	8	2	5.0	Sale	Noesi		2:45	N	19,947	
16	16	Saturday, Apr 21	<a href="#">boxscore</a>	SEA	@ CHW	L	0	4	7	9	2	5.5	Humber	Beavan		2:17	D	22,472	
17	17	Sunday, Apr 22	<a href="#">boxscore</a>	SEA	@ CHW	L	4	7	7	10	3	6.5	Danks	Milwood	Santiago	2:56	D	19,975	
18	18	Tuesday, Apr 24	<a href="#">boxscore</a>	SEA	@ DET	W	7	4	8	10	3	6.0	Vargas	Scherzer	League	3:01	N	30,073	

4

Internet | Protected Mode: Off

125%

- Attendance
- Time of game
- Win or Loss

# Other Required Information

Excel table  
linked to  
PowerPivot

Safeco Field Utility Consumption - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Add-Ins PowerPivot P1 DataLink P1 AF Builder

PowerPivot Window New Measure Delete Measure Measure Settings PivotTable Create KPI Edit KPI Settings KPIs Create Linked Table Update All Settings Field List Relationship Detection

R28

	A	B	C	D	E	F	G	H	I	J	K
1											
2			Date	Location	Opponent	Game Time	Start Time	Outcome	Innings	Duration	Attendance
15			4/13/2012	Home	Athletics	Night	4/13/12 7:00 PM	Loss	9	182	46,026
16			4/14/2012	Home	Athletics	Night	4/14/12 6:00 PM	Win	9	149	21,071
17			4/15/2012	Home	Athletics	Day	4/15/12 1:00 PM	Win	9	156	19,650
18			4/16/2012	Off	na	Off		Off	0	0	0
19			4/17/2012	Home	Indians	Night	4/17/12 7:00 PM	Loss	9	213	12,461
20			4/18/2012	Home	Indians	Night	4/18/12 7:00 PM	Win	9	167	11,343
21			4/19/2012	Home	Indians	Night	4/19/12 7:00 PM	Loss	9	149	12,942
22			4/20/2012	Home	White Sox	Night	4/20/12 7:00 PM	Loss	9	165	19,947
23			4/21/2012	Home	White Sox	Day	4/21/12 1:00 PM	Loss	9	137	22,472
24			4/22/2012	Home	White Sox	Day	4/22/12 1:00 PM	Loss	9	176	19,975
25			4/23/2012	Off	na	Off		Off	0	0	0
26			4/24/2012	Away	Tigers	Night		Win	9	-1	-1
27			4/25/2012	Away	Tigers	Night		Win	9	-1	-1
28			4/26/2012	Away	Tigers	Day		Win	9	-1	-1
29			4/27/2012	Away	Blue Jays	Night		Win	10	-1	-1

Power Use Profile Water Use Profile Schedule and Statistics

Ready

# PowerPivot Data Tables

PowerPivot for Excel - Safeco Field Utility Consumption.xlsx

Home Design Advanced

Data Type: Format: \$ % +.00 -0.00

Clear All Filters Sort by Column

AutoSum Create KPI

Diagram View Show Hidden Calculation Area

[Event] fx

Date	Month	Hour of...	Elapsed Gam...	Hourly Utility Use	Utility	Attendance Gr...
8/19/12	Aug		16	3	894.6	Electricity
8/19/12	Aug		17	4	593.8	Electricity
8/19/12	Aug		18	5	319.0	Electricity
8/19/12	Aug		19	6	263.6	Electricity
8/19/12	Aug		20	7	251.6	Electricity
8/19/12	Aug		21	8	291.5	Electricity
8/19/12	Aug		22	9	304.7	Electricity
8/19/12	Aug		23	10	301.2	Electricity
8/20/12	Aug		0	-19	303.9	Electricity
8/20/12	Aug		1	-18	278.4	Electricity
8/20/12	Aug		2	-17	270.8	Electricity
8/20/12	Aug		3	-16	270.8	Electricity
8/20/12	Aug		4	-15	280.4	Electricity
8/20/12	Aug		5	-14	275.2	Electricity
8/20/12	Aug		6	-13	268.6	Electricity
Day Game Water Le...						
Day Game ...						
Day Game Water St...						

Utility Consumption Meter Location GameAttendanceOrder GameLocationOrder GameOutcomeOrder Schedule ...

