Enabling IIOT through IT/OT Convergence in the Oil and Gas Industry

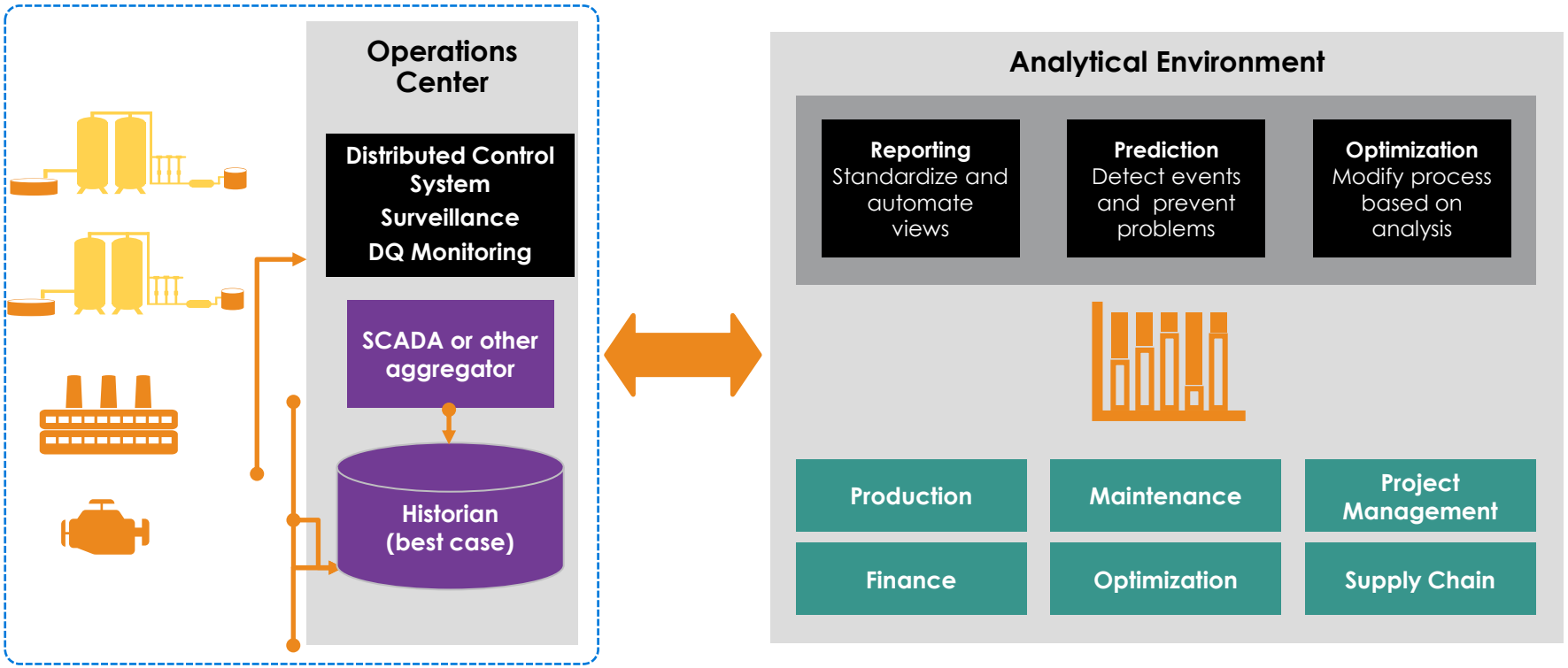
May 8, 2018

Introduction

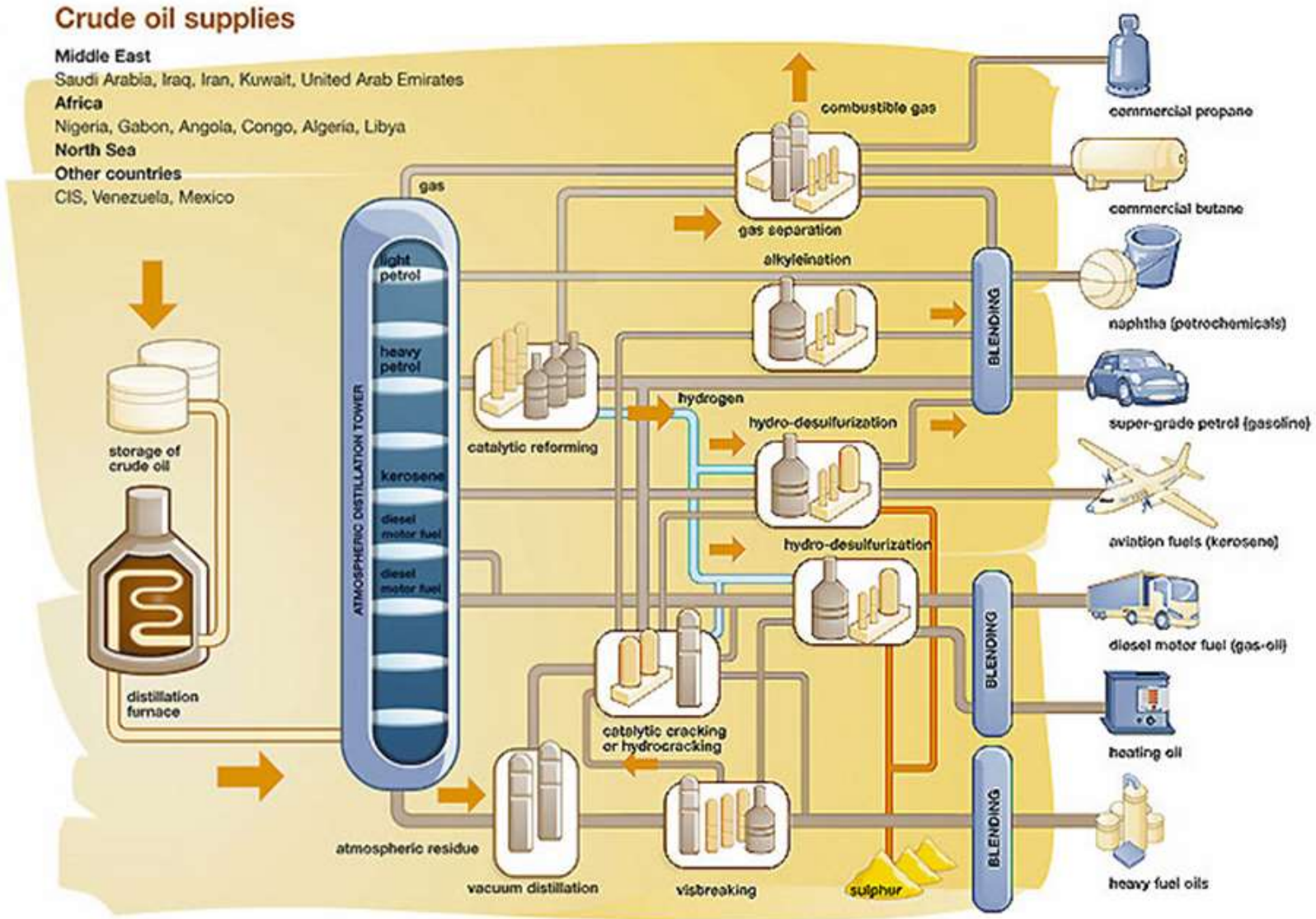
IT (Information Technology) vs. OT (Operational Technology)

OT: Hardware and software that detects or causes a change through the direct monitoring and/or control of physical devices, processes and events in the enterprise.

IT: This is the common term for the entire spectrum of technologies for information processing, including software, hardware, communications technologies and related services.



