



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

Presented by **Curt Hertler, OSIsoft**

Diamond Sponsor

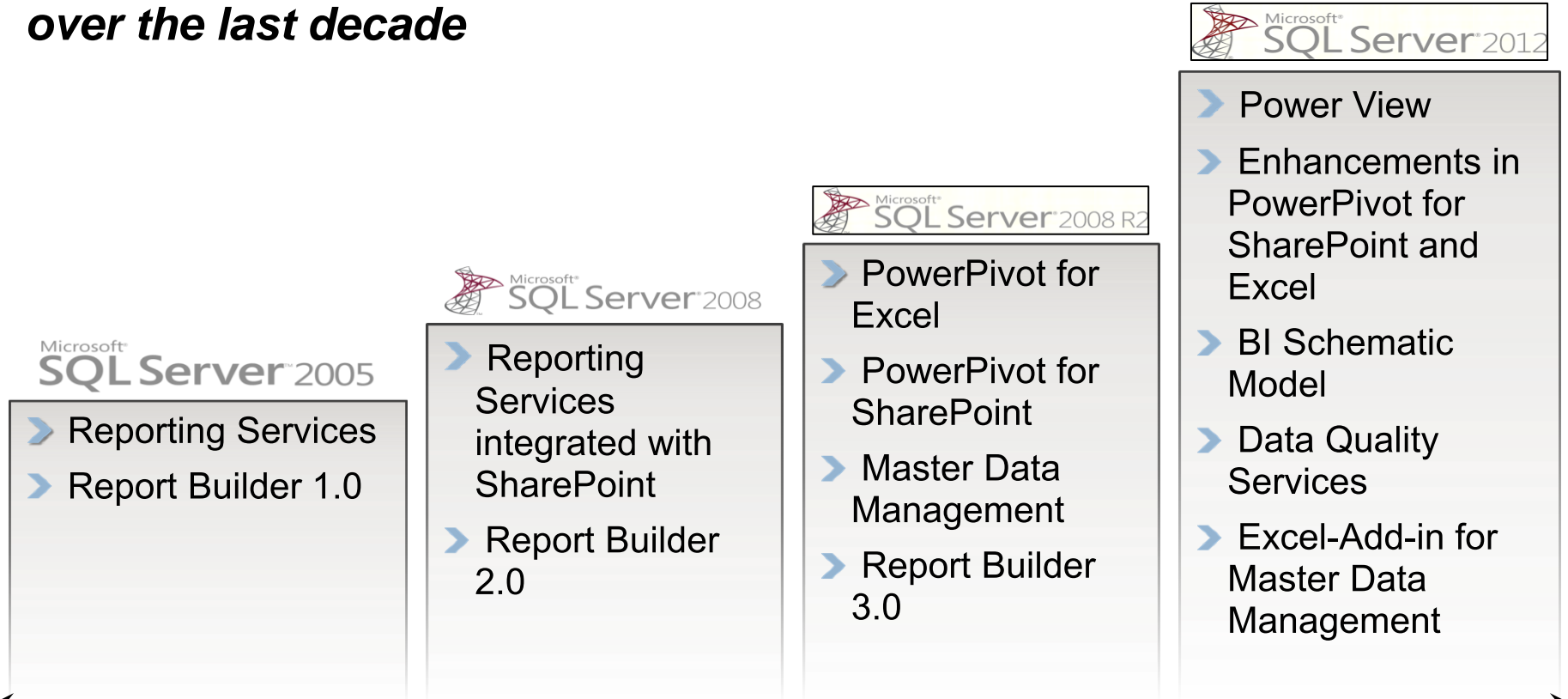
***Microsoft***<sup>®</sup>

# Overview

- Microsoft's Strategy for Business Insight
- OSIsoft's Infrastructure for Operational Insight
  - Business Analytics Toolkit
  - Example: "*Sustainability at Safeco Field*"
  - Demo:
  - ***Coming soon!*** Excel 2013
  - Additional Resources