Record: 1 of 725,970

PI System Data – utility meters

PowerPivot fo... Table Tools

Home Design Advanced Linked Table

Data Type: Format: \$ % +.00 -0.00

Clear All Filters Sort by Column

AutoSum Create KPI

Diagram View Show Hidden Calculation Area

fx

Date	Location	Opponent	Game Ti...	Attend...	Duration	Outcome	Start Time
6/6/12	Away	Angels	Night	-1	-1	Win	
6/7/12	Off	na	Off	0	0	Off	
6/8/12	Home	Dodgers	Night	22028	168	Win	6/8/2012 7:00...
6/9/12	Home	Dodgers	Day	30287	189	Loss	6/9/2012 4:00...
6/10/12	Home	Dodgers	Day	34807	183	Loss	6/10/2012 1:0...
6/11/12	Off	na	Off	0	0	Off	
6/12/12	Home	Padres	Night	13084	182	Loss	6/12/2012 7:0...
6/13/12	Home	Padres	Night	13931	166	Loss	6/13/2012 7:0...
6/14/12	Home	Padres	Night	17306	192	Loss	6/14/2012 7:0...
6/15/12	Home	Giants	Night	29818	165	Loss	6/15/2012 7:0...
6/16/12	Home	Giants	Night	30589	169	Win	6/16/2012 7:0...
6/17/12	Home	Giants	Day	40603	185	Win	6/17/2012 1:0...
6/18/12	Away	Diamondbacks	Night	-1	-1	Loss	
6/19/12	Away	Diamondbacks	Night	-1	-1	Win	
6/20/12	Away	Diamondbacks	Day	-1	-1	Loss	
6/21/12	Off	na	Off	0	0	Off	
6/22/12	Away	Padres	Night	-1	-1	Loss	

Utility Consumption Meter Location GameAttendanceOrder GameLocationOrder GameOutcomeOrder Schedule ...

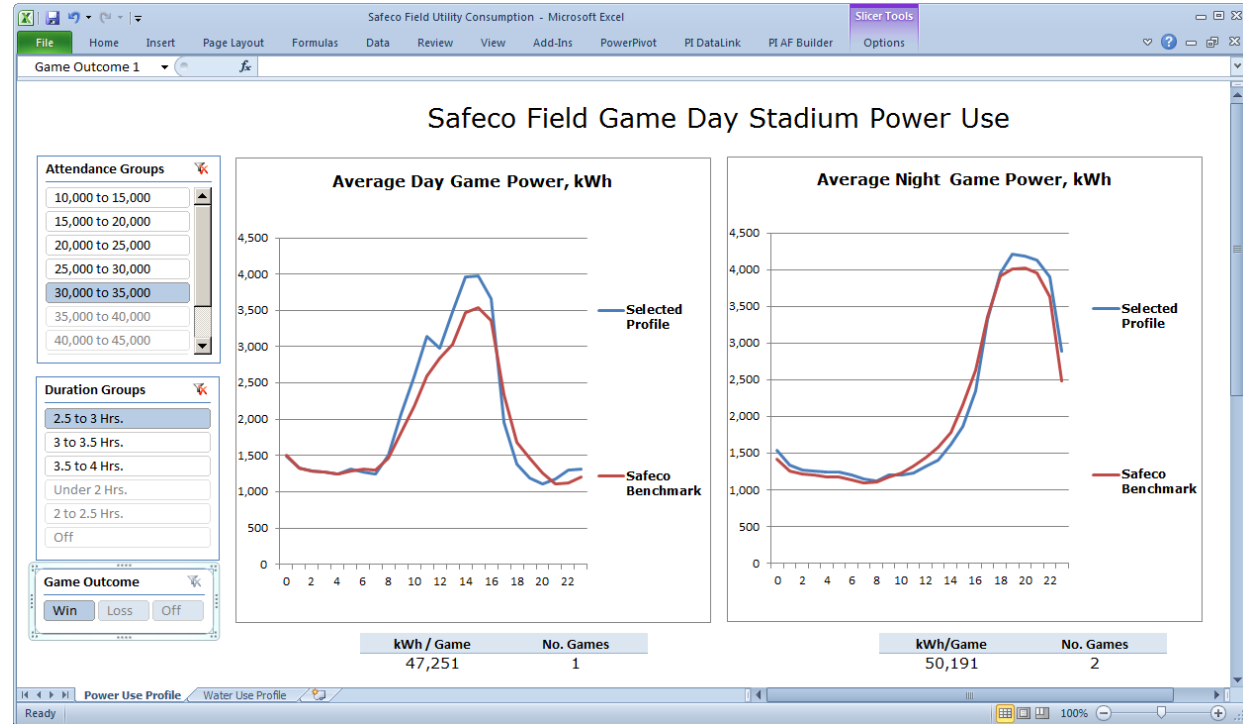
Record: 35 of 145

Internet data – game information

# Utility Use Profile – PowerPivot for Excel 2010

## Benchmarking

- Day and night game profiles
- Benchmark average of all day or night games
- Compare effects of attendance and game duration

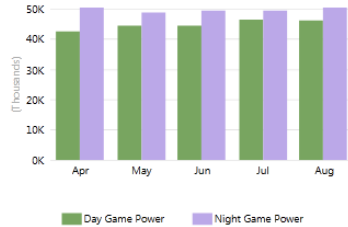


# Season Utility Profiles – Power View

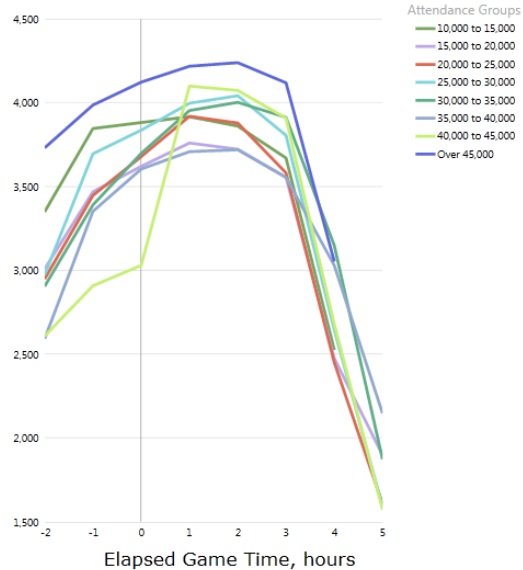
Use by month, time of game and elapsed game time.

