



OSIsoft.

REGIONAL SEMINAR 2012

A P A C

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

INDIA



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

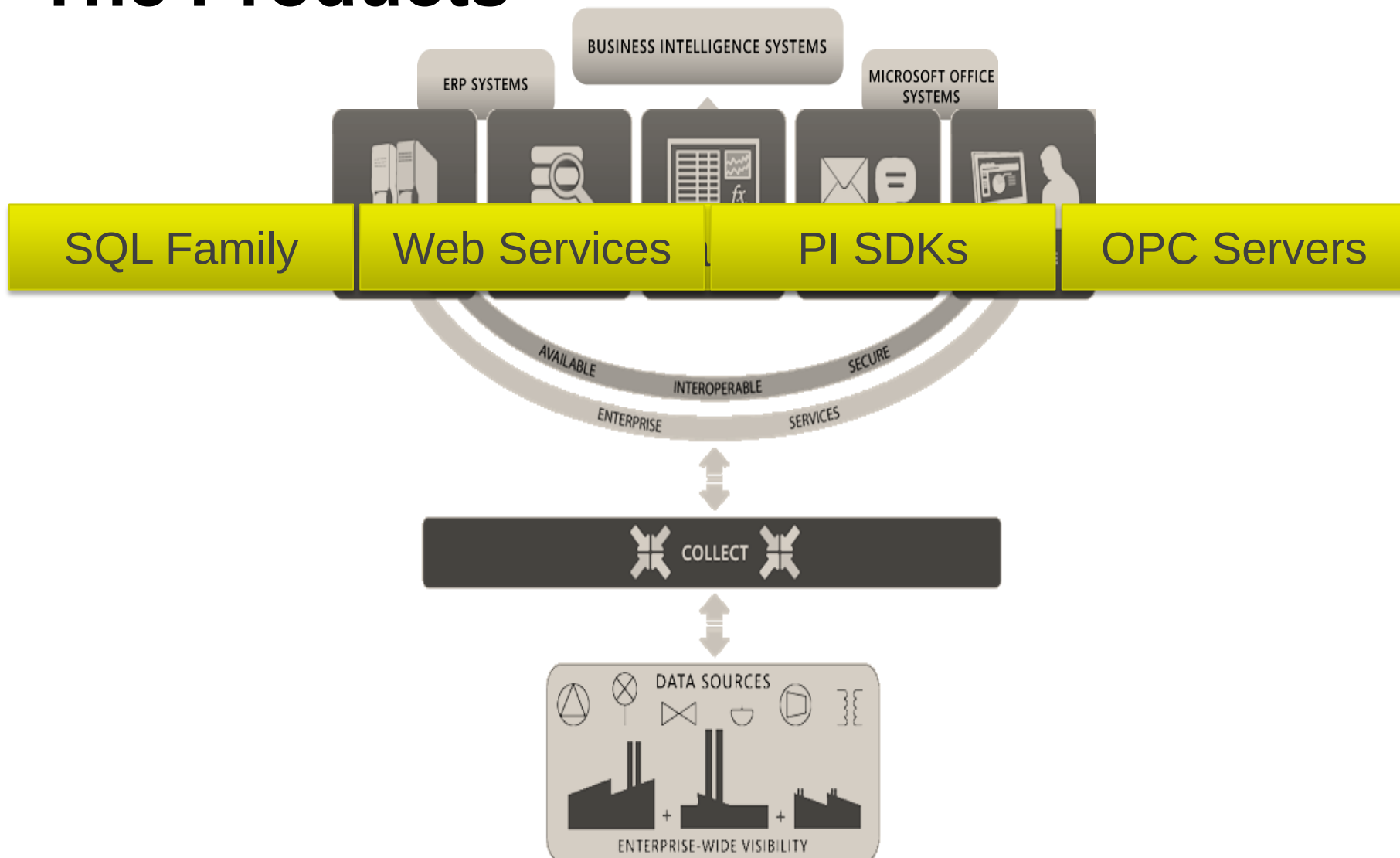
- LoB Systems/Databases
- Orchestration/Workflows
- Web/Non-Windows Platforms
- Analysis/Bi/Reporting
- Custom Applications



