



OSIsoft®
**REGIONAL
SEMINARS** 2012
The **Power** of **Data**



Business Analytics with Microsoft SQL Server 2012 and the PI System

Presented by **Sam Pride**

Centre of Excellence Engineer, OSIsoft Australia

Overview

- Business Analytics Toolkit
- Example: “*Substation Power Distribution Profile*”
 - ***Business Context*** - PI Asset Framework (PI AF)
 - ***Data Access*** - PI OLEDB Enterprise
 - ***Analytic Reporting*** - PowerPivot for Excel 2010
 - ***Ad Hoc Analytics and Reporting*** - Power View
- Power View Integration with PowerPoint
- Project Rubik
- Additional Resources



Insight



Time Series



Relational



Unstructured





Engineers

Self service
access



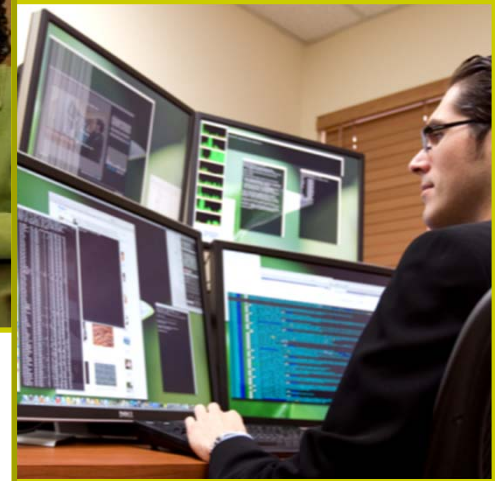
Managers

Always up to date
when I need it.



IT

Secure and easy
to manage.



Analysts

In the applications
that I use.

Business Analytics Toolkit



Microsoft®



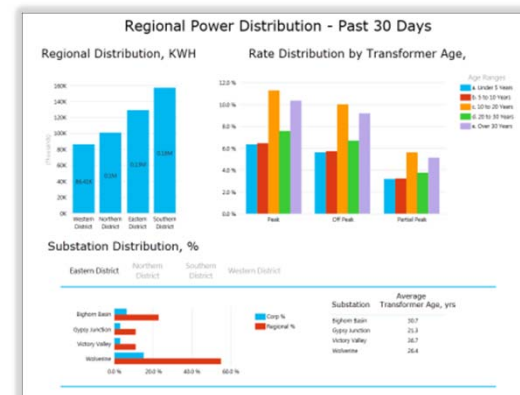
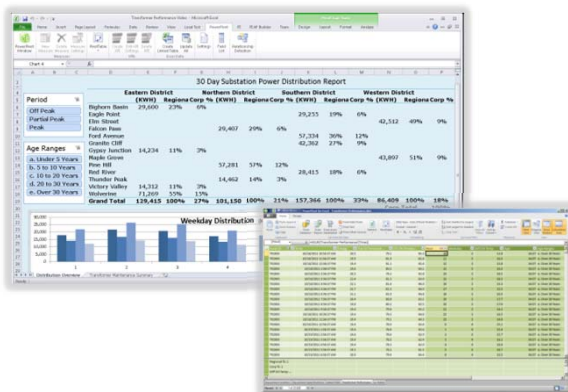
Microsoft®
SQL Server® 2012
Business Intelligence



Microsoft®
SharePoint® 2010
Enterprise



PI Server
PI OLEDB Enterprise



PowerPivot for Excel 2010

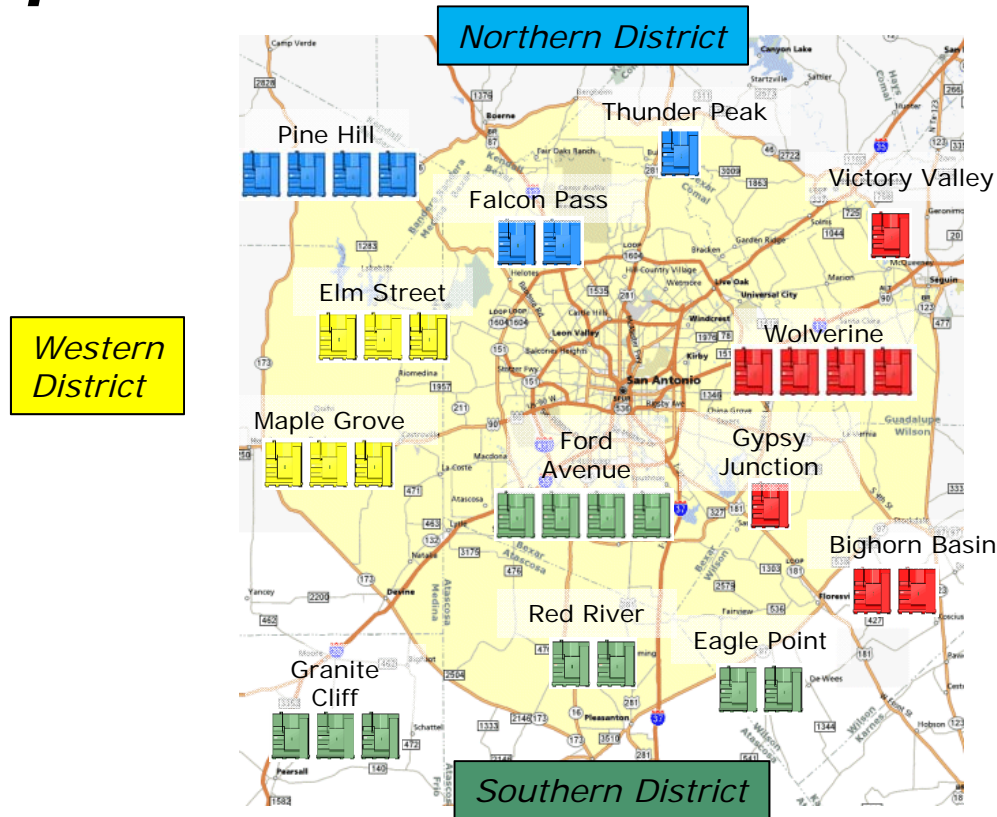


Power View

OSIsoft. REGIONAL SEMINARS 2012

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Example: Substation Power Distribution Profile



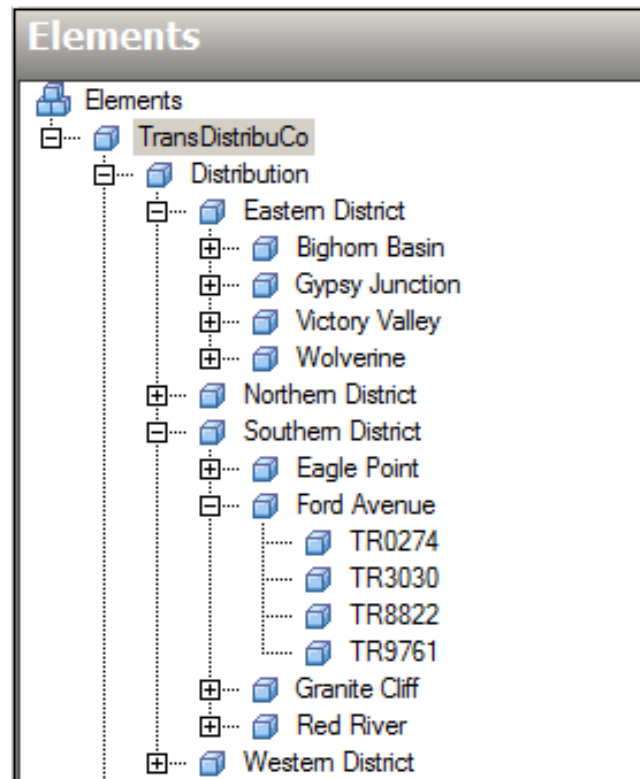
My Objectives

- Regional and Rate Based Power Distribution
- Aging Asset Risk Assessment
- *Want to do it myself !*

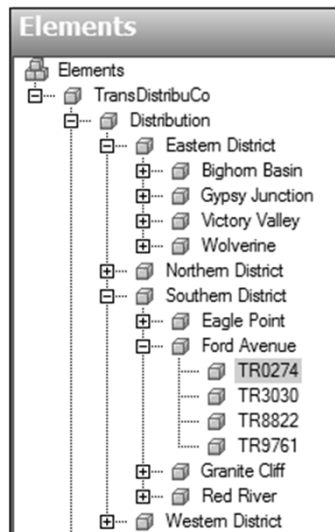
PI Server – *PI Asset Framework*

Asset Hierarchy

- District
- Substation
- Transformer



PI Server – PI Asset Framework



The screenshot shows the details view for transformer TR0274. The view is organized into tabs: 'General', 'Child Elements', 'Attributes', 'Ports', and 'Version'. The 'Attributes' tab is selected, showing a list of attributes categorized by function. The categories are: 'Current DGA Analysis', 'Load Tap Changer', 'Performance', 'Specifications', and 'Tank'.