# Microsoft SQL Server BI Evolution

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



# 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

# Business Analytics Toolkit



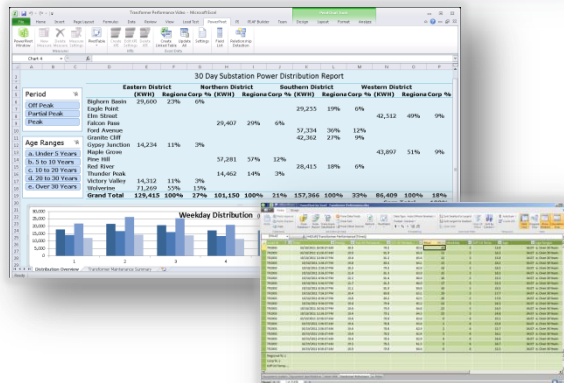
Microsoft

Microsoft®  
Excel 2010

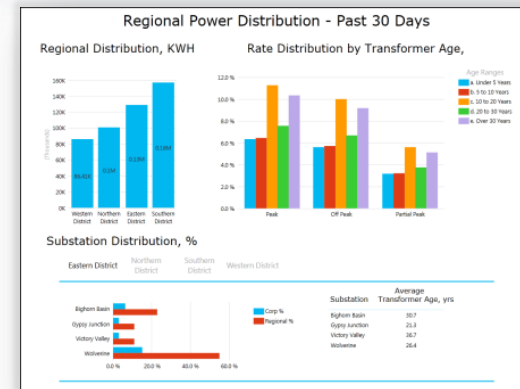
Microsoft®  
SQL Server® 2012  
Business Intelligence

Microsoft®  
SharePoint® 2010  
Enterprise

OSIsoft  
PI Server  
PI OLEDB Enterprise



PowerPivot  
for Excel 2010



Power View

# 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 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	

# Other Required Information



## 2012 Seattle Mariners Schedule

Mariners will open the 2012 season in Japan vs. Oakland on March 28 & 29

SUN	MON	TUE	WED	THU	FRI	SAT
<b>MARCH</b>						
					OAK 7:07	OAK 6:07
	TEX 5:05	TEX 5:05	TEX 5:05	TEX 11:05	OAK 6:10	OAK 6:10
OAK 1:10	CLE 7:10	CLE 7:10	CLE 7:10	CWS 1:05	CWS 1:05	CWS 1:05
CWS 1:10	DET 4:05	DET 4:05	DET 10:05	TOR 4:07	TOR 1:07	TOR 1:07
TOR 10:07	TB 4:10	<b>APRIL</b>				
<b>MAY</b>						
MIN 1:10	DET 7:10	DET 7:10	DET 7:10	MIN 4:05	MIN 1:05	MIN 1:05
NYG 10:05	BOS 4:10	BOS 1:05	CLE 4:05	CLE 9:40	COL 1:10	COL 1:10
COL 12:10	TEX 7:10	TEX 7:10	TEX 12:40	LAA 7:10	LAA 4:15	LAA 4:15
LAA 1:10	TEX 5:05	TEX 5:05	TEX 5:05			
<b>JUNE</b>						
CWS 11:10	LAA 7:05	LAA 7:05	LAA 7:05	LAD 7:10	LAD 4:15	LAD 4:15
LAD 1:10	SD 7:10	SD 7:10	SD 7:10	SF 7:10	SF 7:10	SF 7:10
SF 1:10	ARI 6:40	ARI 6:40	ARI 12:40	SD 7:05	SD 7:05	SD 7:05
SD 1:05	OAK 7:10	OAK 7:10	OAK 12:40	BOS 7:10	BOS 7:10	BOS 7:10
<b>JULY</b>						
KC 1:10	TOR 7:10	TOR 7:10	TOR 7:10			

