



Business Analytics and the PI System

Presented by **Curt Hertler**

Marketing Manager, Microsoft Alliance

Agenda

- Business Analytics introduction
- Business Analytics tools and examples
 - PI Asset Framework
 - PI OLEDB Enterprise
 - MS PowerPivot
 - MS SQL PowerView
 - MS SQL Analysis Services
- Key points to take home



Business Intelligence Fundamentals

- It's about Decision Making
 - Every level of the organization
 - To have value, BI needs “the **Right Information** at the **Right Time** in the **Right Format**”
- The Right Information
 - **FOSH = Financial, Operational, Sales, Human Resources**
- The Right Time
 - With BI System, the right time is real time
- The Right Format
 - Familiarity encourages adoption



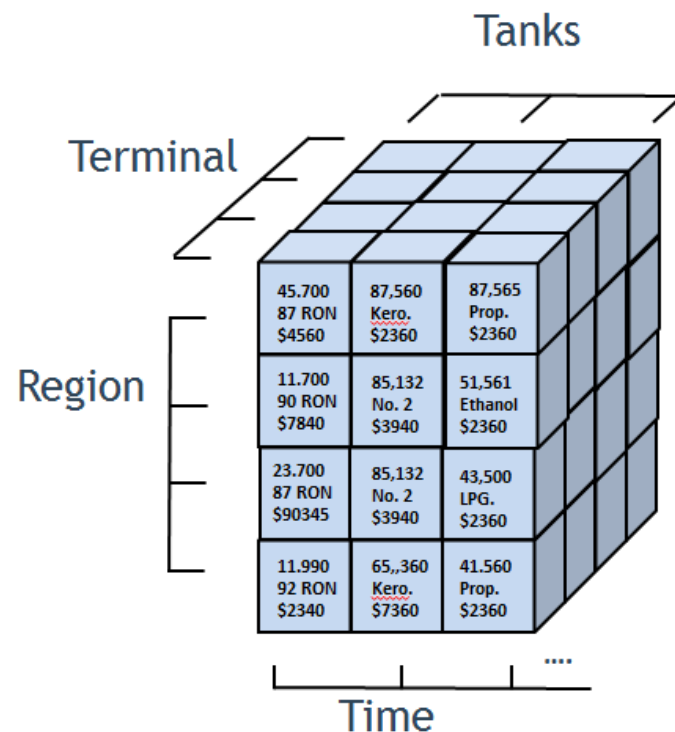
PI System data for reporting and decision making

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

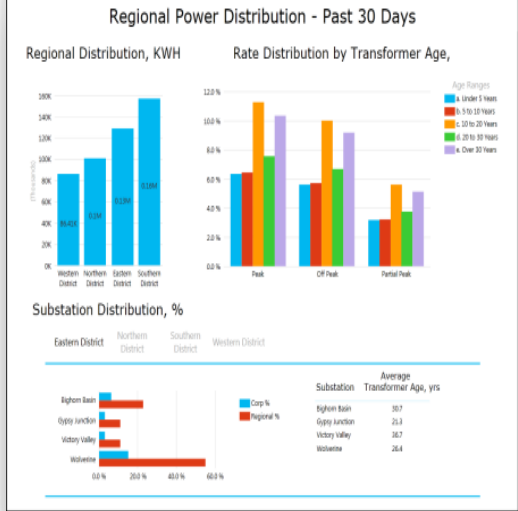
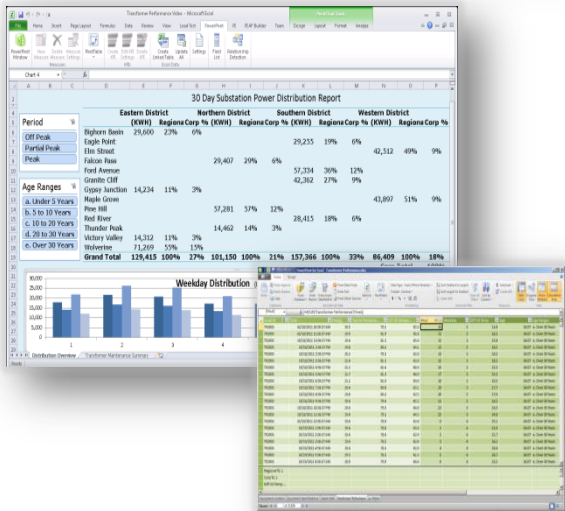


PI System data for reporting and decision making

- Think of data as a cube for decision making.
 - 1st dimension : PI Data Archive history
 - Other dimensions : PI Asset Framework structure.
- Different perspectives can be found when
 - Sorting data
 - Presenting data
 - Analyzing data



