



Optimization, Predictive Analytics, & Real-Time Process Models

Stock Tank Analytics

Opportunity: Accurate Inventory

- Challenges
 - Increase OPEX to fulfill existing commitments
 - Not able to execute future orders (committed)
 - Lack of customer trust in facility operations
- Solution: *OptiRamp* Stock Tank Analytics
 - Accurately forecast and execute transactions to build customer trust
 - Track inventory and line fills in real time
 - Recalculate future inventory following material movement
 - Decrease OPEX
 - Improve system-wide domain knowledge in real time

Opportunity: Extend Asset Life with Technology

- Challenges

- Aging tank gauging systems
 - Do not always provide accurate, efficient, or safe tank level measurements
 - Do not help prevent tank overflow
- Expensive to purchase new system and time consuming to replace

- Solution: *OptiRamp* Stock Tank Analytics

- Provide virtual measurement
- Provide mass balance reconciliation
- Help extend asset life without expensive system upgrades
- Aid in determining instrumentation to increase safety factor

Economics



Reduce OPEX

Costs include product loading rates and chemical injection



Eliminate waste

Identify bottlenecks before they happen



Make faster, better decisions

Optimize the tank farm 24/7 and meet delivery commitments

❖ 1% to 3% improvement in volume management

Increase Productivity	Use existing tanks within operating constraints to reduce need for additional investment in new storage
Better Asset Utilization	Optimize tank farm to improve capacity usage of existing tanks (extra volume from volume management)
Reduce CAPEX	Manage tank assignments to efficiently/optimally balance demand from delivery commitments
Reduce OPEX	Optimize existing assets to reduce costs including demurrage costs, product loading rates, and chemical injection
Better Decisions	Visualize usable data to make quicker and better decisions about optimization and commitments

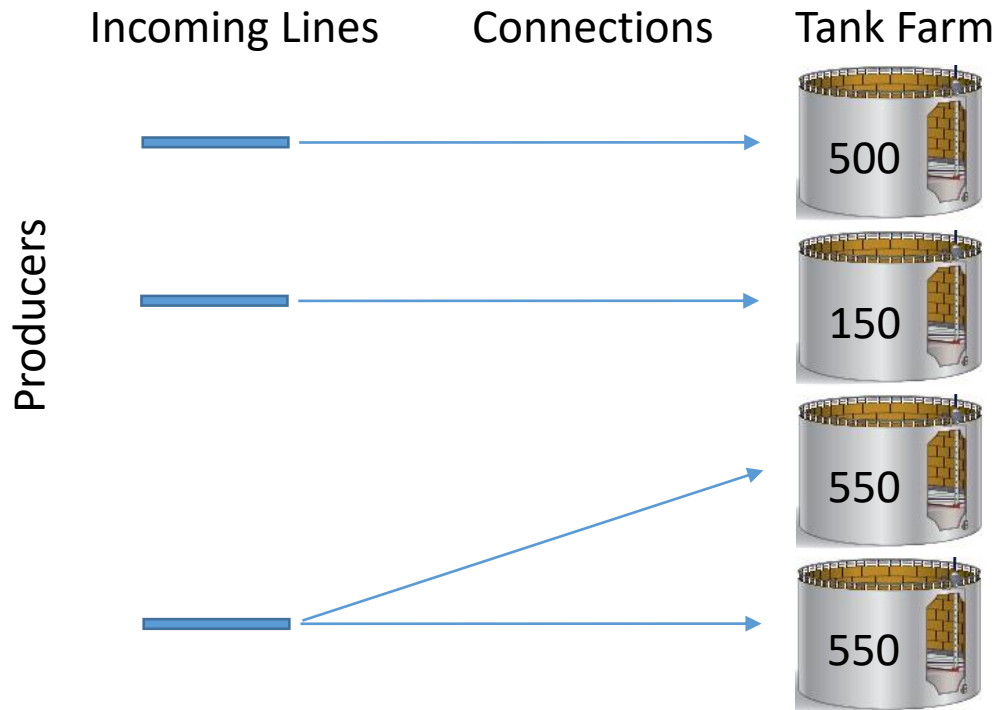
Tank Farm Constraints

- Common constraints
 - Some tanks cannot be loaded and unloaded at same time
 - Some tanks may have minimum volume for unloading tank
 - Some tanks cannot store certain products
 - Shipping not continuous but in discrete volumes in cases of railcars and tank trucks
 - Shipping can only take place during certain hours
 - May have maximum number of systems that can be filled simultaneously

