

OSIsoft®

USERS²⁰¹¹ CONFERENCE



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



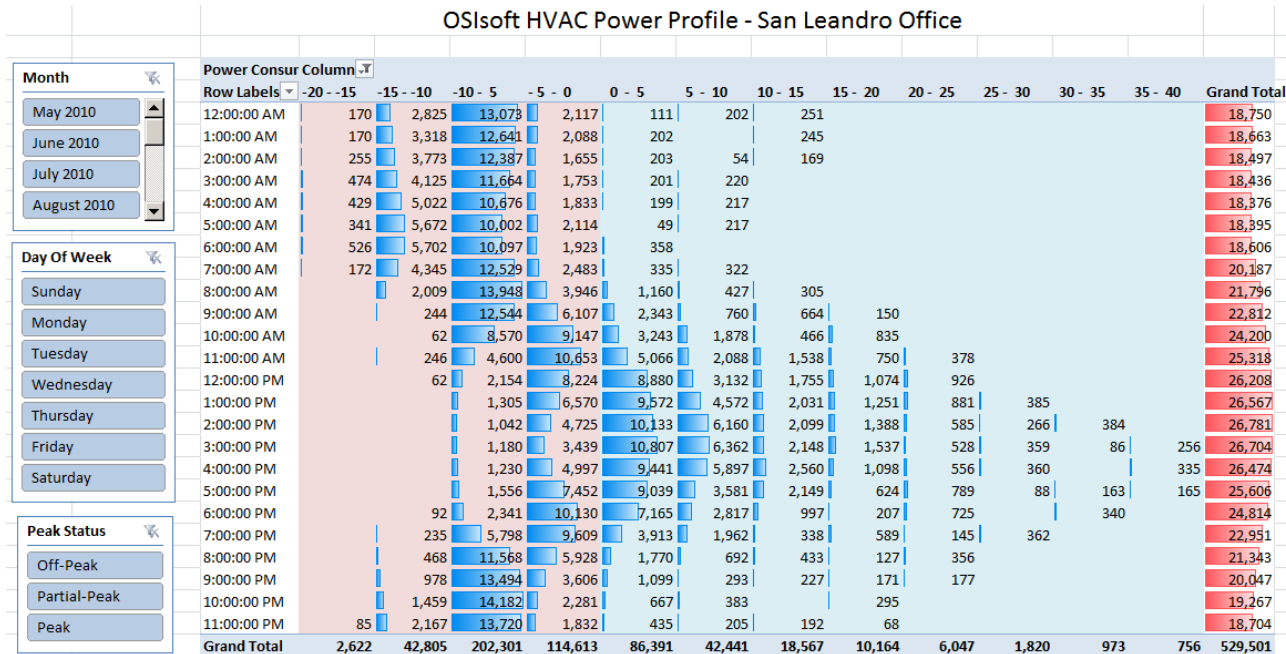
Gaining Insight from PI System Data using PowerPivot and the Microsoft BI Stack

Presented by **Curt Hertler**, Marketing Manager, OSIsoft
William Brown, TSP Business Intelligence, Microsoft

Agenda

- Business Intelligence (BI) Technologies
 - OSIssoft / Microsoft BI Stack
 - Multidimensional Data Analysis
 - Operational Intelligence
- Introduction to the Microsoft BI Stack
 - Server-side SQL Analysis Services 2008 R2
 - Introduction to “Self Service BI”
- PowerPivot example using PI OLEDB Enterprise 2010
- Additional Information

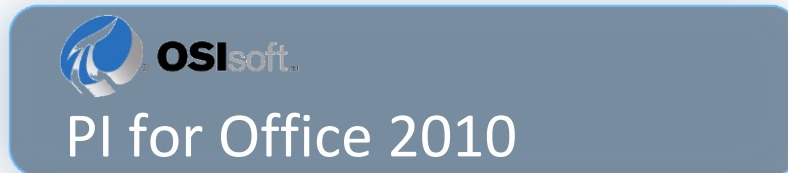
Business Intelligence (BI) Technologies



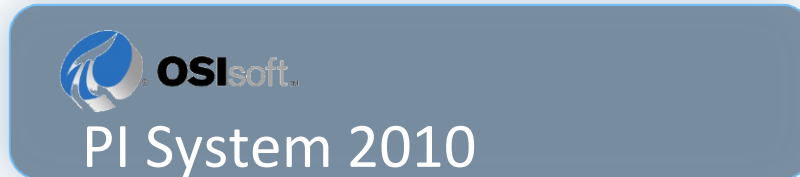
OSIsoft / Microsoft BI Stack



- SQL Analysis Services
- SQL Reporting Services



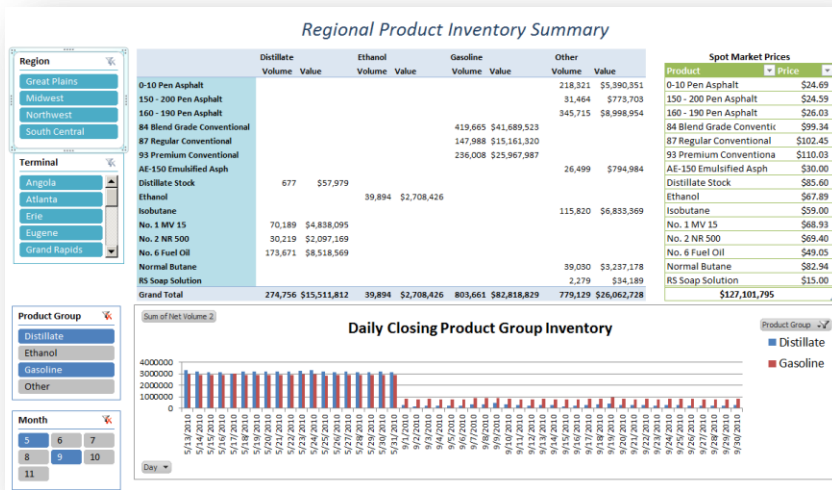
- PI OLEDB Enterprise 2010



- PI AF

Multidimensional Data Analysis

Quick, ad-hoc, aggregation of large amounts of interesting data (facts), based on user-selected criteria (dimensions), to identify opportunities for improvement.



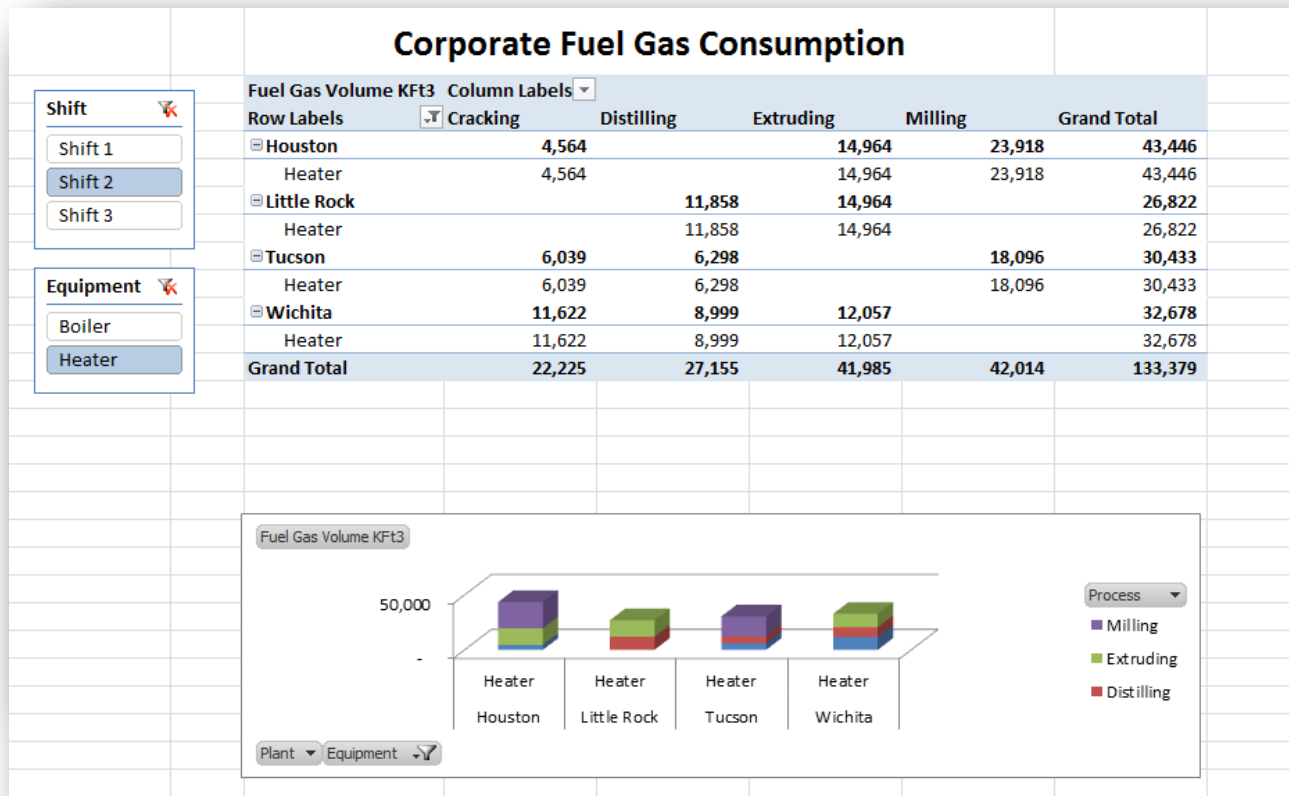
Critical HX Monitoring

Exchanger	Water Velocity Feet/Sec	Skin Temp Deg. F	CW Flow GPM	U-Value BTU/(hr/ft2/deg F)	Heat Load MMBTU	Heat Flux BTU/hr/ft2
E-163-A	3.70	77	2237	45.5	5.1	352.1
E-163-C	3.80	78	2298	48.0	5.8	401.1
E-191-A	2.31	101	4360	62.8	36.6	2782.4
E-191-B	3.08	80	4360	52.1	13.7	1027.2
E-256-A	2.46	97	1726	117.8	6.4	1082.2
E-256-B	2.47	89	1732	130.8	5.4	911.8
E-256-C	2.46	84	1728	141.9	8.0	1362.3
E-271	4.43	132	1930	153.3	40.9	9922.5
E-343	1.79	97	249	63.3	2.6	2443.0
E-38-A	1.81	105	3752	50.9	34.2	2378.9
E-38-B	1.95	82	3731	48.6	13.1	980.1
E-77-A	2.23	105	4204	61.8	36.4	2768.5
E-77-B	2.16	84	4246	57.1	19.0	1391.1
E-98-A	1.58	108	2986	47.3	29.3	2227.0
E-98-B	1.54	86	3013	45.3	15.6	1141.8