Name	Value
Category: Current DGA Analysis	
Acetylene	4 ppm
Carbon Dioxide	3004 ppm
Carbon Monoxide	123 ppm
Ethane	190 ppm
Ethylene	38 ppm
Hydrogen	294 ppm
Methane	121 ppm
Nitrogen	22698 ppm
Oxygen	2340 ppm
Category: Load Tap Changer	
LTC Oil Temperature	65.0885009765625 °F
LTC Oil Temperature - 1H A...	62.7173211853571 °F
Category: Performance	
Energy	20.6299715201975 MWh
Load	20.1319046020508 MW
Category: Specifications	
Installation Date	6/10/1992 12:00:00 AM
Manufacturer	PowerMaster
Model	PM-56
Category: Tank	
Bottom Oil Temperature	48.3781089782715 °F
Top Oil Temperature	79.2328872680664 °F
Top Oil Temperature - 1H A...	83.2808045109946 °F

Transformer Attributes

- PI System Data
- Equipment Specifications
- DGA analysis

PI OLEDB Enterprise

Important Considerations

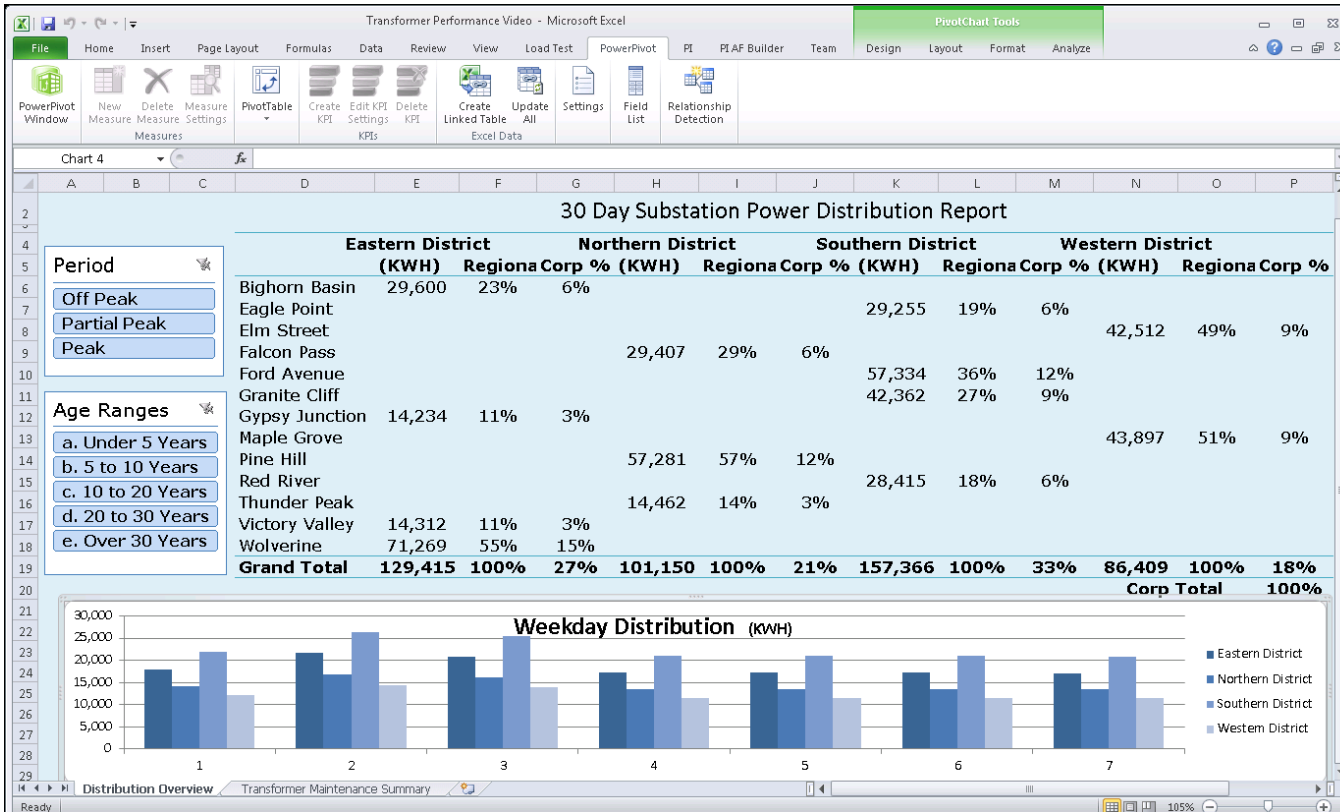
- Leverage structure used throughout your PI Infrastructure
- Insure accurate aggregation of real-time events
- Scale-up by adding PI AF Structure
- Access Event Frames in next release

Asset ID	Time	Energy	Top Oil Temp	Hour	Weekday	Diff Oil Temp	Age Ranges	CH4 to H2
TR2003	8/14/2011 7:41:30 PM	19.95	80.79	19	1	15.5387221724201	e. Over 30 Years	1.471
TR2003	8/14/2011 8:41:30 PM	19.93	80.74	20	1	15.5219753616169	e. Over 30 Years	1.471
TR2003	8/14/2011 9:41:30 PM	19.90	80.68	21	1	15.5052285507958	e. Over 30 Years	1.471
TR2003	8/14/2011 10:41:30 PM	19.87	80.63	22	1	15.4884817399746	e. Over 30 Years	1.471
TR2003	8/14/2011 11:41:30 PM	19.84	80.58	23	1	15.4717349291535	e. Over 30 Years	1.471
TR2003	8/15/2011 12:41:30 AM	19.82	80.52	0	2	15.4549881183323	e. Over 30 Years	1.471
TR2003	8/15/2011 1:41:30 AM	19.79	80.47	1	2	15.4382413075112	e. Over 30 Years	1.471
TR2003	8/15/2011 2:41:30 AM	19.76	80.41	2	2	15.4214944966901	e. Over 30 Years	1.471
TR2003	8/15/2011 3:41:30 AM	19.73	80.36	3	2	15.4047476858689	e. Over 30 Years	1.471
TR2003	8/15/2011 4:41:30 AM	19.71	80.31	4	2	15.3880008750478	e. Over 30 Years	1.471
TR2003	8/15/2011 5:41:30 AM	19.68	80.25	5	2	15.3712540642266	e. Over 30 Years	1.471
TR2003	8/15/2011 6:41:30 AM	19.65	80.20	6	2	15.3545072534055	e. Over 30 Years	1.471
TR2003	8/15/2011 7:41:30 AM	19.63	80.14	7	2	15.3377604425844	e. Over 30 Years	1.471
TR2003	8/15/2011 8:41:30 AM	19.60	80.09	8	2	15.3210136317632	e. Over 30 Years	1.471
TR2003	8/15/2011 9:41:30 AM	21.09	79.96	9	2	13.2137487214932	e. Over 30 Years	1.471
TR2003	8/15/2011 10:41:30 AM	21.20	81.93	10	2	16.6404075066249	e. Over 30 Years	1.471
TR2003	8/15/2011 11:41:30 AM	21.22	82.68	11	2	17.816716837803	e. Over 30 Years	1.471
TR2003	8/15/2011 12:41:30 PM	21.28	81.50	12	2	17.5523482481639	e. Over 30 Years	1.471
TR2003	8/15/2011 1:41:30 PM	20.93	81.59	13	2	16.5219141244888	e. Over 30 Years	1.471

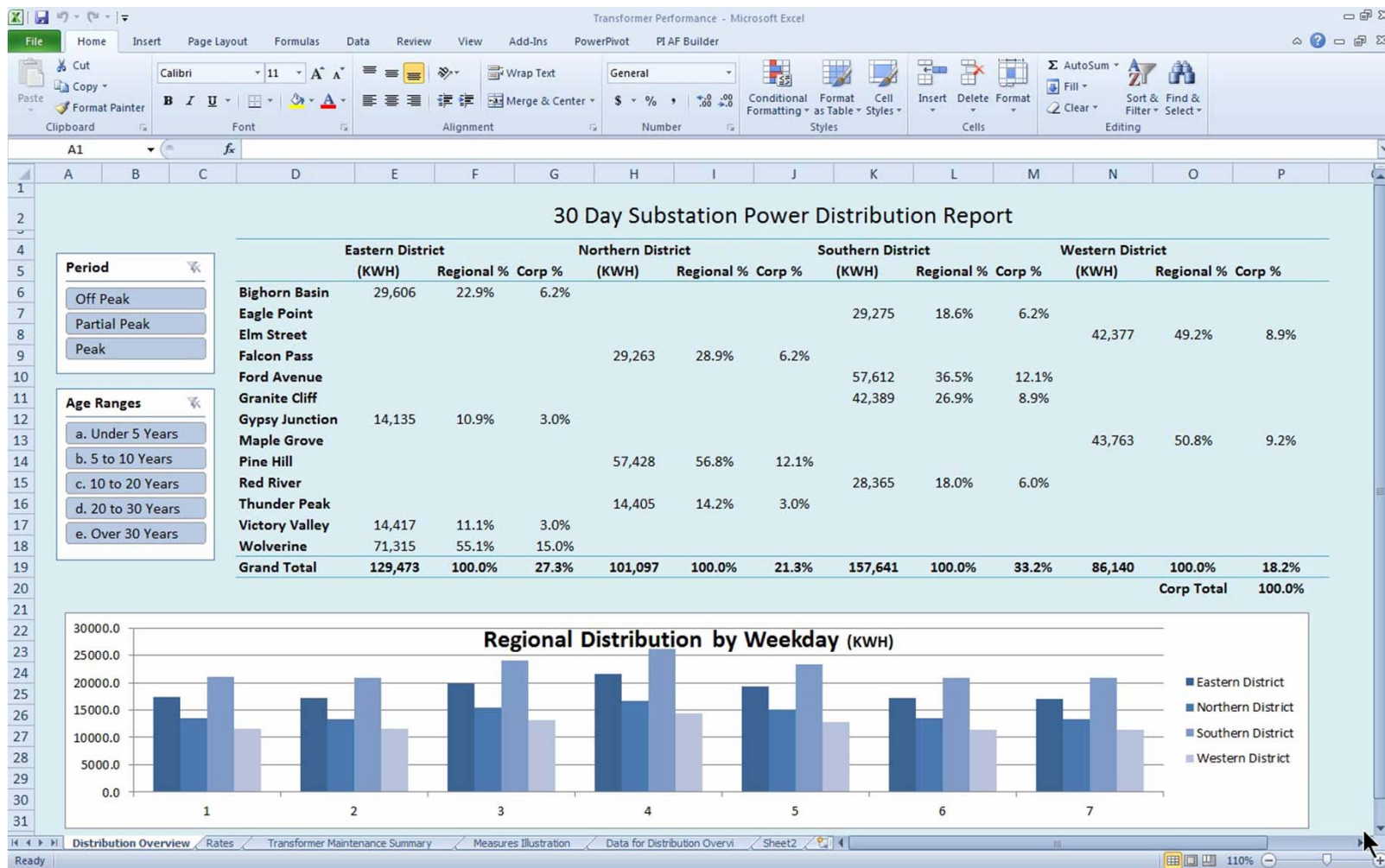
Regional %: 100.0 %
Corp %: 100.0 %
Diff Oil Temp Deviation: 0.0
C2H4 to C2H6 Deviation: 0.00
CH4 to H2 Deviation: 0.00