Refining Overview

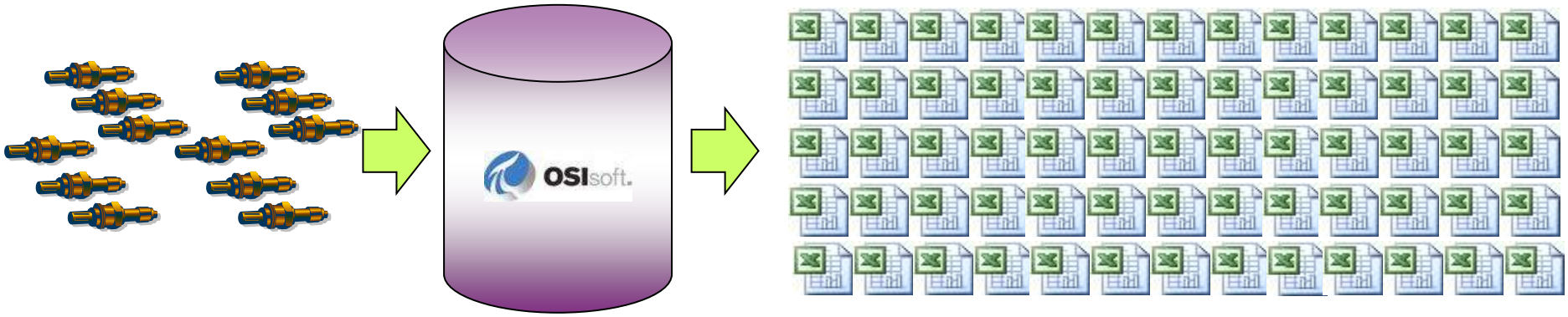


Who is(was) Andeavor?

- Andeavor (NYSE: ANDV) is a Fortune 100/Global 500 company headquartered in San Antonio, with 2013 annual revenues of $37 billion, and over 13,000 employees worldwide. It was created by the merger of Tesoro Corporation and Western Refining.
- Andeavor is an independent refiner and marketer of petroleum products, operating ten refineries in the Western United States with a combined rated crude oil capacity of approximately 1,200,000 barrels (190,000 m3) per day. Andeavor's retail-marketing system includes approx. 3,000 branded retail gas stations, of which more than 595 are company-operated under its own Tesoro brand name, as well as Shell, ExxonMobil, ARCO, and USA Gasoline brands.
- Andeavor also owns significant pipeline assets in the Western United States managed as Andeavor Logistics