Multidimensional Data Analysis

- Optimized, memory-resident data “cubes”
- Scorecards, reports, pivot tables and charts
- Traditionally, a server-based, IT project
- Now, self-service BI for the Information Worker
- Enables Operational Intelligence

Operational Intelligence



Performance Scorecards and Reports

Refinery Scorecard

Time: 01 Dec 2009*

Mass Balance Scorecard

	Actual	Target
Overall Imbalance	2.4 %	●
Reconciled Mass Correction	1.8 %	●

Mass Imbalance and Bad Meters Summary

Filter Mode

	Mass Imbalance Pct		Bad Meters
	Actual	Status	
2CU	-0.1	●	2.0
4CU	-1.0	●	2.0
ALKY	1.9	●	
ATP	0.0	●	
CCR	0.0	●	
COKER	1.5	●	
DFH	-4.8	●	1.0
FCC	-0.5	●	1.0
ISOMAX	0.0	●	
JHP	0.0	●	1.0
NHT1	0.5	●	1.0
NHT2	-3.7	●	
NHT3	5.3	●	
PENEX	-4.1	●	
VGO	-1.0	●	
VRDS	2.4	●	

Feed and Yield Summary

Filter Mode

	Feed				Yield			
	Actual	Reconciled	Plan	Variance#	Actual	Reconciled	Plan	Variance#
2CU	83.9	35.5	0.0	0.0	17.5	32.2	0.0	0.0
4CU	162.0	159.6	210.0	-22.9 %	174.2	176.2	212.5	-18.0 %
ALKY	33.5	34.6	35.9	-6.7 %	7.0	7.4	25.7	-72.8 %
ATP	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
CCR	0.1	0.0	0.0	0.0	0.5	0.0	0.0	0.0
COKER	50.0	49.6	55.8	-10.4 %	34.4	36.1	41.9	-17.9 %
DFH	13.9	14.6	14.0	-0.7 %	13.1	14.7	14.0	-6.4 %
FCC	59.3	59.2	56.0	5.9 %	65.4	66.4	68.0	-3.8 %
ISOMAX	34.1	0.0	31.8	7.2 %	2.2	0.0	37.7	-94.2 %
JHP	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0
NHT1	40.7	40.9	30.0	35.7 %	41.3	41.3	30.1	37.2 %
NHT2	10.6	11.7	8.8	20.5 %	8.6	10.2	2.2	290.9 %
NHT3	15.5	16.9	14.5	6.9 %	15.6	16.4	14.5	7.6 %
PENEX	10.9	11.4	17.0	-35.9 %	10.9	11.1	16.8	-35.1 %
VGO	38.4	39.0	40.0	-4.0 %	39.7	39.9	39.5	0.5 %
VRDS	56.5	53.2	57.0	-0.9 %	58.5	56.6	56.7	3.2 %



El Segundo Refinery

2CU on 12/22/2009

Sigmafine Imbalance(Kib) 1,490.5

Sigmafine Imbalance(%) 7.8 % (Sigmafine Imbalance / Level-1 Inputs total)

Meter Type	Meter Level	Meter Name	Meter Description	Corrected Mass (Kib)	Reconciled Mass (Kib)	Correction (%)	Error (Kib)	Corrected Volume	Reconciled Volume	UOM
Inputs										
Level-2										
Level-1										
		41FC348A	Crude Feed Domestic - A	0.0	0.0	0.0	0.0	0.0	0.0	MBPD
		41FC348B	Crude Feed Domestic - B	0.0	0.0	0.0	0.0	0.0	0.0	MBPD
		41FC349	Minas Feed (Low Sulfur Crude)	0.5	0.5	0.0	0.0	0.0	0.0	MBPD
		41FC350	Crude SJV Feed	15,085.9	14,479.5	-4.0	-606.4	44.0	42.2	MBPD
		41FC351	Mixed Feed (Opportunity Crude)	3,972.3	3,930.2	-1.1	-42.1	13.0	12.8	MBPD
		41FC352	Alternate Crude (Recovered Oil)	0.0	0.0	0.0	0.0	0.0	0.0	MBPD
		41F347	DFH Naphtha	38.5	38.4	-0.3	-0.1	0.1	0.1	MBPD
Total Level-2				19,097.2	18,448.7					
Outputs										
Level-2										
Level-1										
		40FC202	Heavy Gas Oil to FCC/VRDS/Tank	5,128.4	5,233.5	2.0	105.1	15.1	15.4	MBPD
		40FC203	Light Gas Oil to FCC/VRDS/Tank	483.2	537.4	10.1	54.2	1.5	1.5	MBPD
		40F213	Resid to Delayed Coker	11,093.2	6,411.3	-46.1	-5,481.9	32.8	17.7	MBPD
		41FC308	No. 2 Sidecut Heavy Jet to Storage	1,161.8	1,171.0	0.8	9.2	4.0	3.6	MBPD
		41FC309	No. 3 Sidecut Diesel to Storage	2,888.9	2,900.2	0.4	11.3	9.2	8.6	MBPD
		41FC310	No. 4 Sidecut to Isomax, FCC, VGO, or VRDS	1,356.3	1,381.9	1.9	25.6	4.2	4.0	MBPD
		41F317	LPG (C3-C4) to NHT2	3.0	3.0	0.0	0.0	0.0	0.0	MBPD
		41F320	C-308 Bottoms to Storage	754.2	752.5	-0.2	-1.7	3.0	2.6	MBPD
		41F322	V-306 Waste Gas to H2S Plant	0.0	0.0	0.0	0.0	0.0	-0.2	MMSCFD
		41F340	V-302 Waste Gas	68.1	57.6	-15.4	-10.5	0.7	0.6	MMSCFD
		40F221	Vacuum Waste Gas from V-210	0.3	0.3	0.0	0.0	0.1	0.1	MMSCFH
		40F451	TOTAL WASTE GAS	55.3	57.9	4.5	2.6	0.6	0.7	MMSCFD
Total Level-1				23,792.6	18,506.6					



Introduction to the Microsoft BI Stack



Microsoft Business Intelligence

Get more out of products you already own

Business User Experience



Business Collaboration Platform



Data Infrastructure and BI Platform



Familiar User Experience

- Self-service Access and Insight
- Data Exploration and Analysis
- Predictive Analysis
- Data Visualization
- Contextual Visualization

Integrated Content and Collaboration

- Thin Clients
- Dashboards
- BI Search
- Content Management
- Compositions

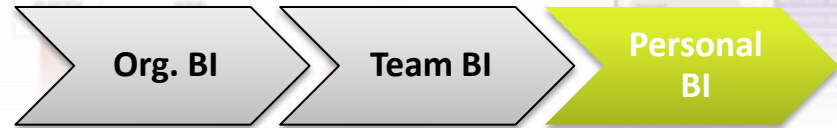
Data Infrastructure and BI Platform

- Analysis Services
- Reporting Services
- Integration Services
- Master Data
- Data Mining Services
- Data Warehousing

Data Analysis & Visualization Self Service BI

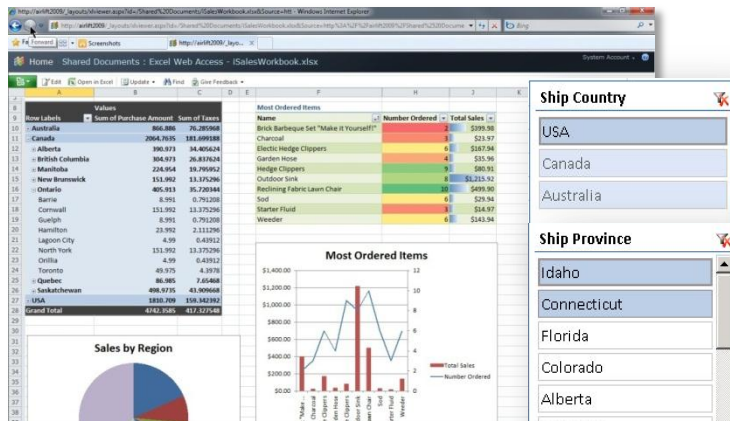
- Additional & improved features
 - Slicers
 - Sparklines
 - New Chart types
 - Search Filters
 - 64bit Support
 - Cube Writeback
 - PowerPivot
 - Named Sets

	Total		Low	High	6/1/2008	6/2/2008
All Books	\$ 325,926		\$8,021	\$13,466	\$ 9,161	\$ 8,611
Arts & Photography	\$ 42,844		\$776	\$1,995	\$ 996	\$ 711
Children's Books	\$ 43,595		\$786	\$1,951	\$ 1,368	\$ 1,311
Computers & Internet	\$ 43,187		\$799	\$1,995	\$ 1,358	\$ 711
History	\$ 25,722		\$350	\$1,407	\$ 1,021	\$ 811
Mystery & Thrillers	\$ 44,833		\$758	\$1,984	\$ 1,471	\$ 911
Romance	\$ 42,365		\$791	\$1,988	\$ 1,129	\$ 1,411
Science Fiction & Fantasy	\$ 41,377		\$789	\$1,936	\$ 859	\$ 1,411
Sports	\$ 41,871		\$756	\$1,937	\$ 959	\$ 911