Optimize Tanks Assignment

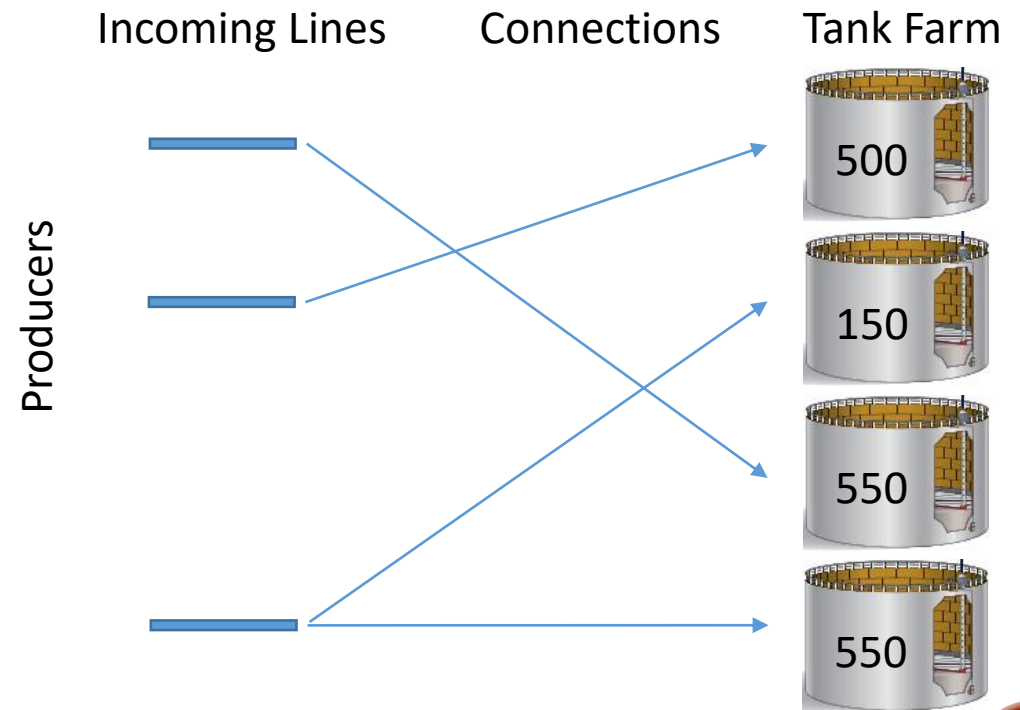
BEFORE

Know how, experience, & best practices



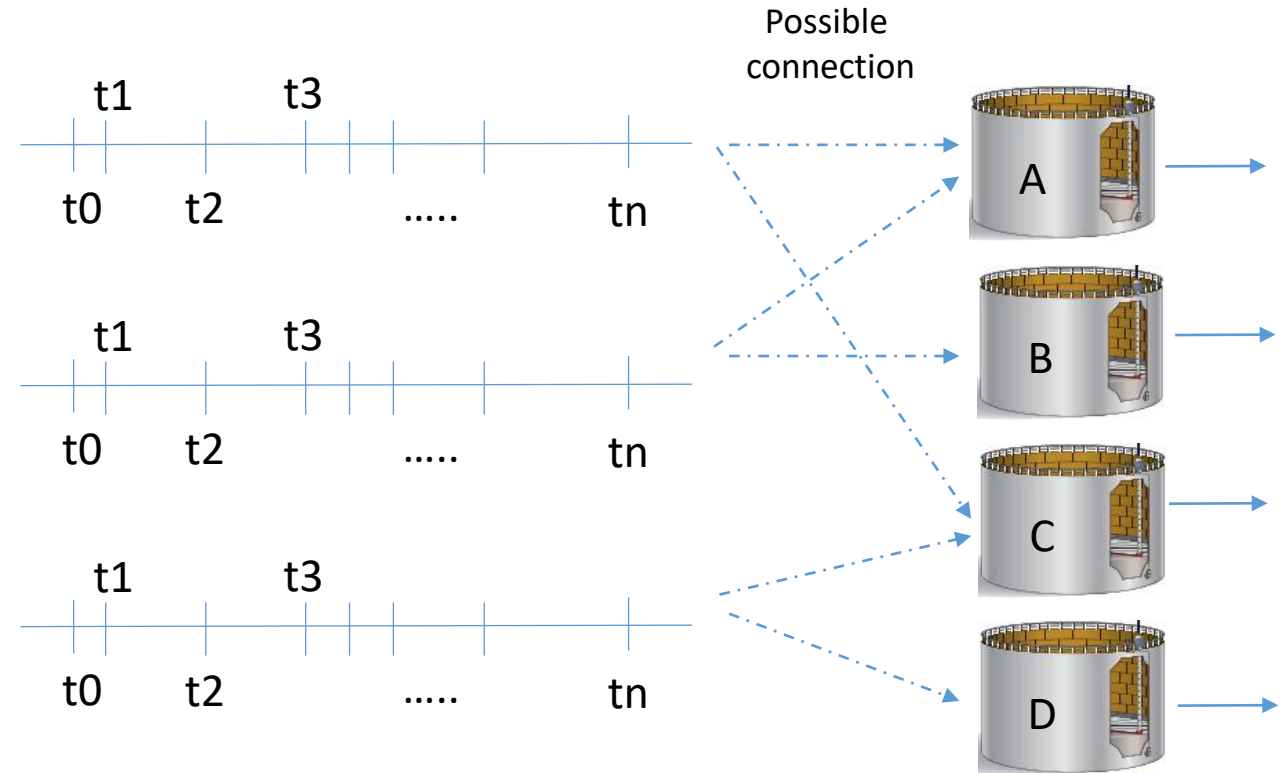
AFTER: *OptiRamp*

Determine optimal tank assignment



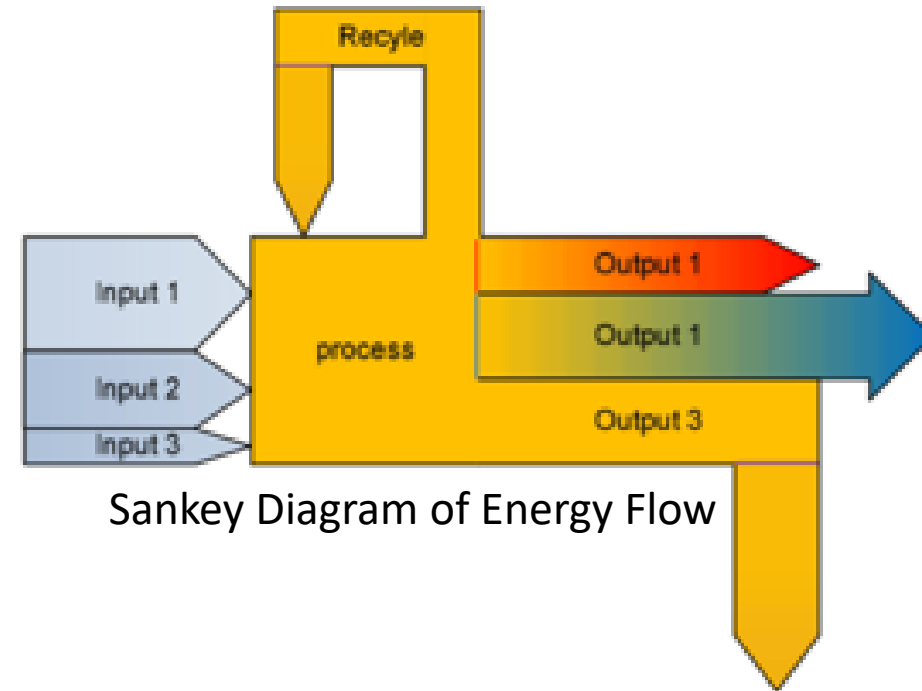
Tank Farm Optimization with Auto-Tuning

- Detail dynamics of tank farm total value stream
- Match production schedule with product and proposed tank
- Set tank constraints based on maximum volume
- Compute mass balance reconciliation for input (producer) and process (tanks)



Mass Balance Reconciliation

- Detect faulty measurement signals
- Adjust material and energy balance
- Estimate measurements and calculation errors
- Identify faulty material movements and alert user
- Identify unexpected material imbalances against computed and/or predefined limits
- Balance transition state of material process streams



Remote Monitoring Examples

SWO CGS10 DASHBOARD

Maintenance Work Activities

Total WO	Open WO	Closed WO
Mechanical 491	503	474
Electrical 564	574	547
Instrument 606	617	585

CGS 10 Production

Oil Production	Today	Yesterday	Last 7 Days (Ave)
	42,128	41,285	41,860

Facility Status

Shipping Tank A Level (%)	54.81	54.81
Shipping Tank B Level (%)	54.81	54.81
GW Tank A Level (%)	54.81	54.81
GW Tank B Level (%)	54.81	54.81

Water Consumption

Ranga Water	Today	Yesterday (Ave)	Last 7 Days (Ave)
	491	503	474
CGS GW	564	574	547

CGS 10 Performance

Shipping Flow Rate	100%	Act: 8090	Target: 8090
Water to NDC	100%	BWPD: 1375	BWPD: 1375
Waste to CP	100%	BWPD: 1375	BWPD: 1375