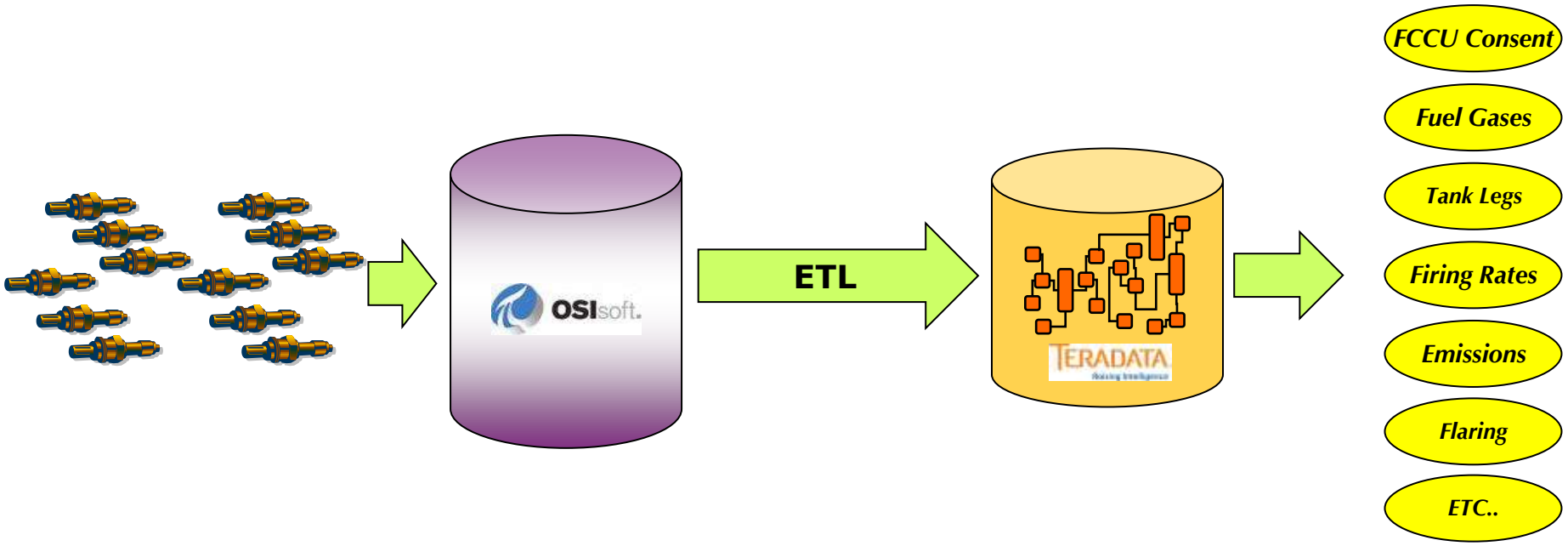
Example Projects

Historian Reporting – Historical Process for Environmental



1. Measurements are generated ~55000 sensors in the refinery.
2. The generated data is sourced from the sensors and stored in PI at a granularity of as low as one reading per sensor per minute.
3. Using an extremely laborious and mostly manual process, the data is sourced from PI on a daily basis into ~65 different spreadsheets. (Excel only)