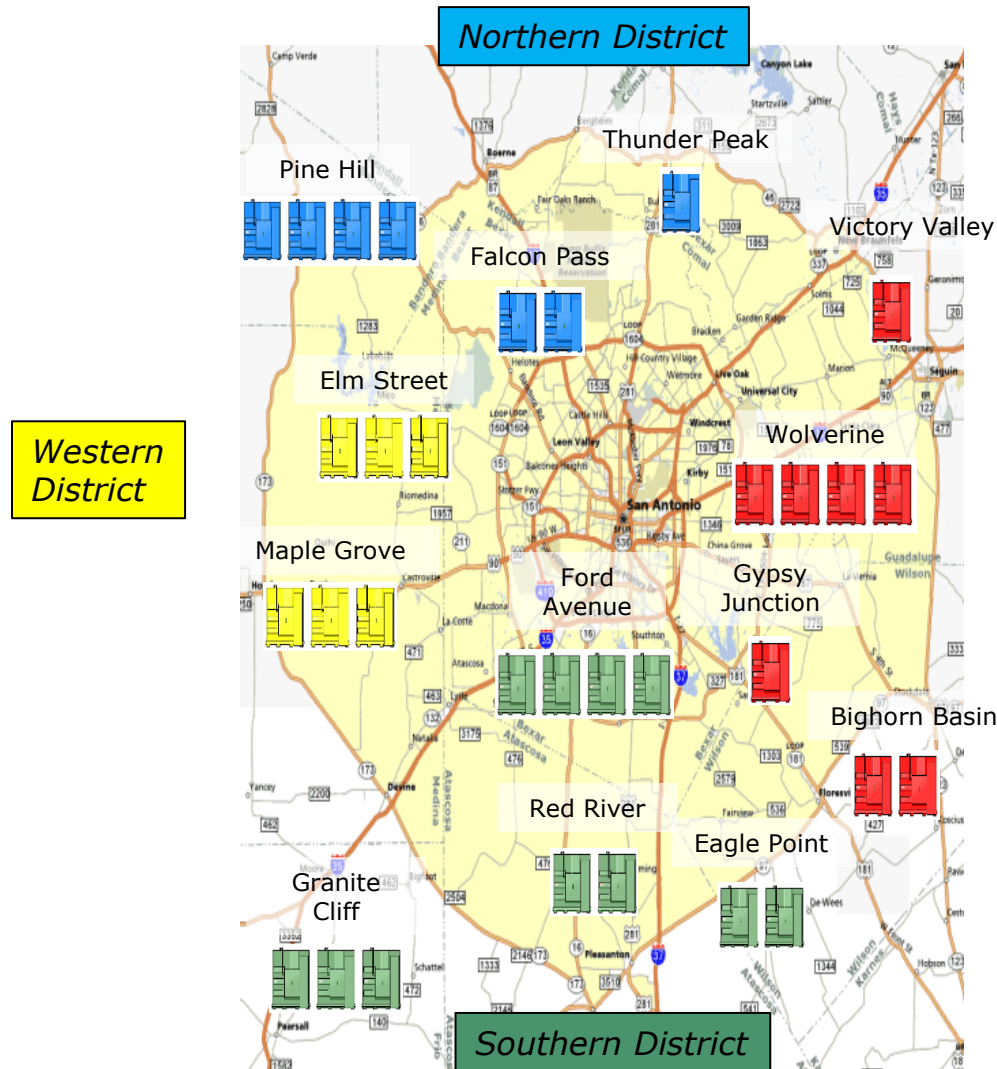
Custom Downtime Analysis Engine

Automated Ordering to Suppliers

The Products



Example: Substation Power Distribution Profile



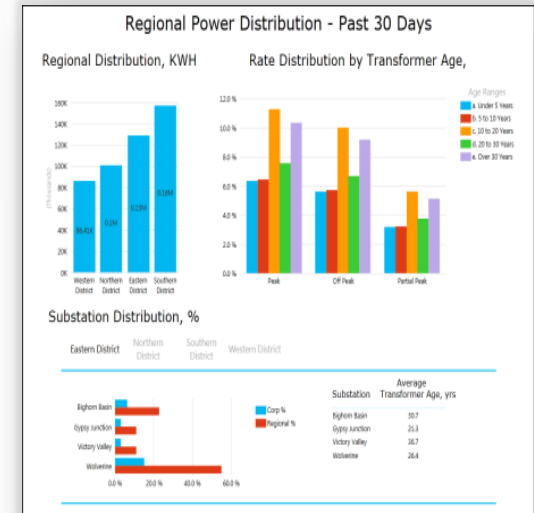
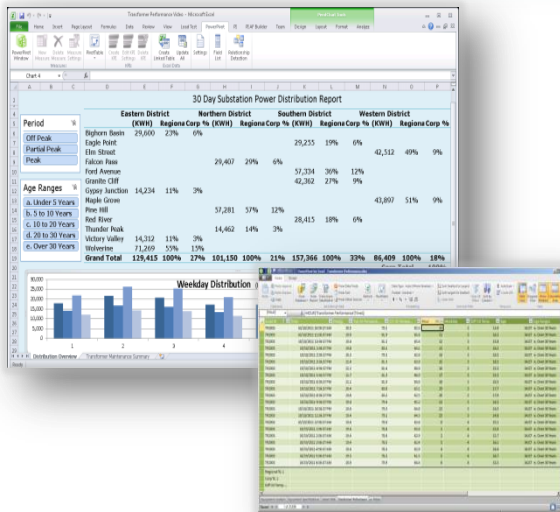
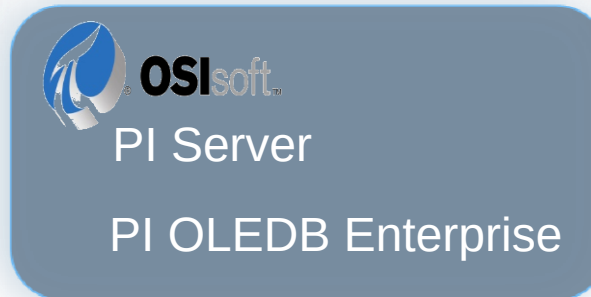
My Objectives

