



OSIsoft.

REGIONAL SEMINAR

2012

A P A C

The **Power** of **Data**

MALAYSIA



Explore and Expose your Data with PI Data Access and Business Intelligence

Presented by **Han Yong Lee**

Exploring and Exposing Data



Gain **visibility** into the right data,
at the right place, at the right time



How?

Need an easy way
to **disseminate** information

Business Challenges

Disparate systems

- Acquired independently, over time
- Different departments/units

Domain, industry, or user-specific needs

- PI System is an infrastructure

Many different targets

- Diverse types of workers
- Different platforms, media

A few use cases, some ideas

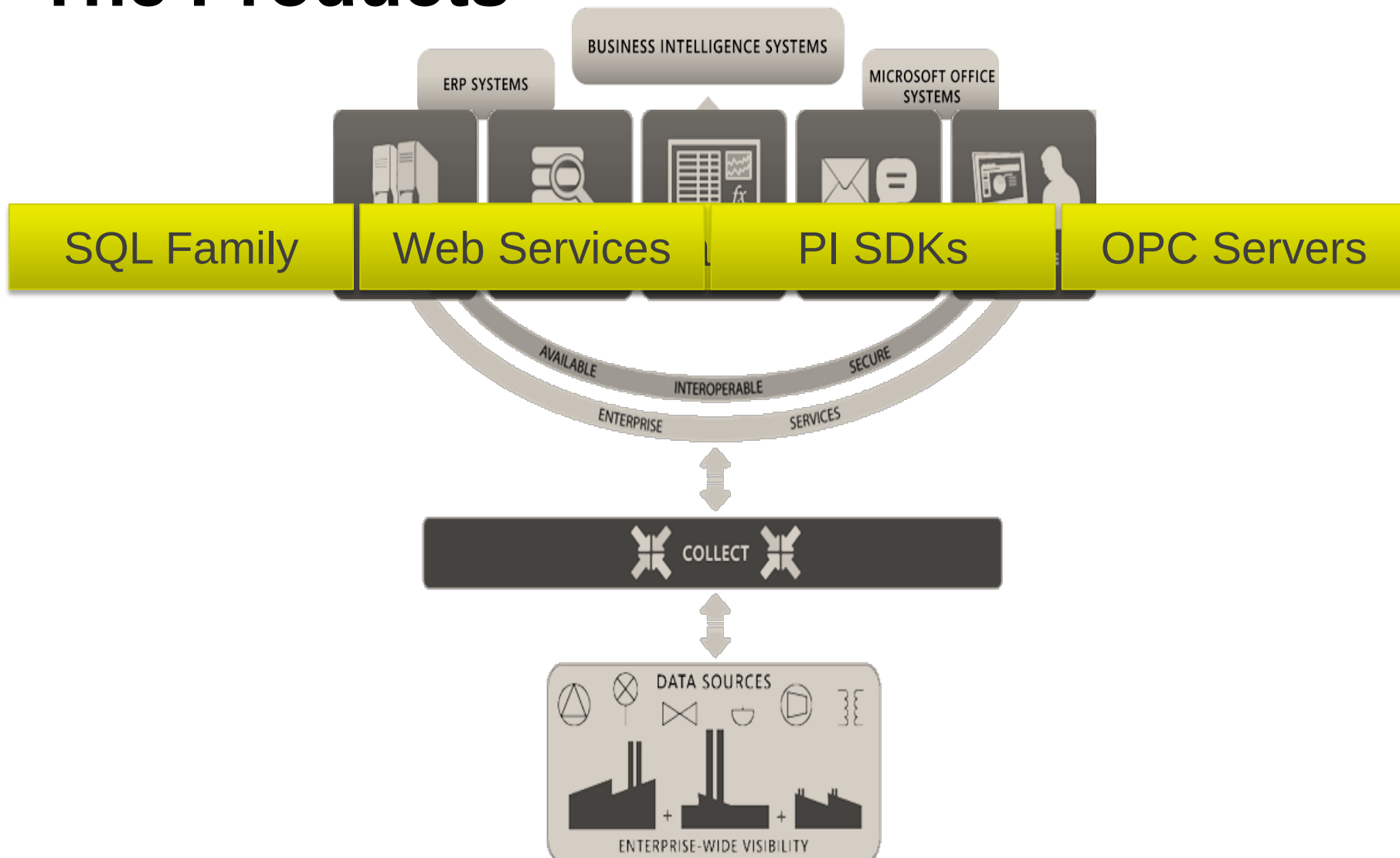
- LoB Systems/Databases
- Orchestration/Workflows
- Web/Non-Windows Platforms
- Analysis/Bi/Reporting
- Custom Applications