## Team Schedule

- 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>

Favorites

2012 Seattle Mariners Schedule, Box Scores and Splits

Page

Safety

Tools

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

Internet | Protected Mode: Off

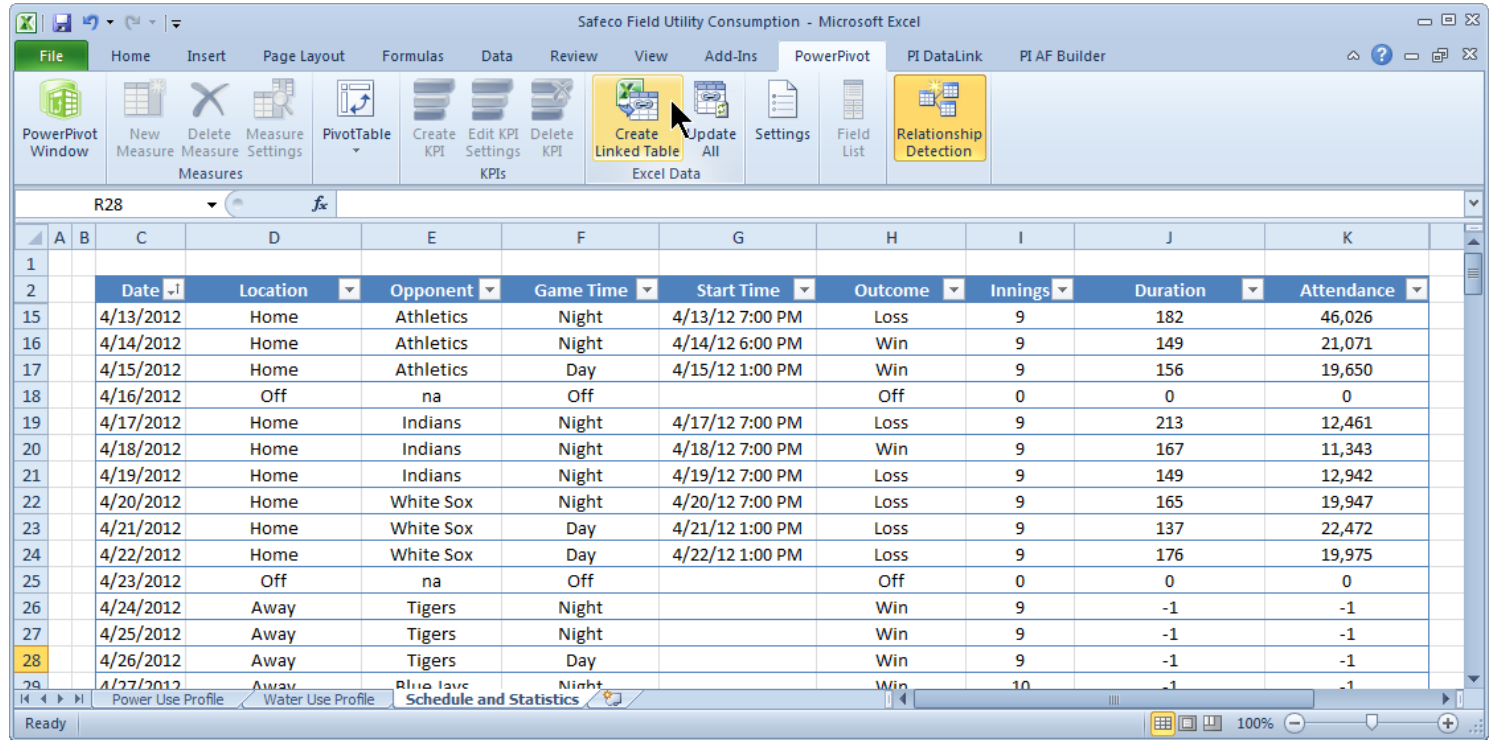
125%

## Team Results

- 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 PI DataLink PI AF Builder

PowerPivot Window New Measure Delete Measure Measure Settings PivotTable Create KPI Edit KPI Settings KPIs Delete KPI 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 100%

# PowerPivot Data Tables

PowerPivot for Excel - Safeco Field Utility Consumption.xlsx

Home Design Advanced

Clipboard: Paste, Get External Data, PivotTable

Formatting: Data Type, Format, \$, %, .00, .00

Sort and Filter: Clear All Filters, Sort by Column

Measures: Create KPI

View: Diagram View, Show Hidden, Calculation Area

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 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

Clipboard: Paste, Get External Data, PivotTable

Formatting: Data Type, Format, \$, %, .00, .00

Sort and Filter: Clear All Filters, Sort by Column

Measures: Create KPI

View: Diagram View, Show Hidden, Calculation Area

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 ...

