

OSIsoft®

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Turning **insight** into **action**.

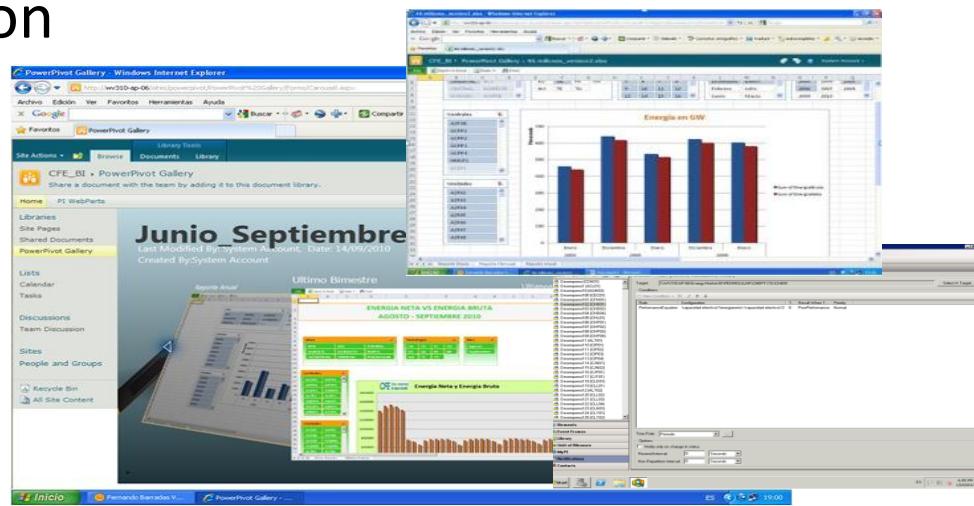


OSIsoft PI System and Microsoft Technology Enabling Business Intelligence for CFE-Mexico Energy Market

Presented by **Fernando Barradas, Comision Federal de Electricidad (CFE)**
Centro Nacional de Control de la Energía (CENACE)

Agenda

- CFE - CENACE Organization
- Overview BI Project
- Description and Architecture
- Infrastructure Implementation
- Project Goals
- Current Status
- Benefits
- Conclusion



CENACE (Centro Nacional de Control de Energía) Organization

CENACE Organization information:

- CFE has over 85,000 employees, including temporary and permanent
 - CENACE has about 1,200 employees
 - CENAL (National Control Center)
 - 8 Control Areas
 - **34** Sub-Areas
 - **779** Generation Units
 - CFE Total Capacity: **52,945 MW**
 - Peak Demand: **34,315 MW** (02/23/2011)

35,870 MW (24/08/2010)

The map illustrates the distribution of Mexico's power generation capacity across various regions (NOR, BCN, NTE, NES, OCC, CEL, ORI) and control areas. It highlights the following data points:

Generation Type	Capacity (MW)	Percentage
Turbogás	2,496.8	4.76%
Geotérmica	886.1	1.69%
Nuclear	1,364.9	2.60%
Carbón	5,378.4	10.24%
Ciclo Combinado	12,771.1	24.32%
Hidráulica	1,040.0	2.00%
Vapor + Comb. Interna	1,040.0	2.00%
Eólica	10.0	0.02%
Total	52,945.4	100.00%

Plantas Principales a Febrero
52,945.4 MW en 779 un.

Includes MW C...

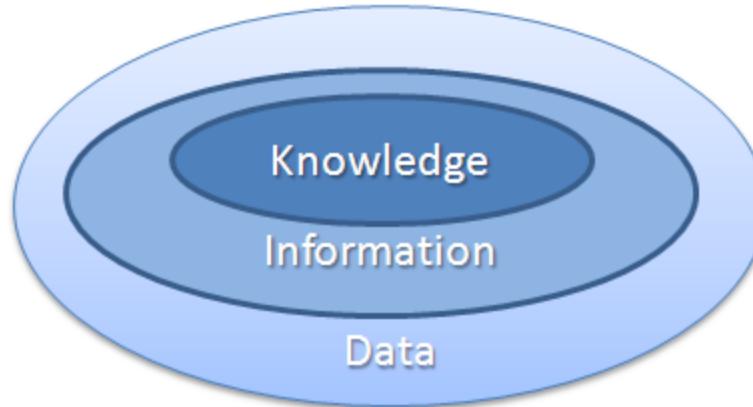
Legend (Simbología):

 - Hidráulica
 - Vapor + Comb. Interna
 - Carbón
 - Nuclear
 - Ciclo Combinado
 - Turbogás
 - Geotérmica



What is Business Intelligence?

Business Intelligence is the ability to transform data into information and information into knowledge, so as to optimize the process of making business decisions



CFE BI Project Vision

- CFE had no Business Intelligence (BI) applications in the information system infrastructure that is currently supported by OSIsoft Technology
- As BI applications are required to achieve rapid and sustained growth of CFE Energy Market
- Utilizing the real-time infrastructure provided by the OSIsoft PI System and Microsoft latest technology offerings