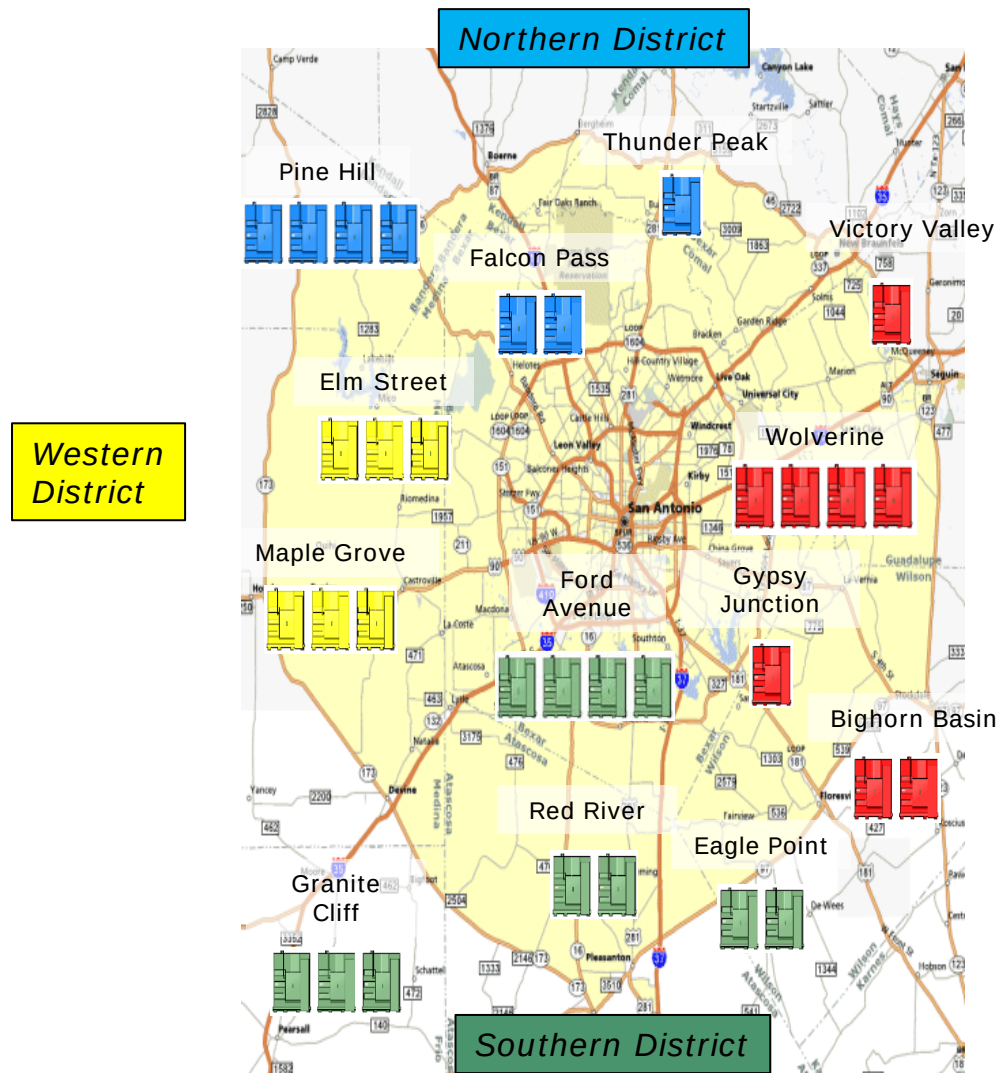
Custom Downtime Analysis Engine

Automated Ordering to Suppliers

The Products



Example: Substation Power Distribution Profile



My Objectives

- Profile 30 day Power Distribution
- Filter and Analyze by Location and Rate Period
- Aging Asset Risk Assessment

Business Analytics Toolkit



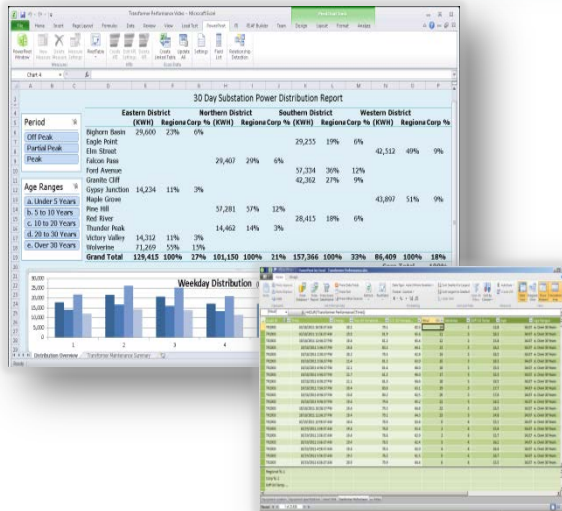
Microsoft®

Microsoft®
Excel 2010

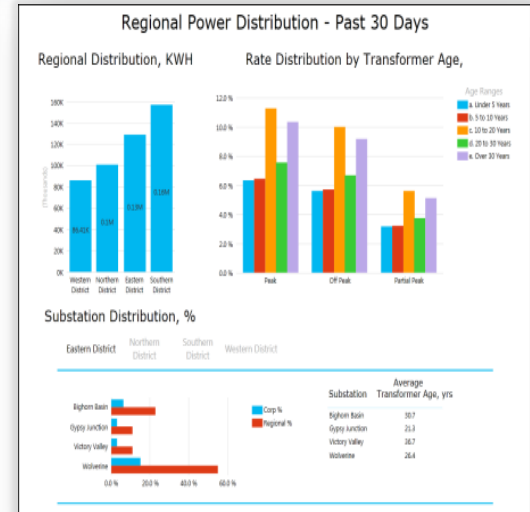
Microsoft®
SQL Server 2012
Business Intelligence