## Safeco Field Power Use Profile - 2012 Season

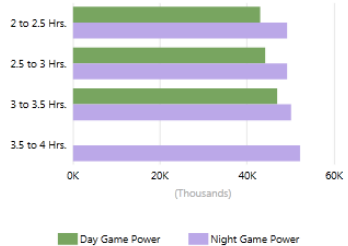
### Use by Month, kWh/game



### Hourly Use by Attendance, kWh/hour

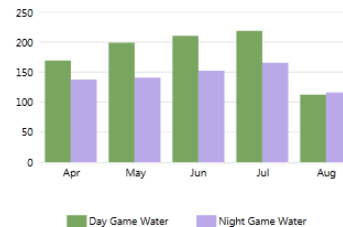


### Use by Game Duration, kWh/game

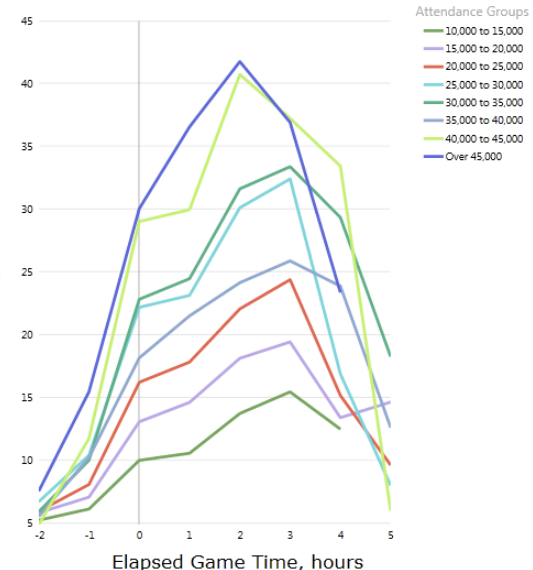


## Safeco Field Water Use Profile - 2012 Season

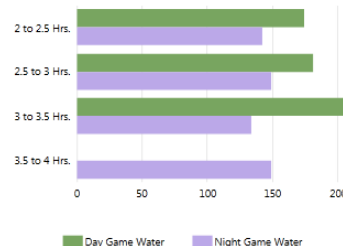
### Use by Month, CCF/game



### Hourly Use by Attendance, CCF/hour



### Use by Game Duration, CCF/game



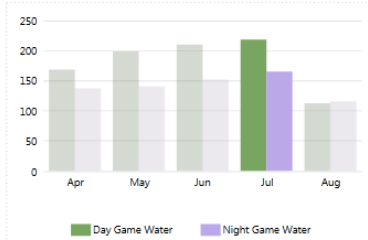
# Season Utility Profile – Selected Conditions