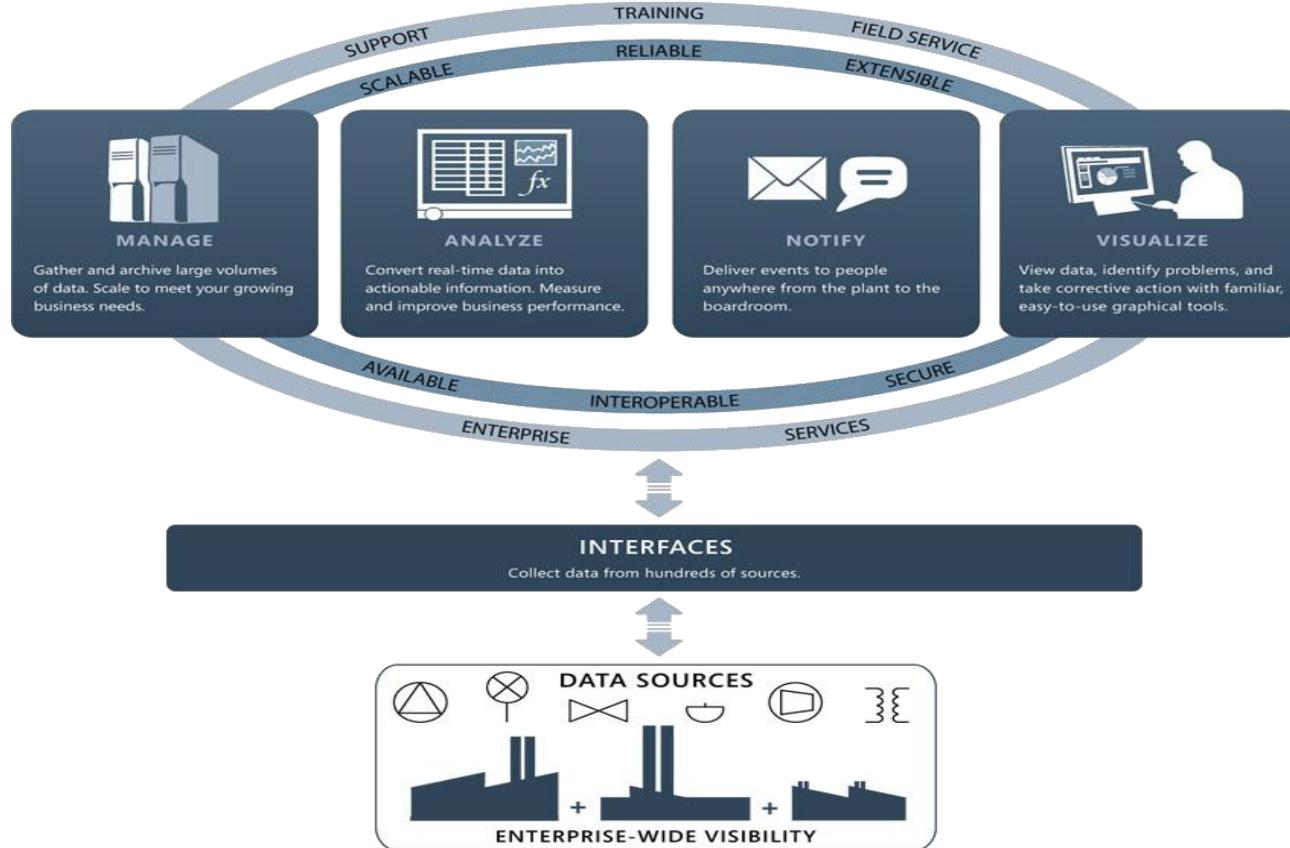
Project Description

- With the latest OSIsoft and Microsoft technology, to build an environment for BI Applications to manage and analyze the generation energy resources and the cost
- Since the software is new, CFE can also provide feedback to OSIsoft and Microsoft
- The application deployment plan
 - Personal BI installed locally for the client, including Excel 2010, PowerPivot for Excel 2010, and PI OLEDB Enterprise 2010
 - Group BI in SharePoint 2010 web environment with PI WebParts 2010 and PowerPivot