Microsoft®
SharePoint 2010
Enterprise

OSIsoft®
PI Server
PI OLEDB Enterprise



**PowerPivot
for Excel 2010**



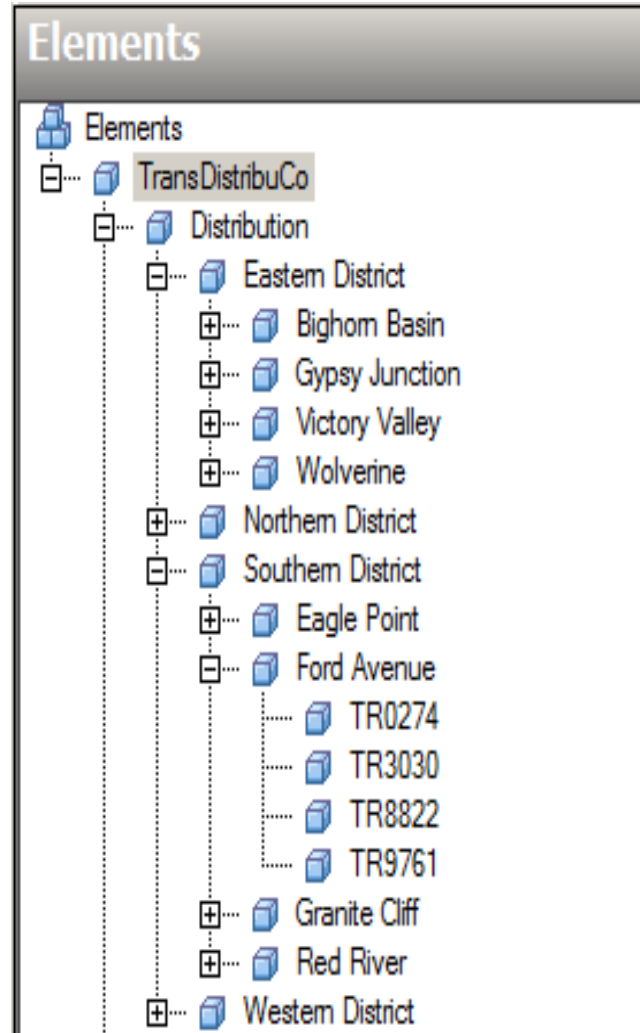
Power View



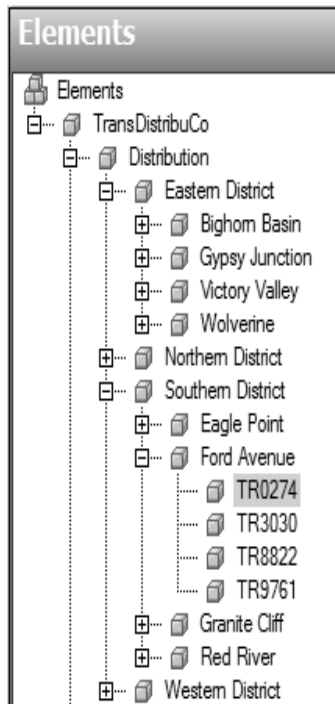
PI Server – *PI Asset Framework*

Asset Hierarchy

- District
- Substation
- Transformer



PI Server – PI Asset Framework



TR0274	
General Child Elements Attributes Ports Version	
Filter	
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