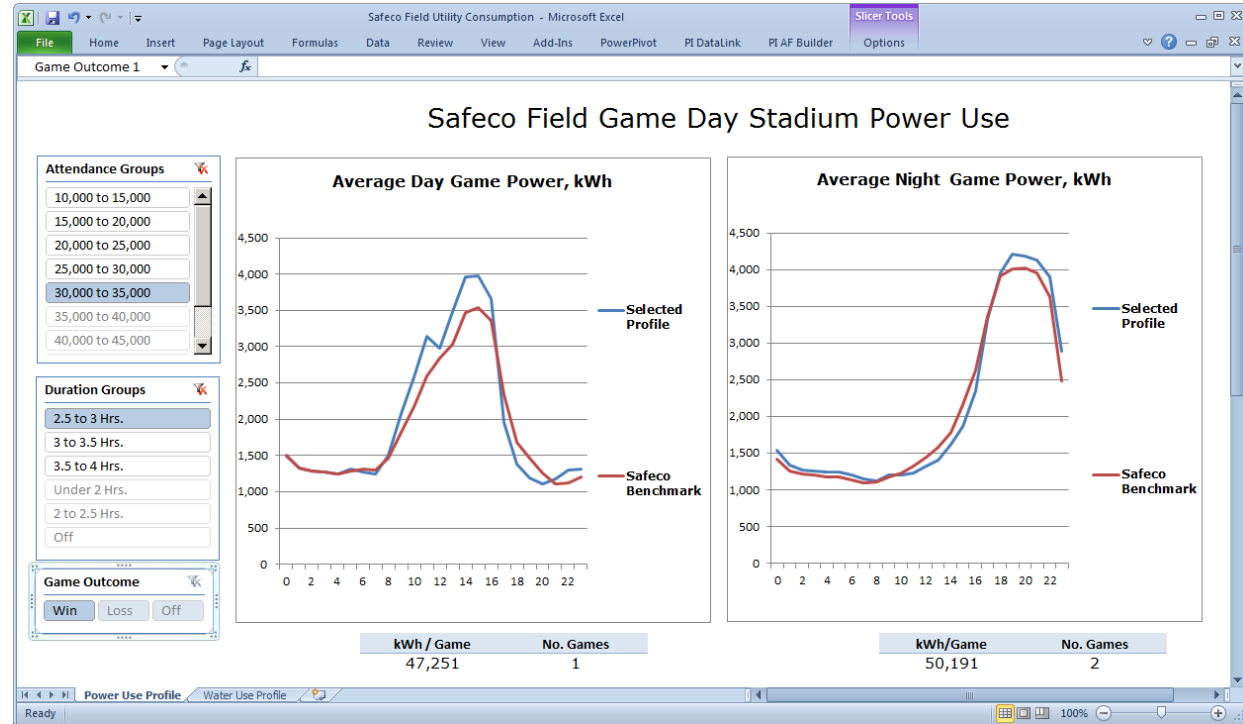
Record: 35 of 145

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



# DEMO

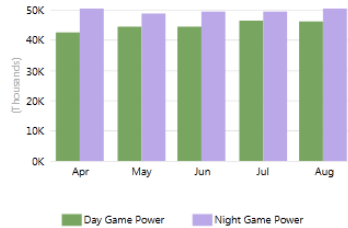
PowerPivot for Excel 2010

# Season Utility Profiles – Power View

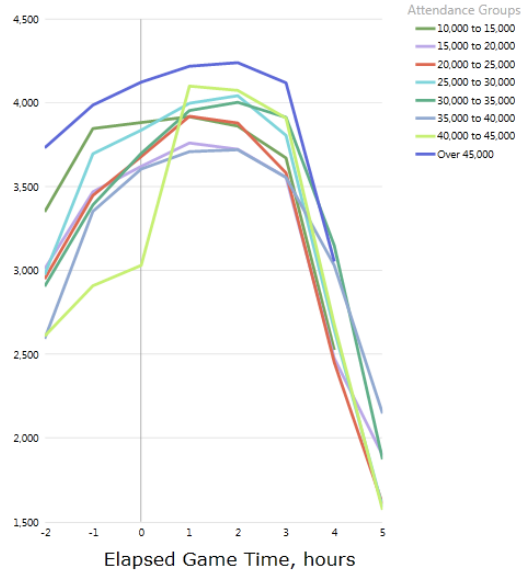
Use by month, time of game and elapsed game time.

## Safeco Field Power Use Profile - 2012 Season

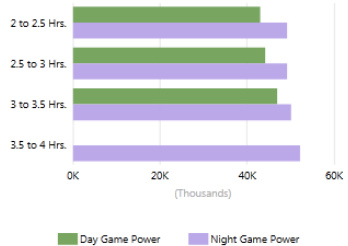