Share Insights

Get a common view of organizational performance

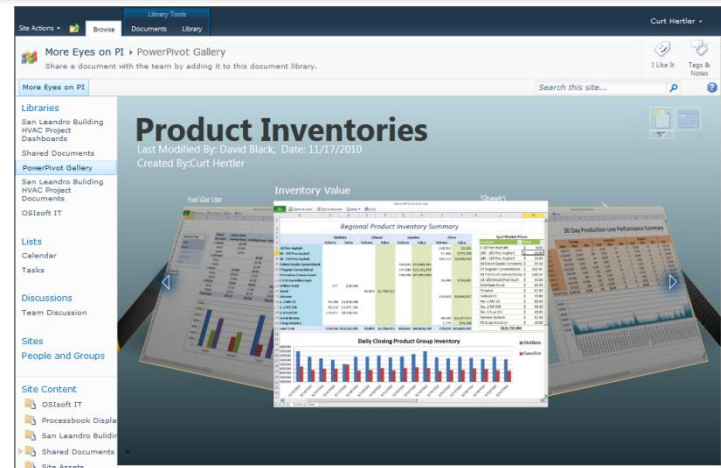


Refresh workbook data manually or automatically

Get access to unlimited data secured in SharePoint with PowerPivot

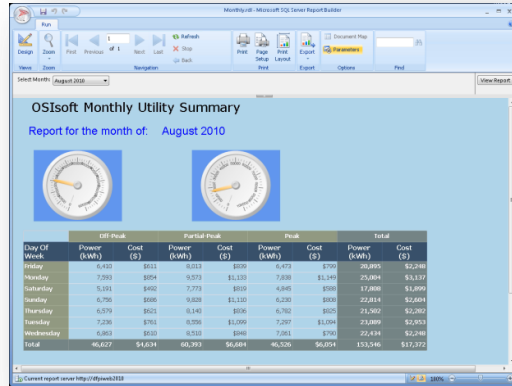
Publish and share rich workbooks to SharePoint

Get the same rich fidelity with a Web browser, including Ribbon and Excel functions

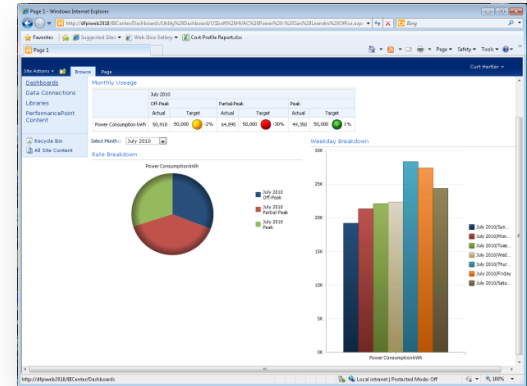


Presentation tools SQL Analysis Services 2008 R2

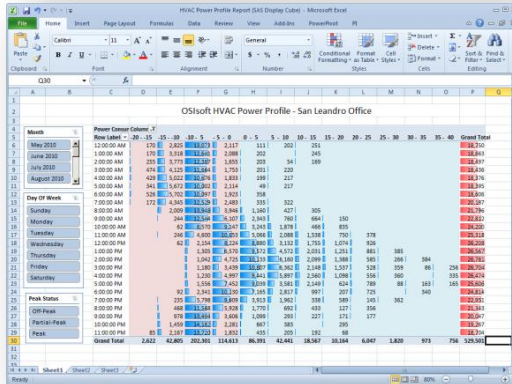
SQL Server
2008 R2
Report Builder
3.0



PerformancePoint
and
Dashboard
Designer



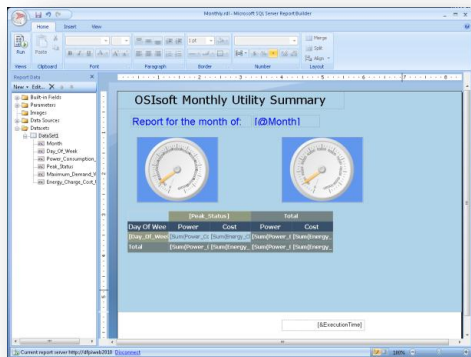
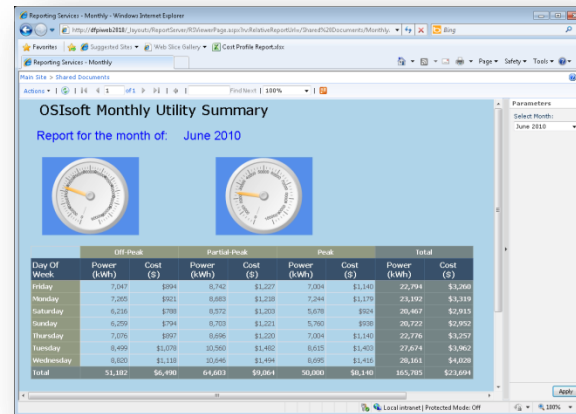
Excel 2010



SQL Server 2008 R2 Report Builder 3.0

- Free download at;
<http://technet.microsoft.com/en-us/library/dd207008.aspx>
- Configurable visualization objects.
- Supports URL actions.

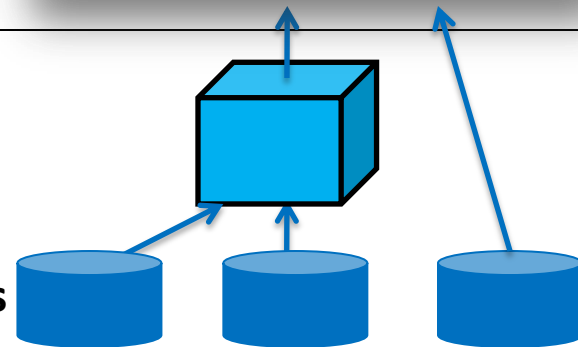
SharePoint 2010



Report Builder 3.0

SQL Analysis
Services 2008 R2
Data Cube

Relational data Sources

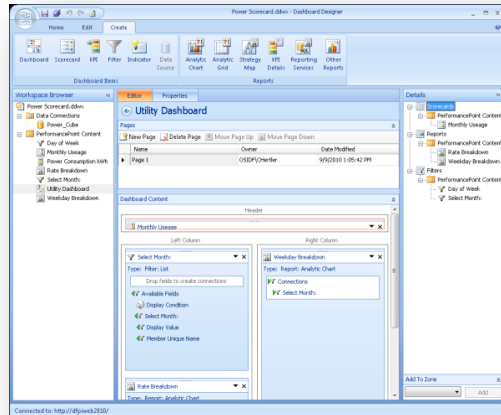
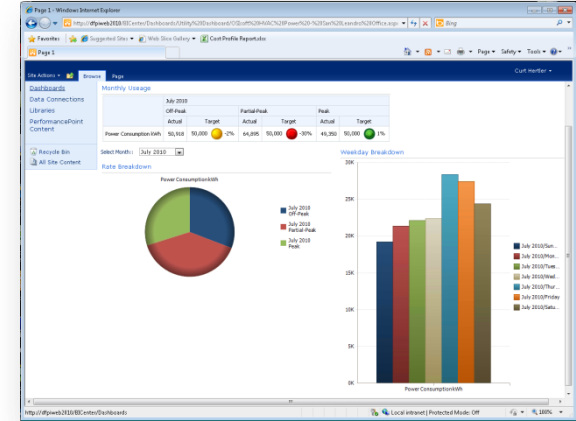


Data Sources: PI, AF, Relational DB's

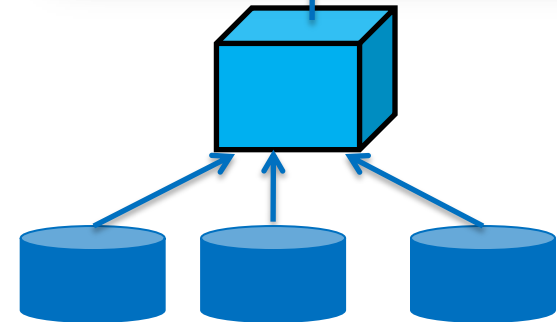
PerformancePoint

- Service in SharePoint 2010
- Define KPI's, scorecards, reports, filters and dashboards.
- Supports drilldown in SharePoint 2010.

SharePoint 2010 PerformancePoint



SQL Analysis Services 2008 R2 Data Cube



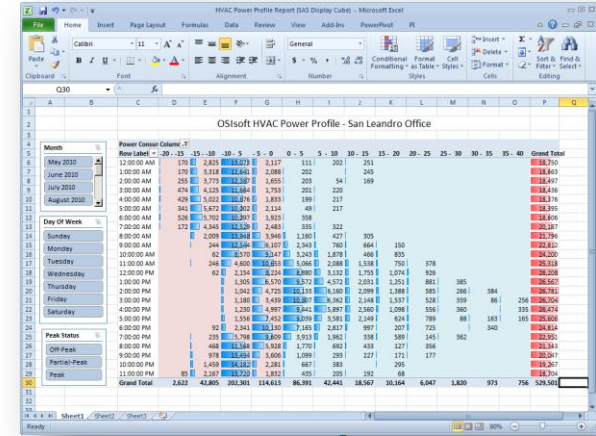
PerformancePoint Dashboard Designer

Data Sources: PI, AF, Relational DB's

Excel 2010

- Data cube created and stored on server using Microsoft SQL Analysis Services (SAS) 2008 R2.
- Standard access from Excel 2010.
- Relationships and calculations are defined on server.
- Analytical functionality supported in SharePoint 2010.
- Data accesses server-based cube directly.