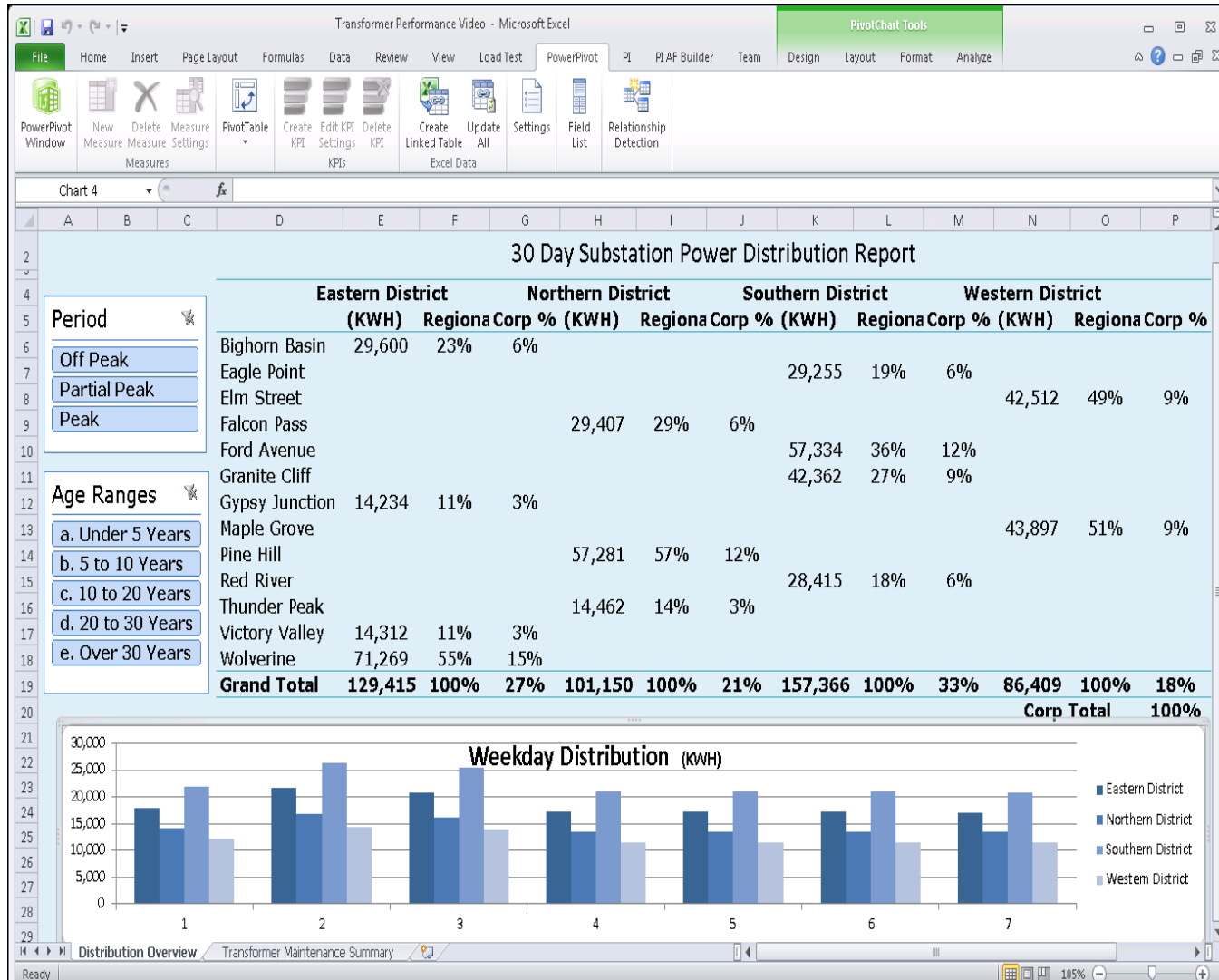
- Leverage structure used throughout your PI Infrastructure
- Insure accurate aggregation of real-time events
- Scale-up by adding PI AF Structure
- Access Event Frames in next release

Asset ID	Time	Energy	Top Oil Temp...	Hour	Weekday	Off Oil Temp	Age Ranges	CH4 to H2
TR2003	8/14/2011 7:41:30 PM	19.95	80.79	19	1	15.5387721774381	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	15.4884817399786	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	15.4214941966901	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	13.2137407314932	e. Over 30 Years	1.471
TR2003	8/15/2011 10:41:30 AM	21.20	81.99	10	2	16.6404075066249	e. Over 30 Years	1.471
TR2003	8/15/2011 11:41:30 AM	21.22	82.68	11	2	17.816716837883	e. Over 30 Years	1.471
TR2003	8/15/2011 12:41:30 PM	21.28	81.50	12	2	17.5523485481639	e. Over 30 Years	1.471
TR2003	8/15/2011 1:41:30 PM	20.93	81.59	13	2	16.5219141244000	e. Over 30 Years	1.471