Business Analytics Toolkit

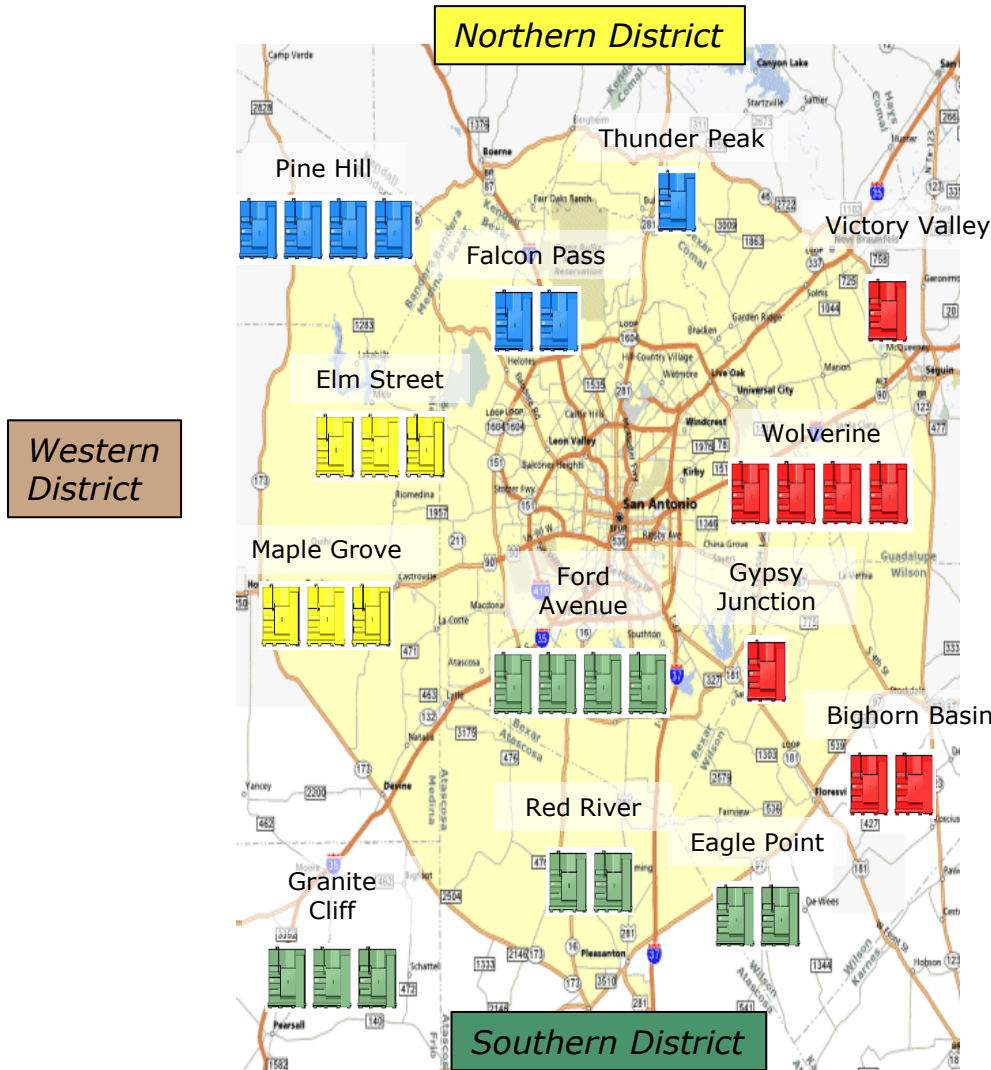


PowerPivot for Excel 2010

Power View



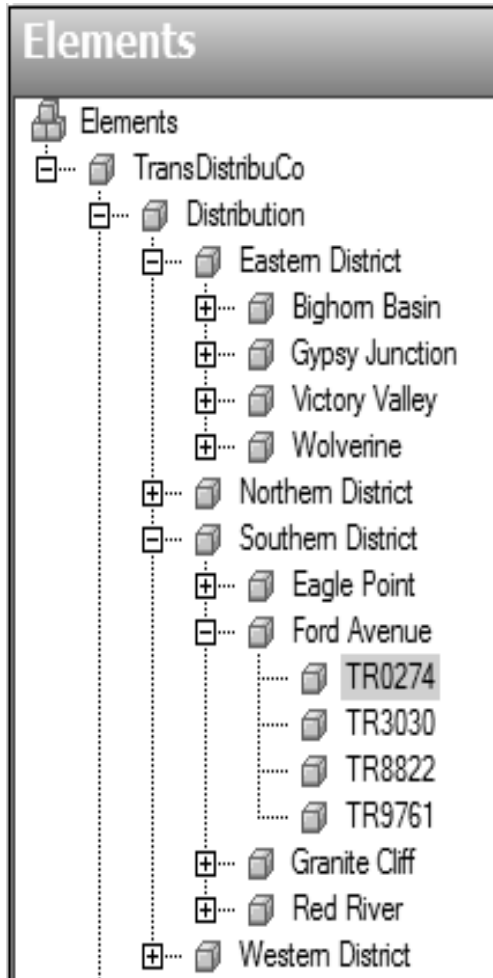
Example: Substation Power Distribution Profile



My Objectives

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

PI Asset Framework (PI AF)