Month of July

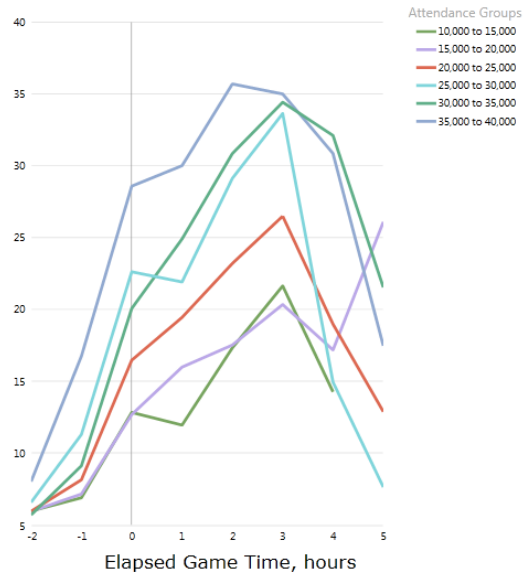
Attendance 25,000 to 30,000

Safeco Field Water Use Profile - 2012 Season

Use by Month, CCF/game

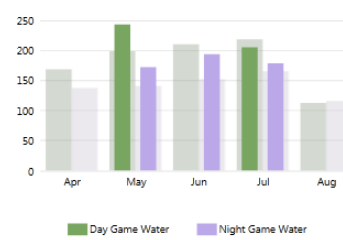


Hourly Use by Attendance, CCF/hour

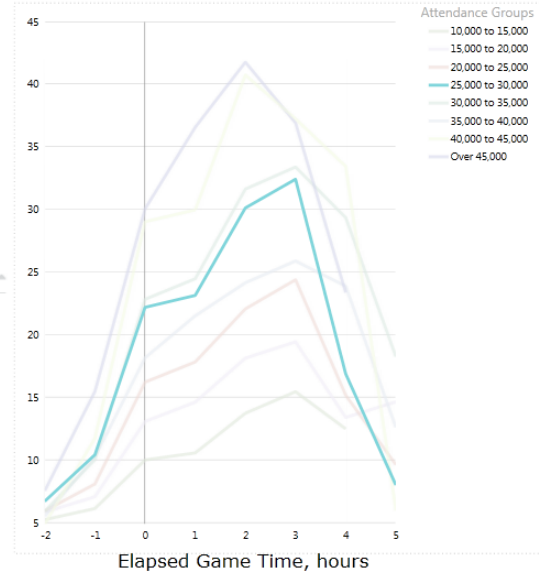


Safeco Field Water Use Profile - 2012 Season

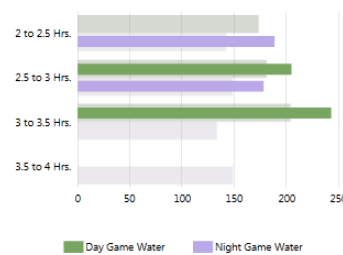
Use by Month, CCF/game



Hourly Use by Attendance, CCF/hour



Use by Game Duration, CCF/game

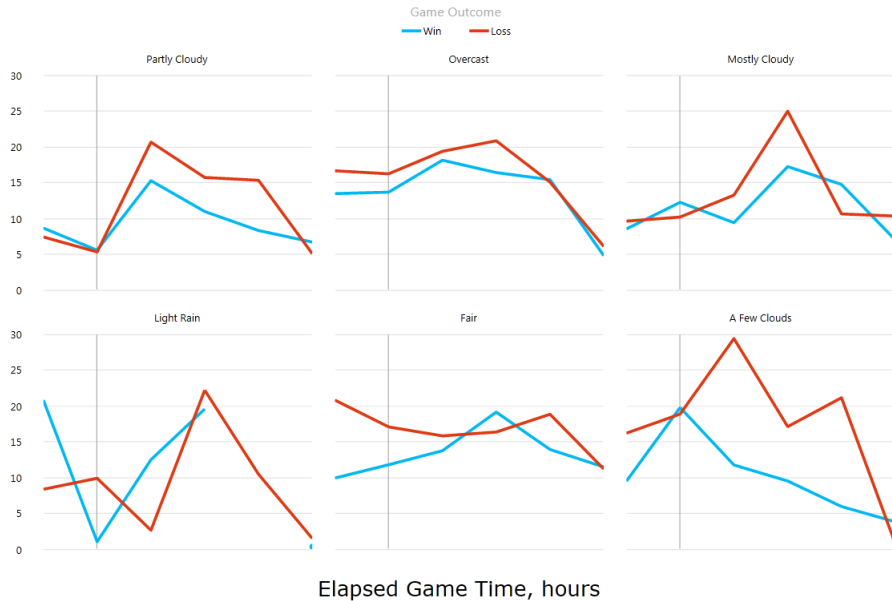


Elapsed Game Time, hours

# Season Utility Profile – Weather Impact

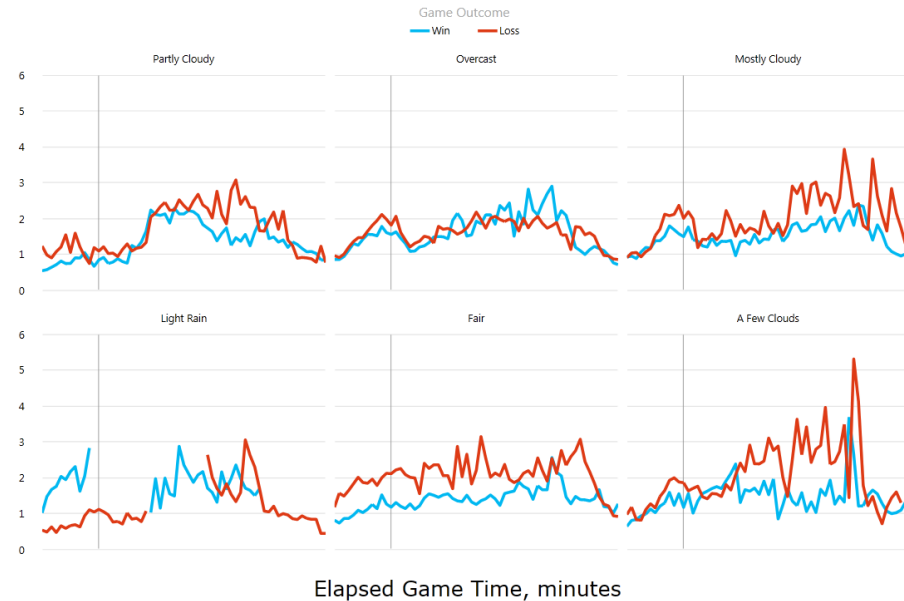
Elapsed Game Time, hrs.

Safeco Field Water Use Profile - Weather Impact



Elapsed Game Time, min.