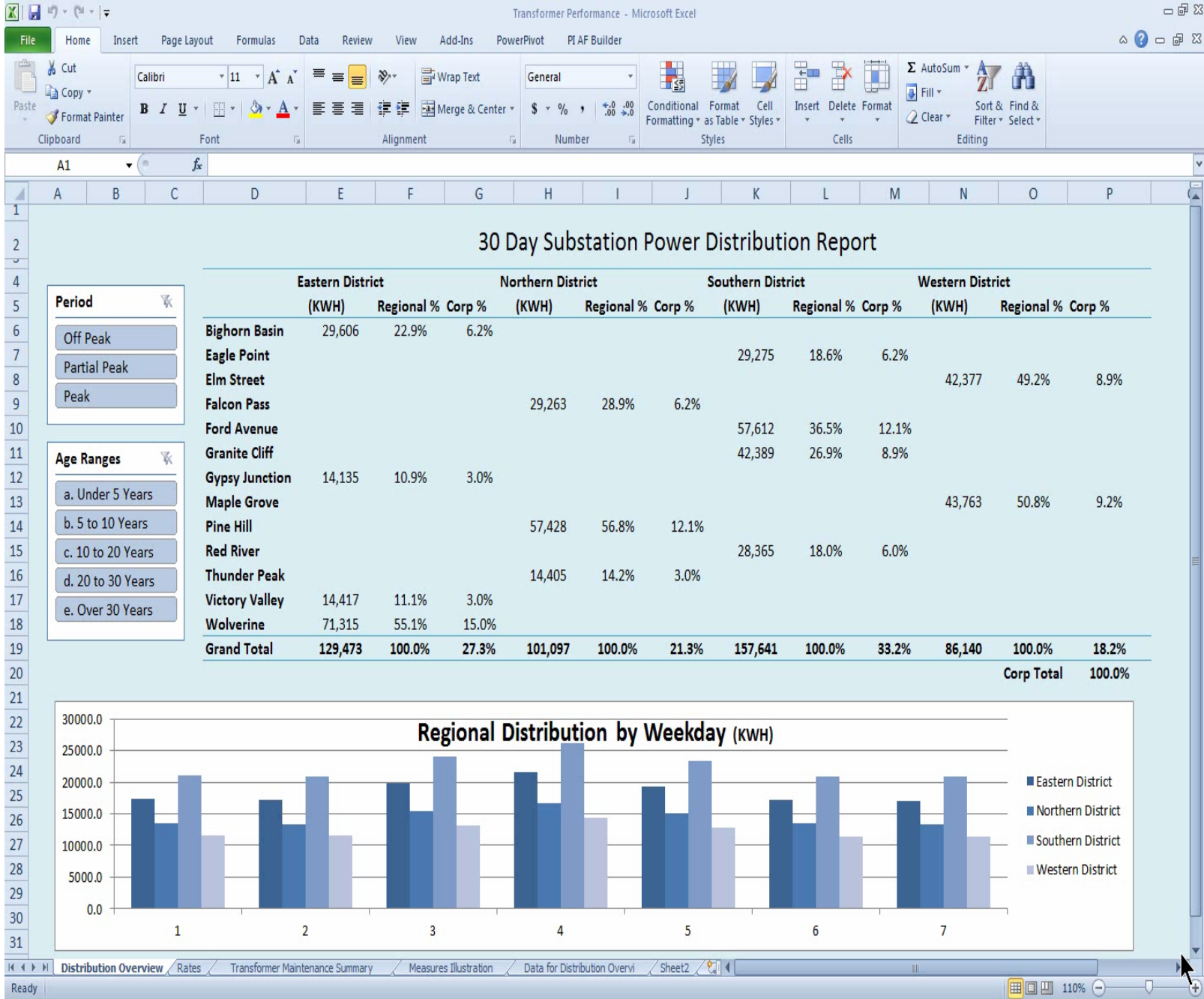
Regional %: 100.0 %
Cop %: 100.0 %
Off Oil Temp Deviation: 0.0
C2H4 to C2H6 Deviation: 0.00
CH4 to H2 Deviation: 0.00

Record: 1 of 23793

PowerPivot for Excel 2010



Power Distribution Report



PowerPivot Enables Data Integration

Elements

- TransDistribCo
 - Distribution
 - Eastern District
 - Bighorn Basin
 - Coppy Junction
 - Victory Valley
 - Wolverine
 - Northern District
 - Engle Point
 - Ford Avenue
 - TR10274
 - TR30300
 - TR5822
 - TR5761
 - Grants Cliff
 - Ford River
 - Western District

OSIsoft
PI Server
PI OLEDB Enterprise

Microsoft SQL Server Management Studio

Server: SQLSERVER01

Database: TransDistribCo

Table: TransDistribCo.DailyRatePeriods

Columns: Hour, Period, Peak

Query Results

Hour	Period	Peak
0	Off Peak	0
1	Off Peak	0
2	Off Peak	0
3	Off Peak	0
4	Off Peak	0
5	Off Peak	0
6	Partial Peak	0
7	Partial Peak	0
8	Partial Peak	0
9	Peak	0
10	Peak	0
11	Peak	0
12	Peak	0
13	Peak	0
14	Peak	0
15	Peak	0
16	Peak	0
17	Peak	0
18	Partial Peak	0
19	Partial Peak	0
20	Partial Peak	0
21	Off Peak	0
22	Off Peak	0
23	Off Peak	0

Microsoft
SQL Server 2012
Business Intelligence

Transformer Performance - Microsoft Excel

PowerPivot for Excel - Transformer Performance

Table: Transformer Performance

Equipment Location	Equipment Specifications	Latest DGA	Transformer Performance	Gas Rates
TR2003	10/18/2011	33.675	20.5	79.1
TR2003	10/18/2011	33.675	19.9	81.9
TR2003	10/18/2011	33.675	19.4	81.2
TR2003	10/18/2011	33.675	19.8	80.2
TR2003	10/18/2011	33.675	20.3	79.3
TR2003	10/18/2011	33.675	21.4	81.3
TR2003	10/18/2011	33.675	22.1	81.4
TR2003	10/18/2011	33.675	21.7	81.3
TR2003	10/18/2011	33.675	21.1	81.0
TR2003	10/18/2011	33.675	20.4	80.8
TR2003	10/18/2011	33.675	19.8	80.2
TR2003	10/18/2011	33.675	19.4	79.4
TR2003	10/18/2011	33.675	19.4	79.3
TR2003	10/18/2011	33.675	19.4	79.1
TR2003	10/19/2011	33.675	19.4	78.9
TR2003	10/19/2011	33.675	19.4	78.8
TR2003	10/19/2011	33.675	19.4	78.6
TR2003	10/19/2011	33.675	19.4	78.5
TR2003	10/19/2011	33.675	19.4	78.3
TR2003	10/19/2011	33.675	19.3	78.2
TR2003	10/19/2011	33.675	20.9	79.9
TR2003	10/19/2011	33.675	21.6	80.8