| 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 |

Asset Attributes

- PI System Data
- Equipment Specifications
- Lab Analysis

PI OLEDB Enterprise

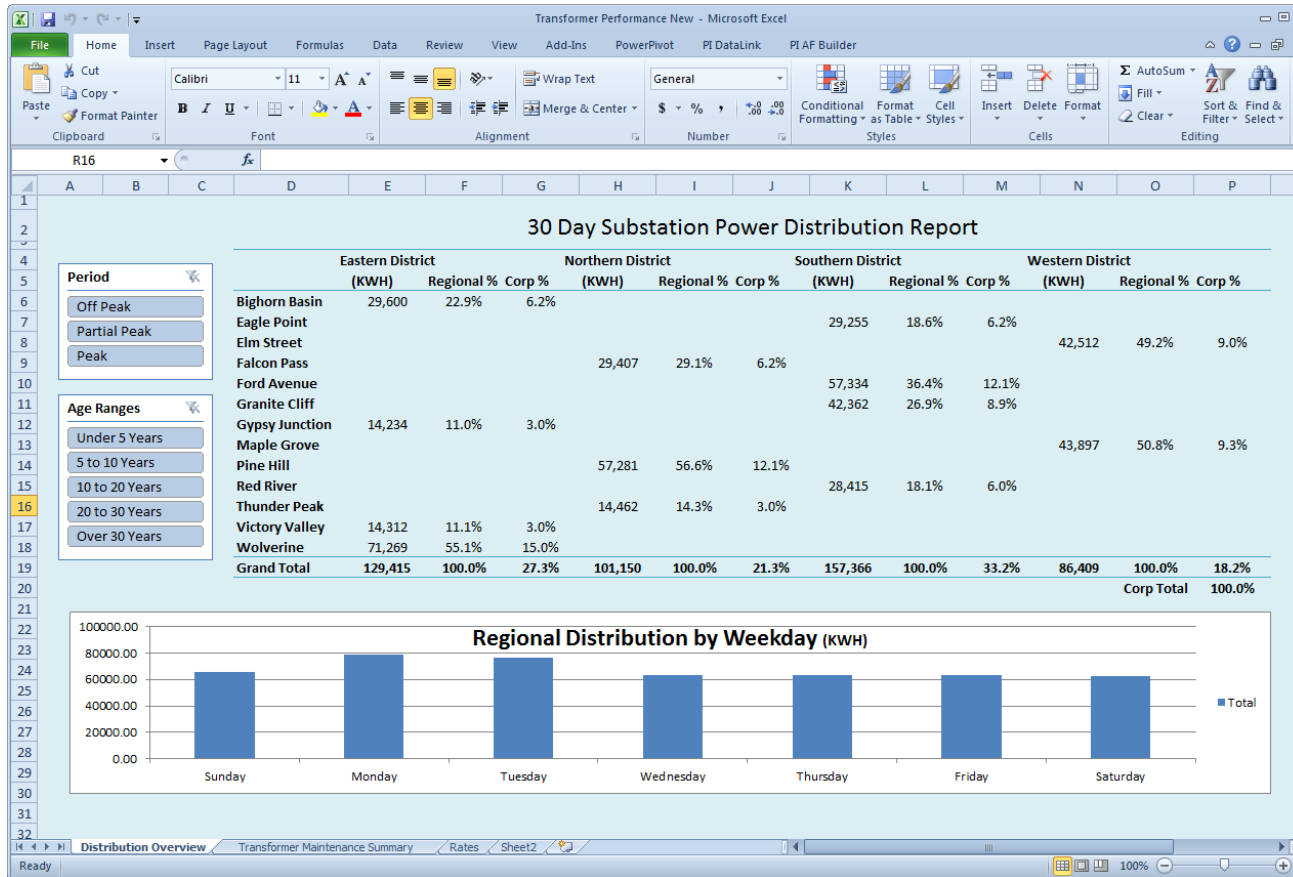
- Leverage structure used throughout your PI System infrastructure
- Insure accurate aggregation of real-time events
- Scale-up by using the PI AF Structure
- Access PI Event Frames (next release)

PowerPivot for Excel - Transformer Performance.xlsx

| Asset ID | Time | Energy | Top Oil Tem... | 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 | 15.4214944966901 | 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 | 13.2137487314932 | e. Over 30 Years | 1.471 |
| TR2003 | 8/15/2011 10:41:30 AM | 21.20 | 81.93 | 10 | 2 | 16.6404075066248 | 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 % | | | | | | | |
| Cop % | 100.0 % | | | | | | | |
| Diff Oil Temp Deviation: | 0.0 | | | | | | | |
| C2H4 to C2H6 Deviation: | 0.00 | | | | | | | |
| CH4 to H2 Deviation: | 0.00 | | | | | | | |

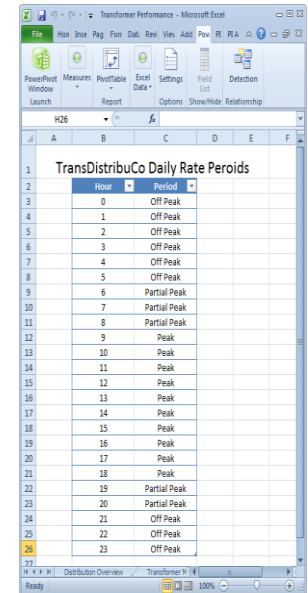
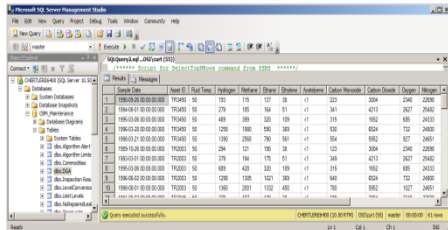
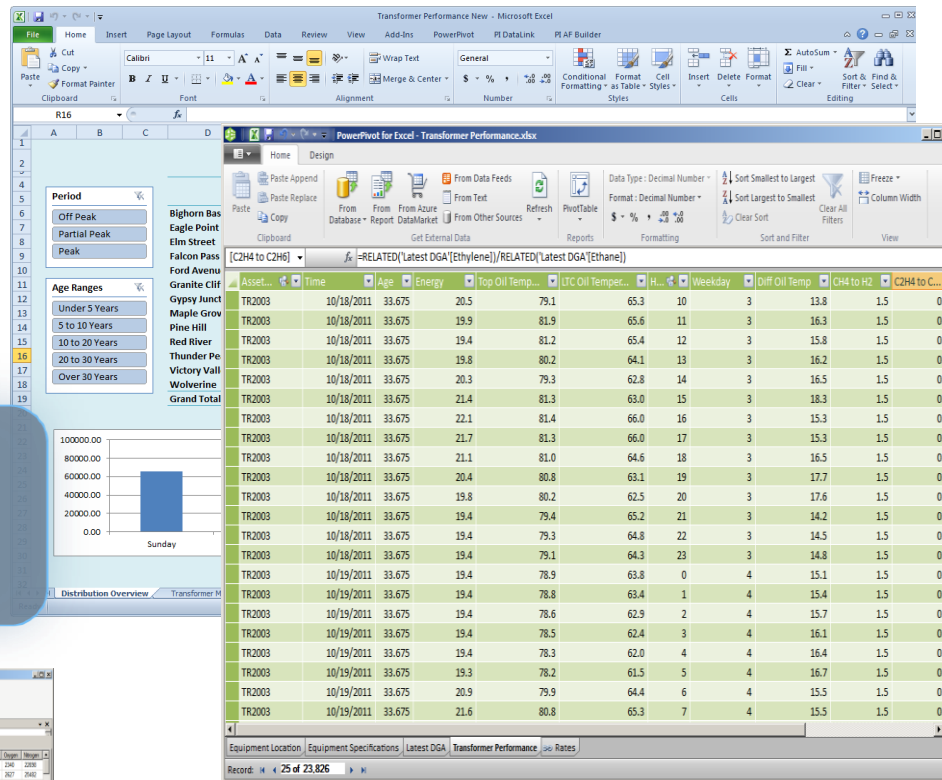
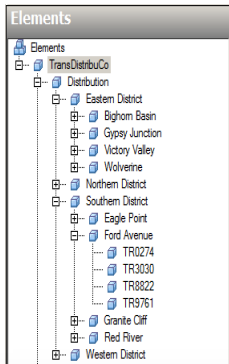
Record: 1 of 23,793