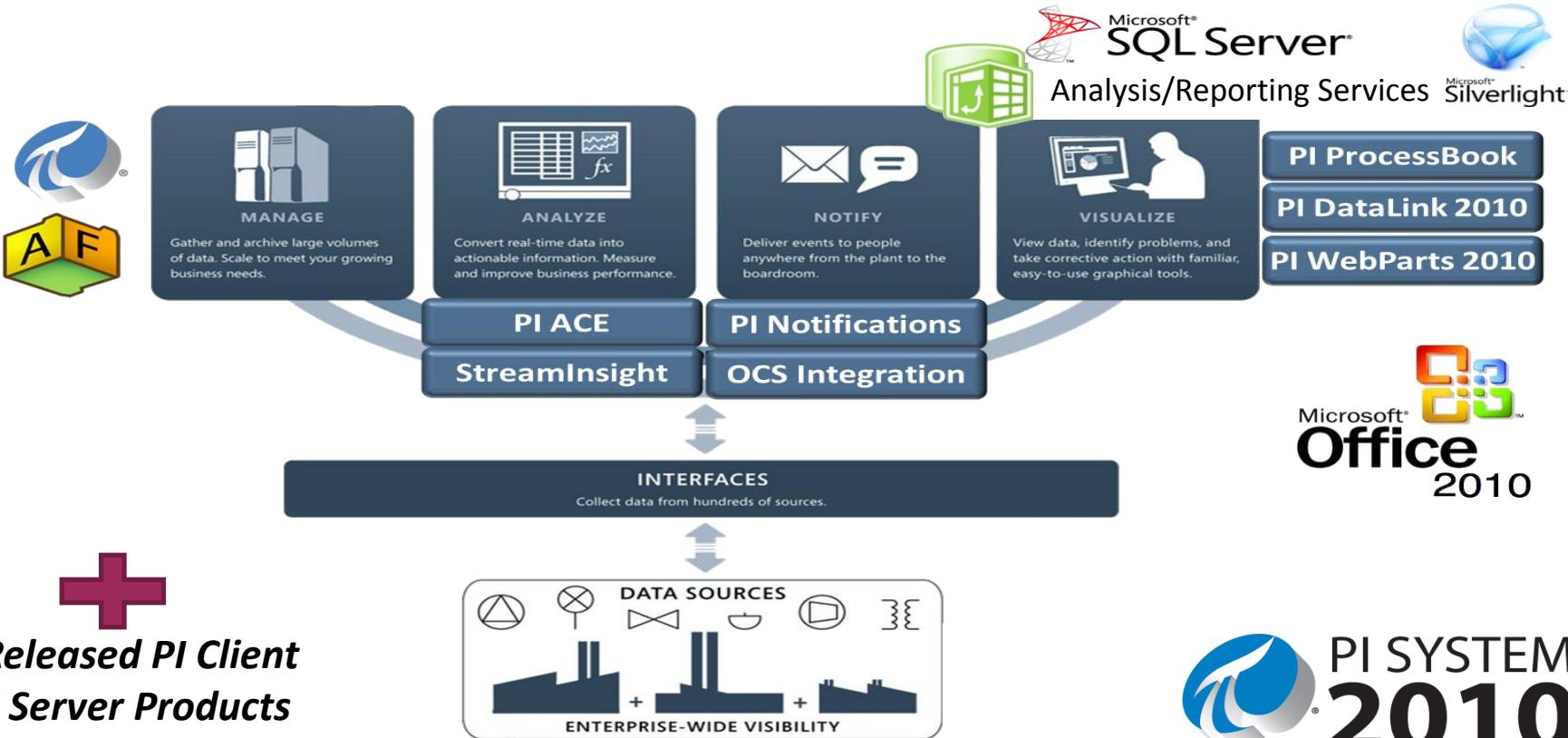
Software Infrastructure

- Windows Server 2008 R2
- SQL Server 2008 R2 Ent.
- SQL PowerPivot Instance
- SQL Reporting Services
- SharePoint 2010 (Farm)
- PI AF
- PI Notifications
- PI OLEDB Enterprise
- PI WebParts 2010
- PI RDBMS

PI System Architecture



PI System Architecture



All Released PI Client and Server Products



PI SYSTEM 2010

OSIsoft/Microsoft Integration

PI System 2010



Microsoft® SQL Server® 2008
Windows Server® 2008

PI Analytics



Microsoft® Visual Studio®
Microsoft® SQL Server® 2008
Analysis Services
Microsoft® SharePoint® 2010

PI for Office 2010



Microsoft® Office 2010
Microsoft® SharePoint® 2010
Microsoft® Office Communications
Server 2007 R2



CONNECT

Collect data from hundreds of sources.

INTERFACES



MANAGE

Gather and archive large volumes of data. Scale to meet your growing business needs.

SERVERS



ANALYZE

Access real-time or historical role-based data for the entire enterprise at any time.

ANALYTICS



PRESENT

View data, identify problems, and take corrective action with familiar, easy-to-use graphical tools.