Transformer Performance - Microsoft Excel

Table: TransDistribCo Daily Rate Periods

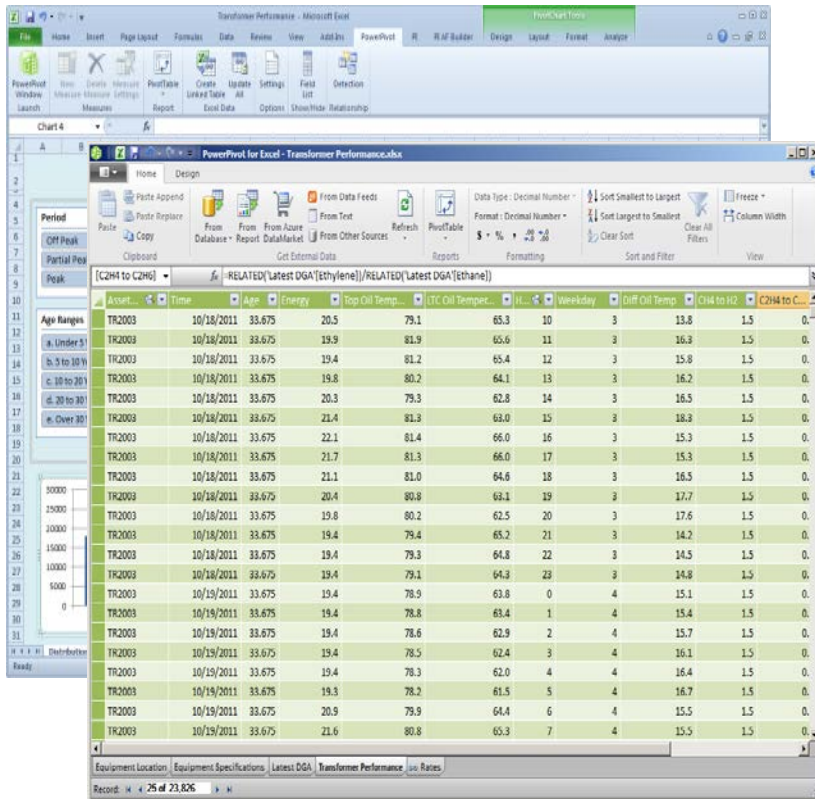
Hour	Period
0	Off Peak
1	Off Peak
2	Off Peak
3	Off Peak
4	Off Peak
5	Off Peak
6	Partial Peak
7	Partial Peak
8	Partial Peak
9	Peak
10	Peak
11	Peak
12	Peak
13	Peak
14	Peak
15	Peak
16	Peak
17	Peak
18	Partial Peak
19	Partial Peak
20	Partial Peak
21	Off Peak
22	Off Peak
23	Off Peak