Demo - PowerPivot for Excel 2010



- Accessible
- Scalable
- Personal
- Organizational

PowerPivot Enables Data Integration



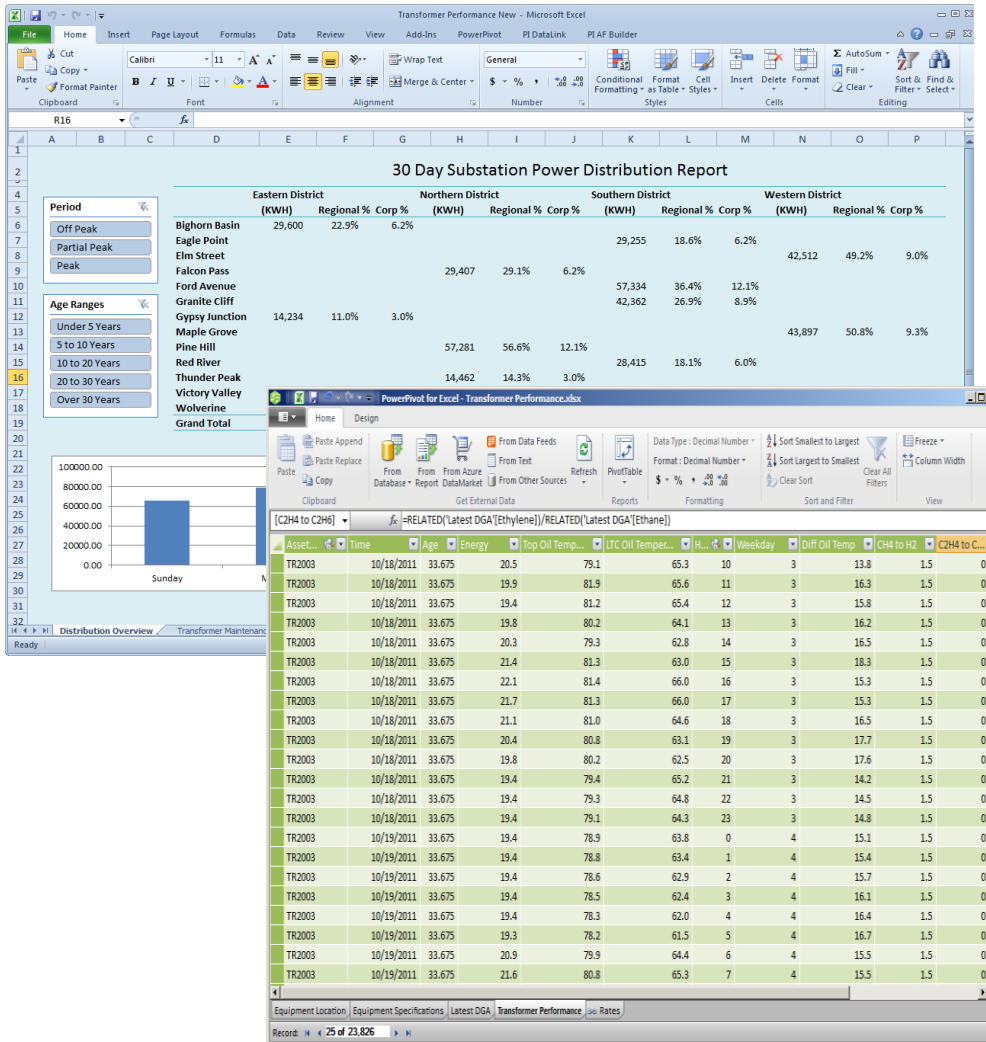
- Connections to many relational sources
- Data sets can be brought from a whole list of different systems