**Client access
through Excel**

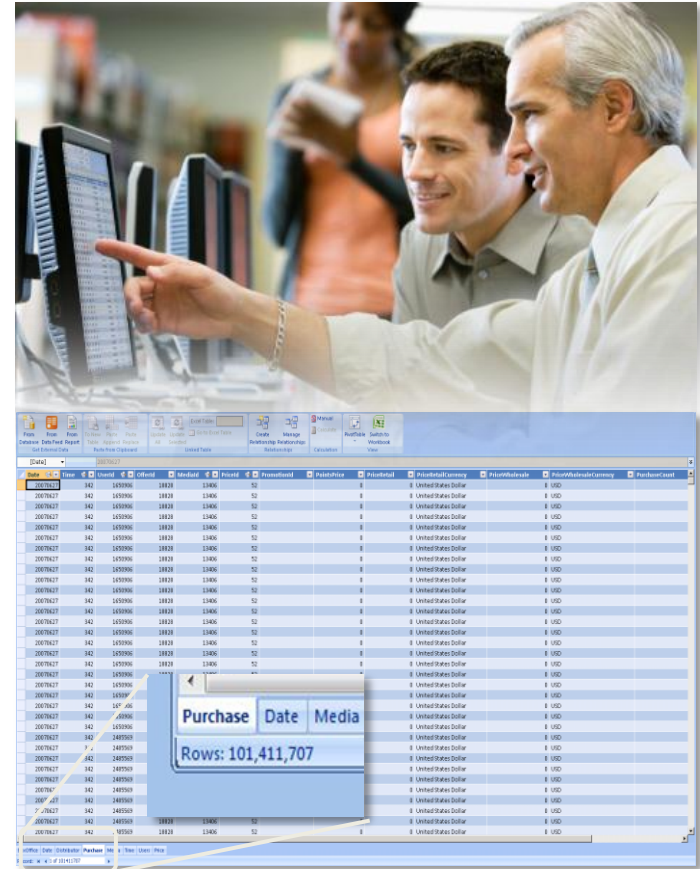


Empowering the End User

Introducing PowerPivot for Excel

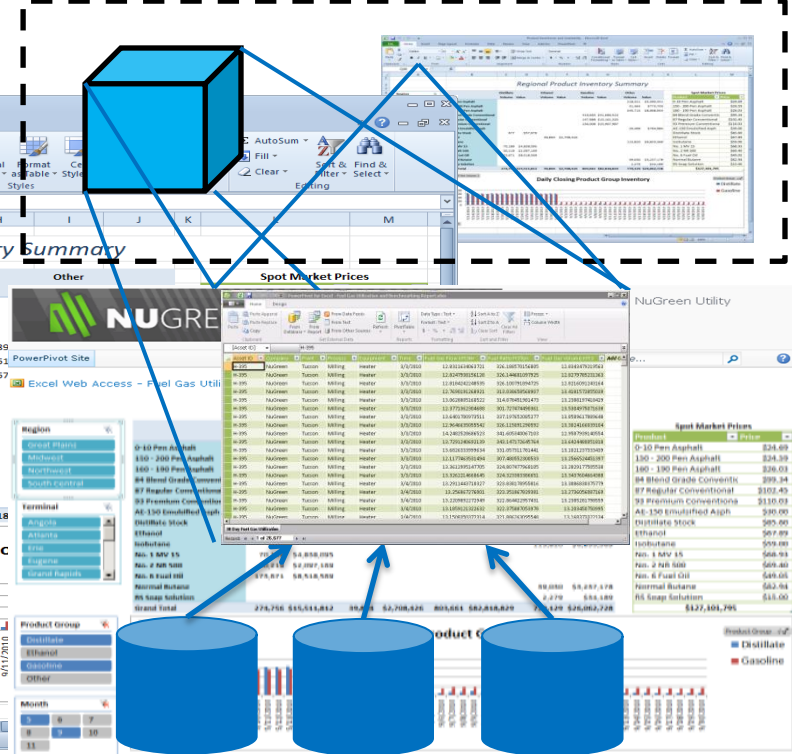
Microsoft®
Excel 2010

- Enable users to perform self-service analysis and intuitively build their own BI solutions
- Allow users to interactively explore and perform calculations on large data sets
- Integrate data from multiple sources
- Minimize dependence on IT support



Microsoft PowerPivot for Excel 2010

- Add-In for Excel 2010. Accessible
- Supports very large datasets from a variety of sources. Scalable
- Relationships and calculations (DAX¹) are easily defined. Configurable
- Data cube created and stored with spreadsheet. Personal
- Analytical functionality supported in SharePoint 2010. Organizational
- Data refresh may be scheduled. Timely