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

Business Analytics Toolkit



Microsoft®



PowerPivot
for Excel 2010

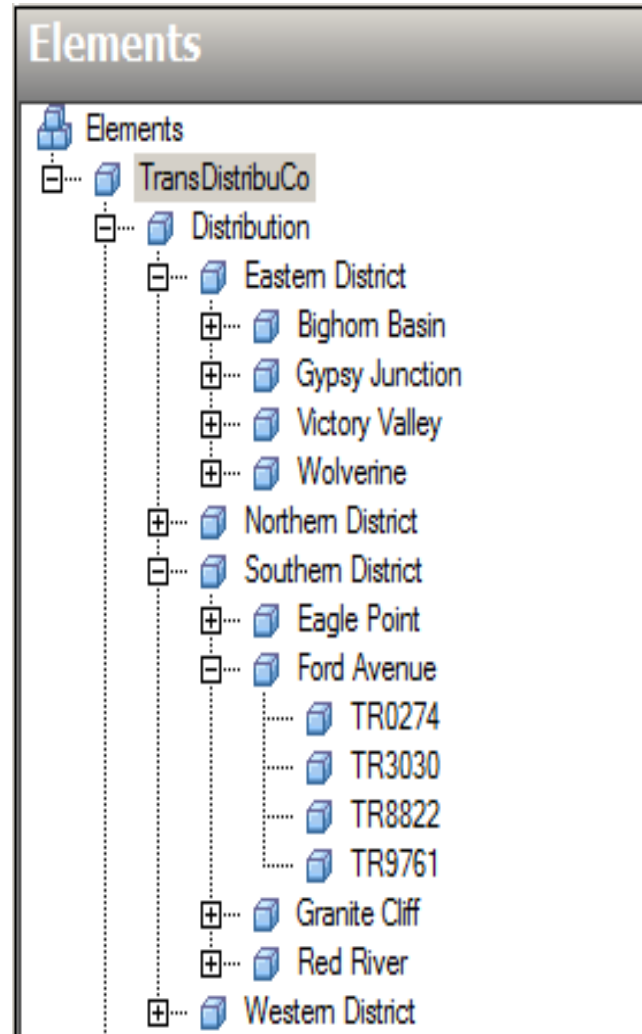
Power View



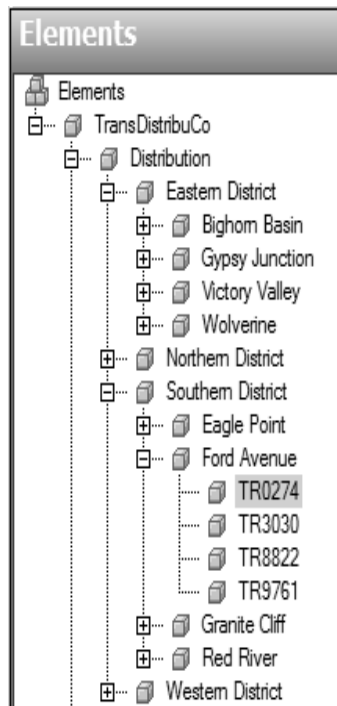
PI Server – *PI Asset Framework*

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

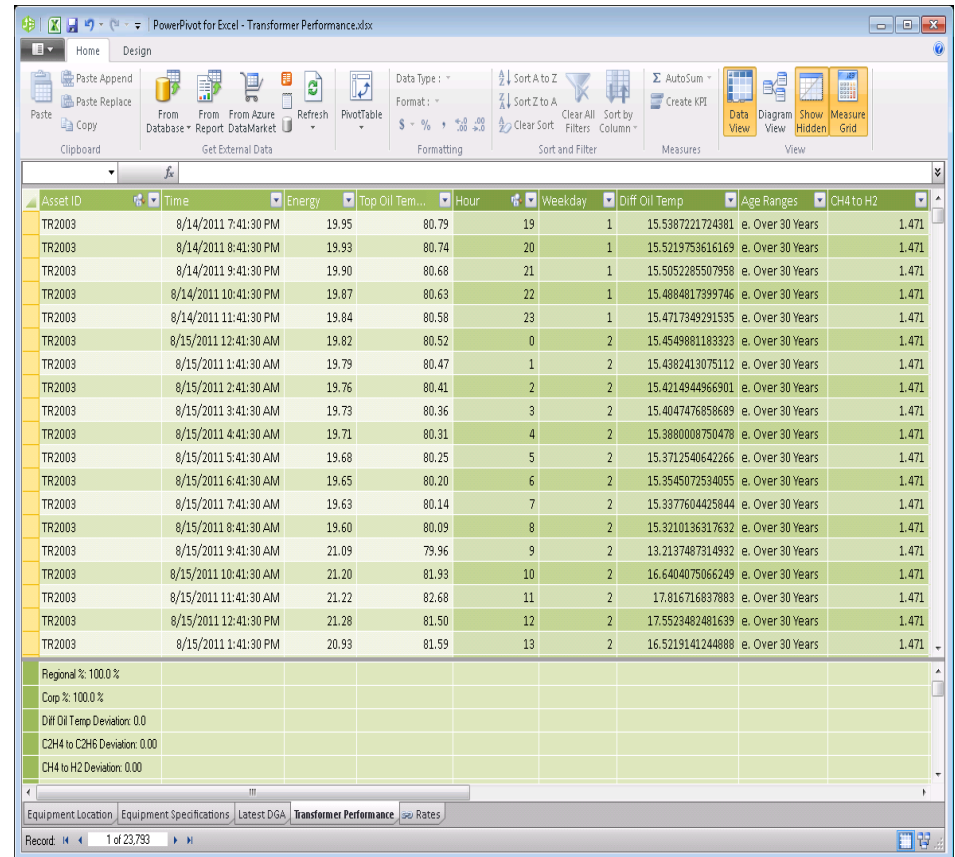
Transformer Attributes

- PI System Data