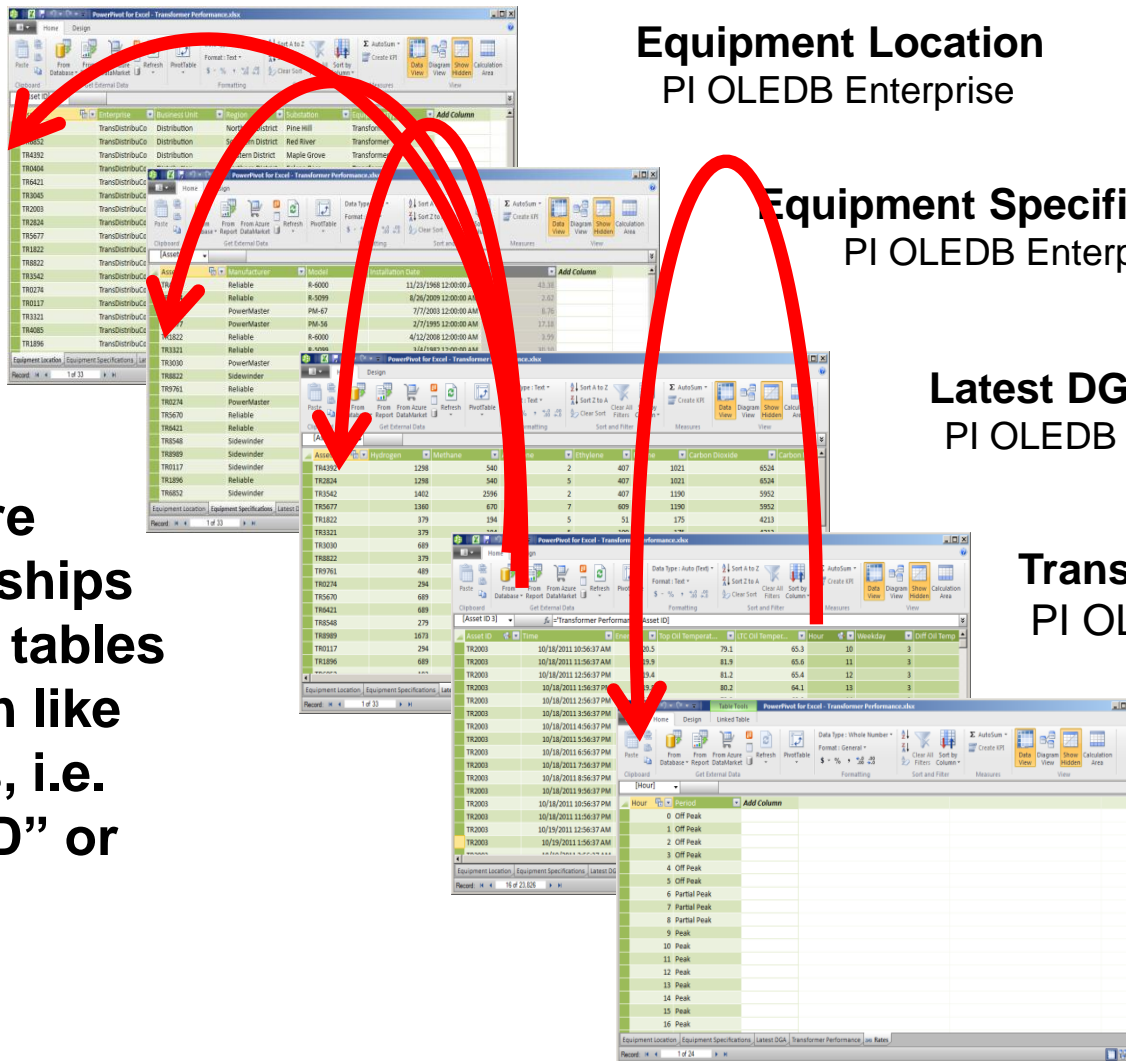
PowerPivot Enables Data Integration

Can I use PI 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 Creates the “Cube”



Equipment Location
PI OLEDB Enterprise

Equipment Specifications
PI OLEDB Enterprise

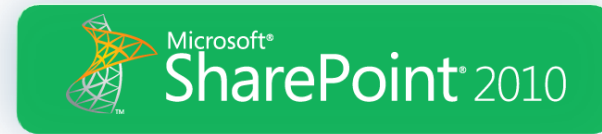
Latest DGA
PI OLEDB Enterprise

Transformer Performance
PI OLEDB Enterprise

Rates
Excel Linked Table

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

PowerPivot for Sharepoint



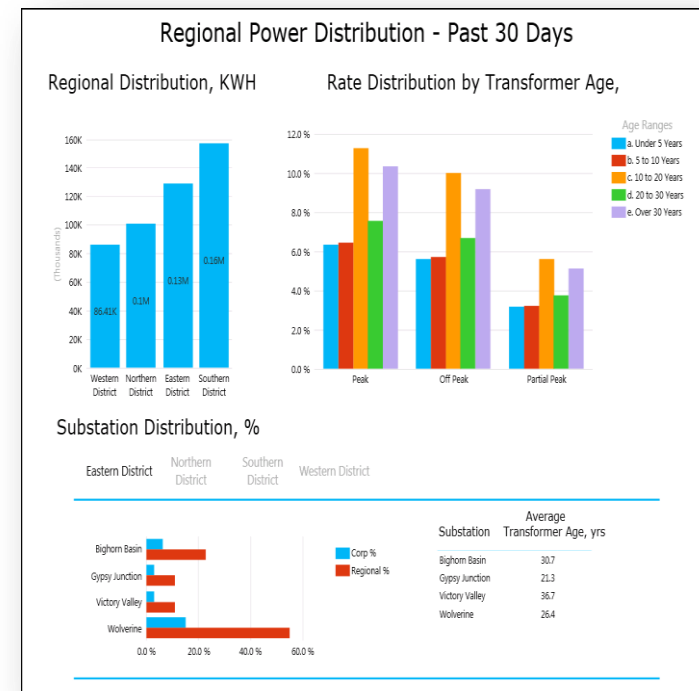
The screenshot shows a SharePoint 2010 portal with the following content:

- Navigation:** Site Actions (Browse, Documents, Library), Site Pages, Shared Documents, PowerPivot Gallery, Lists, Calendar, Tasks, Discussions, Team Discussion, Sites, People and Groups, Site Content, Shared Documents, Site Assets, Announcements, Calendar, Links, PowerPivot Gallery, Site Pages, Tasks.
- Header:** PowerPivot Gallery - Windows Internet Explorer, URL: http://osicentral.osisoft.int/Departments/SalesMarketing/Marketing/Microsoft/BI/PowerPivot%20Gallery/Forms/Gallery.aspx, Search this site...
- Content:**
 - Fleet Generation Report:** Last Modified By: Curt Hertler, Date: 11/15/2010, Created By: Curt Hertler. Includes a bar chart and a table with columns for 'Region', 'Product', and 'Value'.
 - Product Inventories and Availability:** Last Modified By: Curt Hertler, Date: 11/15/2010, Created By: Curt Hertler. Includes a bar chart and a table with columns for 'Region', 'Product', and 'Value'.