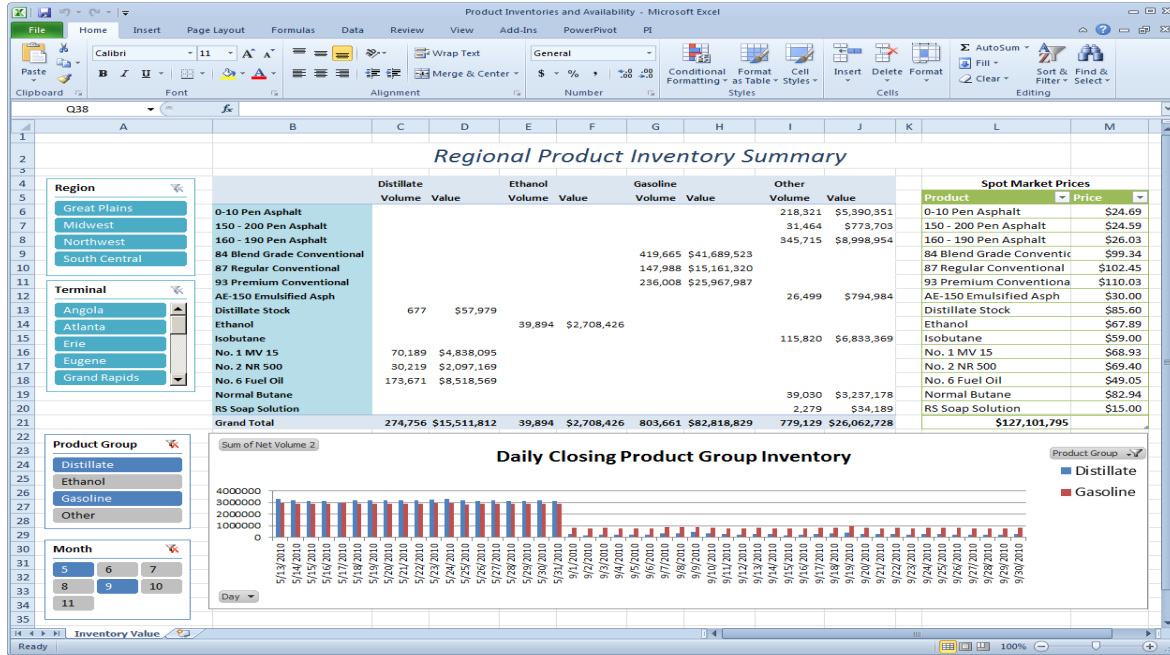


1. Data Analysis Expression Language

Data Sources: PI, RDB, SAS Cubes, Spreadsheet

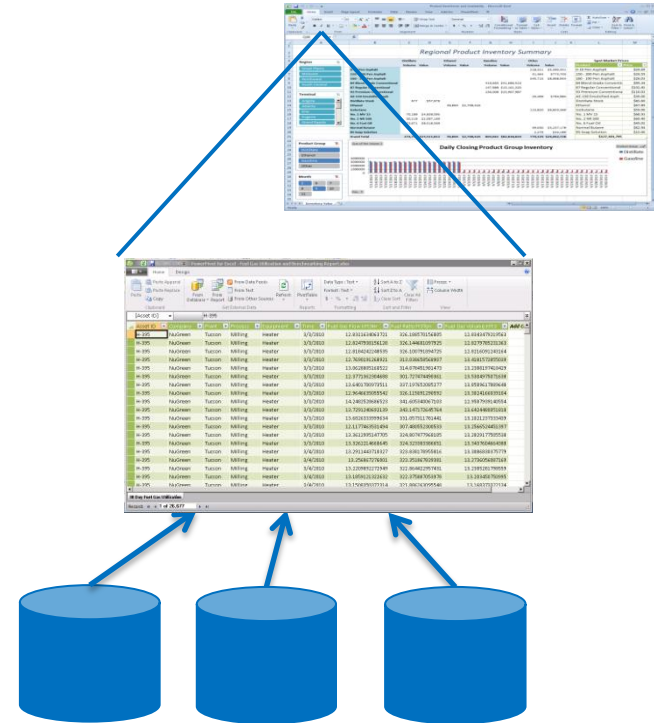
Microsoft PowerPivot for Excel 2010

- Add-In for Excel 2010. Accessible



Microsoft PowerPivot for Excel 2010

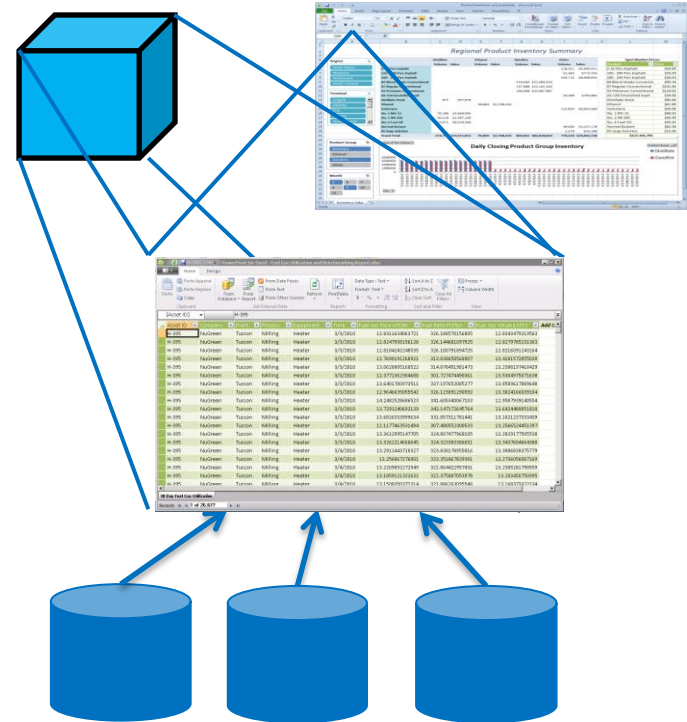
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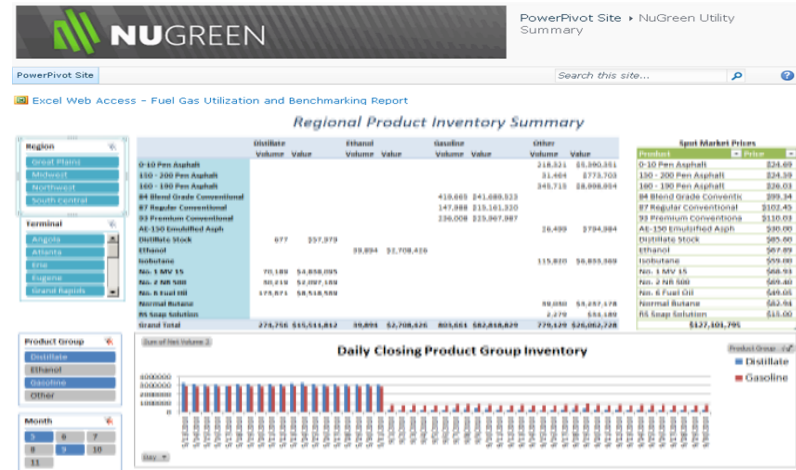
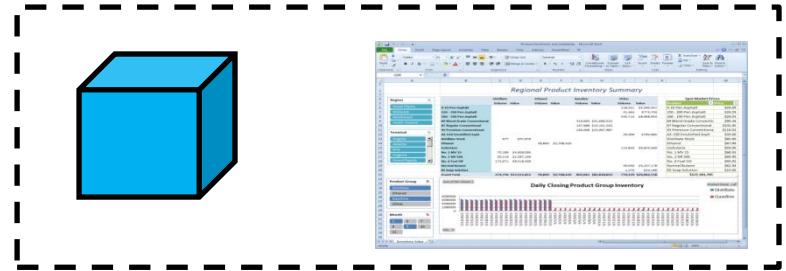


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Microsoft PowerPivot for Excel 2010

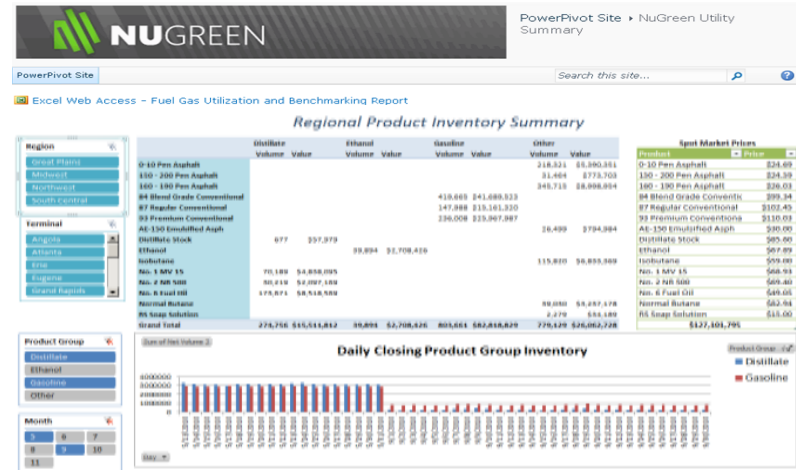
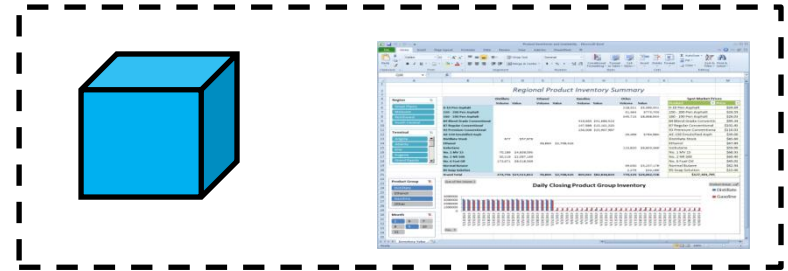
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1. Data Analysis Expression Language

Introduction to “Self-Service” BI

Democratizing Business Intelligence

Improving organizations by providing business insights to ***all*** employees leading to better, faster, and more relevant decisions.

Delivered through a familiar environment

Integrated into business productivity infrastructure

Built on a trusted and extensible platform



PowerPivot example using PI OLEDB Enterprise 2010

Regional Product Inventory Summary

Region

Great Plains
Midwest
Northwest
South Central

Terminal

Norman East
Norman West
Omaha NW
Tulsa
Wichita

	Distillate		Ethanol		Gasoline		Other	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
0-10 Pen Asphalt							1,059	\$26,139
150 - 200 Pen Asphalt							12,737	\$313,195
160 - 190 Pen Asphalt							18,736	\$487,711
84 Blend Grade Conventional					3,451	\$342,778		
87 Regular Conventional					14,256	\$1,460,555		
93 Premium Conventional					13,154	\$1,447,356		
AE-150 Emulsified Asph								
Distillate Stock								
Ethanol			5,423	\$368,142				
Isobutane							104,040	\$6,138,333
No. 1 MV 15								
No. 2 NR 500								
No. 6 Fuel Oil	128,444	\$6,300,192						
Normal Butane								
RS Soap Solution								
Grand Total	128,444	\$6,300,192	5,423	\$368,142	30,861	\$3,250,690	136,571	\$6,965,378

Spot Market Prices	
Product	Price
0-10 Pen Asphalt	\$24.69
150 - 200 Pen Asphalt	\$24.59
160 - 190 Pen Asphalt	\$26.03
84 Blend Grade Conventic	\$99.34
87 Regular Conventional	\$102.45
93 Premium Conventiona	\$110.03
AE-150 Emulsified Asph	\$30.00
Distillate Stock	\$85.60
Ethanol	\$67.89
Isobutane	\$59.00
No. 1 MV 15	\$68.93
No. 2 NR 500	\$69.40
No. 6 Fuel Oil	\$49.05
Normal Butane	\$82.94
RS Soap Solution	\$15.00
\$16,884,402	

Self-service BI Toolkit for PI System

- Facts and Dimensions
 - PI AF (PI System 2010)
- Datasets for BI Data Extraction
 - PI OLEDB Enterprise 2010 (PI for Office 2010)
- Desktop Analysis and Cube Configuration
 - Microsoft PowerPivot for Excel 2010
- Enterprise Accountability
 - Microsoft PowerPivot for SharePoint 2010
 - Microsoft SharePoint 2010 Enterprise
 - Microsoft SQL Server 2008 R2 Enterprise or above