VISUALS

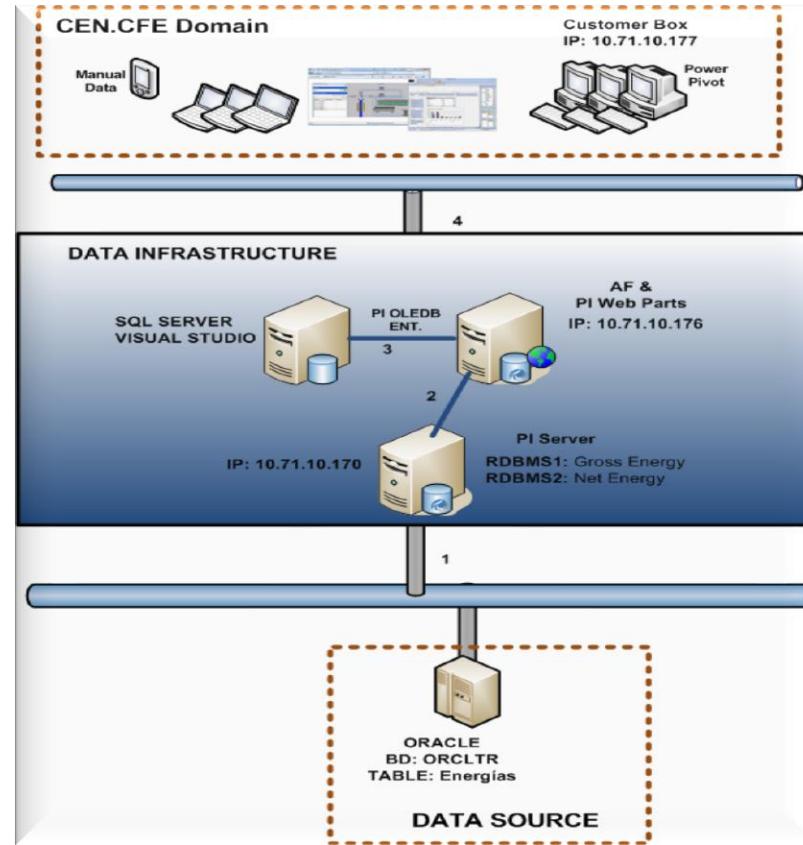
Managed PI System

ENTERPRISE AGREEMENTS

SERVICES

Software + Services

BI Architecture



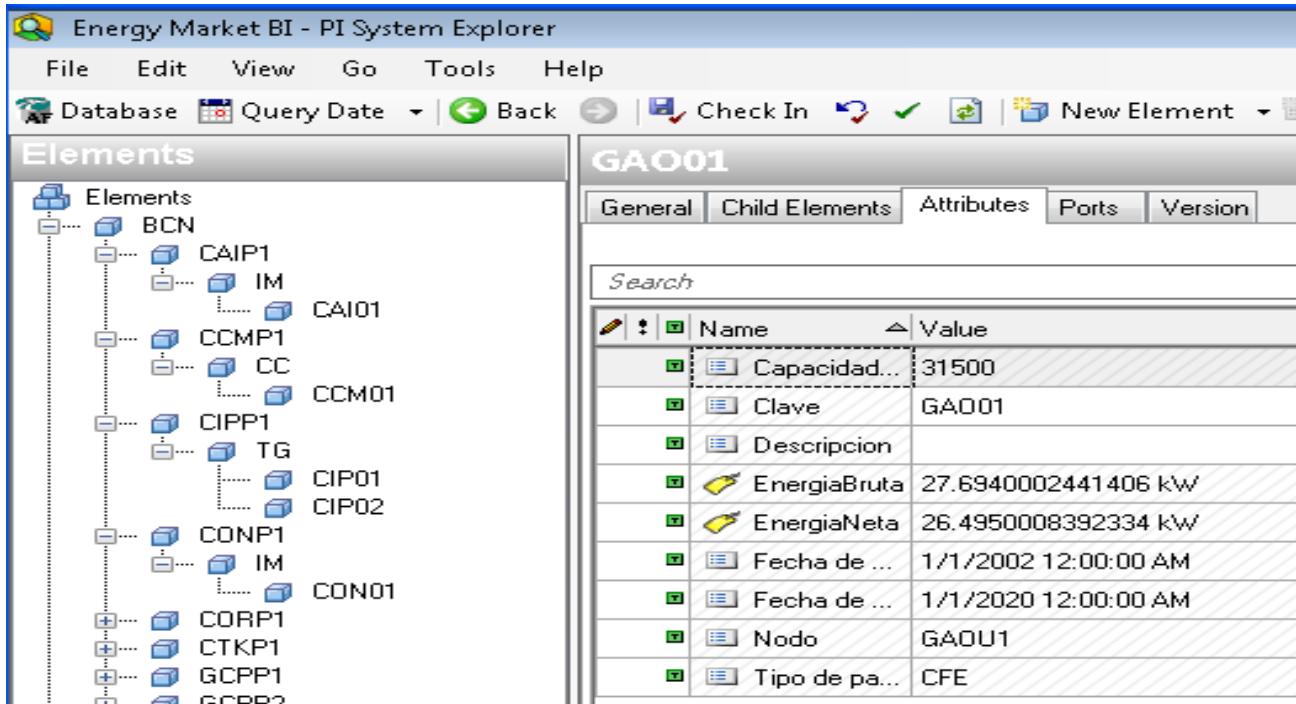
Project Implementation Goals

- Installation of the infrastructure of the development environment for the BI Applications
- Connect the PI System 2010 with the different sources of information to provide real time data to the BI Applications
- Construction of PI AF hierarchical structure for the BI Applications
- Configuration of all the products needed for the visualization of the BI Applications, personal and by group (Office 2010, SharePoint 2010, PI WebParts 2010)
- Configuration of PI Notifications for the notification of business rules
- Configuration of a SharePoint 2010 site with PowerPivot and PI WebParts 2010

Current Status

- Development of:
 - PI AF Hierarchy
 - PowerPivot reports and uploads those reports in SharePoint Site Gallery
 - PI WebParts in SharePoint
 - Business Rules with PI Notifications
 - Displays in PI ProcessBook
- Currently Oracle data is sent to the PI Server through RDBMS
- With this information data dictionary hierarchy structure was created in the PI System
- The information is sent to a SQL then imported to PowerPivot