- Provides the analysis capabilities of PowerPivot within the SharePoint portal
- Allows users to access and work with PowerPivot workbooks without downloading the workbook and data

Microsoft SQL 2012 PowerView

- Reports creation combining all PI System sources
 - PI Asset Framework
 - PI Data Archive
 - SQL Server data
- Thin client
- Rich and dynamic client
- Collaborative tool
- Windows integrated security
- SharePoint and PowerPoint integration



Demo – PowerView in SharePoint 2010

The screenshot shows a SharePoint 2010 web browser window displaying a PowerView dashboard. The browser address bar shows the URL: <http://dfdenali/PowerPivot%20Examples/Forms/Carousel.aspx>. The page title is "Distribution Profile", last modified by Curt Hertler on 1/13/2012, and created by Curt Hertler. The dashboard features several charts and tables:

- Regional Power Distribution - Past 30 Days:** A bar chart showing KWH distribution across four districts: Western, Northern, Eastern, and Southern. The values are 88438, 9338, 11394, and 15891 respectively.
- Rate Distribution by Transformer Age:** A grouped bar chart showing the percentage of transformers in different age ranges (Under 5 Years, 5 to 10 Years, 10 to 20 Years, 20 to 30 Years, Over 30 Years) across Peak, Off Peak, and Partial Peak periods.
- Substation Distribution, %:** A horizontal bar chart comparing Cong % and Regional % for Bin Street and Maple Grove substations. Bin Street has a Cong % of approximately 20% and a Regional % of approximately 45%. Maple Grove has a Cong % of approximately 10% and a Regional % of approximately 45%.
- Other Charts:** The dashboard also includes a "Burner Performance" chart, a "Distribution Profile - Past 30 Days" chart, and a "Distribution by Weekday vs. Substation Temperature" chart.

PowerView – Interactive Analysis

- Interactive report updates using filters

Regional Power Distribution - Past 30 Days

Regional Power Distribution - Past 30 Days

Regional Power Distribution - Past 30 Days

Regional Distribution, KWH

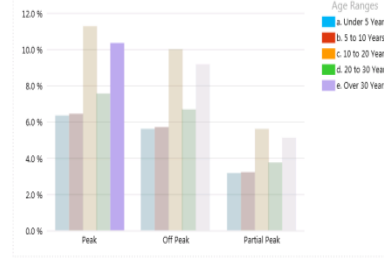
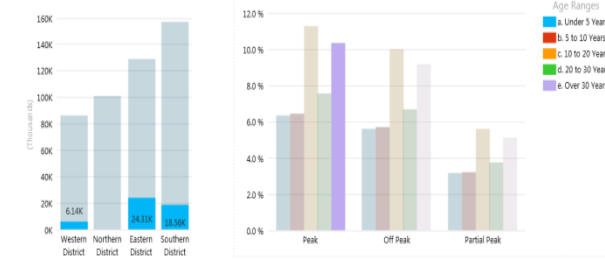
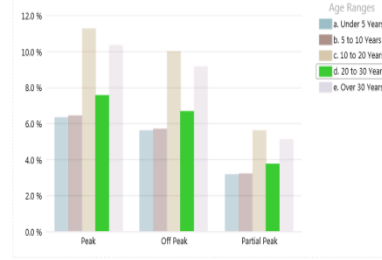
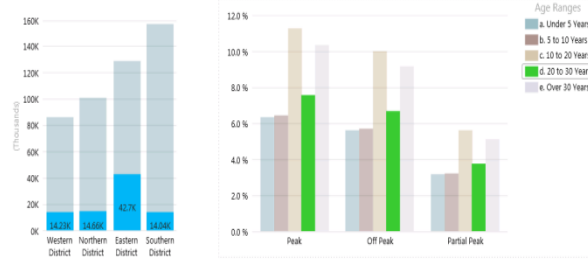
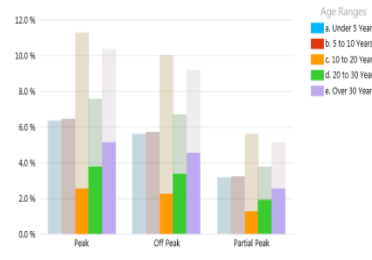
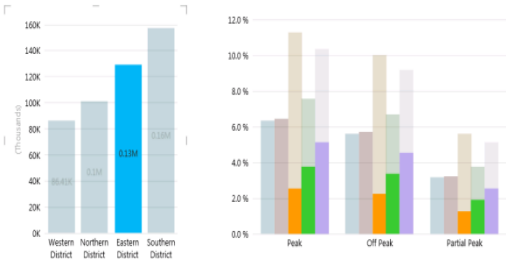
Rate Distribution by Transformer Age,

Regional Distribution, KWH

Rate Distribution by Transformer Age,

Regional Distribution, KWH

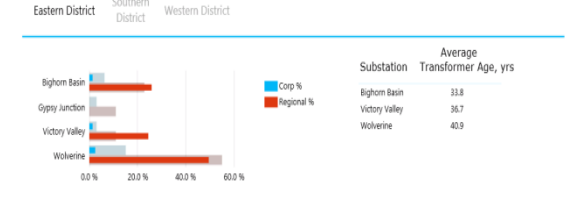
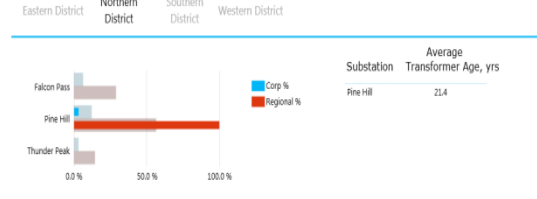
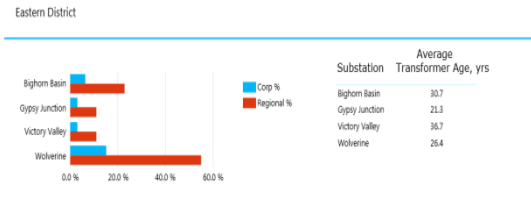
Rate Distribution by Transformer Age,



Substation Distribution, %

Substation Distribution, %

Substation Distribution, %



Distribution by District

Distribution by Transformer Age

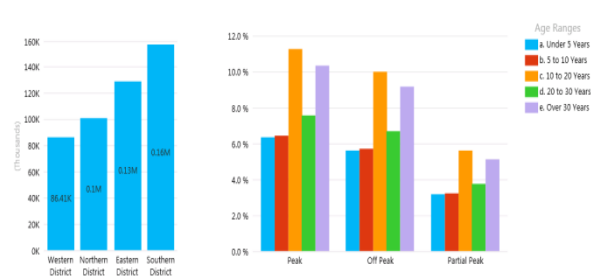
Distribution by Age and Rate

PowerView - Multiple Views and Pages

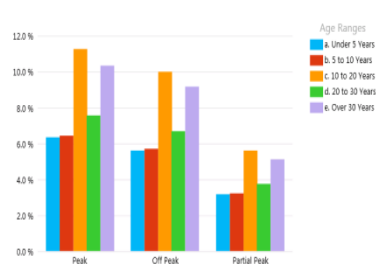
- Create different reports from a single data cube