### Use by Month, kWh/game



### Hourly Use by Attendance, kWh/hour

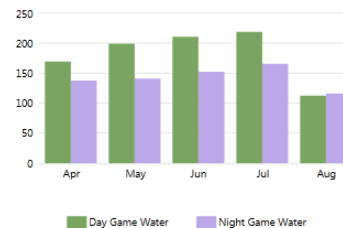


### Use by Game Duration, kWh/game

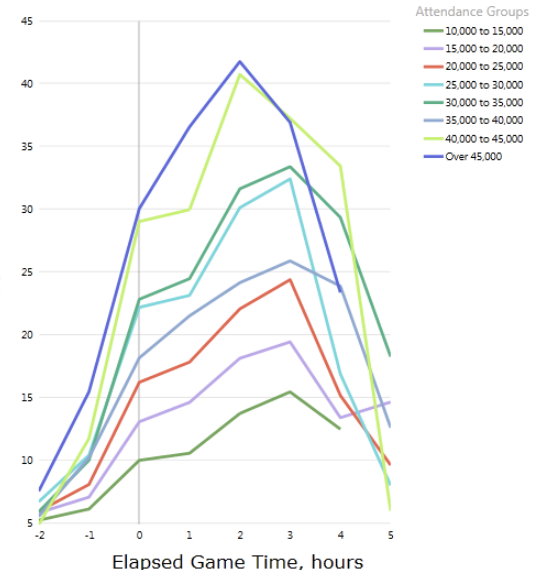


## Safeco Field Water Use Profile - 2012 Season

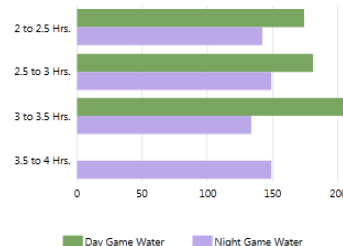
### Use by Month, CCF/game



### Hourly Use by Attendance, CCF/hour



### Use by Game Duration, CCF/game



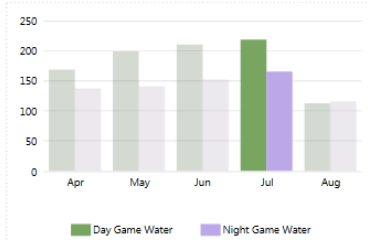
# Season Utility Profile – Selected Conditions