4. The data remains in the spreadsheets for an entire year to generate the needed reports. Some of these spreadsheets can grow to several hundred MBs and take significant time (several hours/day) to source data and perform the necessary calculations.
5. The data is stale. Changes or updates to PI are not reflected back into the spreadsheets.

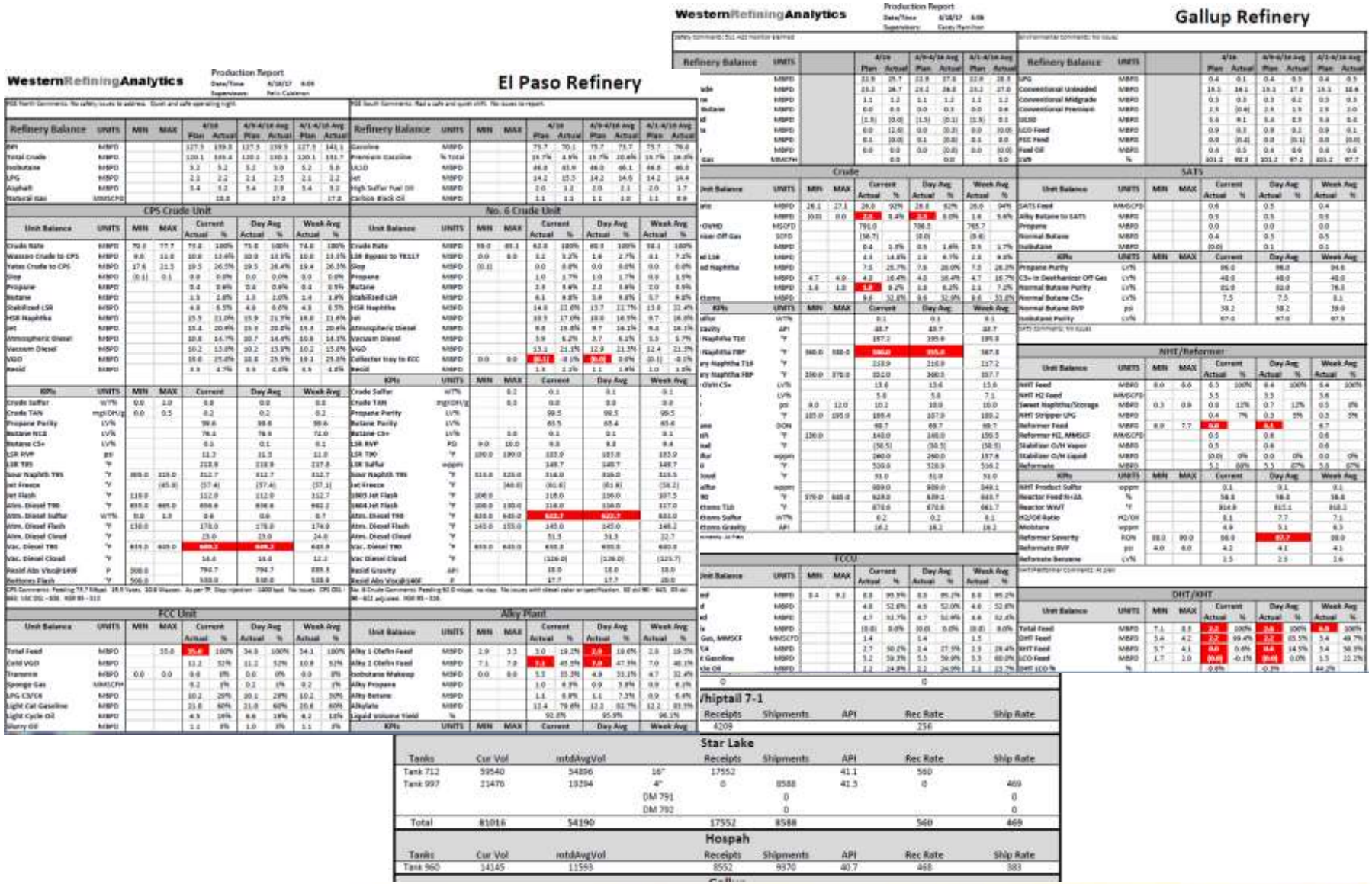
Historian Reporting – Converged Process for Environmental