Example: Product Inventories



PI AF Associates Facts and Dimensions

Dimensions

Facts

AF Hierarchy

Attributes

Region

Volume

PI Point

Terminal

Product

Formula

Tank

Product Group

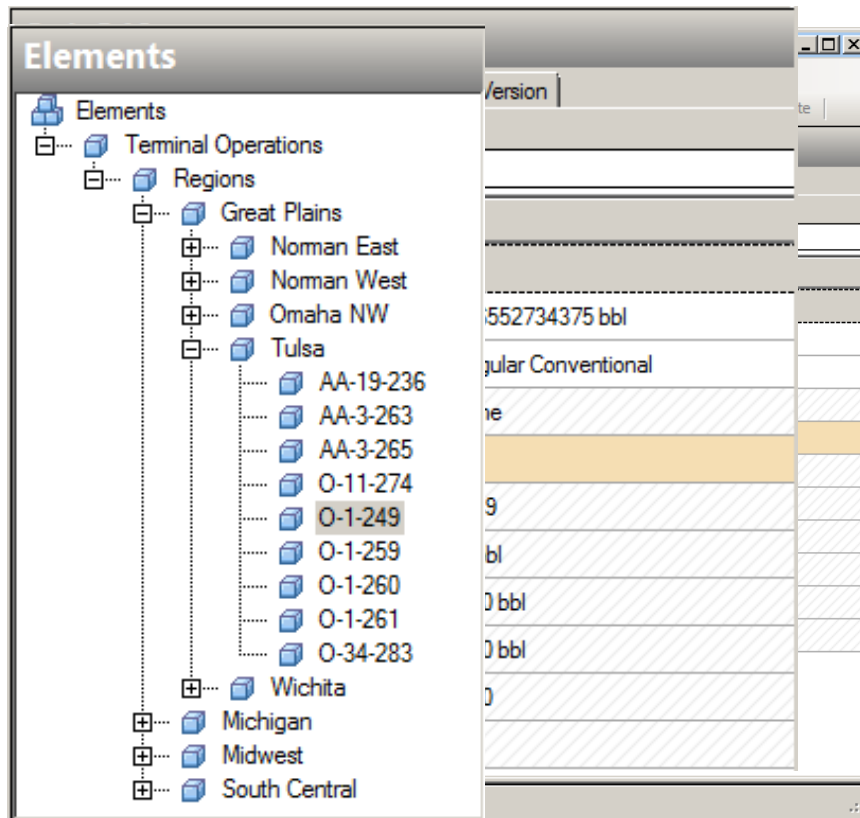
Other

Dimensions

Hierarchy

Templates

Categories



PI OLEDB Enterprise 2010

Enterprise Attribute Hierarchy Commander

	Tank ID	Time		Tank ID	Type	Region	Terminal	Nominal Volume
000001	T-14	9/20/2010 5:58:..	001	23-373	Tank	Great Plains	Norman East	50250
000002	T-14	9/20/2010 6:58:..	002	12-372	Tank	Great Plains	Norman East	50250
000003	T-14	9/20/2010 7:58:..	003	24-374	Tank	Great Plains	Norman East	50250
000004	T-14	9/20/2010 8:58:..	004	24-375	Tank	Great Plains	Norman East	50250
000005	T-14	9/20/2010 9:58:..	005	24-376	Tank	Great Plains	Norman East	50250
000006	T-14	9/20/2010 10:58:..	006	40-370	Tank	Great Plains	Norman East	50250
000007	T-14	9/20/2010 11:58:..	007	41-371	Tank	Great Plains	Norman East	50250
► 000008	T-14	9/21/2010 12:58:..	008	52-377	Tank	Great Plains	Norman East	50250
000009	T-14	9/21/2010 1:58:..	009	15-11	Tank	Great Plains	Omaha NW	50250
000010	T-14	9/21/2010 2:58:..	010	35-1	Tank	Great Plains	Omaha NW	50250
000011	T-14	9/21/2010 3:58:..	011	35-2	Tank	Great Plains	Omaha NW	50250
000012	T-14	9/21/2010 4:58:..	012	35-9	Tank	Great Plains	Omaha NW	50250
000013	T-14	9/21/2010 5:58:..	013	55-12	Tank	Great Plains	Omaha NW	50250
000014	T-14	9/21/2010 6:58:..	014	55-3	Tank	Great Plains	Omaha NW	50250
000015	T-14	9/21/2010 7:58:..	015	55-7	Tank	Great Plains	Omaha NW	50250
000016	T-14	9/21/2010 8:58:..	016	80.4	Tank	Great Plains	Omaha NW	50250
000017	T-14	9/21/2010 9:58:..	017	80.6	Tank	Great Plains	Omaha NW	50250
000018	T-14	9/21/2010 10:58:..	018	T-1-3	Tank	Great Plains	Omaha NW	50250
			019	AA-10-2	Tank	Great Plains	Omaha NW	50250
			020	T-8-1	Tank	Great Plains	Omaha NW	50250
			021	RB-10-1	Tank	Great Plains	Omaha NW	50250
			022	AA-19-236	Tank	Great Plains	Tulsa	50250

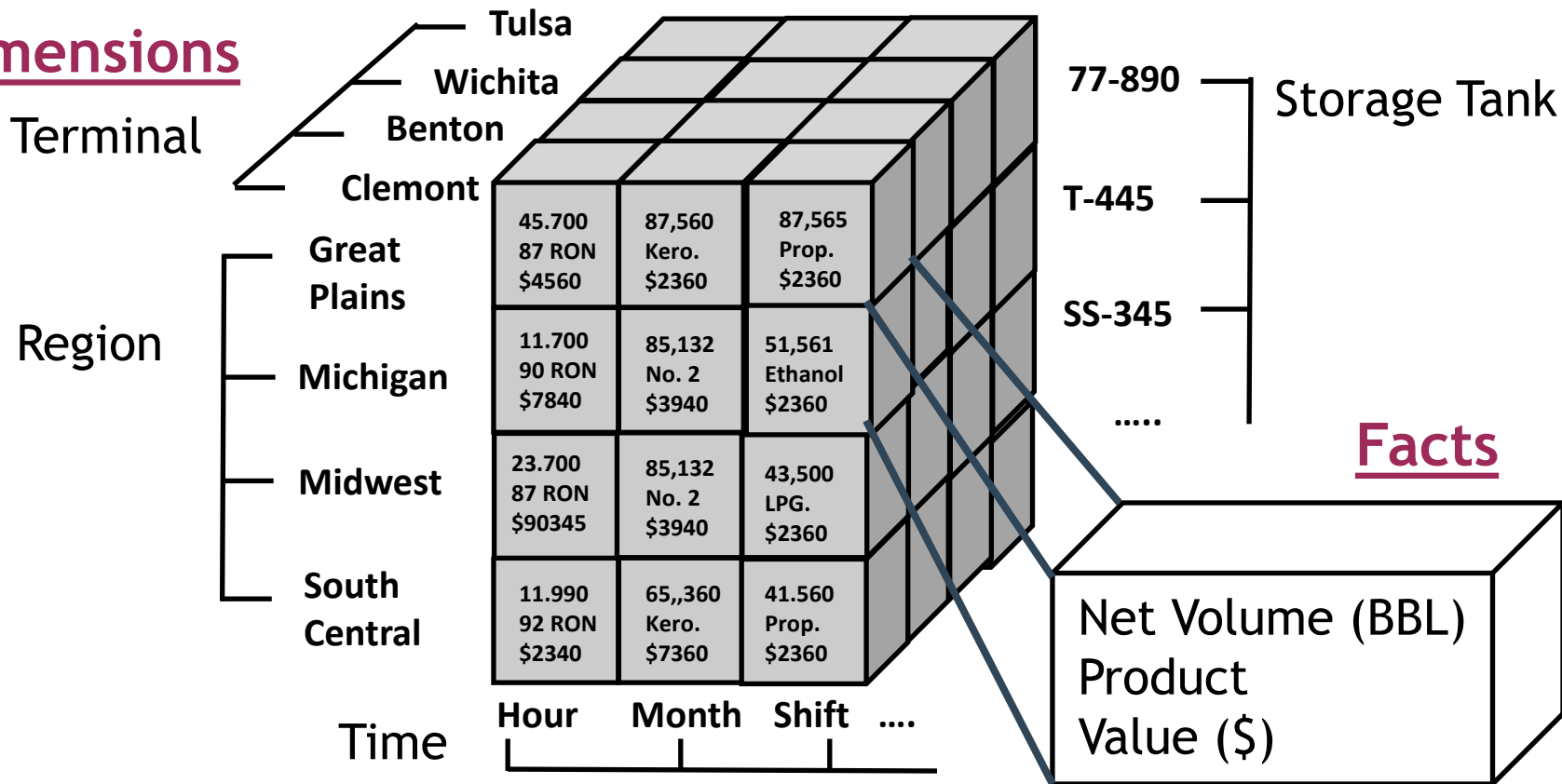
Ready

Ch 1

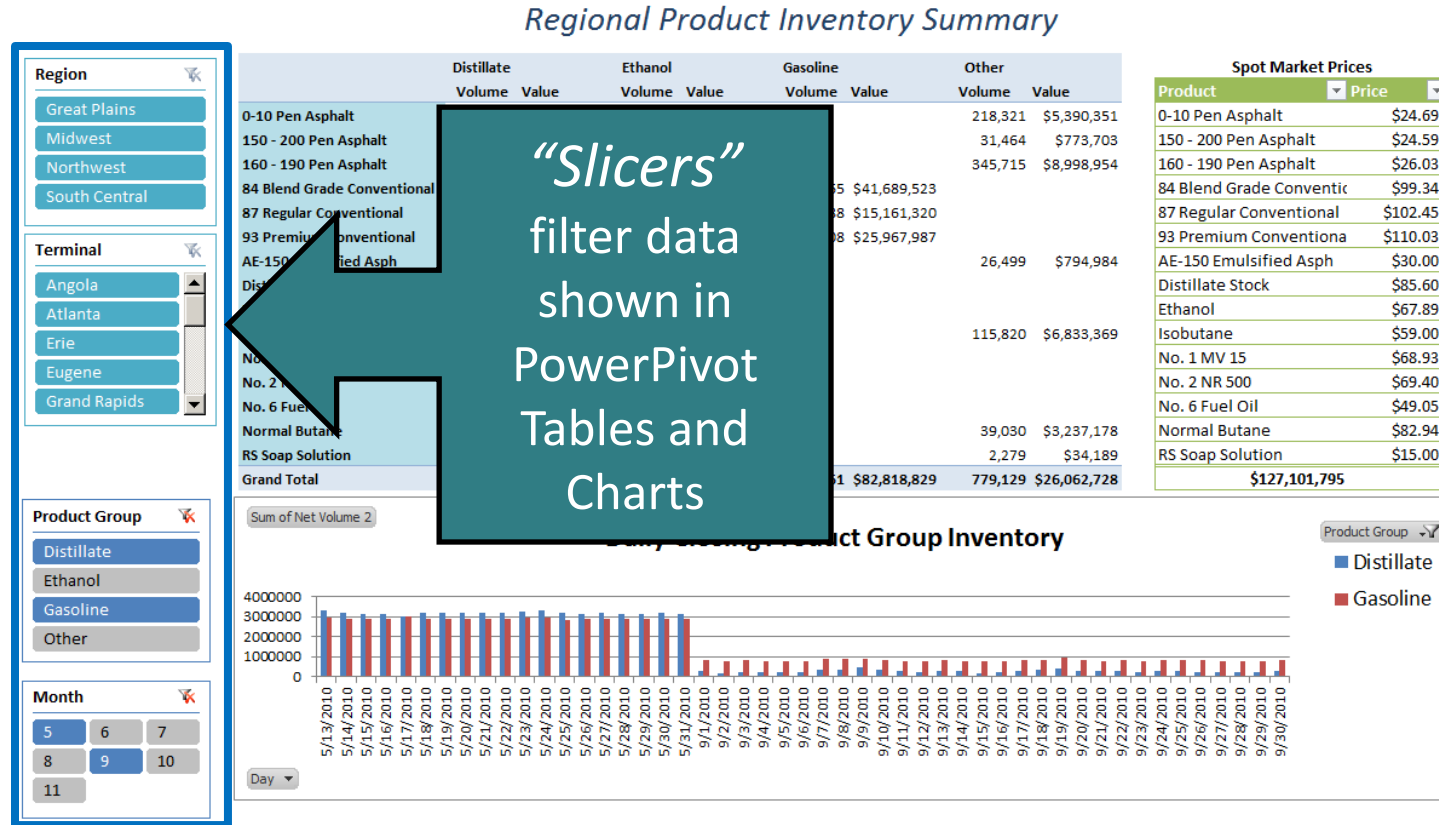
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Multidimensional Data “Cube”