Month of July

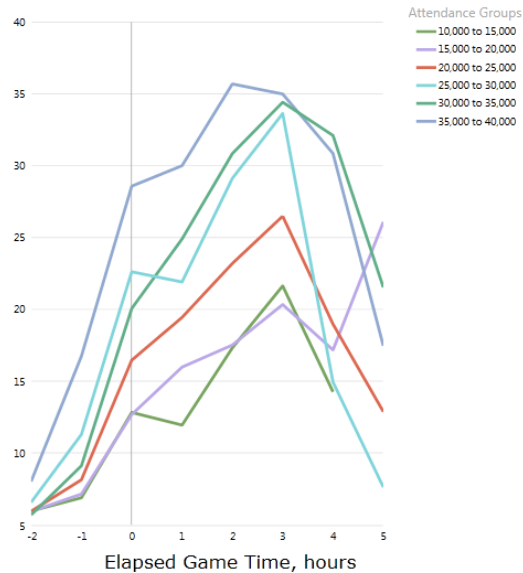
Attendance 25,000 to 30,000

Safeco Field Water Use Profile - 2012 Season

Use by Month, CCF/game

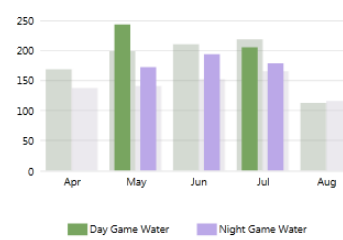


Hourly Use by Attendance, CCF/hour

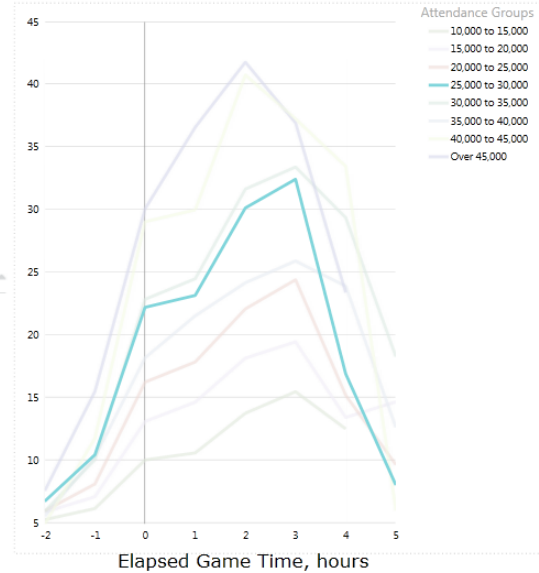


Safeco Field Water Use Profile - 2012 Season

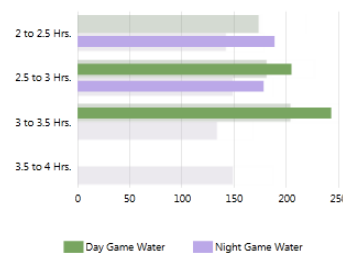
Use by Month, CCF/game



Hourly Use by Attendance, CCF/hour



Use by Game Duration, CCF/game