Record: 1 of 22,792

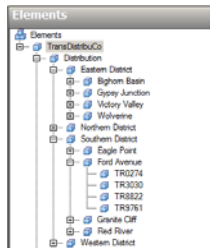
PowerPivot for Excel 2010



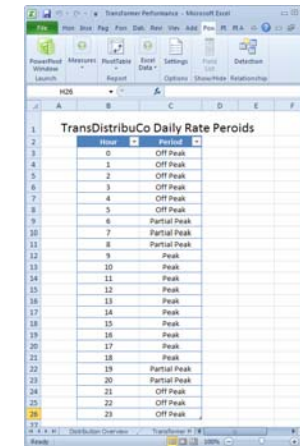
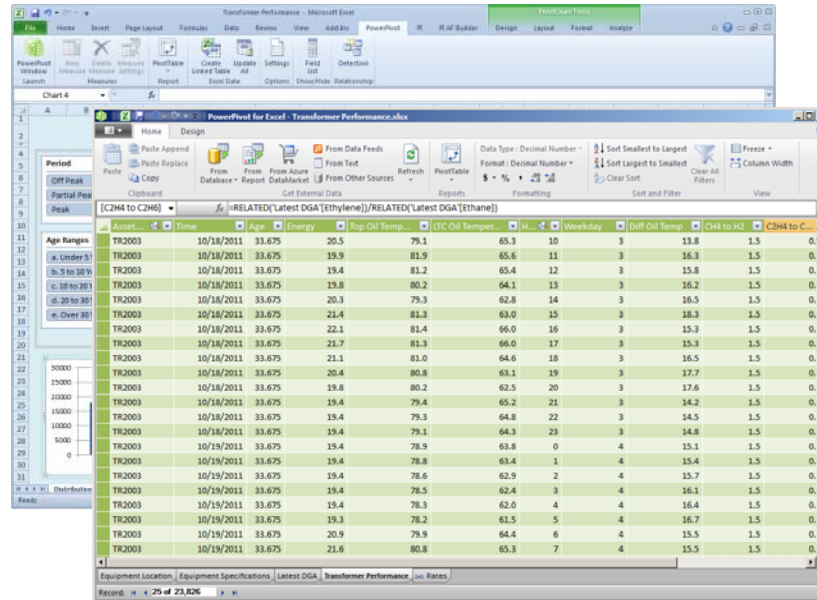
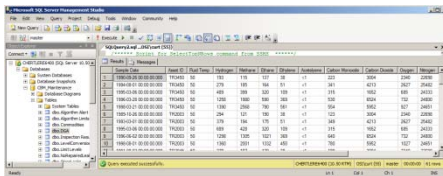
Power Distribution Report



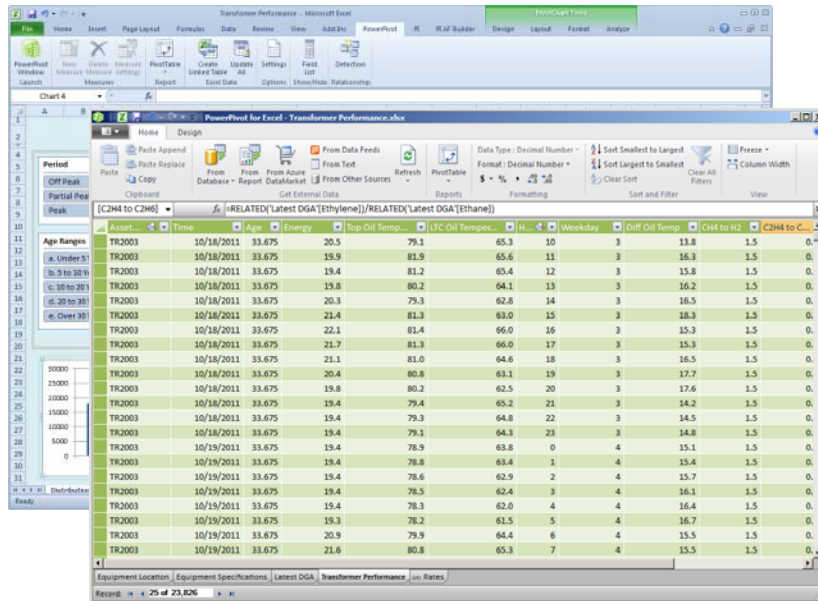
PowerPivot Enables Data Integration



PI Server
PI OLEDB Enterprise



PowerPivot Enables Data Integration



Can I use DataLink?

- Manual refresh step required to copy and paste values
- Limited to ~1 million rows
- No support for upsizing to SQL Analysis Services 2012



PowerPivot Enables Extended Analysis

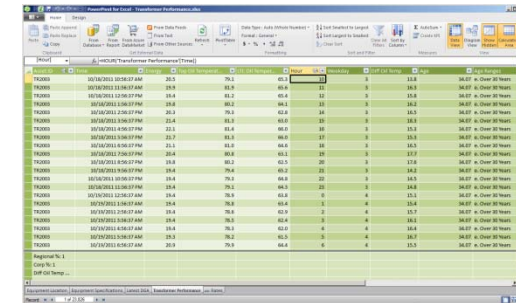
DAX – Data Analysis Expression Language

Transformer Age Column

=YEARFRAC('Equipment Specifications'[Installation Date],NOW())

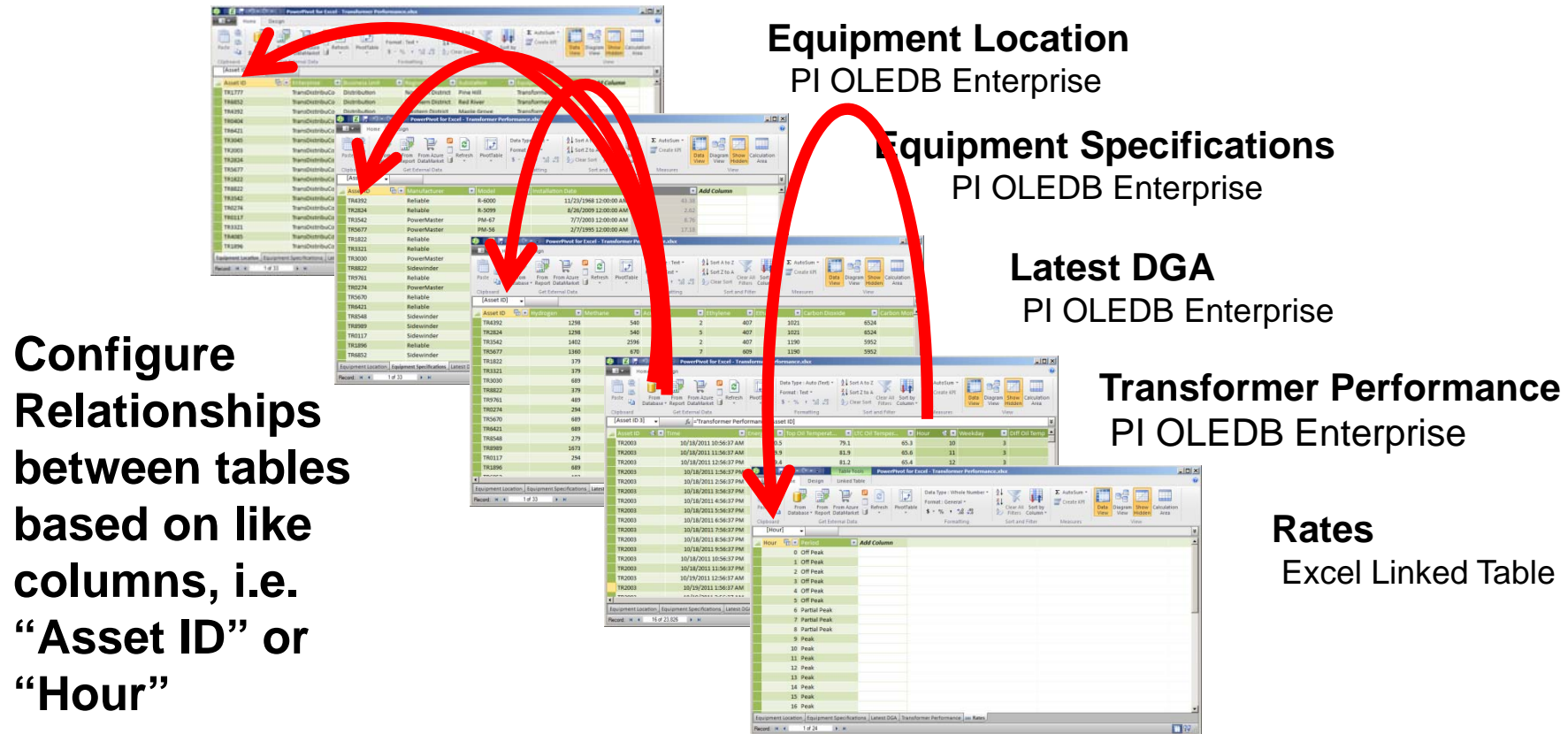
Transformer Age Ranges Column

=IF('Transformer Performance'[Age]>30,"e. Over 30 Years", IF('Transformer Performance'[Age]>20,"d. 20 to 30 Years", IF('Transformer Performance'[Age]>10,"c. 10 to 20 Years", IF('Transformer Performance'[Age]>5,"b. 5 to 10 Years", "a. Under 5 Years"))))