- Equipment Specifications
- DGA analysis

PI OLEDB Enterprise

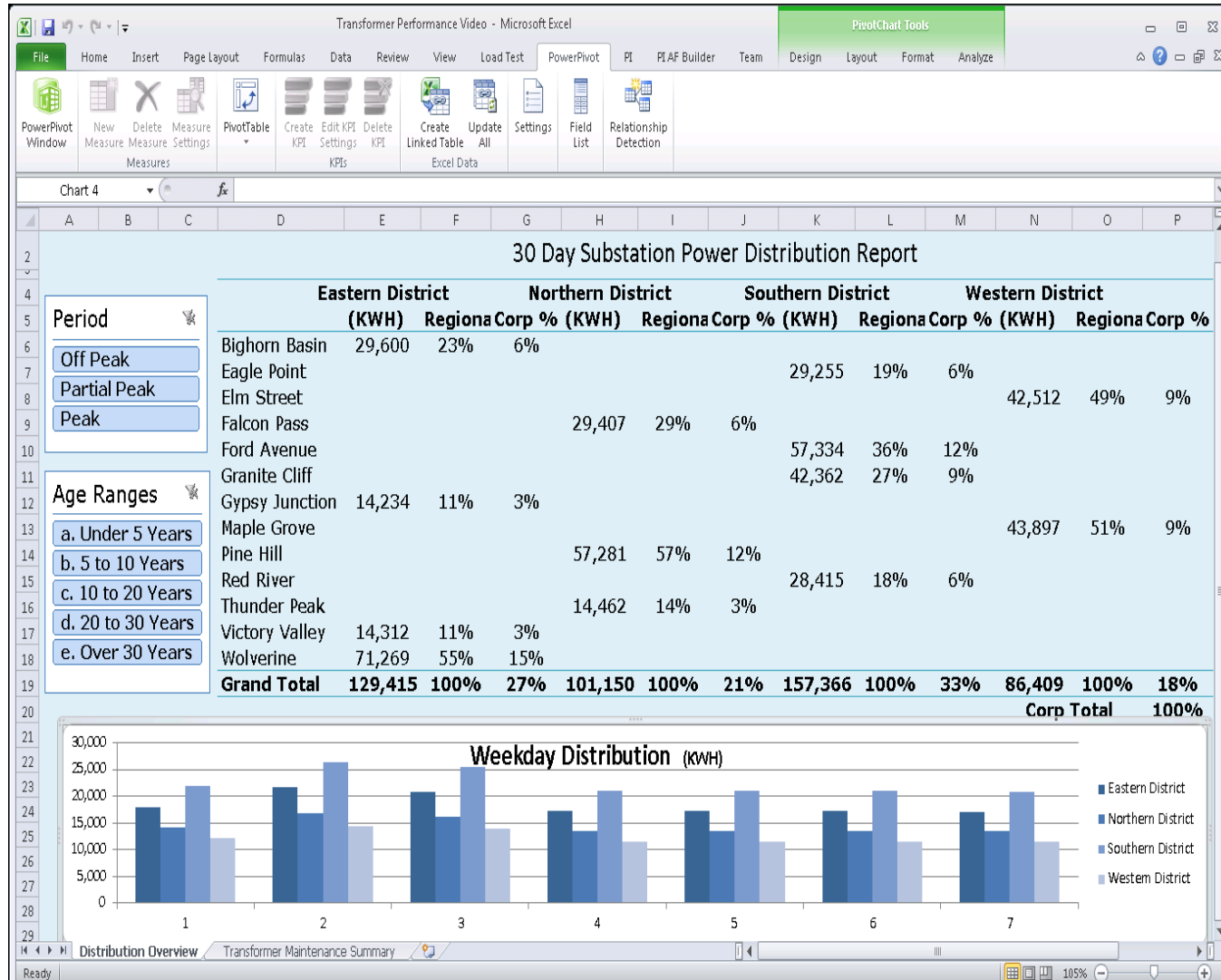
Important Considerations

- 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

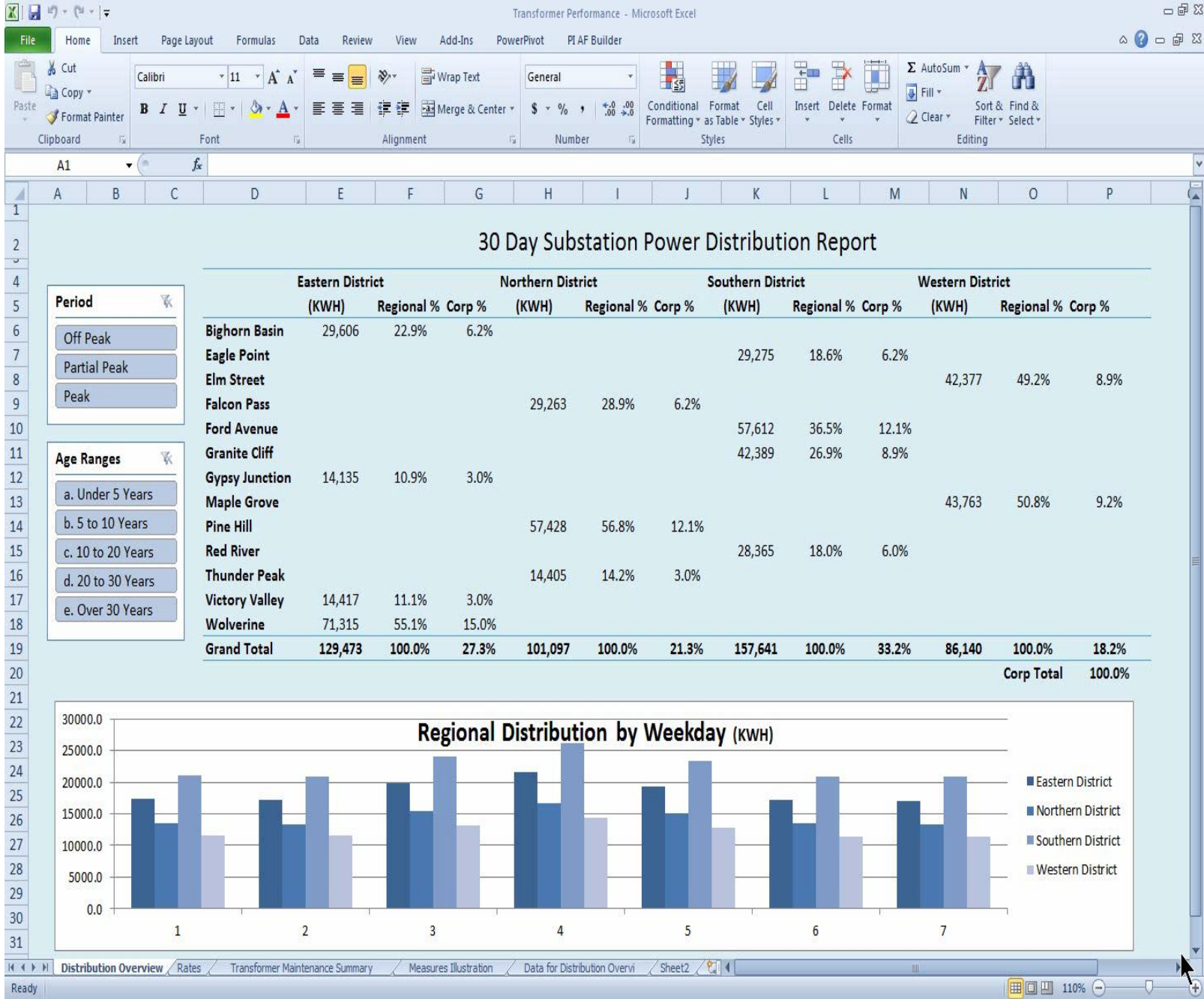


Asset ID	Time	Energy	Top Oil Temp	Hour	Weekday	Diff Oil Temp	Age Ranges	CH4 to H2
TR2003	8/14/2011 7:41:30 PM	19.95	80.79	19	1	15.5387221724381	e. Over 30 Years	1.471
TR2003	8/14/2011 8:41:30 PM	19.93	80.74	20	1	15.5219753616169	e. Over 30 Years	1.471
TR2003	8/14/2011 9:41:30 PM	19.90	80.68	21	1	15.5052285507958	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	15.42149444966901	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	13.2137487914932	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	17.816716837883	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								