Microsoft
Excel 2010

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



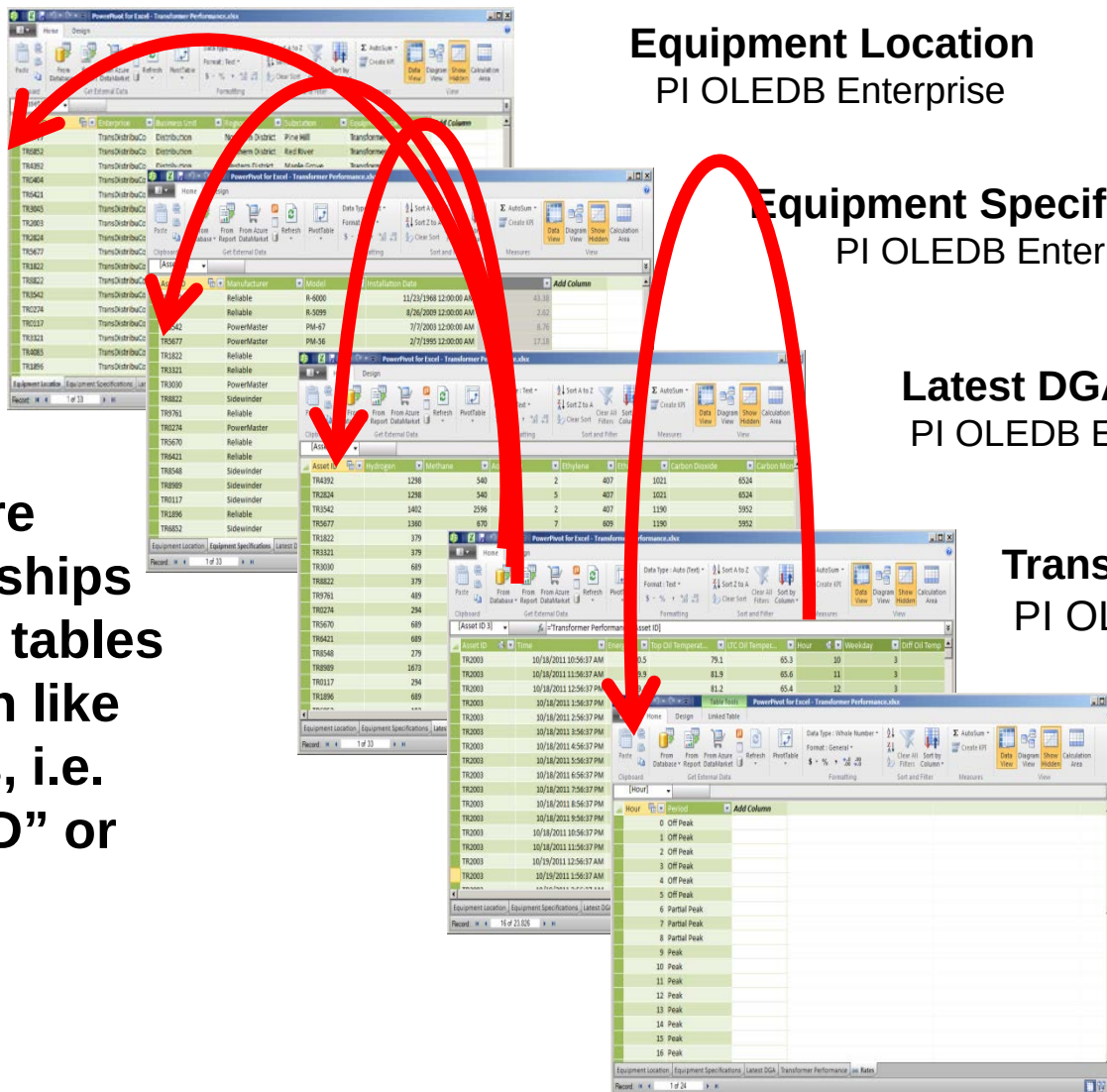
DAX – Data Analysis Expression Language

Transformer Age Column

Transformer Age Ranges Column

16

PowerPivot Creates the “Cube”



Configure Relationships between tables based on like columns, i.e. “Asset ID” or “Hour”