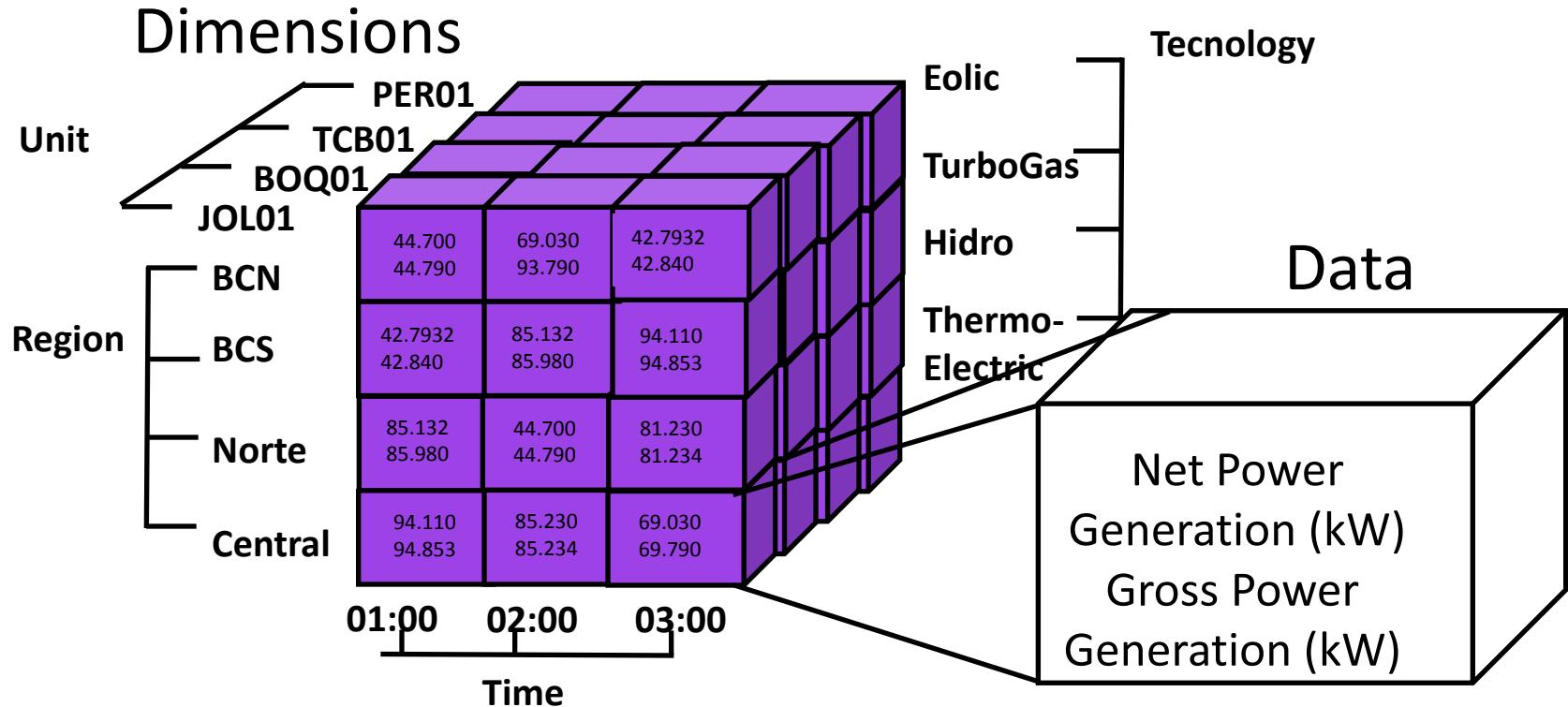
PI AF Hierarchy



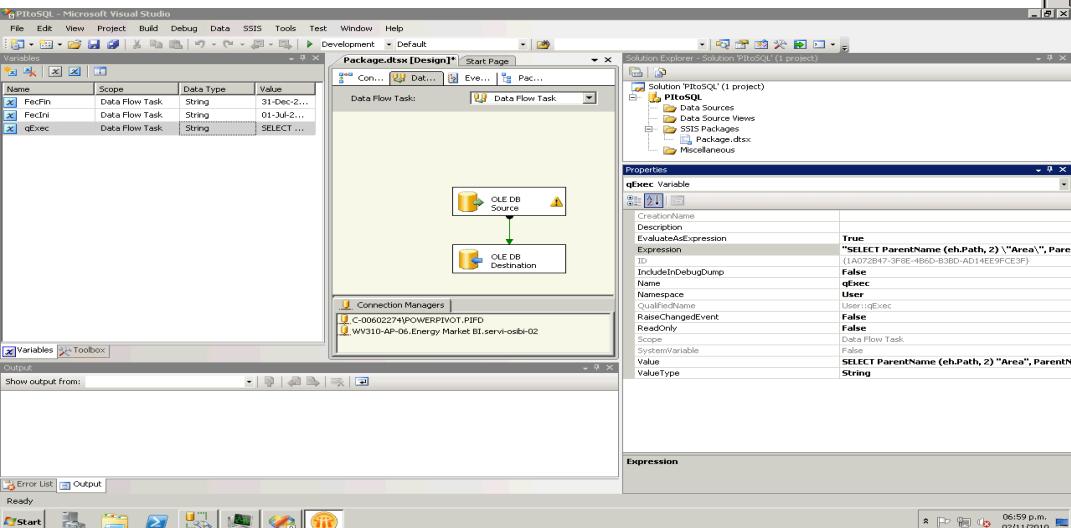
Built Complete Hierarchy

For Area, Central, Type of Generation Unit

Cube Structure



PI OLEDB Enterprise 2010 / PI SQL Commander Visual Studio 2008



Result		Message							
		Area	Centrales	Tecnologia	Unidades	Time	EnergiaBruta	EnergiaNeta	
000683	CENTRAL	ATEP1	TG	ATE01	6/26/2010 11:00...	32.00500106811...	32.00500106811...	32.00500106811...	
000684	CENTRAL	ATEP1	TG	ATE01	6/26/2010 12:00...	32.00999832153...	32.00999832153...	32.00999832153...	
000685	CENTRAL	ATEP1	TG	ATE01	6/26/2010 1:00...	32.00299835205...	32.00299835205...	32.00299835205...	
000686	CENTRAL	ATEP1	TG	ATE01	6/26/2010 2:00...	32.00600051879...	32.00600051879...	32.00600051879...	
000687	CENTRAL	ATEP1	TG	ATE01	6/26/2010 3:00...	31.73200035095...	31.73200035095...	31.73200035095...	
000688	CENTRAL	ATEP1	TG	ATE01	6/26/2010 4:00...	31.92900085449...	31.92900085449...	31.92900085449...	
000689	CENTRAL	ATEP1	TG	ATE01	6/26/2010 5:00...	31.91399955749...	31.91399955749...	31.91399955749...	
000690	CENTRAL	ATEP1	TG	ATE01	6/26/2010 6:00...	31.77199935913...	31.77199935913...	31.77199935913...	
000691	CENTRAL	ATEP1	TG	ATE01	6/26/2010 7:00...	32.02199935913...	32.02199935913...	32.02199935913...	
000692	CENTRAL	ATEP1	TG	ATE01	6/26/2010 8:00...	32.02000045776...	32.02000045776...	32.02000045776...	
000693	CENTRAL	ATEP1	TG	ATE01	6/26/2010 9:00...	30.72800064086...	30.72800064086...	30.72800064086...	
000694	CENTRAL	ATEP1	TG	ATE01	6/26/2010 10:00...	0.025000000372...	0	0	
000695	CENTRAL	ATEP1	TG	ATE01	6/27/2010 11:00...	0.071999996900...	0	0	
000696	CENTRAL	ATEP1	TG	ATE01	6/27/2010 12:00...	0.119999997317...	0	0	
000697	CENTRAL	ATEP1	TG	ATE01	6/27/2010 1:00...	0.167999997735...	0	0	
000698	CENTRAL	ATEP1	TG	ATE01	6/27/2010 2:00...	0.216000005602...	0	0	