Safeco Field Water Use Profile - Weather Impact



*Deep, fast process history*

**PI Data**

*Context & Calculations*

**PI AF**

**& Templates**

*SQL Wizards & Connectivity*

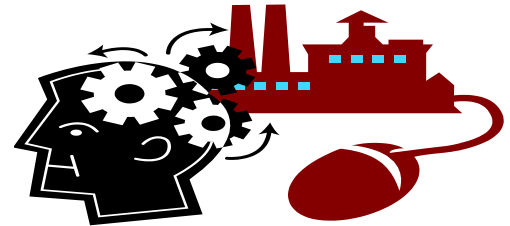
**PI-OLEDB  
Enterprise**

*The World's Leading  
Data Forge*

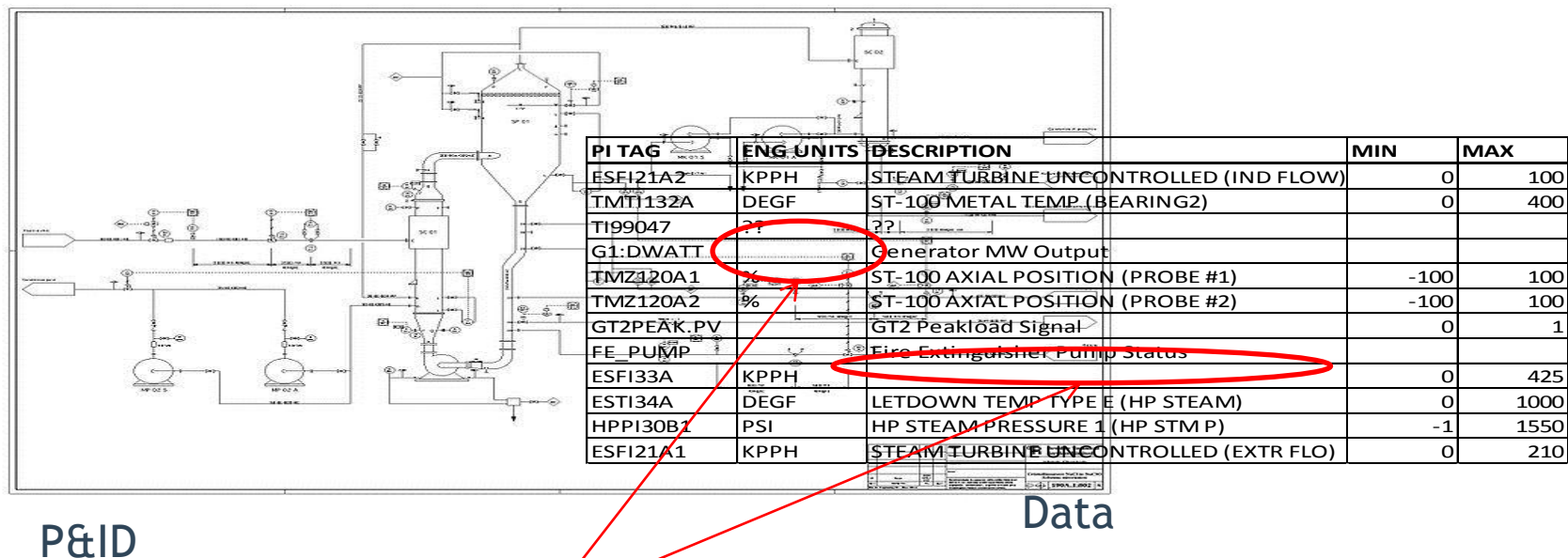
**Power Pivot**  
**For Microsoft  
Excel 2010**

# PI AF

- A database of user configured “Process Object Models” called elements which represent the logical components – the assets – in your process.
- The elements form a data directory “middle layer” for PI clients which **transforms PI data into information.**



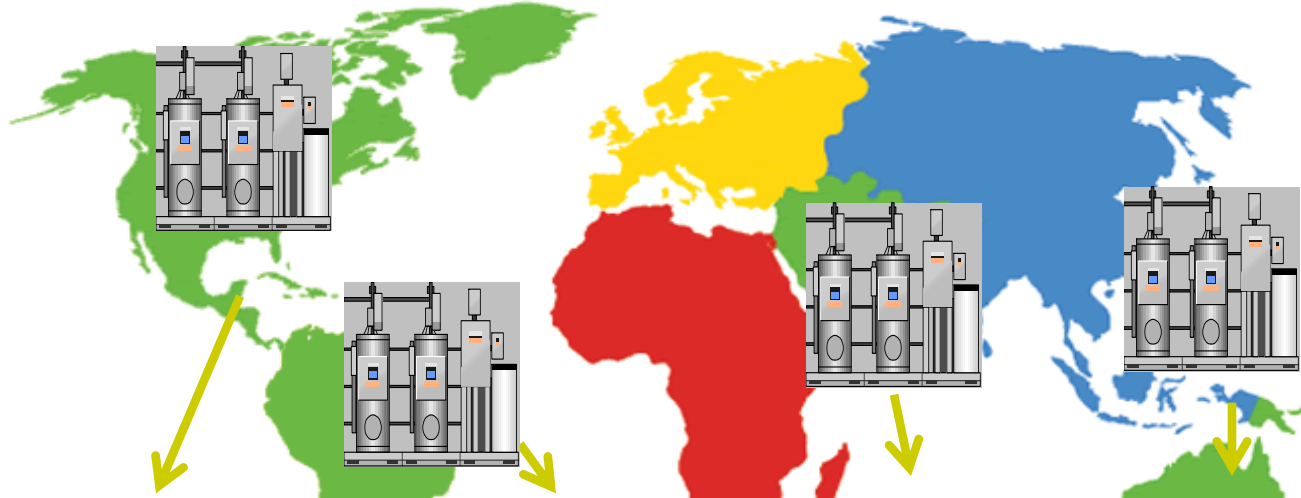
# The complexity of digital instrumentation