1. Measurements are generated ~55000 sensors in the refinery.
2. The generated data is sourced from the sensors and stored in PI at a granularity of as low as one reading per sensor per minute.
3. The data from all sensors can be automatically sourced from PI to Teradata via Informatica in near real time and stored in a Teradata database table. The need for daily spreadsheet updates is removed.
4. The data remains in the database and can be made available for immediate and efficient reporting over any date range and any metric to the tool of choice.

Data can now be easily reported in combination with data from other systems such as LIMS, yield management, blending, etc.

Refining Operations – Key Operational Reports



WesternRefiningAnalytics

Production Report

El Paso Refinery

Gallup Refinery

Crude

CPS Crude Unit

No. 6 Crude Unit

SATS

NHT/Reformer

FCCU

DHT/KHT

FCC Unit

Alky Plant

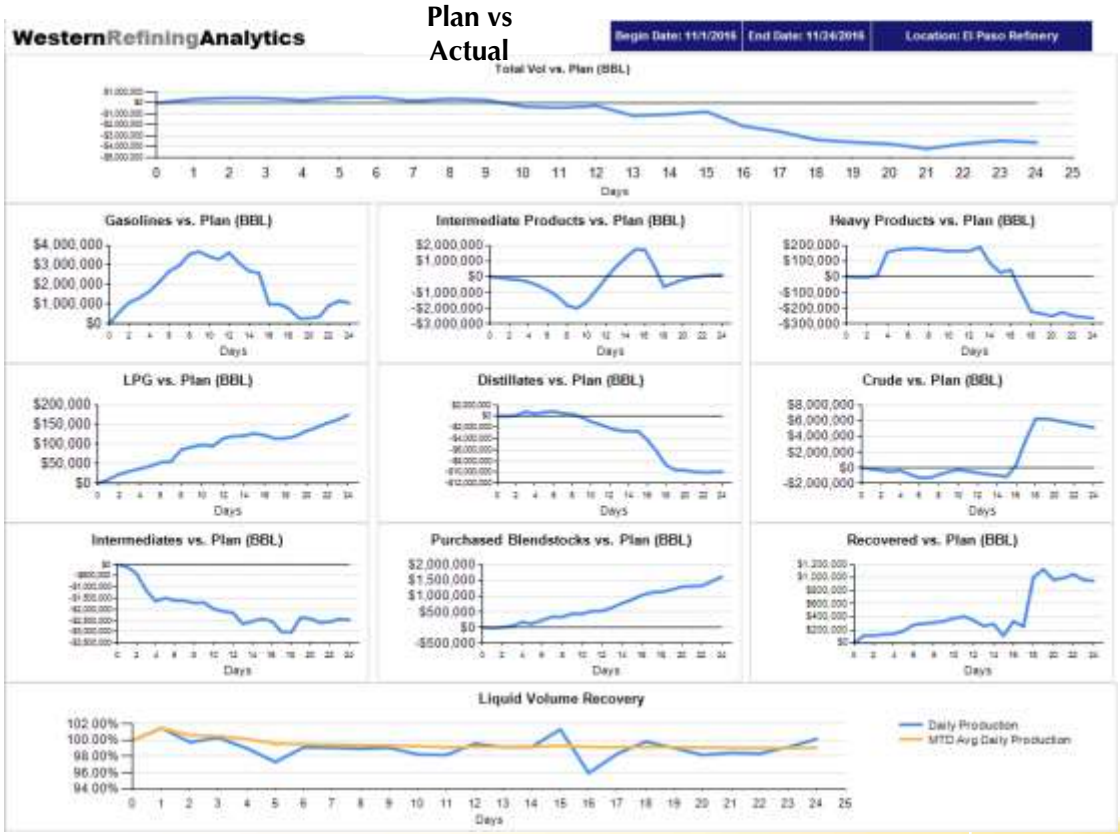
Shiptail 7-1

Star Lake

Hospah

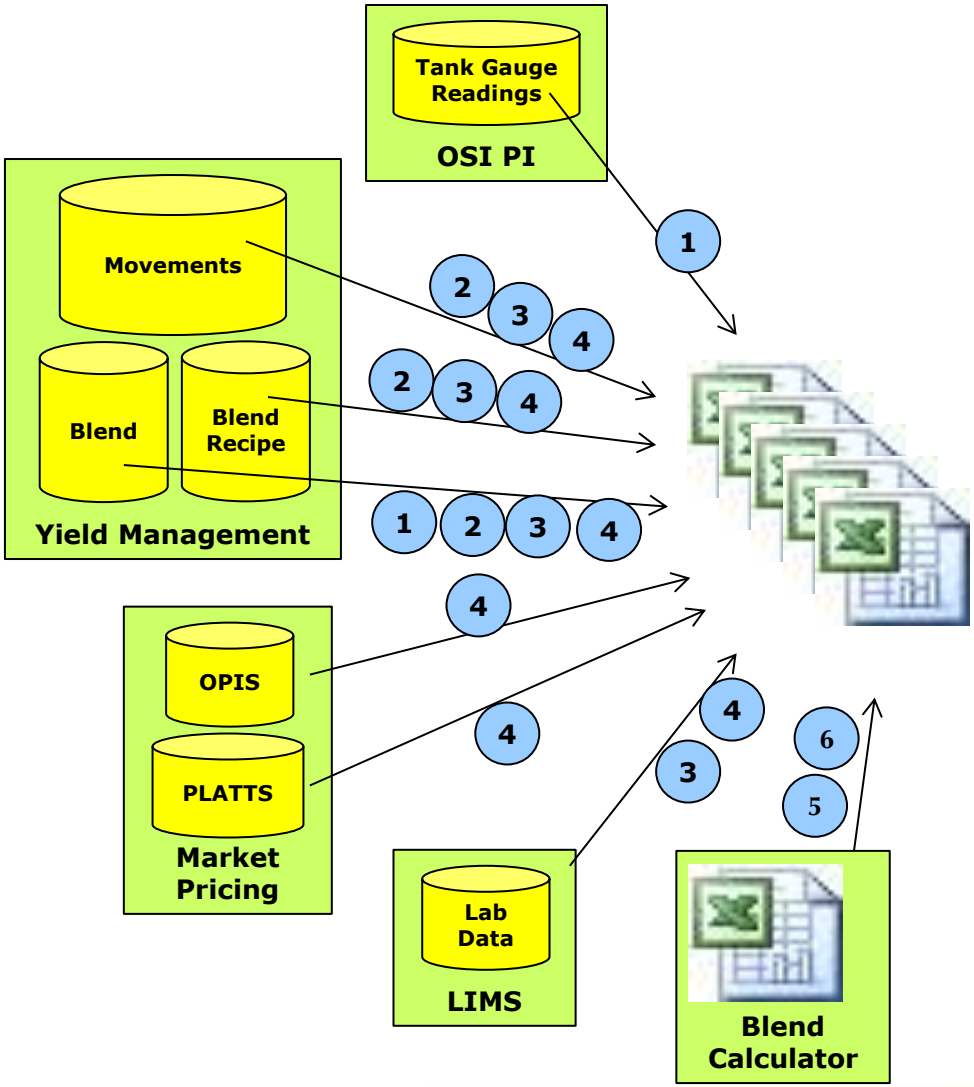
Refining Operations NRT Plan vs. Actual

- Original processes only allowed refining operations to see performance of plan vs. actual and LVR in $$$ after the close of the accounting month – usually 8-12 days into the month following
- Integrating the data in the data warehouse now allows refining operations to see plan vs. actual and LVR performance expressed in $$$ in real time