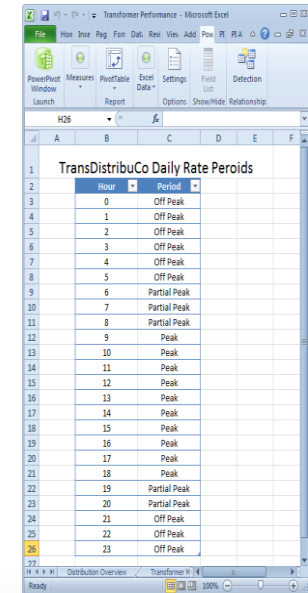
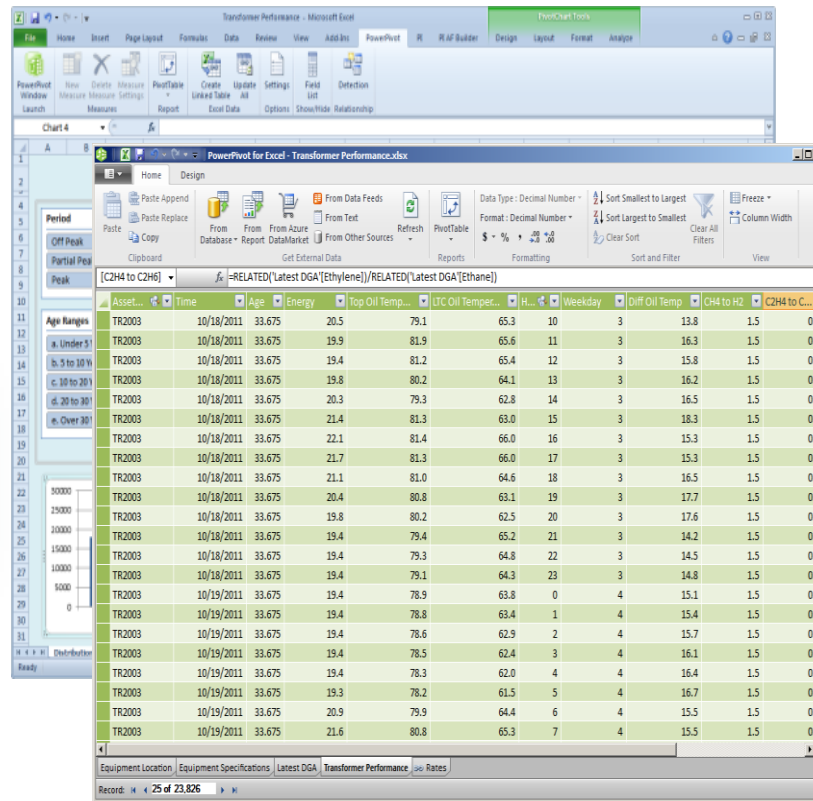
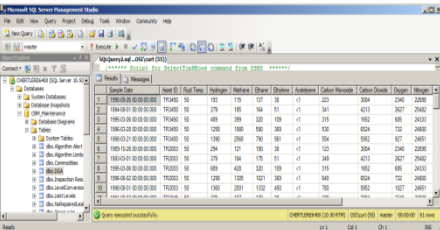
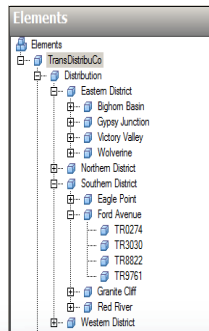
PowerPivot for Excel 2010



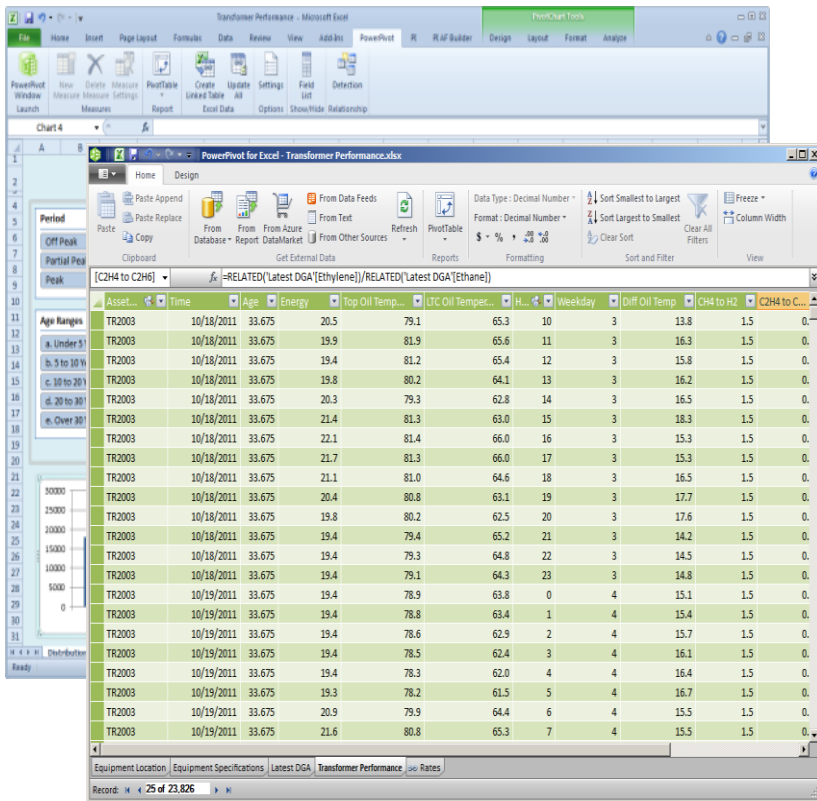
Power Distribution Report



PowerPivot Enables Data Integration



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

[illegible]

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

```
=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")))))
```

PowerPivot Creates the “Cube”

The image displays four screenshots of the PowerPivot for Excel interface, illustrating the relationships between different data tables. Red arrows indicate the flow of relationships from the 'Equipment Location' table to 'Equipment Specifications', then to 'Latest DGA', and finally to 'Transformer Performance'.