Missing or incomplete data - difficult to find what you need

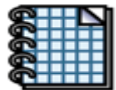
# The process is the same

- the instrumentation is different..



<b>B1:TI333A.pv</b>	<b>\\CalderaA\temp</b>	<b>TE-BLR-996-R</b>	<b>\\BLR_N\MTR47</b>
622 DegF	314 Deg C	611 K	288 Deg C

## PI User Clients



**PI Processbook**



**PI Webparts**

Microsoft Sharepoint



**PI Coresight**

## PI Analytics



**PI Notifications**



**PI Event Frames**

## PI OLEDB/E



Microsoft®  
**PowerPivot**

**Dashboards &  
Reporting**



**PI AF** (Asset Framework)



# PI OLEDB Enterprise

Client side SQL interpreter for PI-AF-SDK

with server side components

- Integrated PI data & PI AF meta-data & calculations with time context
- Delivered as other PI AF SDK data over 5457 & 5459
- Can be “linked in” to SQL Server – but is not direct SQL Server data

## & PI SQL Commander...

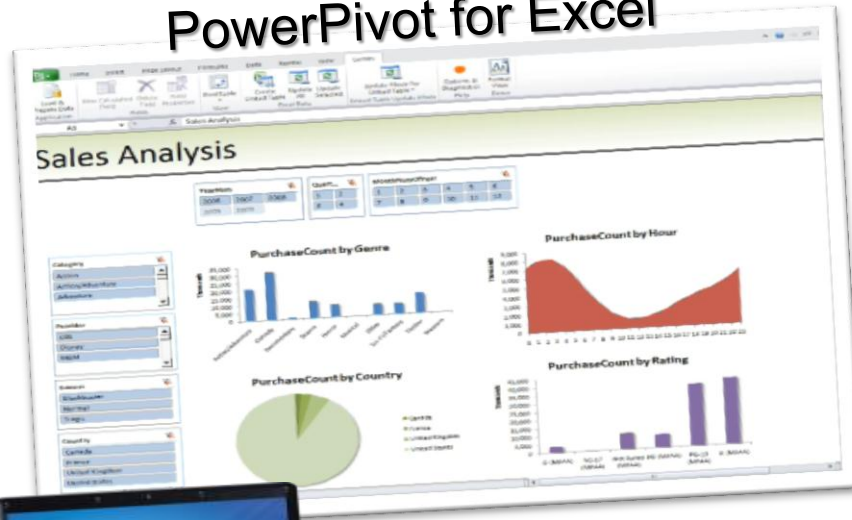
- PI AF Database explorer
- SQL Sample Compendium
- Function Code Generator
- View and Query Manager



# PowerPivot

Powerful in-memory data mashup and data exploration tool providing analytical performance to process billions of rows.

PowerPivot for Excel



Microsoft®  
Excel 2010

PowerPivot for SharePoint



Microsoft®  
SharePoint® 2010  
Microsoft®  
SQL Server® 2012



# Power View



## Highly Visual Design Experience

- Interactive, web-based authoring and sharing of information
- Familiar Microsoft Office design patterns
- Powerful data layout with banding, callout, and small multiples visualizations

## Rich metadata-driven interactivity

- Fully integrated with PowerPivot
- Drive greater insight through smart and powerful querying
- Zero configuration highlighting and filtering
- Animated trending and comparisons



## Presentation-ready at all times

- Presentation and story board turn pervasive information into persuasive information
- Deliver and collaborate through SharePoint
- Interactive PowerPoint runtime

# Microsoft SQL Server BI Evolution

*Increased BI functionality and enterprise-level performance over the last decade*

## Microsoft SQL Server 2005

- Reporting Services
- Report Builder 1.0

## Microsoft SQL Server 2008

- Reporting Services integrated with SharePoint
- Report Builder 2.0

## Microsoft SQL Server 2008 R2

- PowerPivot for Excel
- PowerPivot for SharePoint
- Master Data Management
- Report Builder 3.0

## Microsoft SQL Server 2012

- Power View
- Enhancements in PowerPivot for SharePoint and Excel
- BI Schematic Model
- Data Quality Services
- Excel-Add-in for Master Data Management

# Seamless Transition Across BI Spectrum

## Personal BI

Empowered

### My Context

BI solution created by user.  
Context is only for user & exists  
as document.