Dimensions

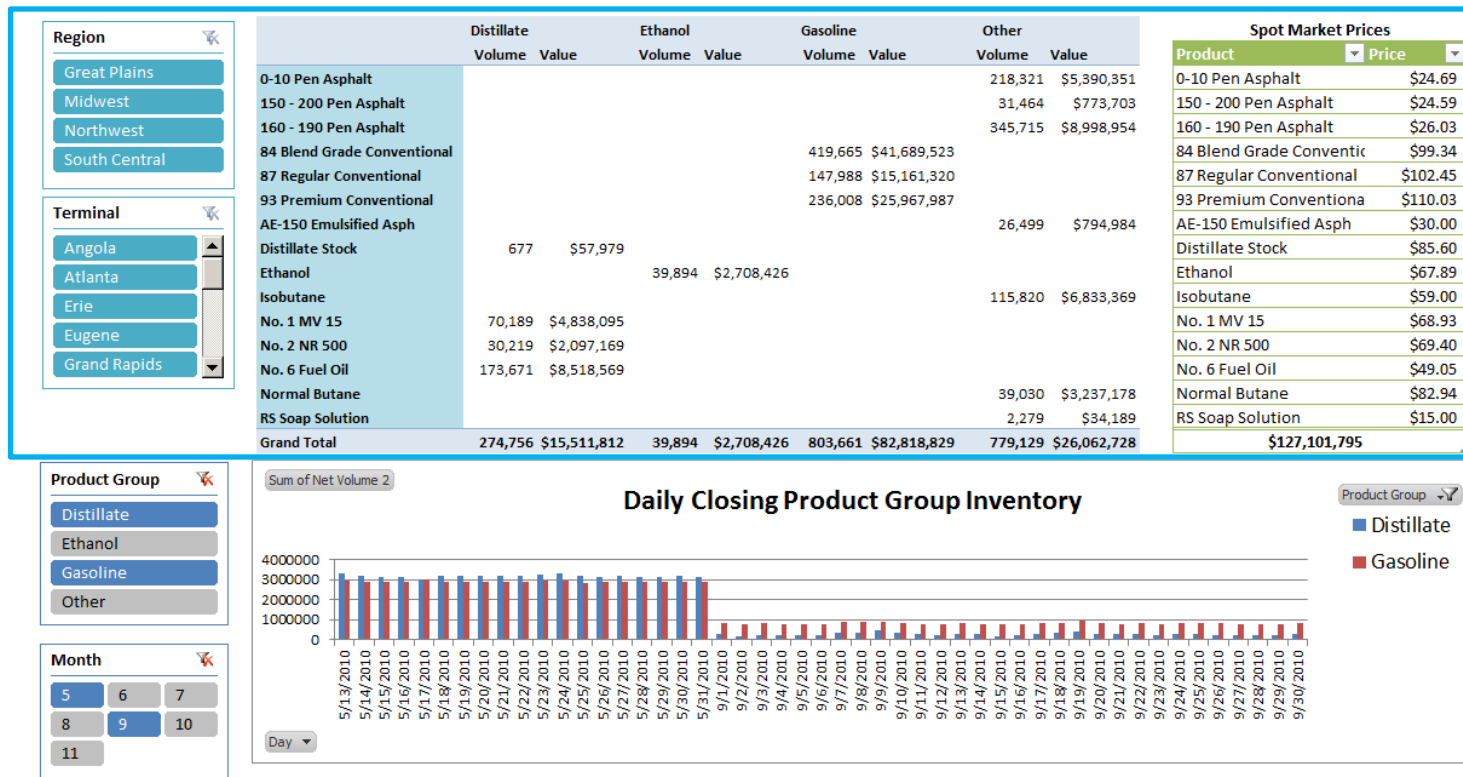


Product Inventories and Valuation



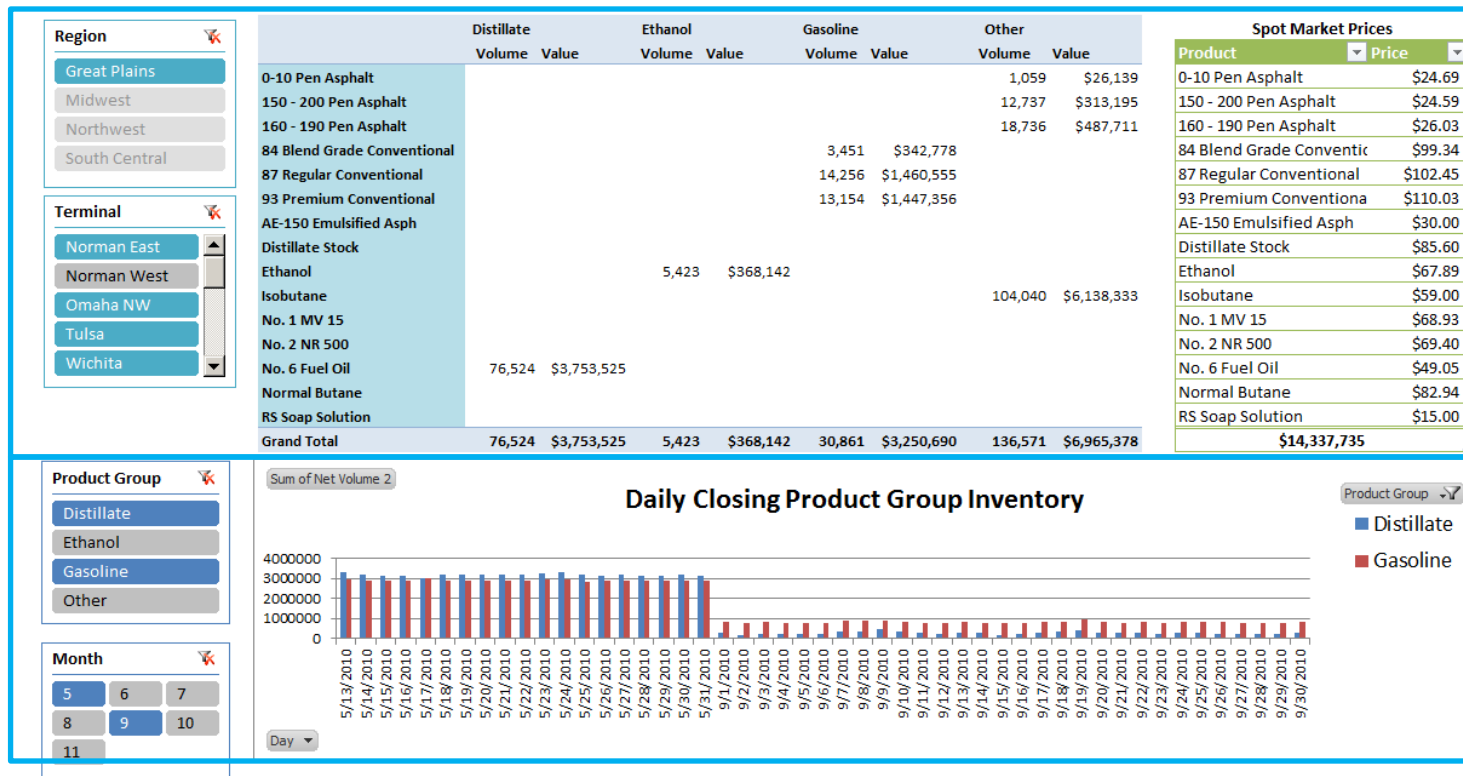
Product Inventories and Valuation

Regional Product Inventory Summary



Product Inventories and Valuation

Regional Product Inventory Summary



Product Group

Distillate

Ethanol

Gasoline

Other

Month

5

6

7

8

9

10

11

Sum of Net Volume 2

Daily Closing Product Group Inventory

Product Group: Distillate (Blue), Gasoline (Red)

Product Inventories and Valuation

Regional Product Inventory Summary

Region

Great Plains

Midwest

Northwest

South Central

Terminal

Norman East

Norman West

Omaha NW

Tulsa

Wichita

	Distillate		Ethanol		Gasoline		Other	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
0-10 Pen Asphalt							1,059	\$26,139
150 - 200 Pen Asphalt							12,737	\$313,195
160 - 190 Pen Asphalt							18,736	\$487,711
84 Blend Grade Conventional					3,451	\$342,778		
87 Regular Conventional					14,256	\$1,460,555		
93 Premium Conventional					13,154	\$1,447,356		
AE-150 Emulsified Asph								
Distillate Stock								
Ethanol			5,423	\$368,142				
Isobutane							104,040	\$6,138,333
No. 1 MV 15								
No. 2 NR 500								
No. 6 Fuel Oil	76,524	\$3,753,525						
Normal Butane								
RS Soap Solution								
Grand Total	76,524	\$3,753,525	5,423	\$368,142	30,861	\$3,250,690	136,571	\$6,965,378