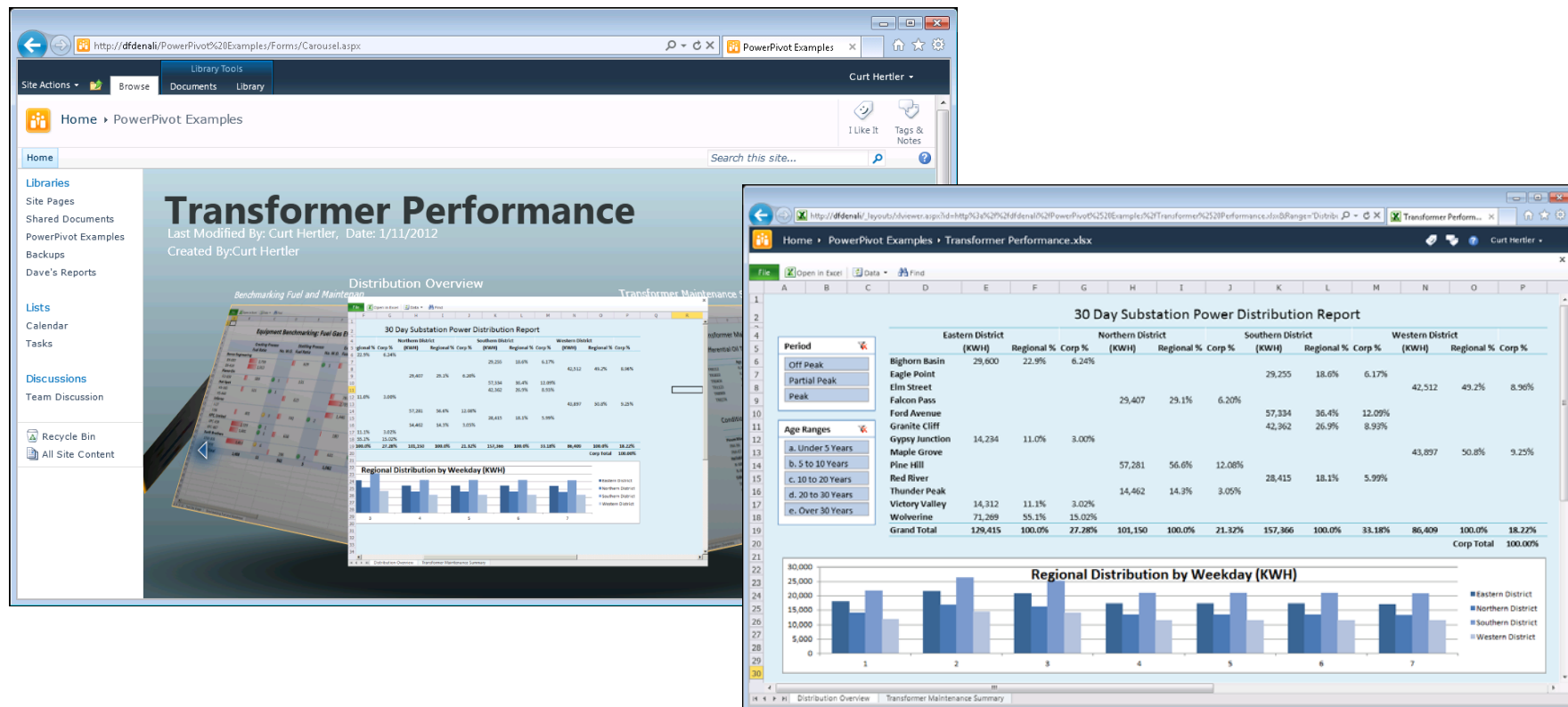


ID	Installation Date	Age	Age Range
TR0001	10/10/2011 10:00:00 AM	2.1	a. Under 5 Years
TR0002	10/10/2011 11:00:00 AM	2.2	a. Under 5 Years
TR0003	10/10/2011 12:00:00 PM	2.3	a. Under 5 Years
TR0004	10/10/2011 1:00:00 PM	2.4	a. Under 5 Years
TR0005	10/10/2011 2:00:00 PM	2.5	a. Under 5 Years
TR0006	10/10/2011 3:00:00 PM	2.6	a. Under 5 Years
TR0007	10/10/2011 4:00:00 PM	2.7	a. Under 5 Years
TR0008	10/10/2011 5:00:00 PM	2.8	a. Under 5 Years
TR0009	10/10/2011 6:00:00 PM	2.9	a. Under 5 Years
TR0010	10/10/2011 7:00:00 PM	3.0	a. Under 5 Years
TR0011	10/10/2011 8:00:00 PM	3.1	a. Under 5 Years
TR0012	10/10/2011 9:00:00 PM	3.2	a. Under 5 Years
TR0013	10/10/2011 10:00:00 PM	3.3	a. Under 5 Years
TR0014	10/10/2011 11:00:00 PM	3.4	a. Under 5 Years
TR0015	10/10/2011 12:00:00 AM	3.5	a. Under 5 Years
TR0016	10/10/2011 1:00:00 AM	3.6	a. Under 5 Years
TR0017	10/10/2011 2:00:00 AM	3.7	a. Under 5 Years
TR0018	10/10/2011 3:00:00 AM	3.8	a. Under 5 Years
TR0019	10/10/2011 4:00:00 AM	3.9	a. Under 5 Years
TR0020	10/10/2011 5:00:00 AM	4.0	a. Under 5 Years
TR0021	10/10/2011 6:00:00 AM	4.1	a. Under 5 Years
TR0022	10/10/2011 7:00:00 AM	4.2	a. Under 5 Years
TR0023	10/10/2011 8:00:00 AM	4.3	a. Under 5 Years
TR0024	10/10/2011 9:00:00 AM	4.4	a. Under 5 Years
TR0025	10/10/2011 10:00:00 AM	4.5	a. Under 5 Years
TR0026	10/10/2011 11:00:00 AM	4.6	a. Under 5 Years
TR0027	10/10/2011 12:00:00 PM	4.7	a. Under 5 Years
TR0028	10/10/2011 1:00:00 PM	4.8	a. Under 5 Years
TR0029	10/10/2011 2:00:00 PM	4.9	a. Under 5 Years
TR0030	10/10/2011 3:00:00 PM	5.0	b. 5 to 10 Years
TR0031	10/10/2011 4:00:00 PM	5.1	b. 5 to 10 Years
TR0032	10/10/2011 5:00:00 PM	5.2	b. 5 to 10 Years
TR0033	10/10/2011 6:00:00 PM	5.3	b. 5 to 10 Years
TR0034	10/10/2011 7:00:00 PM	5.4	b. 5 to 10 Years
TR0035	10/10/2011 8:00:00 PM	5.5	b. 5 to 10 Years
TR0036	10/10/2011 9:00:00 PM	5.6	b. 5 to 10 Years
TR0037	10/10/2011 10:00:00 PM	5.7	b. 5 to 10 Years
TR0038	10/10/2011 11:00:00 PM	5.8	b. 5 to 10 Years
TR0039	10/10/2011 12:00:00 AM	5.9	b. 5 to 10 Years
TR0040	10/10/2011 1:00:00 AM	6.0	b. 5 to 10 Years
TR0041	10/10/2011 2:00:00 AM	6.1	b. 5 to 10 Years
TR0042	10/10/2011 3:00:00 AM	6.2	b. 5 to 10 Years
TR0043	10/10/2011 4:00:00 AM	6.3	b. 5 to 10 Years
TR0044	10/10/2011 5:00:00 AM	6.4	b. 5 to 10 Years
TR0045	10/10/2011 6:00:00 AM	6.5	b. 5 to 10 Years
TR0046	10/10/2011 7:00:00 AM	6.6	b. 5 to 10 Years
TR0047	10/10/2011 8:00:00 AM	6.7	b. 5 to 10 Years
TR0048	10/10/2011 9:00:00 AM	6.8	b. 5 to 10 Years
TR0049	10/10/2011 10:00:00 AM	6.9	b. 5 to 10 Years
TR0050	10/10/2011 11:00:00 AM	7.0	c. 10 to 20 Years
TR0051	10/10/2011 12:00:00 PM	7.1	c. 10 to 20 Years
TR0052	10/10/2011 1:00:00 PM	7.2	c. 10 to 20 Years
TR0053	10/10/2011 2:00:00 PM	7.3	c. 10 to 20 Years
TR0054	10/10/2011 3:00:00 PM	7.4	c. 10 to 20 Years
TR0055	10/10/2011 4:00:00 PM	7.5	c. 10 to 20 Years
TR0056	10/10/2011 5:00:00 PM	7.6	c. 10 to 20 Years
TR0057	10/10/2011 6:00:00 PM	7.7	c. 10 to 20 Years
TR0058	10/10/2011 7:00:00 PM	7.8	c. 10 to 20 Years
TR0059	10/10/2011 8:00:00 PM	7.9	c. 10 to 20 Years
TR0060	10/10/2011 9:00:00 PM	8.0	c. 10 to 20 Years
TR0061	10/10/2011 10:00:00 PM	8.1	c. 10 to 20 Years
TR0062	10/10/2011 11:00:00 PM	8.2	c. 10 to 20 Years
TR0063	10/10/2011 12:00:00 AM	8.3	c. 10 to 20 Years
TR0064	10/10/2011 1:00:00 AM	8.4	c. 10 to 20 Years
TR0065	10/10/2011 2:00:00 AM	8.5	c. 10 to 20 Years
TR0066	10/10/2011 3:00:00 AM	8.6	c. 10 to 20 Years
TR0067	10/10/2011 4:00:00 AM	8.7	c. 10 to 20 Years
TR0068	10/10/2011 5:00:00 AM	8.8	c. 10 to 20 Years
TR0069	10/10/2011 6:00:00 AM	8.9	c. 10 to 20 Years
TR0070	10/10/2011 7:00:00 AM	9.0	d. 20 to 30 Years
TR0071	10/10/2011 8:00:00 AM	9.1	d. 20 to 30 Years
TR0072	10/10/2011 9:00:00 AM	9.2	d. 20 to 30 Years
TR0073	10/10/2011 10:00:00 AM	9.3	d. 20 to 30 Years
TR0074	10/10/2011 11:00:00 AM	9.4	d. 20 to 30 Years
TR0075	10/10/2011 12:00:00 PM	9.5	d. 20 to 30 Years
TR0076	10/10/2011 1:00:00 PM	9.6	d. 20 to 30 Years
TR0077	10/10/2011 2:00:00 PM	9.7	d. 20 to 30 Years
TR0078	10/10/2011 3:00:00 PM	9.8	d. 20 to 30 Years
TR0079	10/10/2011 4:00:00 PM	9.9	d. 20 to 30 Years
TR0080	10/10/2011 5:00:00 PM	10.0	e. Over 30 Years
TR0081	10/10/2011 6:00:00 PM	10.1	e. Over 30 Years
TR0082	10/10/2011 7:00:00 PM	10.2	e. Over 30 Years
TR0083	10/10/2011 8:00:00 PM	10.3	e. Over 30 Years
TR0084	10/10/2011 9:00:00 PM	10.4	e. Over 30 Years
TR0085	10/10/2011 10:00:00 PM	10.5	e. Over 30 Years
TR0086	10/10/2011 11:00:00 PM	10.6	e. Over 30 Years
TR0087	10/10/2011 12:00:00 AM	10.7	e. Over 30 Years
TR0088	10/10/2011 1:00:00 AM	10.8	e. Over 30 Years
TR0089	10/10/2011 2:00:00 AM	10.9	e. Over 30 Years
TR0090	10/10/2011 3:00:00 AM	11.0	e. Over 30 Years