PowerPivot For Excel

## Team BI

### Our Context

BI Solution created by power  
user. Context is for a small team  
& it's managed on a server.



PowerPivot For SharePoint

## Organizational BI

Aligned

### The Org's Context

BI Solution created by IT,  
Established corporate context & is  
reusable, scalable and backed up.



Analysis Services



PLEASE  
PAUSE  
FOR  
DEMO

# Office 2013 for BI



## Power View in Excel 2013

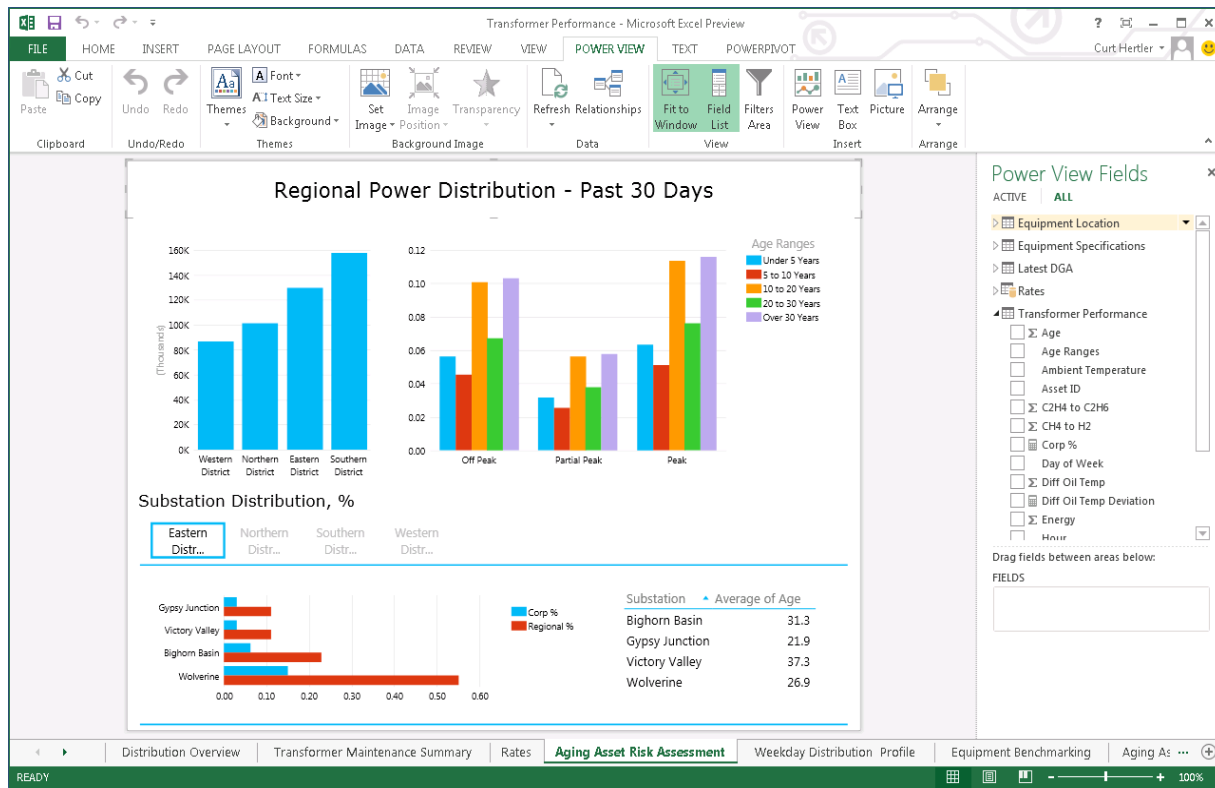
- As Power View in SharePoint 2013
- Interactive data exploration, visualization, and presentation
- Interactive tables, matrices, maps, and a variety of charts

## PowerPivot in Excel 2013

- The PowerPivot Add-In ships as an Excel feature
- Fully integrated engine, Data Model and Field List of Excel