Spot Market Prices

Product	Price
0-10 Pen Asphalt	\$24.69
150 - 200 Pen Asphalt	\$24.59
160 - 190 Pen Asphalt	\$26.03
84 Blend Grade Conventic	\$99.34
87 Regular Conventional	\$102.45
93 Premium Conventiona	\$110.03
AE-150 Emulsified Asph	\$30.00
Distillate Stock	\$85.60
Ethanol	\$67.89
Isobutane	\$59.00
No. 1 MV 15	\$68.93
No. 2 NR 500	\$69.40
No. 6 Fuel Oil	\$49.05
Normal Butane	\$82.94
RS Soap Solution	\$15.00
Total	\$14,337,735

Product Group

Distillate

Ethanol

Gasoline

Other

Month

5

6

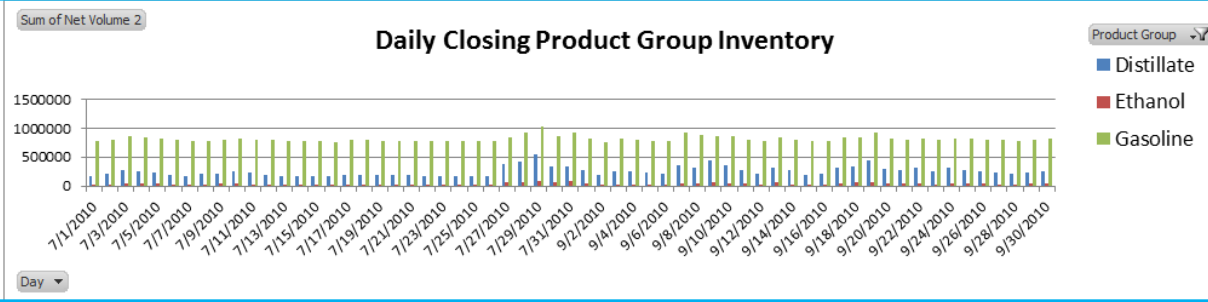
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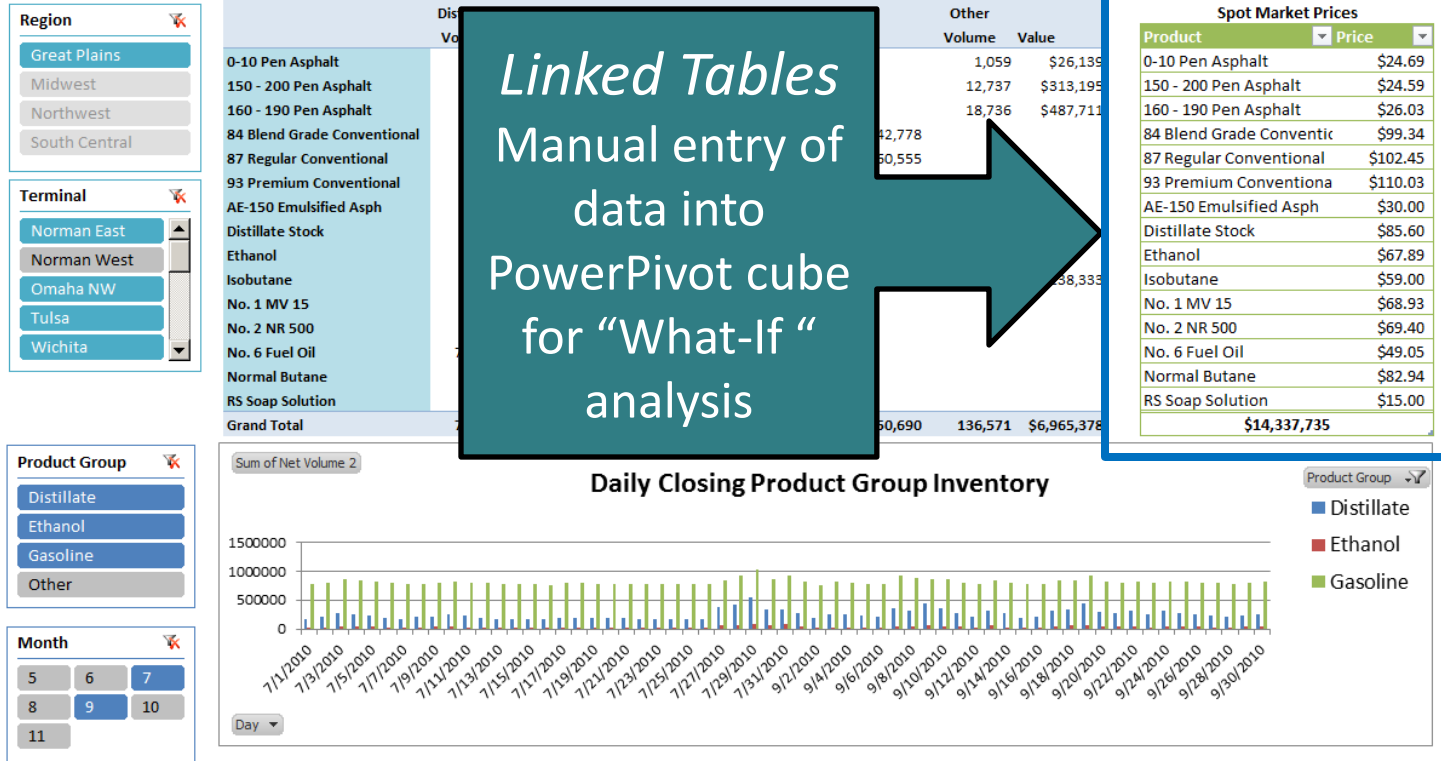
10

11



Product Inventories and Valuation

Regional Product Inventory Summary



Import Data into PowerPivot

='Current Product Inventories'[Net Volume]*RELATED(Product_Prices[Price])

PowerPivot
Add-In for
Excel 2010

Configure
Relationships

Add Calculations
Using DAX¹

1. Data Analysis Expression Language

Value

\$152,661.44
\$226,440.90
\$84,130.78
\$126,491.38
\$863,093.15
\$180,081.09
\$107,543.63
\$112,970.57
\$290,407.91
\$442,314.19
\$205,521.74
\$405,515.56
\$63,987.56
\$1,266,947.89

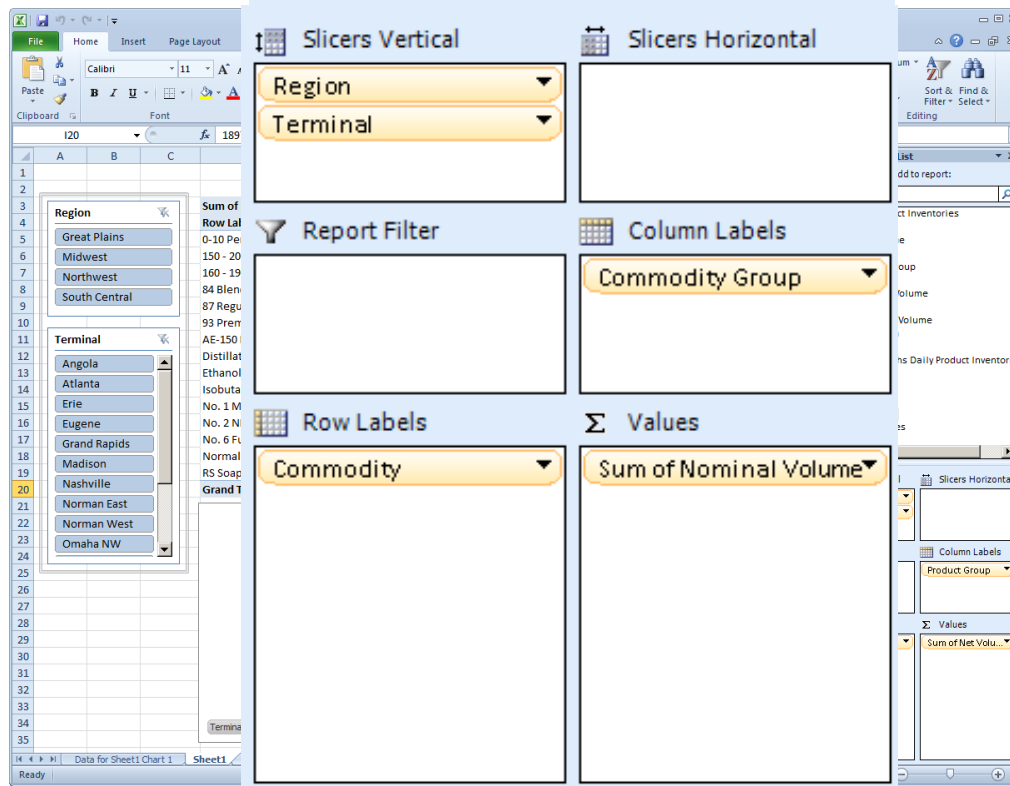
Current Product Inventories
PI OLEDB Enterprise 2010

Six Months Daily Inventories
PI OLEDB Enterprise 2010

Tank Location
PI OLEDB Enterprise 2010

Commodity Prices
Excel Linked Table

Build PowerPivot Tables and Charts



Upload to PowerPivot Gallery

- SilverLight visualization
- Report usage statistics
- Scheduled updates



Additional Information



Additional Information

- Customer Resources
 - Recorded OSIsoft vCampus Presentations
 - “Personal BI with PI DataLink and Office 2010”
 - “Building a BI Infrastructure Part 1: Warehousing, ETL, and Cube Building”
 - “Building a BI Infrastructure Part 2: Visualization, Analysis, and Personalization”
 - Prescriptive Architecture Guides
- Microsoft Resources
 - PowerPivot (www.PowerPivot.com)
 - CFE Case Study (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)
 - Windows Azure DataMarket (datamarket.azure.com)



Thank you

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