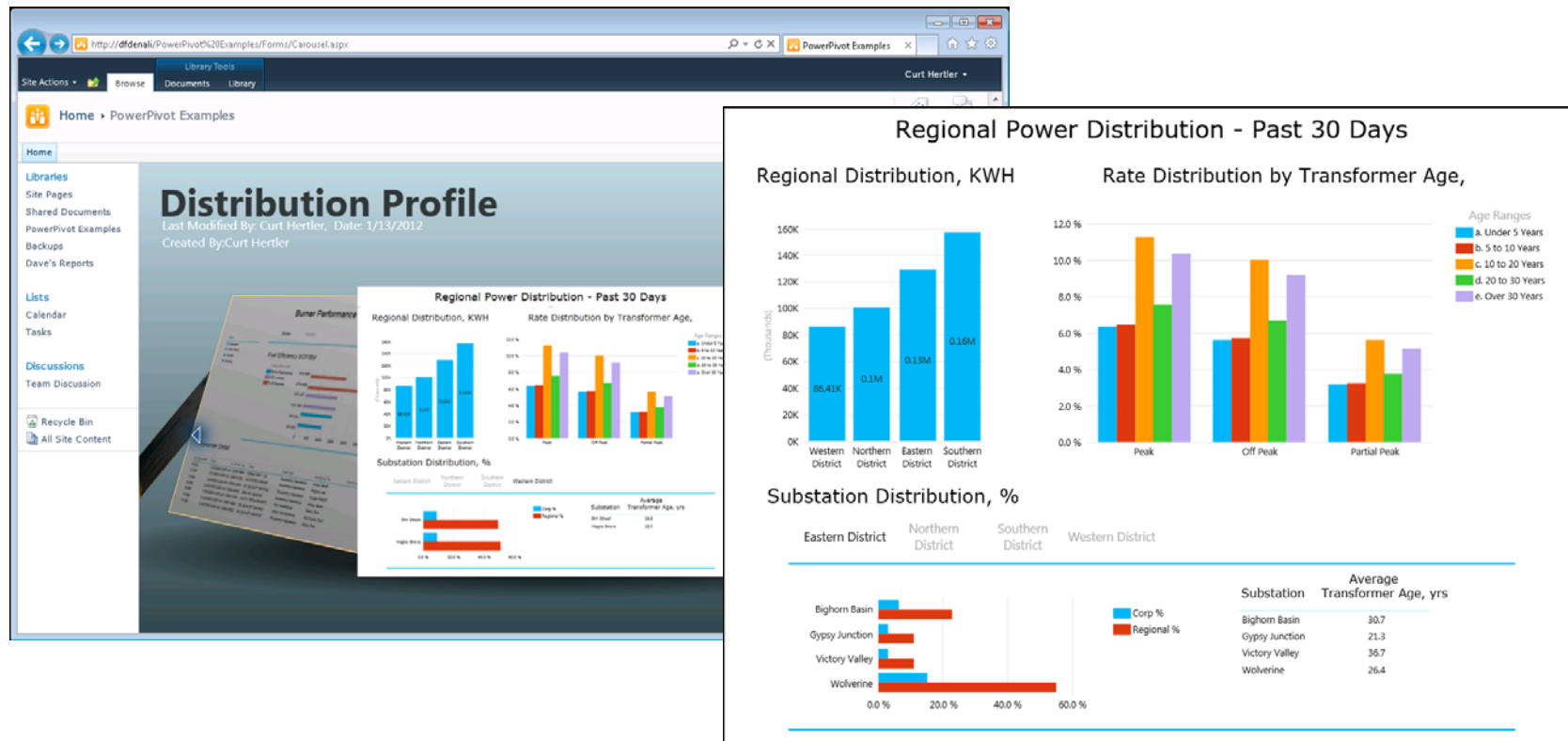
PowerPivot Creates the “Cube”



SharePoint 2010 Enterprise – *PowerPivot Gallery*



SharePoint 2010 Enterprise – Power View



PowerPivot Gallery - Windows Internet Explorer

http://74.217.101.216/PowerPivot%20Gallery/Forms/Carousel.aspx

PowerPivot Gallery

Site Actions Browse Library Tools Documents Library Curt Hertler

Main Site > PowerPivot Gallery

Share a document with the team by adding it to this document library.

Main Site PI Fundamentals Product Demos Storyboard Demos Search this site...

Recycle Bin All Site Content

Transformer Performance

Last Modified By: Curt Hertler, Date: 4/6/2012
Created By: Curt Hertler

Server Performance Dashboard Distribution Overview Transformer Maintenance Summary

30 Day Substation Power Distribution Report

	Northern District (KWH)	Southern District (KWH)	Western District (KWH)
Regional % Corp %	22.3%	25.2%	42.5%
Regional % Corp %	6.24%	18.6%	6.17%
Regional % Corp %	25,407	37,334	42,512
Regional % Corp %	29.1%	36.4%	49.2%
Regional % Corp %	6.20%	12.09%	8.96%
Regional % Corp %	42,362	26.9%	8.93%
Regional % Corp %	11.0%	3.00%	41,897
Regional % Corp %	3.00%	50.8%	9.25%
Regional % Corp %	37,281	56.6%	12.08%
Regional % Corp %	14,462	14.3%	3.00%
Regional % Corp %	17,11%	3.02%	5.99%
Regional % Corp %	55.1%	33.02%	33.18%
Regional % Corp %	300.0%	27.28%	300.0%
Regional % Corp %	300.0%	100.0%	100.0%
Regional % Corp %	300.0%	28.32%	100.0%
Regional % Corp %	300.0%	157,366	100.0%
Regional % Corp %	300.0%	33.18%	100.0%
Regional % Corp %	300.0%	86,409	100.0%
Regional % Corp %	300.0%	18.22%	100.0%
Regional % Corp %	300.0%	100.0%	100.0%

Regional Distribution by Weekday (KWH)

Transformer Maintenance Summary

Differential Oil Temperature Thermal Fault

Conditions by Manufacturer

PowerPivot Gallery - Windows Internet Explorer

http://74.217.101.216/PowerPivot%20Gallery/Forms/Carousel.aspx?InitialTabId=Ribbon%2EDocument&VisibilityContext=WSTabPersistence

PowerPivot Gallery

Curt Hertler

Library Tools

Documents Library

Site Actions

New: New Document, Upload Document, New Folder

Open & Check Out: Check Out, Check In, Discard Check Out, Edit Document

Manage: View Properties, Edit Properties, Version History, Document Permissions, Delete Document

Share & Track: E-mail a Link

Copies: Download a Copy, Send To, Manage Copies, Go To Source

Workflows: Workflows, Publish, Approve/Reject, Cancel Approval

Tags and Notes: I Like It, Tags & Notes

Transformer Performance

Last Modified By: Curt Hertler, Date: 4/6/2012
Created By: Curt Hertler

Server Performance Dashboard

Distribution Overview

Transformer Maintenance Summary

30 Day Substation Power Distribution Report

	Northern District (KWH)	Southern District (KWH)	Western District (KWH)
Regional % Corp %	22.3%	25.2%	42.5%
Regional % Corp %	29.407	37.334	42.512
Regional % Corp %	11.0%	26.9%	50.8%
Regional % Corp %	3.00%	8.93%	9.25%
Regional % Corp %	37.281	28.413	41.897
Regional % Corp %	14.462	18.1%	5.99%
Regional % Corp %	17.11%	3.02%	
Regional % Corp %	55.1%	33.02%	
Regional % Corp %	300.0%	27.28%	300.0%
Regional % Corp %	305,150	100.0%	157,366
Regional % Corp %	28.32%	100.0%	33.58%
Regional % Corp %	86,409	100.0%	18,22%
Regional % Corp %	100.00%		100.00%

Regional Distribution by Weekday (KWH)