CGS Production

Net Prod	Today	Yesterday	Last 7 Days (Ave)
	173,684	174,563	175,239

Exception Report Summary

Facility/Equipment	Availability	Total Qty
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Pump	606	617

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Terminal Schedule

Tanker	Product	Capacity	Status	ETA	ETD	Berth
PROVIDENCE	Heavy Steels	14,000	Offloading	8:50 AM 03/01	2:50 PM 03/01	4
ARTOS	Heavy Steels	38,000	To Arrive	8:50 PM 03/01	10:50 AM 04/01	1
SUNLIGHT JEWEL	Heavy Steels	48,000	To Arrive	2:50 PM 04/01	8:50 PM 04/02	2
FLAMBE	Heavy Steels	58,000	To Arrive	12:50 AM 04/03	8:50 PM 04/03	3
PACIFIC AMBER	Heavy Steels	78,000	To Arrive	4:50 PM 04/04	2:50 AM 04/05	4

Storage Tanks

Heavy Steels	217
Light Steels	47
LPG	148

Planned Dispatches

Tanker	Product	Capacity	Departure Port	ETA	ETD	Berth
DEEP HULL	LPG	14,000	Offloading	6:58 AM 03/01	2:58 PM 03/01	4
FLIGHTER	LSDO 45ppm	40,000	Malaysia	6:58 PM 03/01	10:58 AM 04/01	7
CRIMSON HARB	JET 15-1	40,000	Singapore	3:58 PM 04/01	6:58 PM 04/02	3
SEA GLADES	Heavy Steels	60,000	Indonesia	10:58 AM 04/03	8:58 PM 04/03	7
PACIFIC GREEN	LPG	70,000	Singapore	4:58 PM 04/04	2:58 AM 04/05	4
AMER MARY	LSDO 45ppm	40,000	Malaysia	10:58 PM 04/05	6:58 AM 04/06	5
OCEAN GLISS	Heavy Steels	35,000	Indonesia	11:58 PM 04/06	9:58 AM 04/07	1

Dispatch Tanks

LSDO	215
Jet 15-1	257
Heavy Steels	217
LPG	148

FPSO

Current Status

Date	Wind Dir / SWS	Sea S	Weather
41 Wed	SWS 15/03	2-4	Showers
42 Thu	W 15/03	3-5	Showers ending
43 Fri	WNW 20/05	6-12	Strong gale
44 Sat	W 20/05	4-6	Light gale
45 Sun	SW +10	2-3	-
46 Mon	SW +10	2-3	-
47 Tue	SW +10	2-3	-

Production

Targets vs Actuals - Production

MTD: 35,728
TGT: 80,800
ACT: 44.2 %

Oil in Water

Tons Offloaded (next 7 days): 158,674
Max. O/W Concentration (mg/l): 21.5
Average O/W Concentration (mg/l): 11.5
Max. Delta (%): 22.8

Maintenance

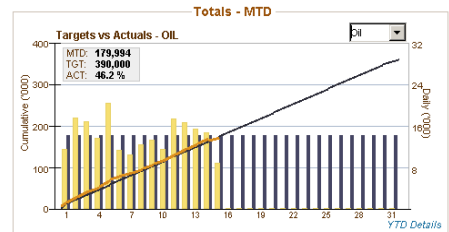
Equipment: All Types

Scheduled Downtime
Deferred Downtime

Oil in Water - last 7 Days

Draw Date: 8:57 AM 03/01
Sample ID: 0302122
Result: 21.5 mg/l
Units: mg/l
Max: 20
Limit: 25
Delta: 22.8

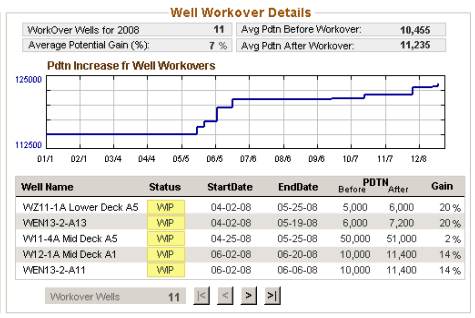
Production



Suspended Wells

Well Name	Status	Flowrate	Pdt Time	WHP	Choke%
PW20	Suspended	####	####	0	0
PW23	Suspended	####	####	0	0

Well Count: 2



Benefits

- Monitor from anywhere using HTML5 technology
- Optimize all operating scenarios
- Optimize pumps and valves (using Predictive Analytics)
- Provide virtual metering and mass balance reconciliation
- Compute allocation factors
- Manage stock
- Make better, quicker decisions for current situation and “what if” scenarios (contract, loading, pump operations, switching plans)