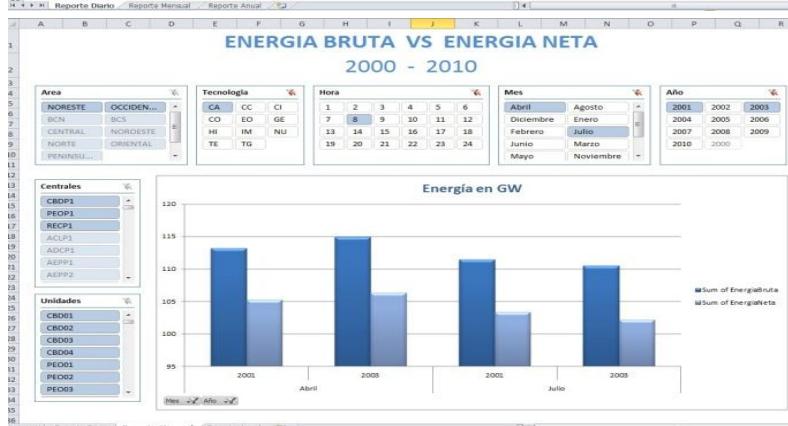
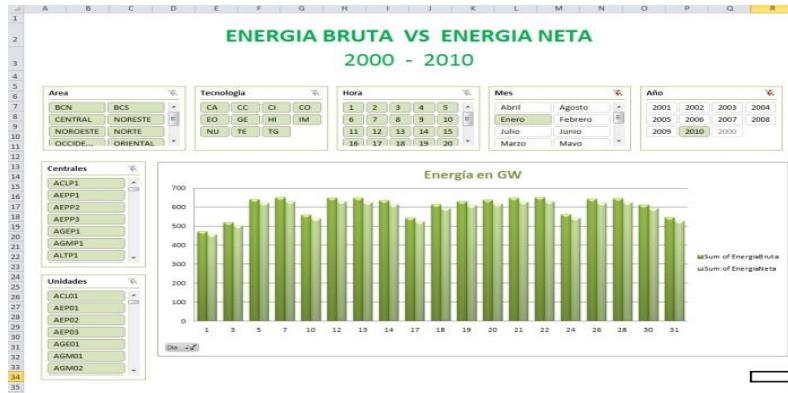
SharePoint Site Implementation

The image displays three separate SharePoint browser windows, each showing a different implementation of PowerPivot data visualization.

- Top Left:** A SharePoint site titled "Junio_Septiembre_2010". It features a dashboard with several charts and tables. One chart is titled "ENERGIA NETA VS ENERGIA BRUTA AGOSTO - SEPTIEMBRE 2010". The dashboard also includes a "Ultimo Bimestre" section and a "Últimos 6 meses" section.
- Top Right:** A SharePoint site titled "46 millones_version2.xlsx". This page shows a Microsoft Excel spreadsheet interface within SharePoint. A bar chart titled "Energía en GW" compares "Sum of EnergiaBruta" (blue bars) and "Sum of EnergiaNeta" (red bars) across four time periods: Junio, Julio, Agosto, and Septiembre. The Y-axis represents "Thousand" units from 0 to 700.
- Bottom:** A SharePoint site titled "CFE_BI - PI WebParts 2010". It features a "PI TimeRange" search bar at the top. Below it is a "PI TreeView" navigation pane listing various regional nodes like BCN, CENTRAL, NOROESTE, NORTE, OCCIDENTAL, PENINSULAR, and several CPCP1 nodes. To the right is a "PI Trend" chart showing energy data over time, with a Y-axis ranging from 0 to 450. The chart has three data series: "EnergiaBruta" (green), "EnergiaNeta" (blue), and "EnergiaTotal" (yellow). The X-axis shows dates from 8/13/2002 to 8/13/2010. On the far right, there is a "PowerPivot Gallery" library view.

End Users PowerPivot Reports

- Internet Explorer 8
 - Silverlight
 - Office 2010
 - PowerPivot for Office 2010
 - PI SQL Commander
 - PI System Explorer 2010
 - PI DataLink 2010



Report Generation

ENERGIA BRUTA VS ENERGIA NETA

2000 - 2010

Area	
BCN	BCS
CENTRAL	NORESTE
NOROESTE	NORTE
OCCIDE...	ORIENTAL

A horizontal menu bar with the word "Tecnologia" in bold black font at the top left. To its right are four green rectangular buttons labeled "CA", "CC", "CI", and "CO" from left to right. Below these are four more green rectangular buttons labeled "EO", "GE", "HI", and "IM". At the bottom are four green rectangular buttons labeled "NU", "TE", "TG", and "IM". The "IM" button at the bottom right is identical to the one in the middle row.