Transformer Maintenance Summary

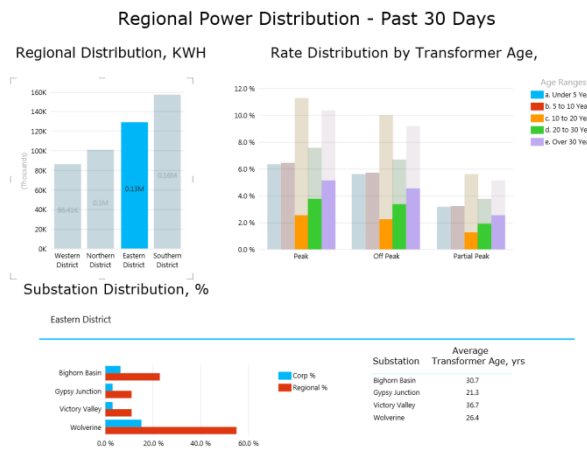
Differential Oil Temperature

Thermal Fault

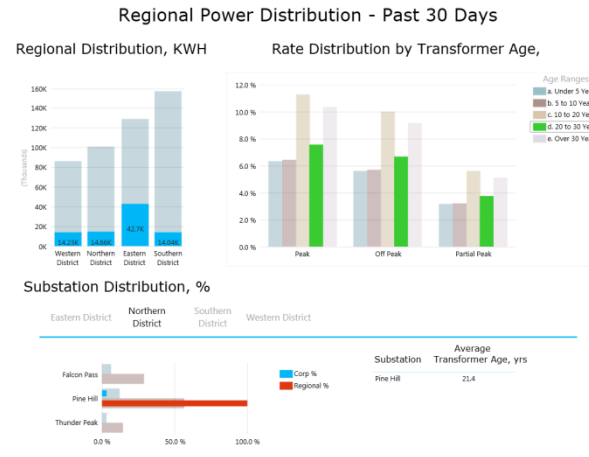
Conditions by Manufacturer

Microsoft SQL 2012 Power View

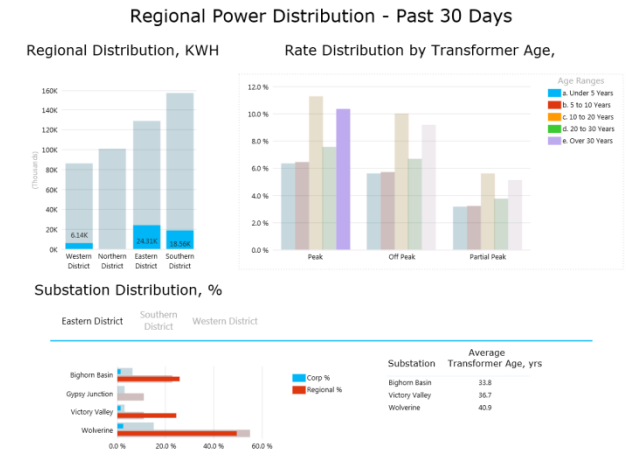
Interactive Analysis



Distribution by District



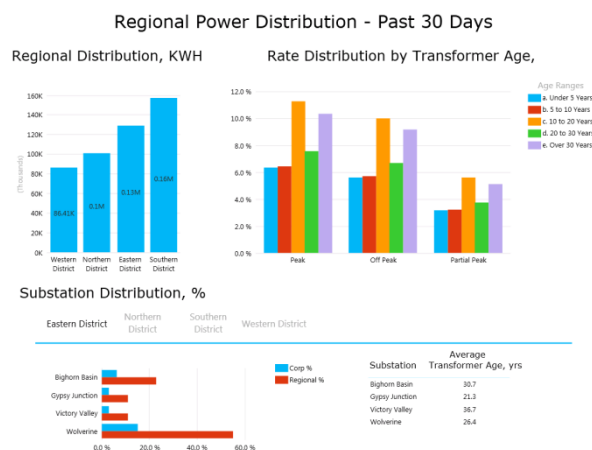
Distribution by Transformer Age



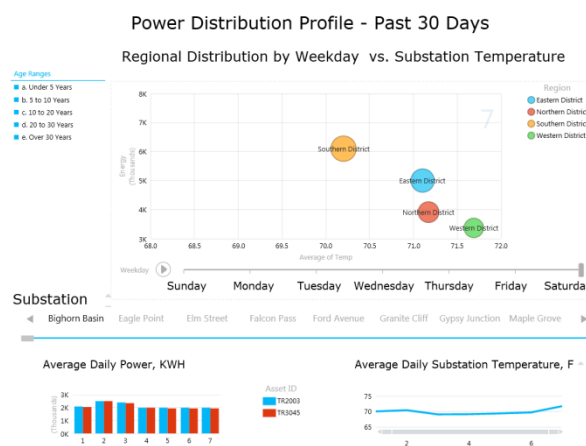
Distribution by Age and Rate

Microsoft SQL 2012 Power View

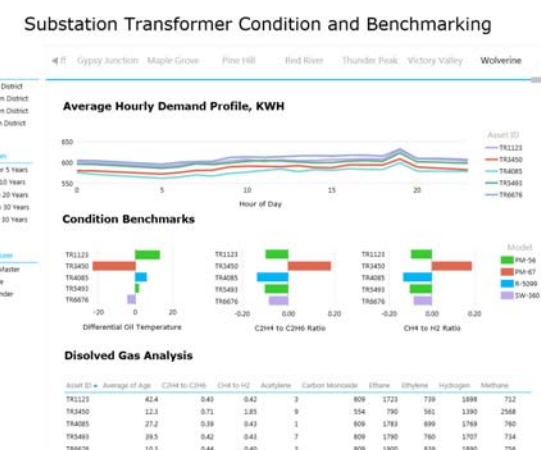
Multiple Views \ Pages



Aging Asset Risk Assessment

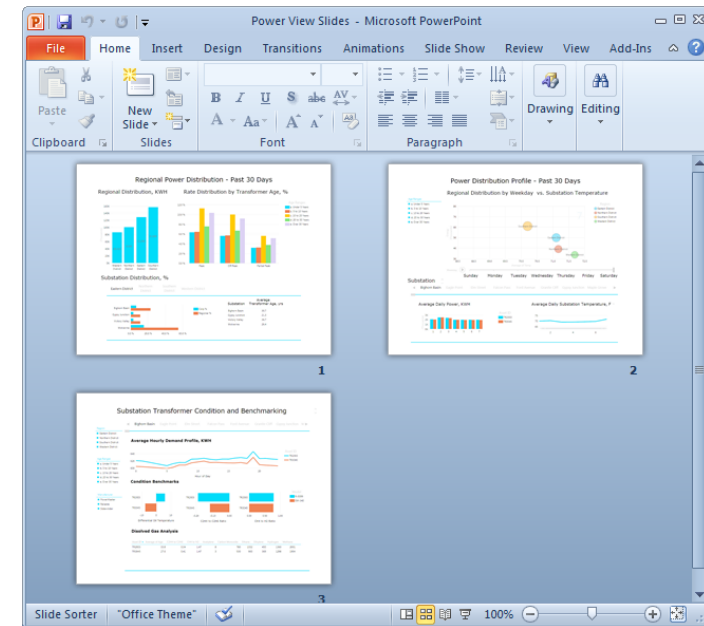
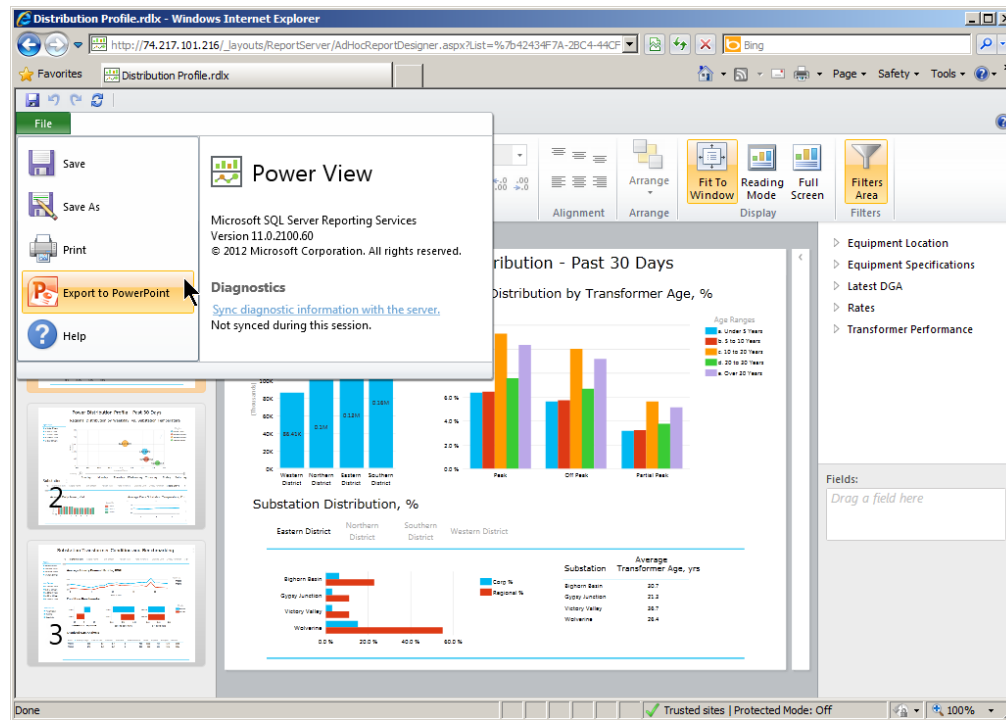


Weekday Distribution Profile

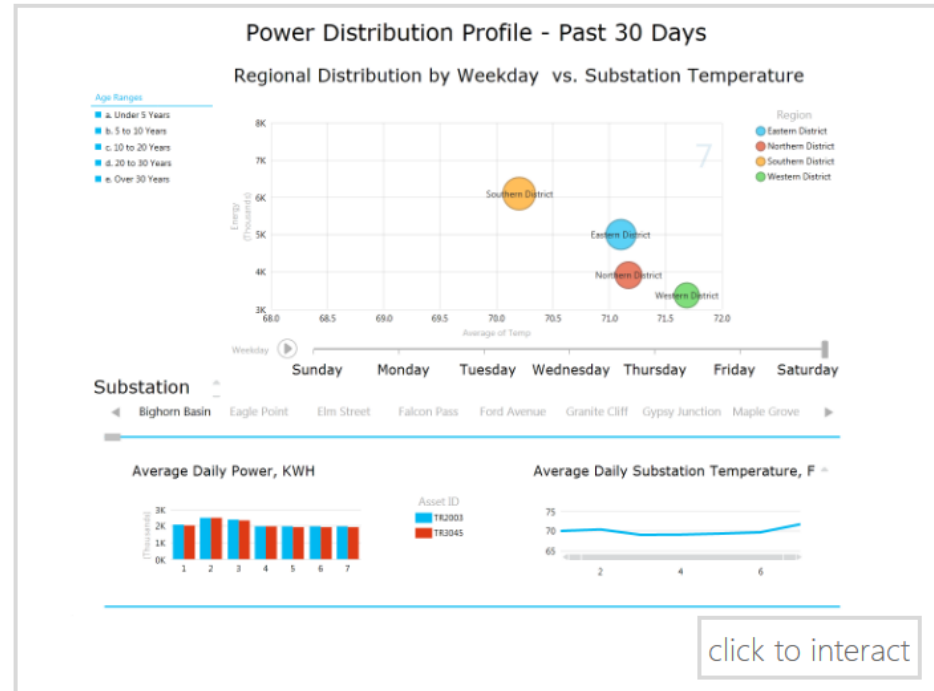
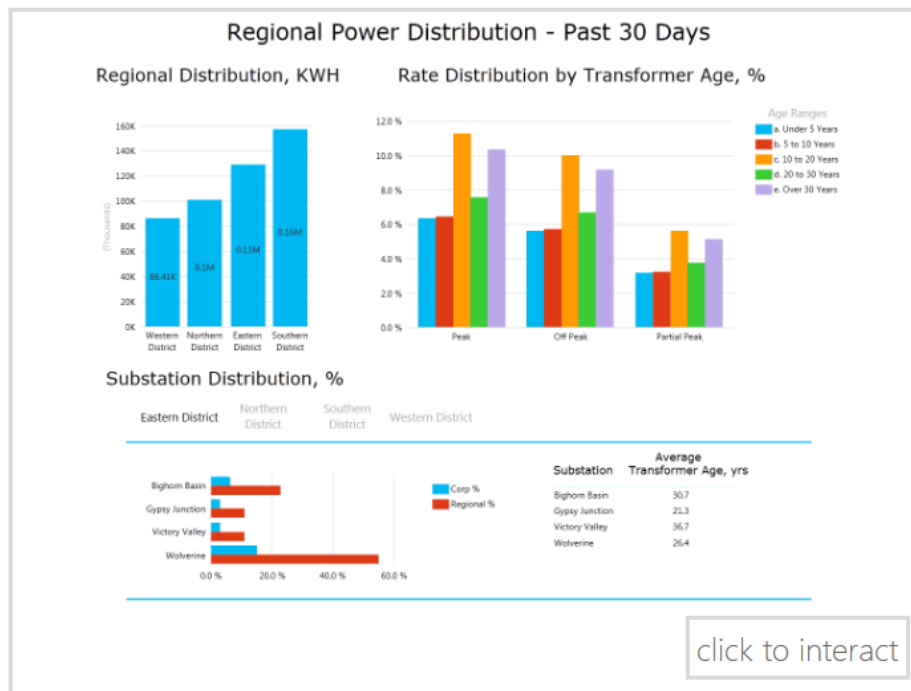