Equipment Location
PI OLEDB Enterprise

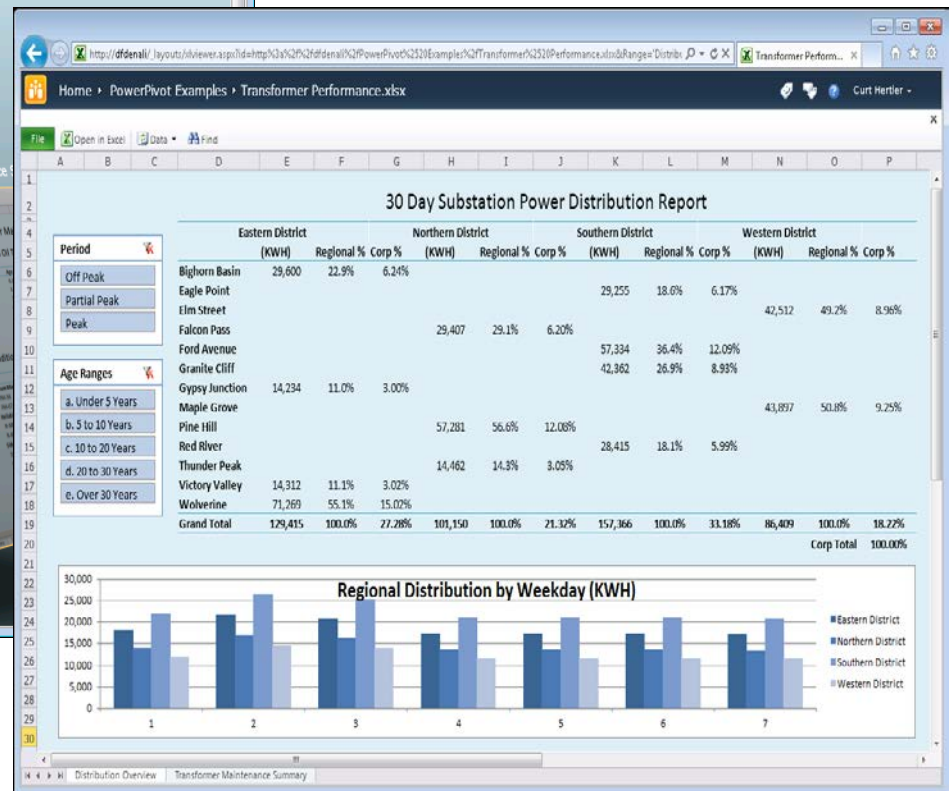
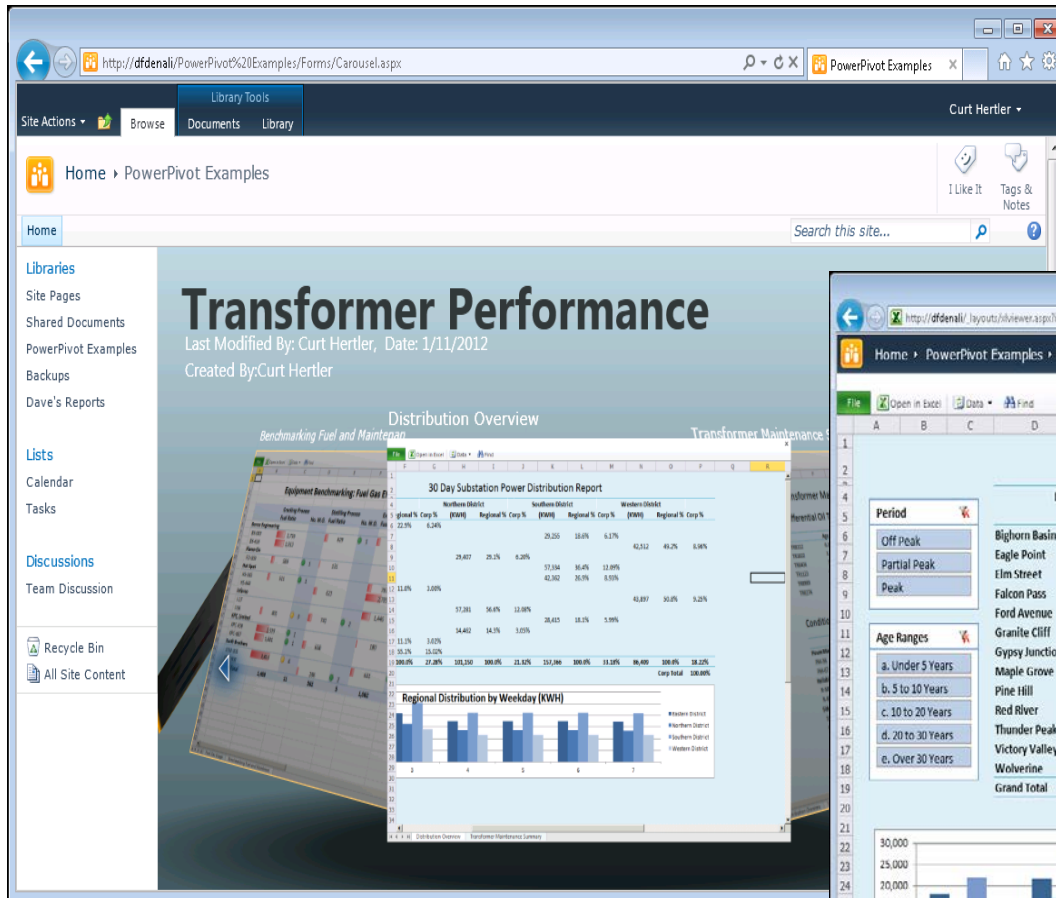
Equipment Specifications
PI OLEDB Enterprise

Latest DGA
PI OLEDB Enterprise

Transformer Performance
PI OLEDB Enterprise

Rates
Excel Linked Table

SharePoint 2010 Enterprise – PowerPivot Gallery



Additional Information

OSIsoft Resources

- “Business Analytics with your PI System Data using Microsoft PowerPivot”
- PI T&D Users Group Site extranet.osisoft.com
- OSIssoft 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 2013”, Art Tennick



How to get PI Data Access

- ```

AFTimeRange tr = new AFTimeRange(new AFTime(textBox1.Text),
AFValues vals = _afDB.Elements["Pump123"].Attributes["Pump123"].Values;

lstValues.Items.Clear();
foreach(AFValue val in vals)
{
 lstValues.Items.Add(val.Value.ToString() + val.Timestamp.ToString());
}

```

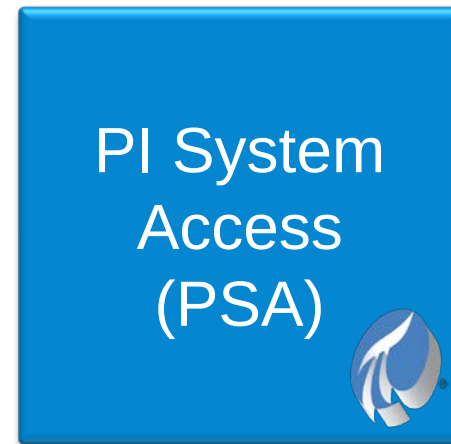
products  
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time licenses  
d)



=





# 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)



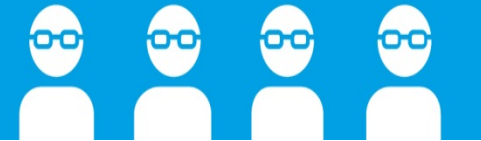
<http://vCampus.osisoft.com>  
[vCampus@osisoft.com](mailto:vCampus@osisoft.com)





# vCampus **Live!** 2012

**WHERE PI GEEKS MEET**



**Week of November 26<sup>th</sup>**

**Grand Hyatt Union Square, San Francisco**

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