Elapsed Game Time, hours

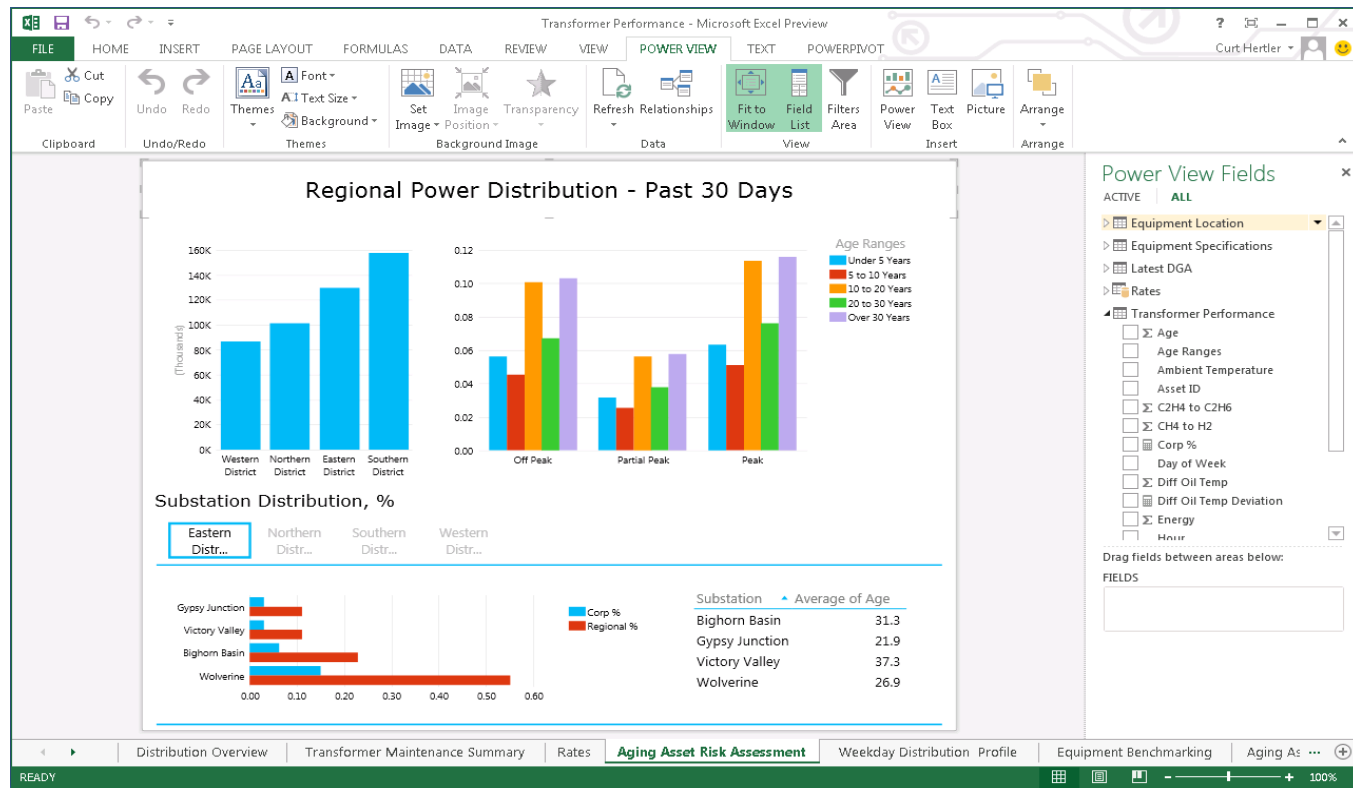


# DEMO

Power View for SQL 2012

# Power View in Excel 2013

Microsoft  
Power View  
Included with  
Excel 2013

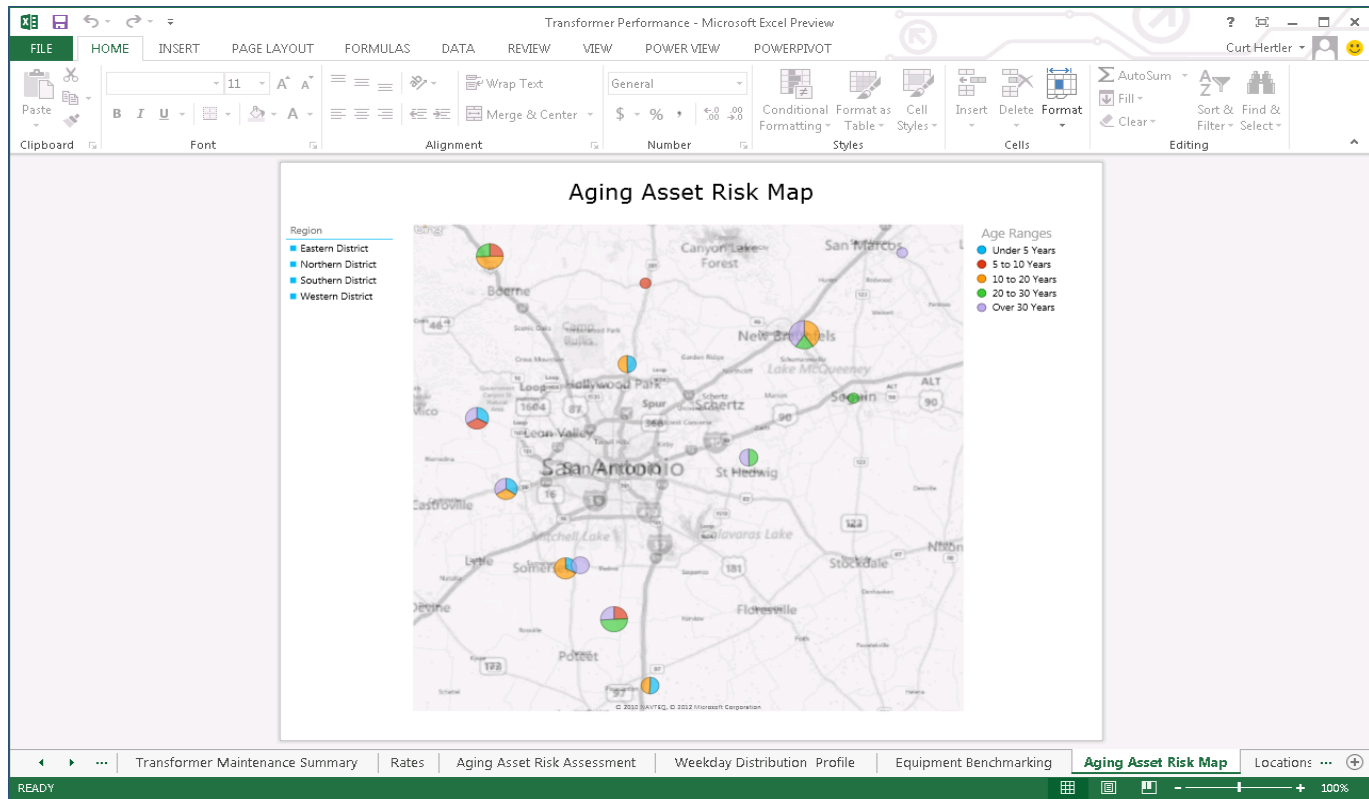


# Power View in Excel 2013

## Microsoft Power View Included with Excel 2013

### Bing Map Integration

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



# Additional Information

## OSIsoft Resources

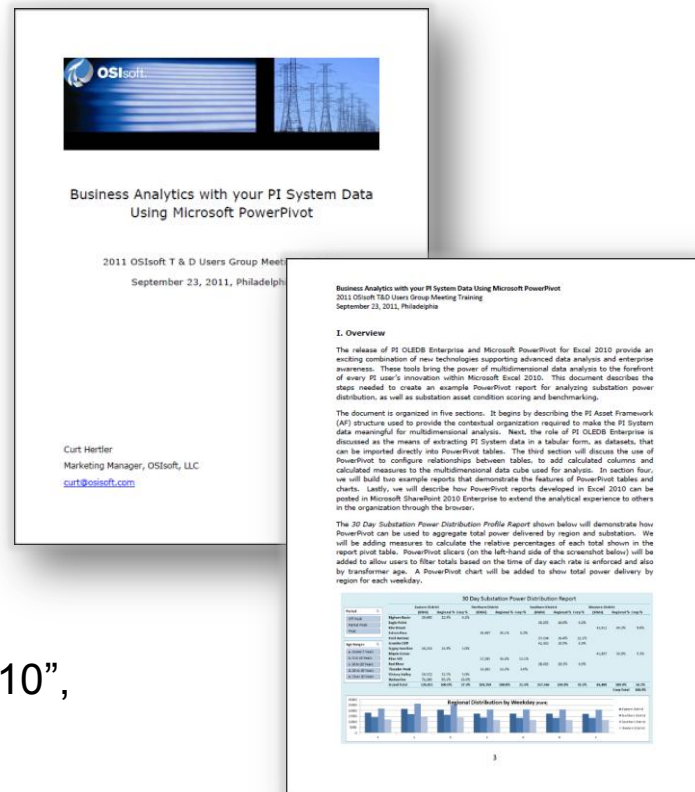
- “Business Analytics with your PI System Data using Microsoft PowerPivot”
- PI T&D Users Group Site [extranet.osisoft.com](http://extranet.osisoft.com)
- OSIsoft vCampus [vcampus.osisoft.com](http://vcampus.osisoft.com)
- For SRP Customers [learning.osisoft.com](http://learning.osisoft.com)

## 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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