Equipment Location
PI OLEDB Enterprise

Asset ID	Manufacturer	Model	Installation Date	Asset ID
TR652	TransformCo	Distribution	11/21/2008 12:00:00 AM	43.38
TR432	TransformCo	Distribution	8/26/2009 12:00:00 AM	2.62
TR404	TransformCo	Distribution	7/7/2009 12:00:00 AM	6.76
TR421	TransformCo	Distribution	2/7/2009 12:00:00 AM	17.18
TR505	TransformCo	Distribution		
TR203	TransformCo	Distribution		
TR324	TransformCo	Distribution		
TR567	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR182	TransformCo	Distribution		
TR342	TransformCo	Distribution		
TR274	TransformCo	Distribution		
TR117	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR605	TransformCo	Distribution		
TR186	TransformCo	Distribution		

Equipment Specifications
PI OLEDB Enterprise

Asset ID	Manufacturer	Model	Installation Date	Asset ID
TR432	TransformCo	Distribution	11/21/2008 12:00:00 AM	43.38
TR404	TransformCo	Distribution	8/26/2009 12:00:00 AM	2.62
TR421	TransformCo	Distribution	7/7/2009 12:00:00 AM	6.76
TR505	TransformCo	Distribution	2/7/2009 12:00:00 AM	17.18
TR203	TransformCo	Distribution		
TR324	TransformCo	Distribution		
TR567	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR182	TransformCo	Distribution		
TR342	TransformCo	Distribution		
TR274	TransformCo	Distribution		
TR117	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR605	TransformCo	Distribution		
TR186	TransformCo	Distribution		

Latest DGA
PI OLEDB Enterprise

Asset ID	Manufacturer	Model	Installation Date	Asset ID
TR432	TransformCo	Distribution	11/21/2008 12:00:00 AM	43.38
TR404	TransformCo	Distribution	8/26/2009 12:00:00 AM	2.62
TR421	TransformCo	Distribution	7/7/2009 12:00:00 AM	6.76
TR505	TransformCo	Distribution	2/7/2009 12:00:00 AM	17.18
TR203	TransformCo	Distribution		
TR324	TransformCo	Distribution		
TR567	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR182	TransformCo	Distribution		
TR342	TransformCo	Distribution		
TR274	TransformCo	Distribution		
TR117	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR605	TransformCo	Distribution		
TR186	TransformCo	Distribution		