# Power View in Excel 2013

Microsoft  
Power View  
Included with  
Excel 2013

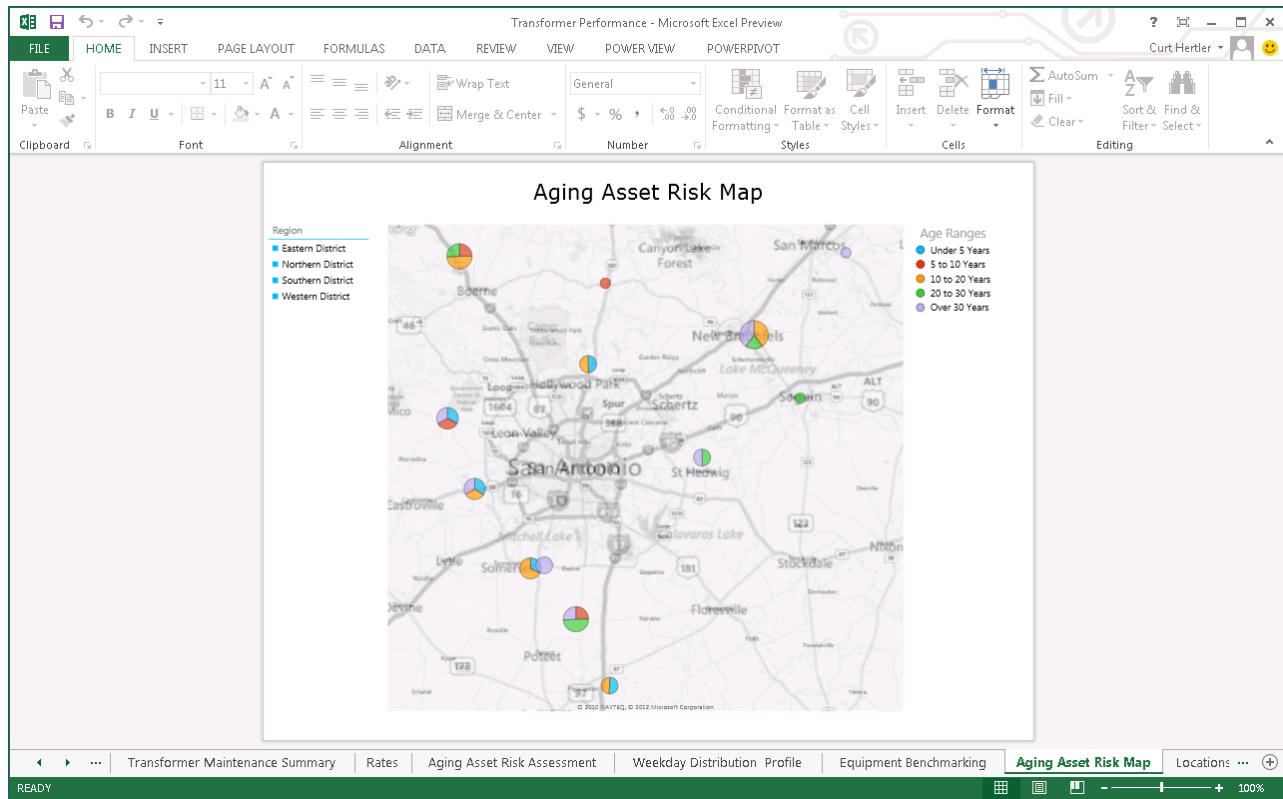


# Power View in Excel 2013

Microsoft  
Power View  
Included with  
Excel 2013

Bing Map  
Integration

- Street Address
- Lat – Long
- Filtered Zoom and Pan



# Additional Information

## OSIsoft Resources

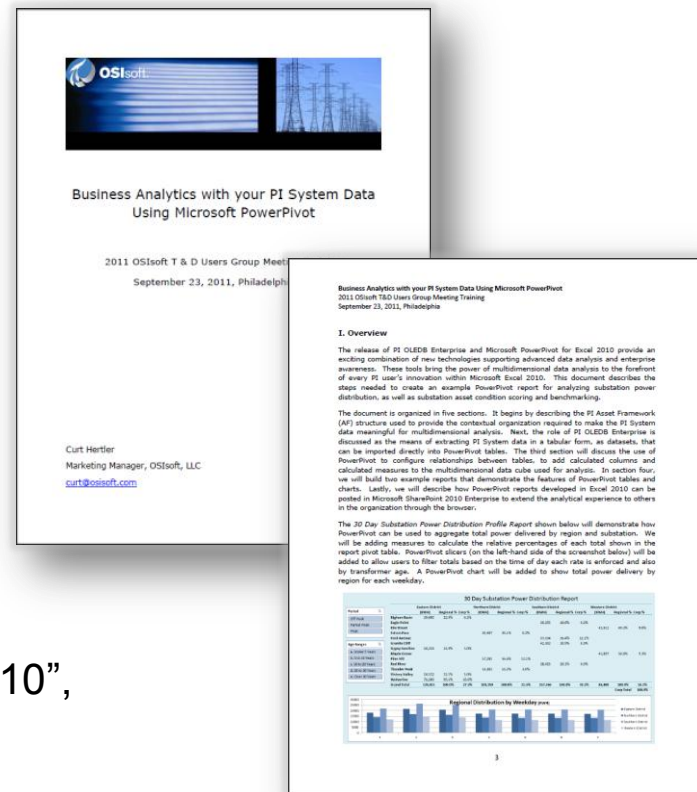
- “Business Analytics with your PI System Data using Microsoft PowerPivot”
- PI T&D Users Group Site [extranet.osisoft.com](http://extranet.osisoft.com)
- OSIsoft vCampus [vcampus.osisoft.com](http://vcampus.osisoft.com)
- For SRP Customers [learning.osisoft.com](http://learning.osisoft.com)

## Microsoft Resources

- [www.microsoft.com/en-us/bi/powerpivot.aspx](http://www.microsoft.com/en-us/bi/powerpivot.aspx)

## Helpful Books

- “PowerPivot for the Data Analyst”, Bill Jelen
- “Practical PowerPivot & DAX Formulas for Excel 2010”, Art Tennick



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# THANK YOU

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