Regional Power Distribution - Past 30 Days

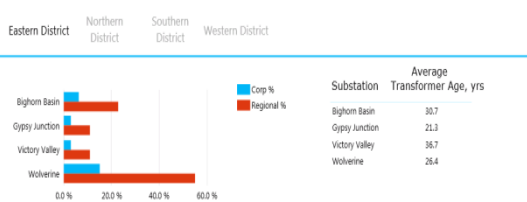
Regional Distribution, KWH



Rate Distribution by Transformer Age,



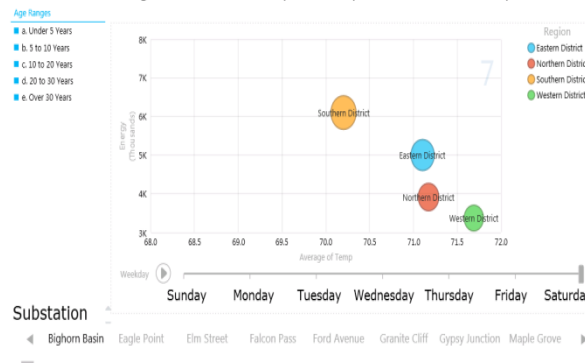
Substation Distribution, %



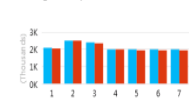
Aging Asset Risk Assessment

Power Distribution Profile - Past 30 Days

Regional Distribution by Weekday vs. Substation Temperature



Average Daily Power, KWH

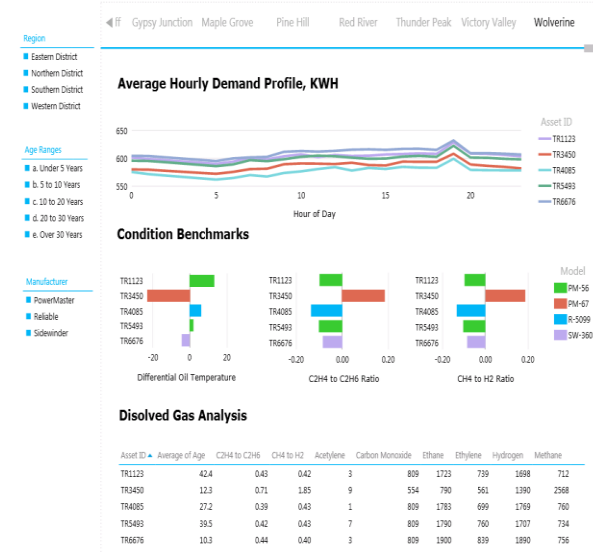


Average Daily Substation Temperature, F



Weekday Distribution Profile

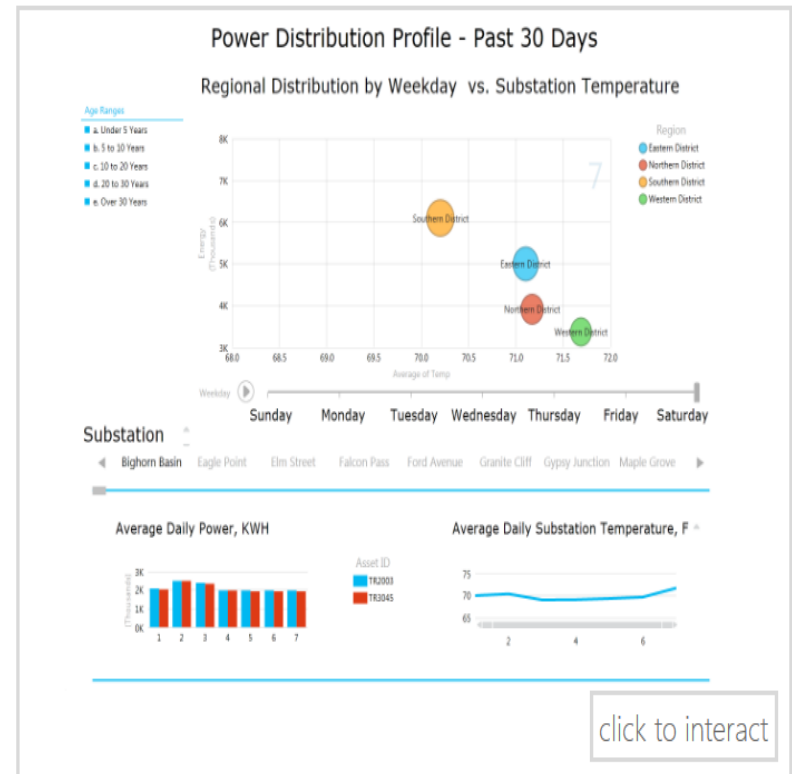
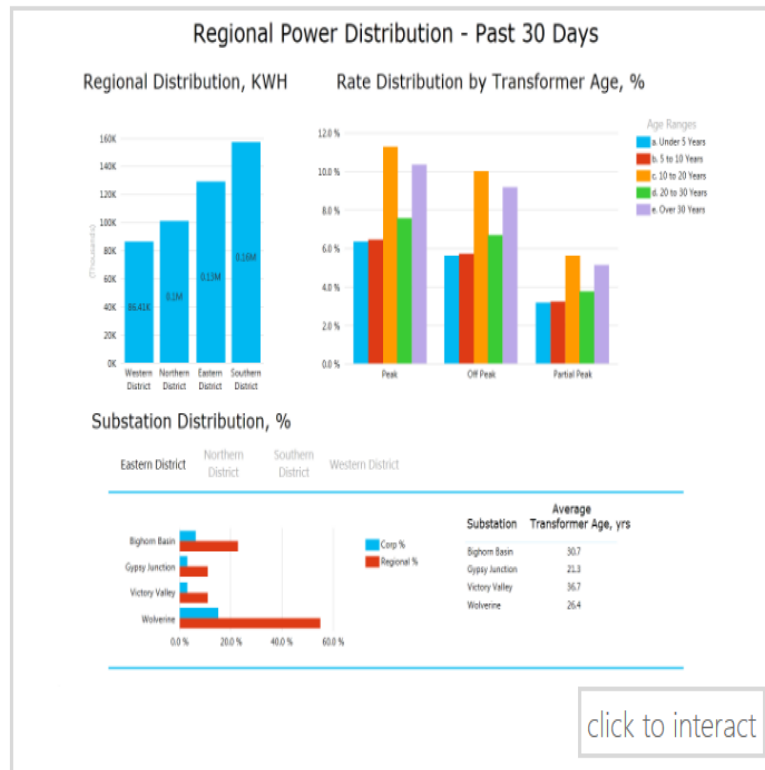
Substation Transformer Condition and Benchmarking