Blending Giveaway

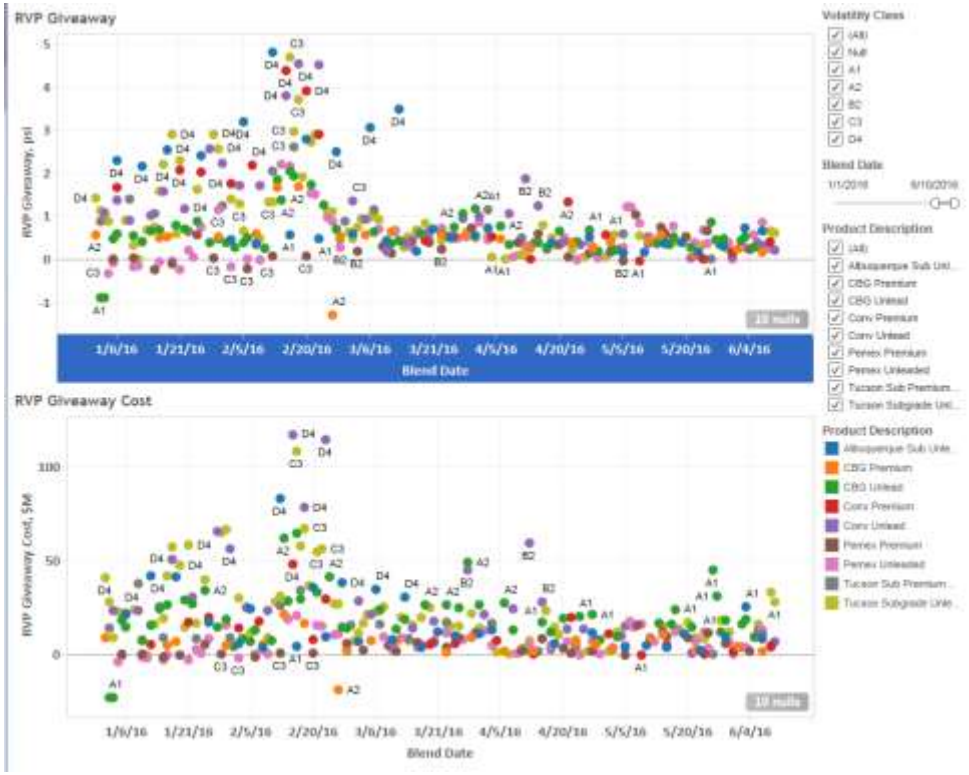
Previous Manual Process

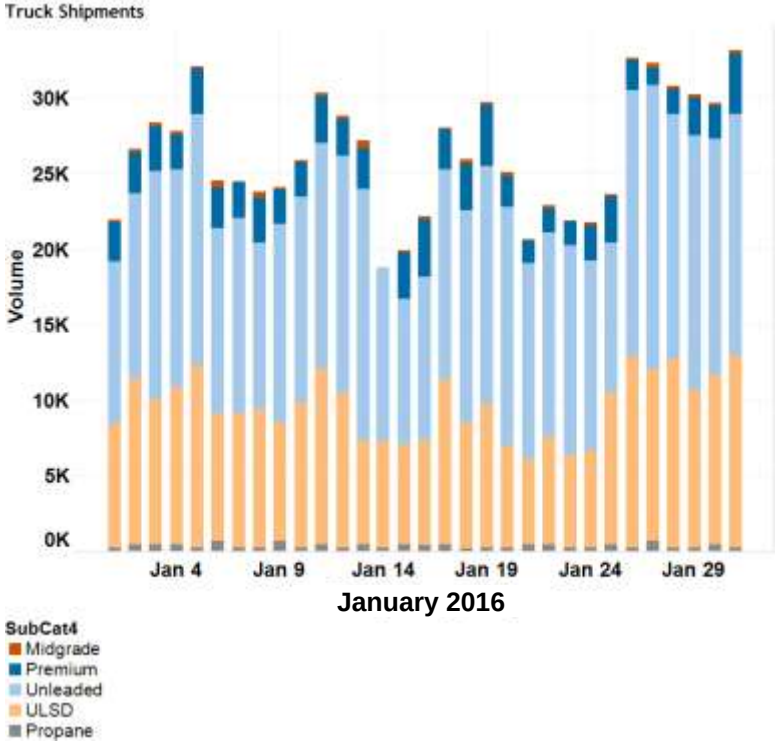


1. Tank Gauge to Blend Volume Reconciliation
2. Blend Component Calculation (including drawoffs, prepumps, corrections and reblends)
3. Real time RVP and Octane Giveaway calculation
4. RVP and Octane Giveaway pricing impact for individual blends and product groups in real time and YTD
5. Component data is manually entered from the Blend Calculator into a consolidated spreadsheet for calculation of monthly and quarterly component summaries
6. Actual and predicted lab data is manually entered from the Blend Calculator and the LIMS into a consolidated spreadsheet for blend recipe calculations and adjustments

Blending Dashboards

- Integrating the multiple data sources allows a self service environment enabling Refining Operations to analyze and present blending, inventory, receipts and shipment information in any manner they wish





Machine Learning and Predictive Analytics

- There are many refining processes which can be predicted if sufficient data to characterize the current process exists

- Prototype Example: Predicting Octane in Gasoline Blends
  - Blenders develop component recipes In order to predict octane in gasoline blends
  - Component recipes need to take into account component octanes, component volumes and component interactions
  - 2 methods: Straight Line and Predictive Linear Model
  - Results: Statistical Deviation from Actual Octane in 10 Randomly Selected Blends

Straight Line	2 Interactions	9 Interactions
0.72%	0.52%	0.24%

  - Further enhancements will take into account larger data sets to better train the model, component inventory levels and real time component market pricing

- Other areas of application: Retail Propensity, Customer Loyalty, LP Tuning, Predictive Maintenance, etc…

Operational Application Integration

- In order for the Optimizer programs to work correctly, they must have up to date information from many areas of refinery operations:

- In a typical implementation, interfaces to the myriad systems where this data is held would all have to be built individually. Because of an already-integrated data warehouse, all of this information was being stored in one place and we were able to write a single interface that satisfied all of these needs.

- This approach saved millions of dollars and several months on the initial implementation of just this one software package as well as significant, but unquantified, long term support costs

Conclusion

- Data is data. IT and OT are not different domains but only appear to be because they use different toolsets. There is no valid reason outside of empire building why the data from these functional areas has to be kept separate

- Combining OT and IT information can yield valuable insights leading to significant ROI

- Some (but not all) IT Tools are well positioned to enable the analysis of OT data

- Visualization of data is much better for humans than text evaluation and the majority of really good visualization tools exist on the IT side

QUESTIONS