Hora				
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20

Mes	
Abril	Agosto
Enero	Febrero
Julio	Junio
Marzo	Mayo

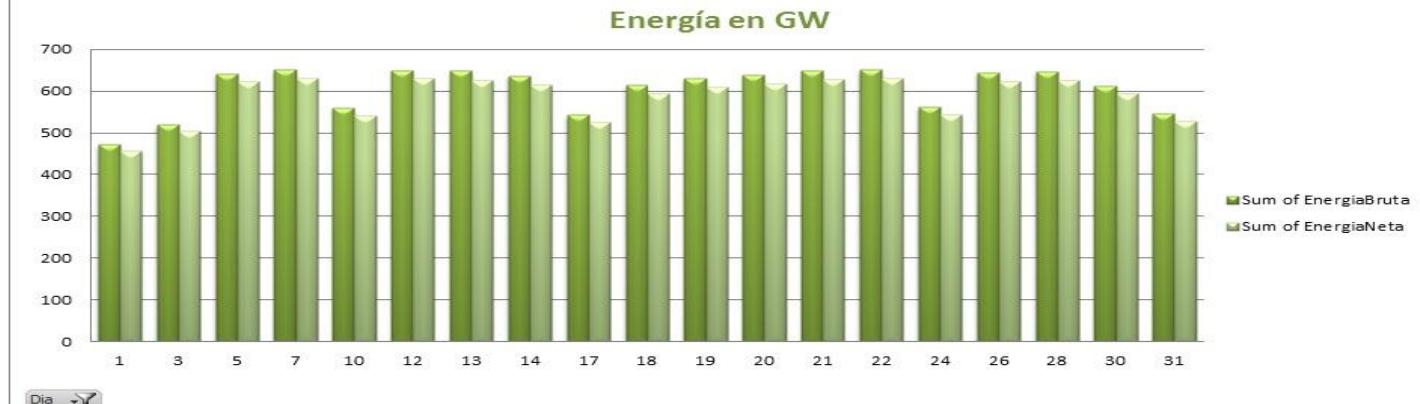
Año			
2001	2002	2003	2004
2005	2006	2007	2008
2009	2010	2000	