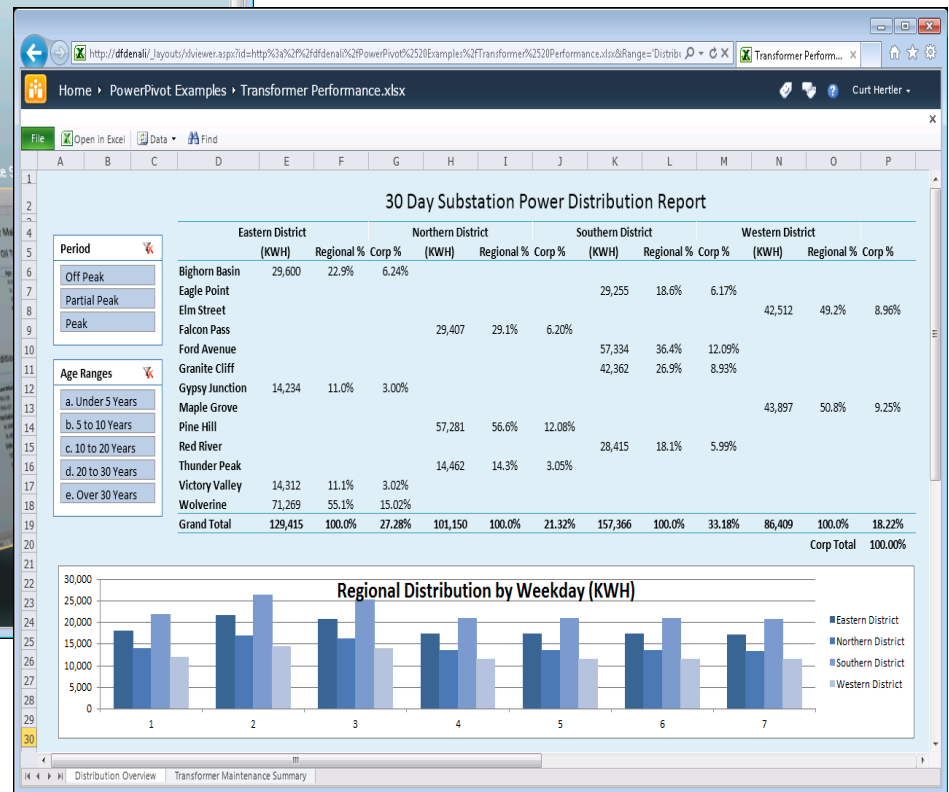
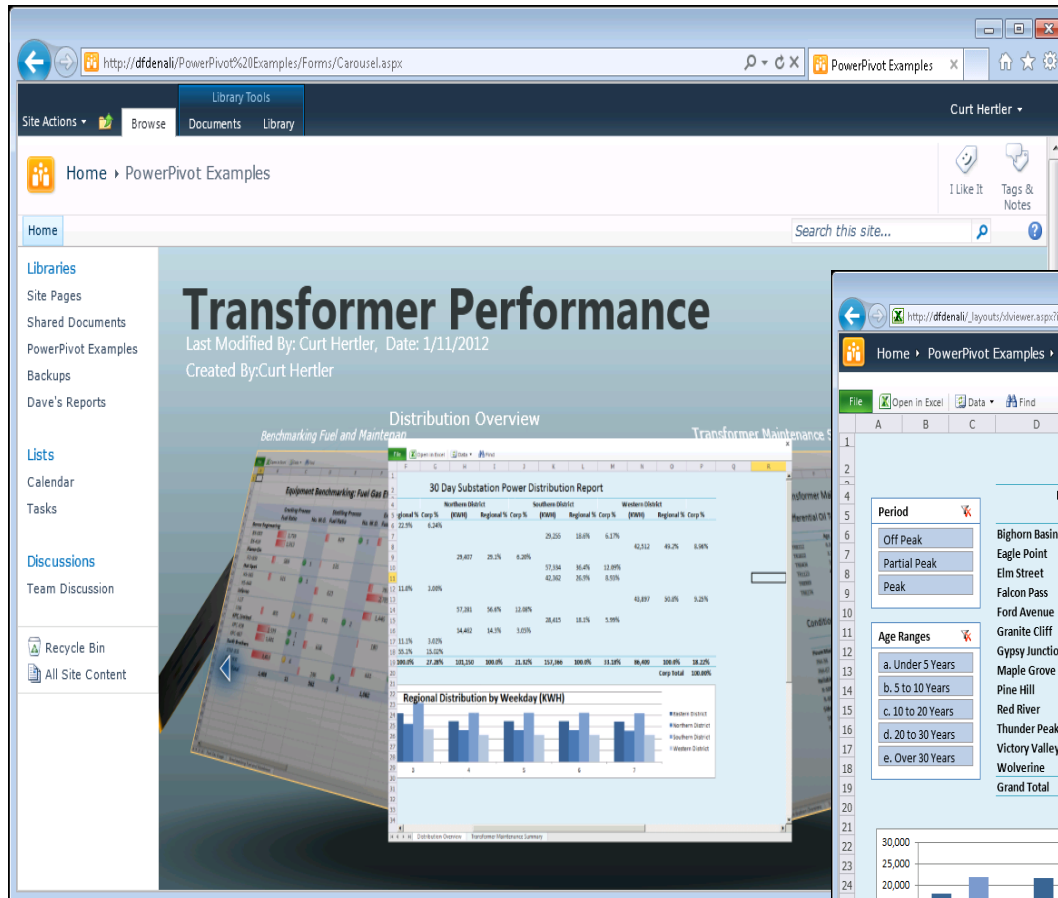
Transformer Performance
PI OLEDB Enterprise

Asset ID	Manufacturer	Model	Installation Date	Asset ID
TR432	TransformCo	Distribution	11/21/2008 12:00:00 AM	43.38
TR404	TransformCo	Distribution	8/26/2009 12:00:00 AM	2.62
TR421	TransformCo	Distribution	7/7/2009 12:00:00 AM	6.76
TR505	TransformCo	Distribution	2/7/2009 12:00:00 AM	17.18
TR203	TransformCo	Distribution		
TR324	TransformCo	Distribution		
TR567	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR182	TransformCo	Distribution		
TR342	TransformCo	Distribution		
TR274	TransformCo	Distribution		
TR117	TransformCo	Distribution		
TR132	TransformCo	Distribution		
TR605	TransformCo	Distribution		
TR186	TransformCo	Distribution		

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

Rates
Excel Linked Table

SharePoint 2010 Enterprise – PowerPivot Gallery



Additional Information

OS/soft 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



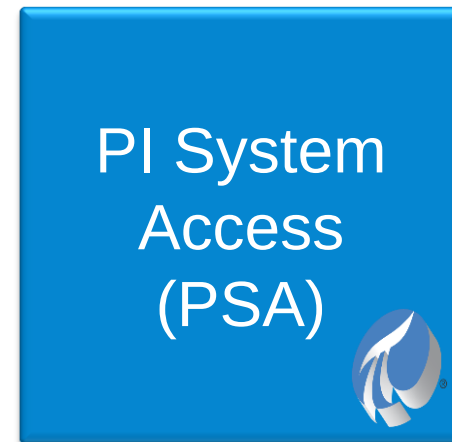
How to get PI Data Access

- ```

AFTimeRange tr = new AFTimeRange(new AFTime(tex
AFValues vals = _afDB.Elements["Pump123"].Attri
products
it all)

1stValues.Items.Clear();
foreach(AFValue val in vals)
{
 1stValues.Items.Add(val.Value.ToString() +
time licenses
})

```



# 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

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

**Grand Hyatt Union Square, San Francisco**



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vCampus Support Engineer  
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