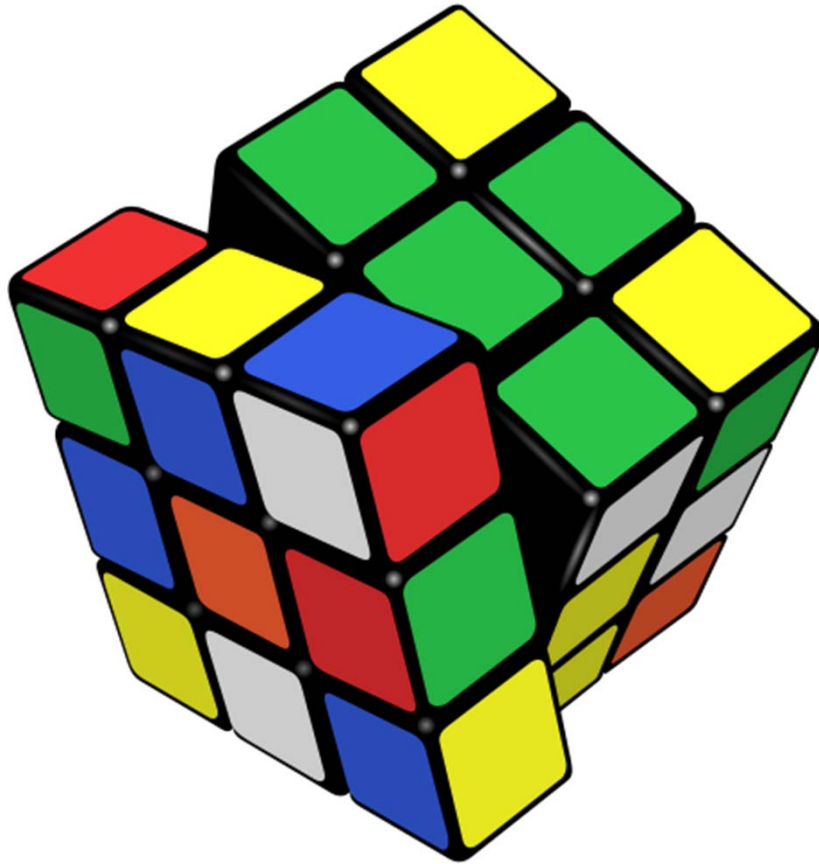
Equipment Condition Benchmarking

Power View Reports in *PowerPoint*

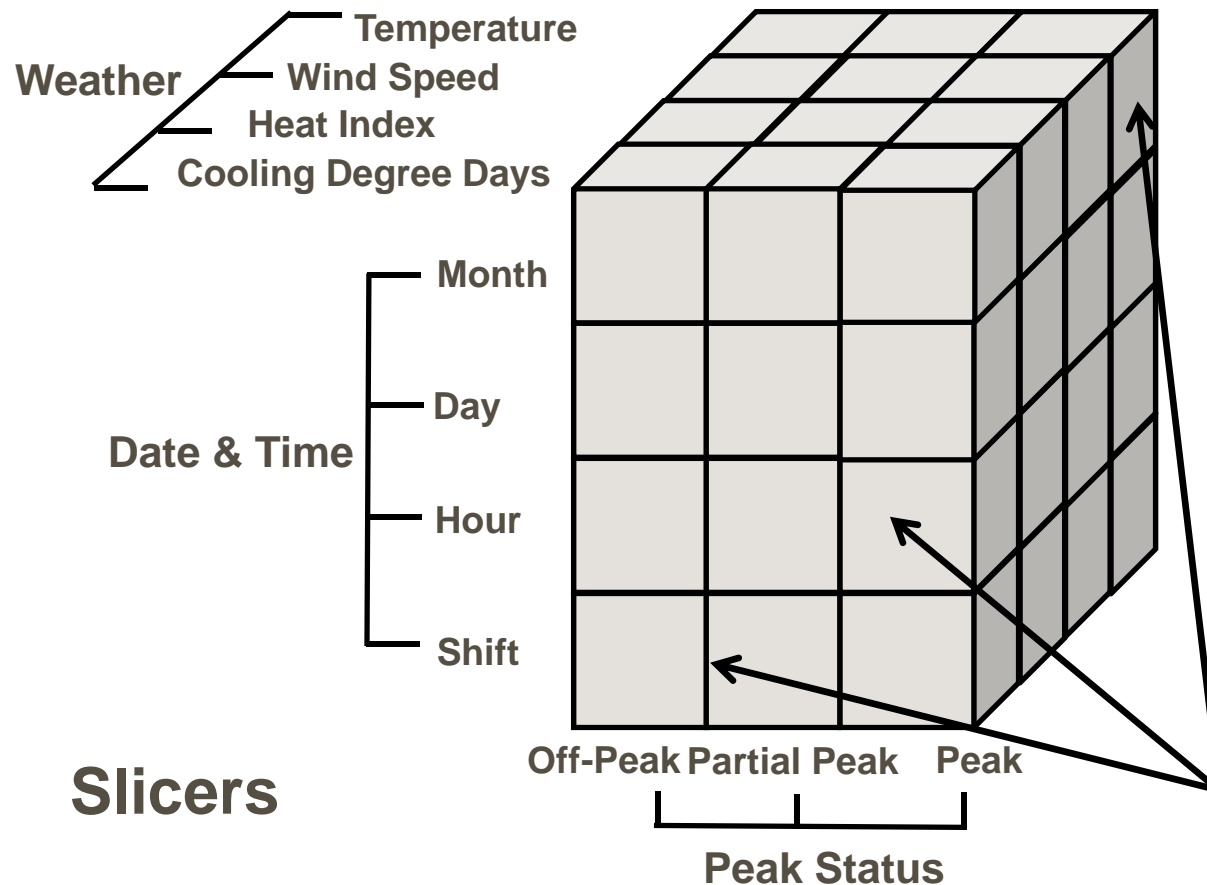


Power View Reports in PowerPoint





Project Rubik



Show me the
total energy
cost

For the first
shift

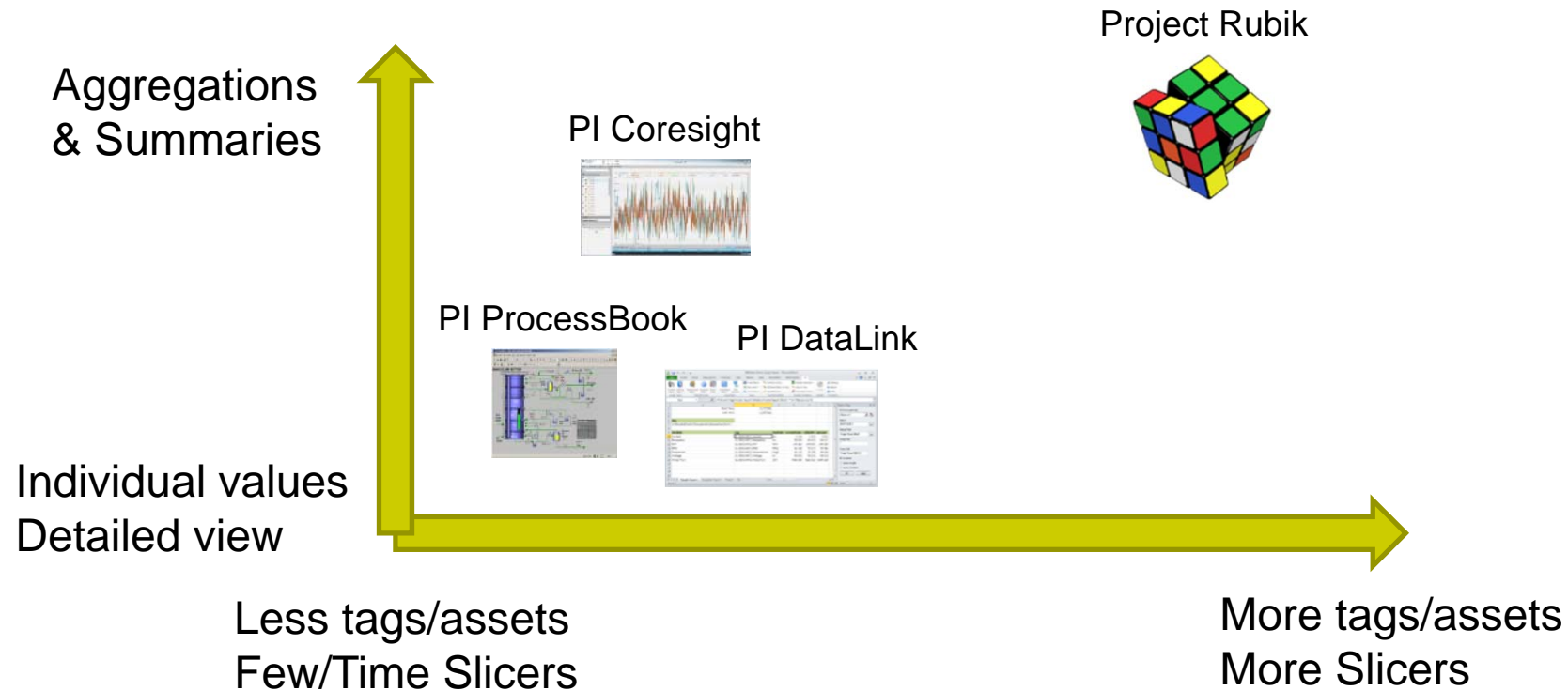
During Peak
Status

Facts (Energy Cost)