Centrales

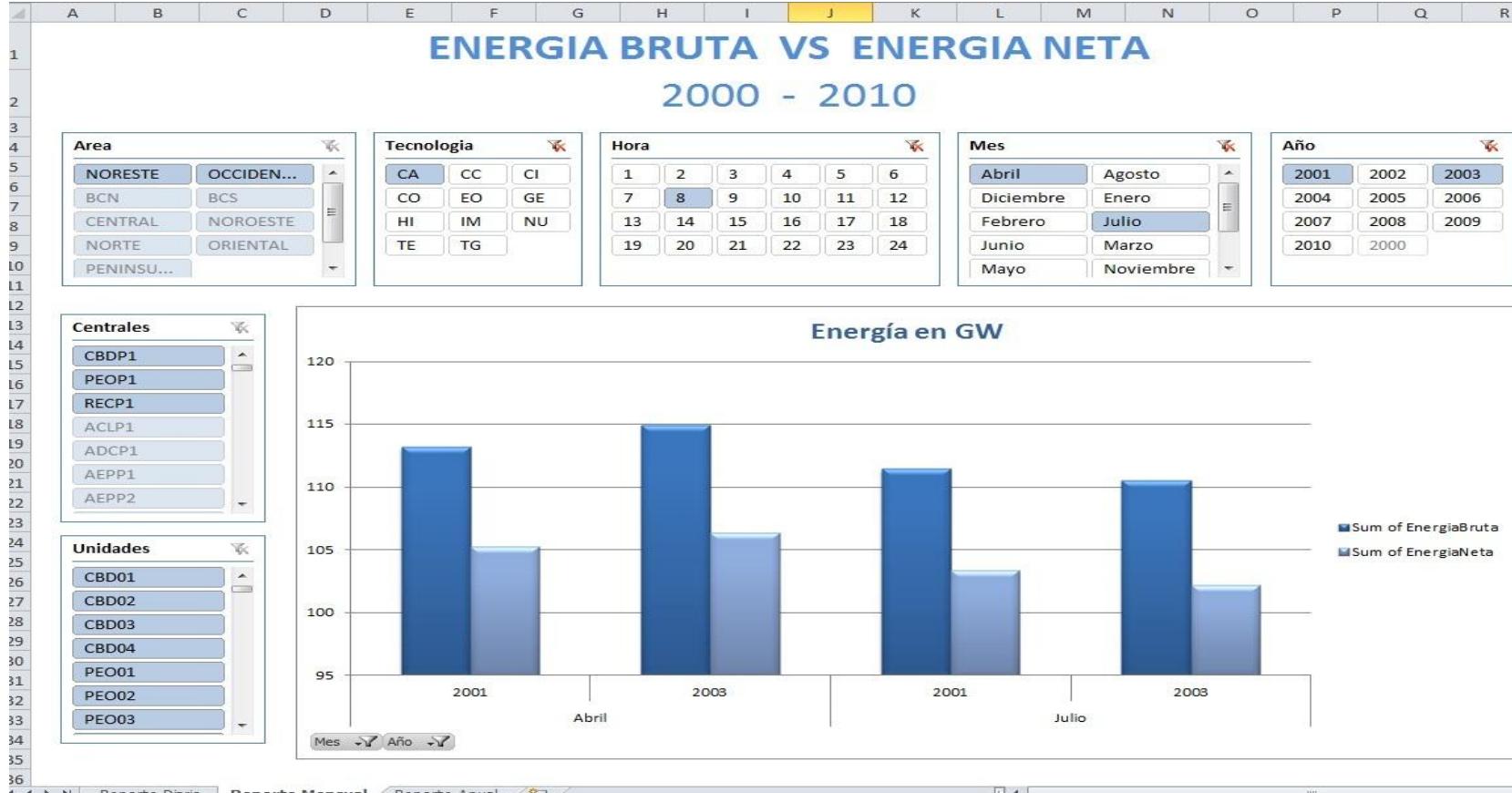
- ACLP1
- AEPP1
- AEPP2
- AEPP3
- AGEP1
- AGMP1
- ALTP1

Unidades

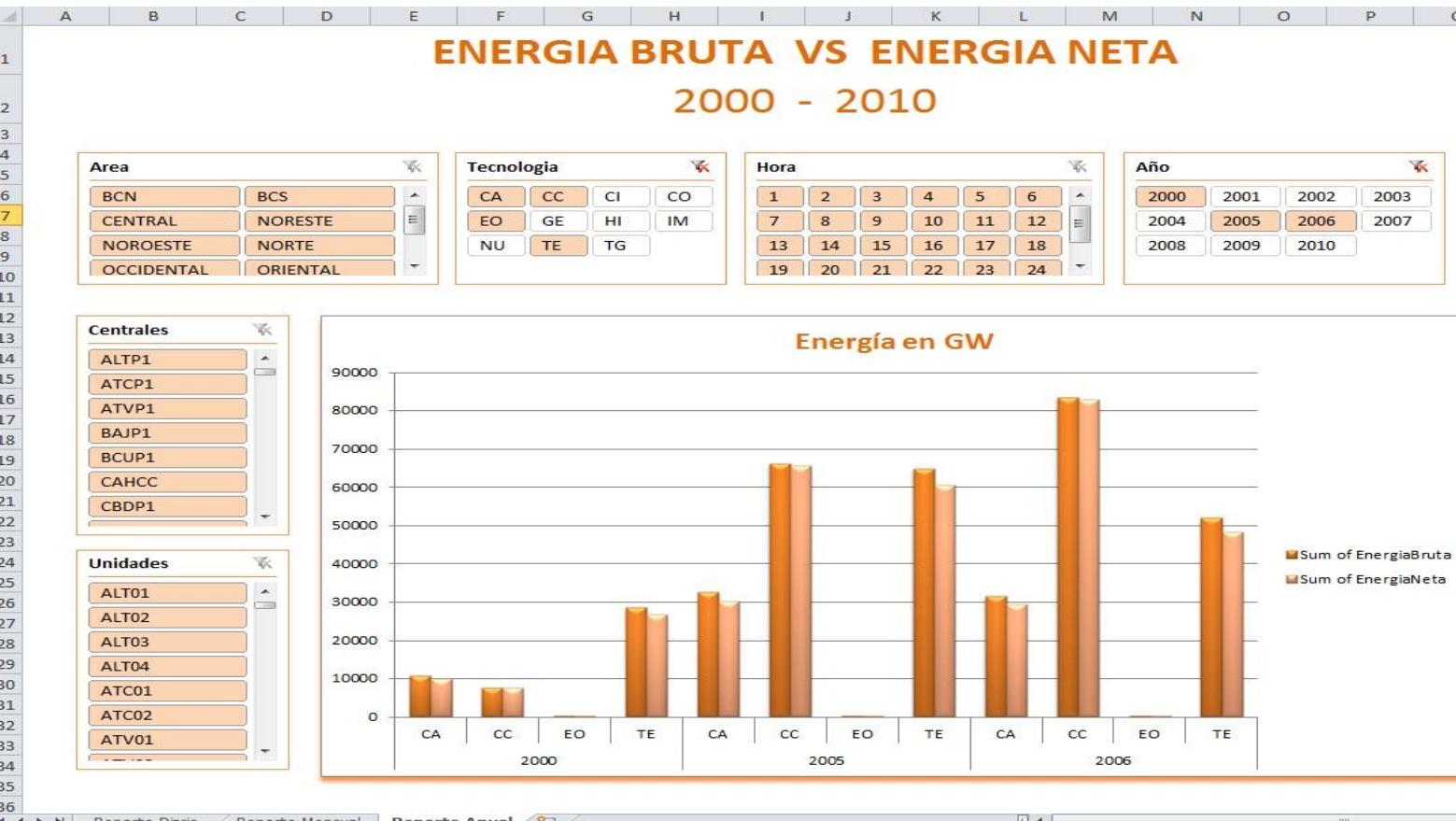
- ACL01
- AEP01
- AEP02
- AEP03
- AGE01
- AGM01
- AGM02



Report Generation



Report Generation



Case Study Publication

A case study was published on Microsoft's website on Aug. 4, 2010

<http://www.microsoft.com/casestudies/Microsoft-Sharepoint-Server-2010/Comisi-n-Federal-de-Electricidad-CFE/Mexico-s-Electrical-Utility-Sees-Saving-Millions-of-Dollars-through-Collaborative-BI/4000007996>

Intangible Benefits

- To provide the users with a single channel to operate comprehensive information brought from different data sources
- Users can generate their own reports and analyze data
- Users can publish their own reports
- Users can download reports to the local machines for their own further analysis
- Have a common repository for all reports
- Provide analysis in time
- Provide the mass data storage but with excellent response time (in seconds)

Tangible Benefits

- Providing business awareness
- Incorporating business process knowledge
- **\$\$\$\$ SAVINGS:**
 - **11,520,000 \$MX pesos per unit per day**
 - **42,048,000 \$MX pesos a year if operation availability of one unit improved by 1%**

Marginal Cost (CM) - Cost Integral (CI) * 24 hours/day * Max. Efficiency Generating Unit

Taking Petacalco Unit 7 (U7 PEO) with maximum efficiency of 640 MW

- The marginal cost is taken from a marginal unit that may be changing for 24 hrs a day
- For first time the marginal unit was 1320 \$MX pesos and PEO U7 was generating 548 \$MX pesos
CM (1320) - CI (548) = 772
- To repeat for the remaining 23 hrs with marginals divided by 24 units per day, average **CM – CI = 750**
750 * 24 * 640 = 11,520,000 \$MX pesos

By improving availability of one generating unit by 1% of the year (3.65 days), the savings:

42,048,000.00 \$MXN (aprox. 3,446,557.00 \$USD) *CFE has 779 generation units*****

Summary

- Great collaboration with OSIsoft and Microsoft in Business Intelligence solutions for the electric energy market process optimization
- System was quickly built and functional in production environment at CFE CENACE
- Successful demonstration of latest OSIsoft and Microsoft technologies for developing BI applications



Thank you

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into action.