Equipment Condition Benchmarking

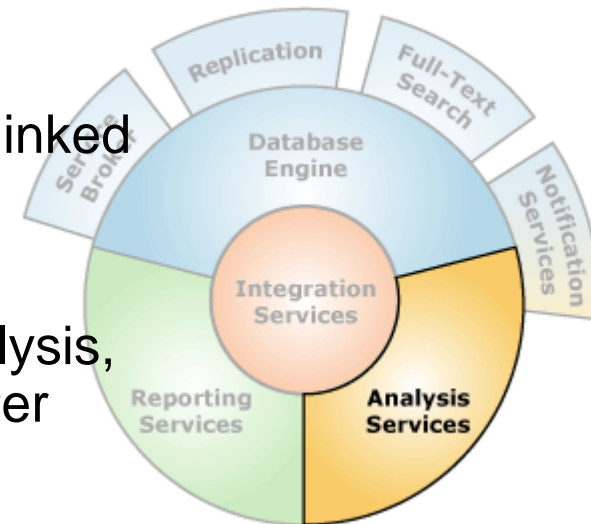
Power View Reports in PowerPoint

- PowerView reports can be used interactively in PowerPoint presentations



SQL Server Analysis Services - Overview ...

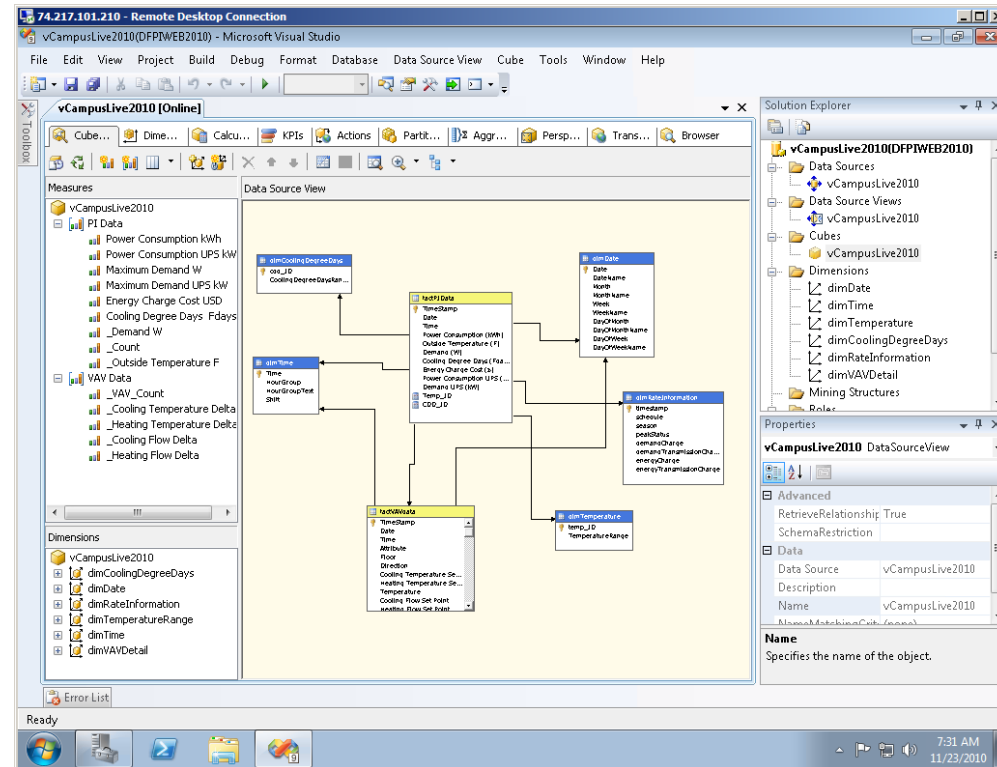
- Microsoft version: SQL Server Analysis Services (SSAS) provides comprehensive, enterprise scale analytic solutions that deliver actionable insights through familiar tools.
- Plain(er) English: SSAS allows you to design, build, and refresh data cubes from multiple sources and make them available for client analysis.
- Key features:
 - Source data can be stored directly or simply linked
 - Source data can be incrementally refreshed
 - Data can be shared to many users efficiently
 - Data can be used as a source for further analysis, providing a middle tier for analytics and greater efficiency



SQL Server Analysis Services - Clients ...

Administrative

- **Business Intelligence Development Studio**
 - Build new BI Solutions
 - Microsoft Visual Studio 2008
 - Currently not supported in MS Visual Studio 2010
 - Components:
 - Cube Designer
 - Dimension Designer
 - etc
- **SQL Server Management Studio**
 - Administer existing BI solutions



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

Key points to take home

- Intuitive BI tools from OSIsoft and Microsoft
- Democratization of information
- Users can perform their own analysis
- Find the Right Information at the Right Time in the Right Format !





THANK YOU

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