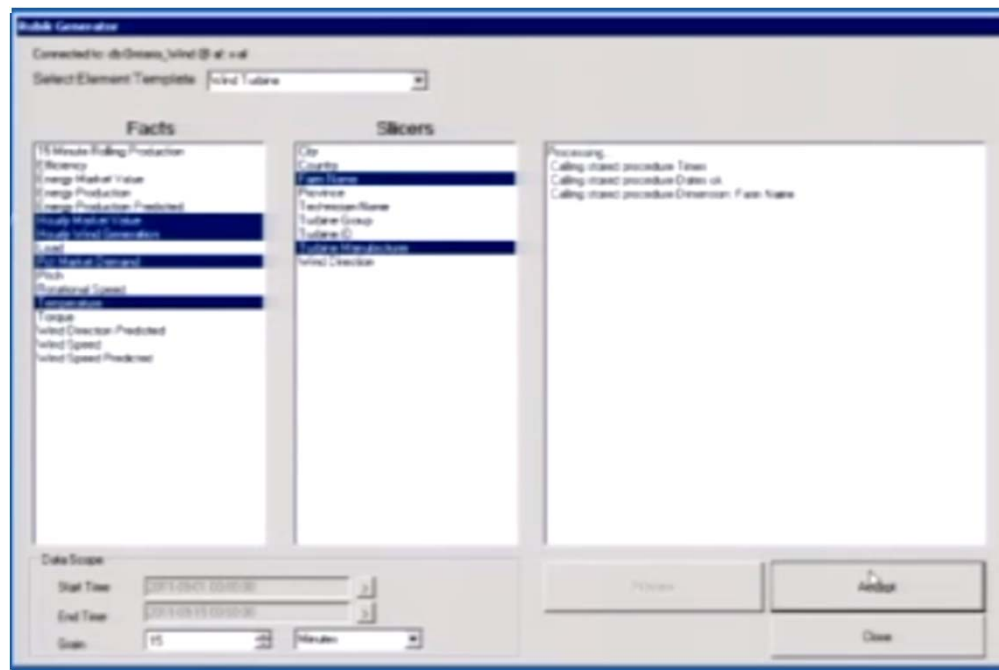
A close-up photograph of a Rubik's cube. The cube is partially solved, showing faces of red, blue, yellow, and green. A black grid pattern is overlaid on the cube's faces, creating a perspective effect. The grid lines are thicker on the faces that are more directly facing the camera and thinner on the receding faces.

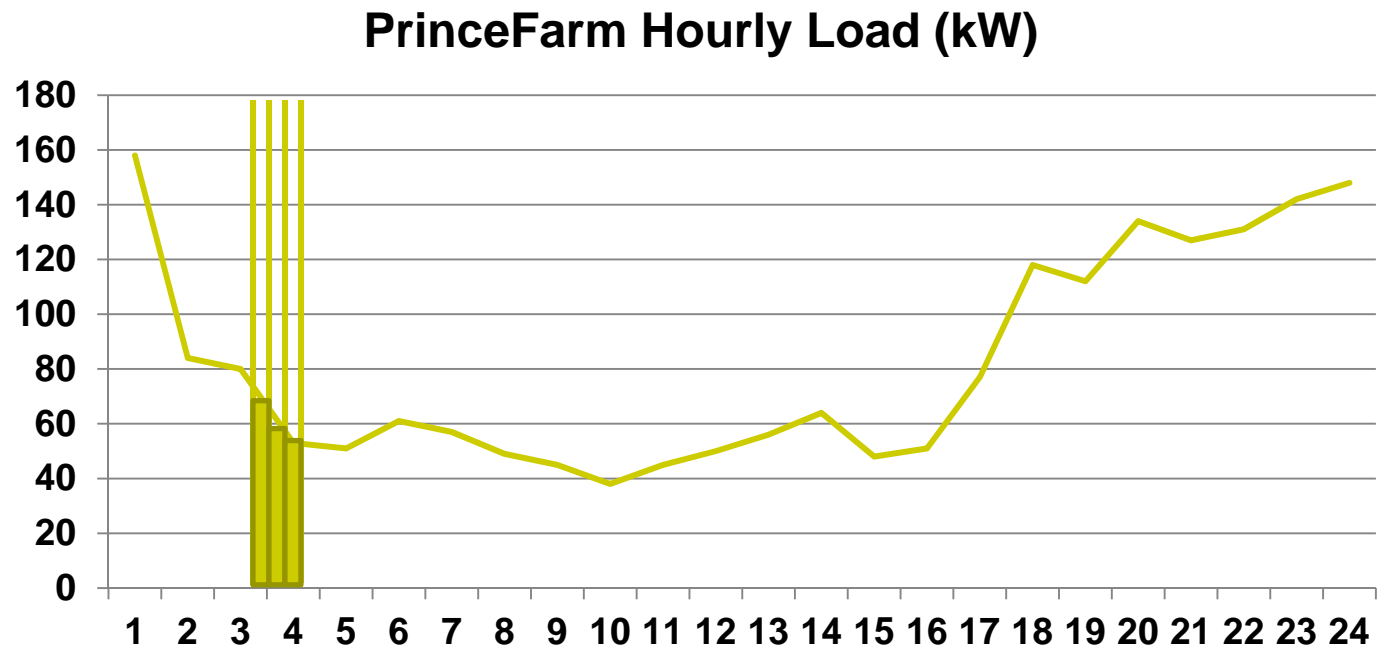
Project Rubik

Right Data, Right Detail



Simple process and Easy to Use





Time Interval	kWh
3:15	17.5
3:30	15
3:45	11.3
Rubik makes it ready	



Support all types of PI System data ... rates, strings, enumerations, non-summables ... to build the right model

Additional Information

OSIsoft Resources

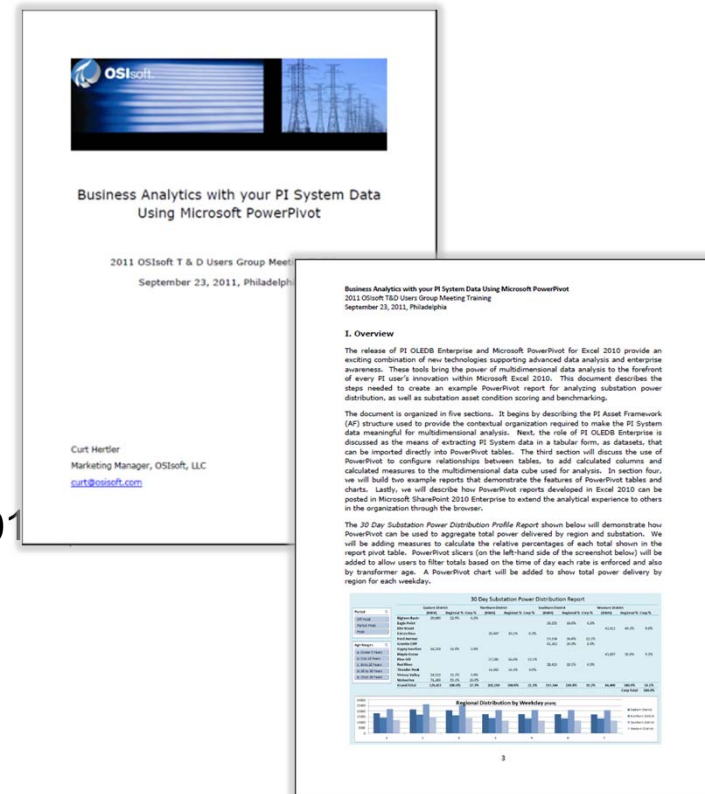
- “Business Analytics with your PI System Data using Microsoft PowerPivot”
- PI T&D Users Group Site extranet.osisoft.com
- OSIsoft vCampus vcampus.osisoft.com

Microsoft Resources

- www.microsoft.com/en-us/bi/powerpivot.aspx

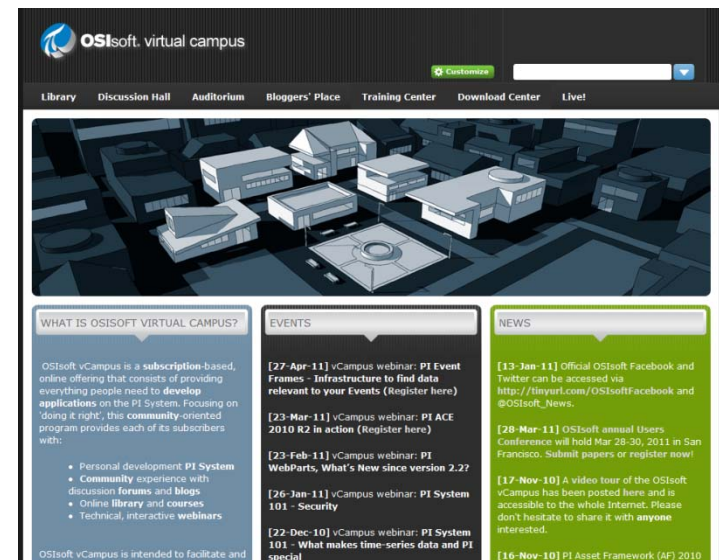
Helpful Books

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



OSIsoft Virtual Campus (vCampus)

- **Online, community-oriented** program
 - Software + Resources + Collaboration
 - Focus on development and integration
 - Partners, customers and OSIsoft
 - Exclusive contents (CTPs, Betas, technical papers)
- Personal **development PI System**
 - Development licenses for PI Data Access products (for developers and integrators)



<http://vCampus.osisoft.com>
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WHERE PI GEEKS MEET



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Grand Hyatt Union Square, San Francisco

Sam Pride

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