HONEYWELL UOP CONNECTED SERVICES

DIGITALLY ENABLED PREMIERPLUS PERFORMANCE SERVICES

ED SAHLI
CONNECTED SERVICES
SR. DIRECTOR, OFFERING MANAGEMENT

Honeywell
UOP

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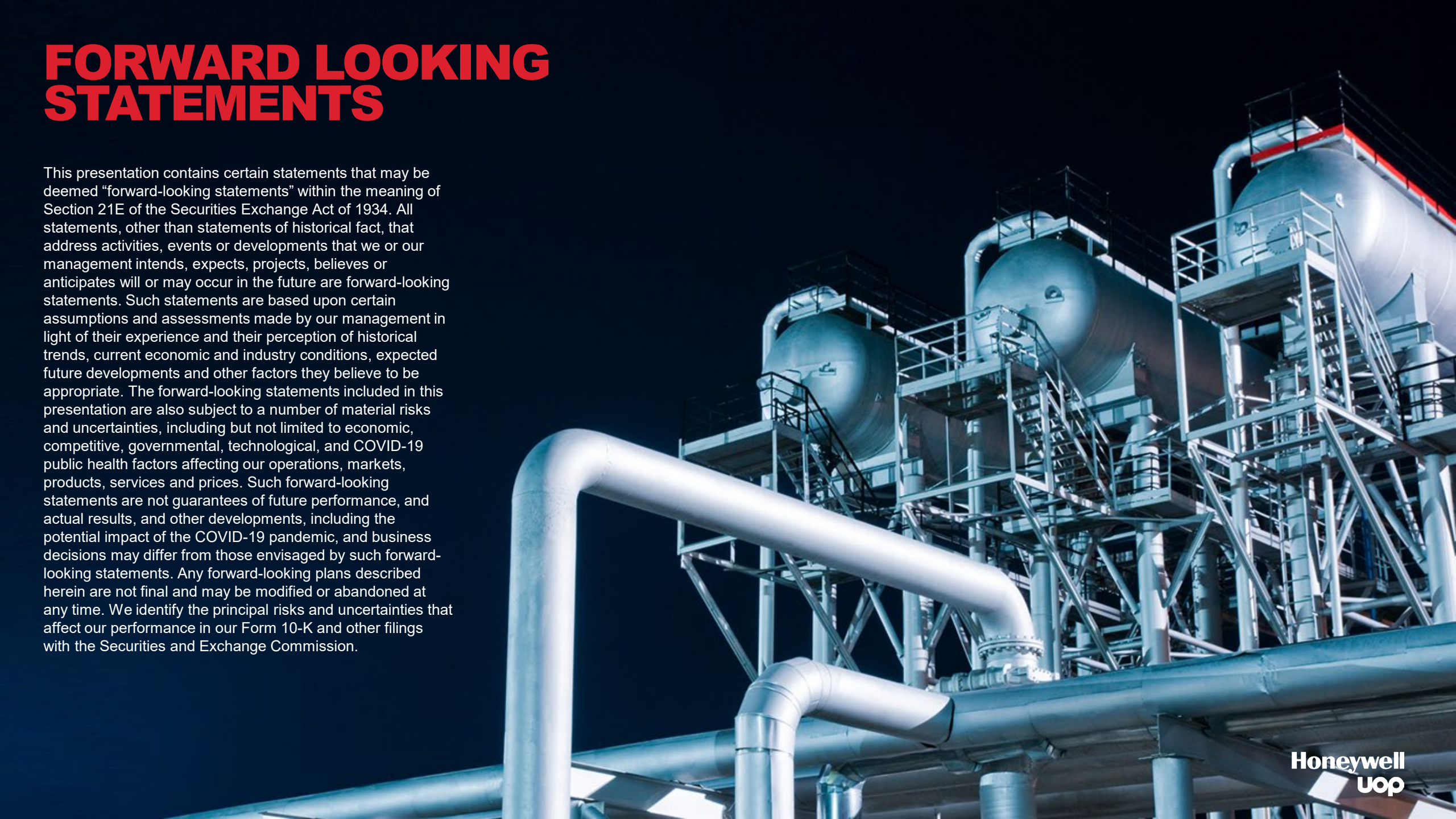


Honeywell UOP

AGENDA

01 Challenges

02 The Solution

- Key Components
- Model
- Offering

03 Use Cases & Value

04 Honeywell UOP Advantage

OPERATIONS

TYPICAL CHALLENGES TO ADDRESS

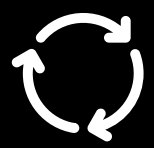
1. **Avoid Unplanned Downtime**
   - Process issues
   - Equipment failures

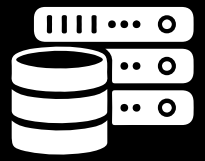
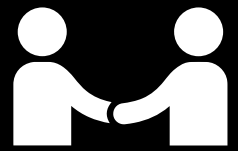
2. **Optimize Process Performance**
   - Manage changing conditions
   - Performance vs expected

3. **Manage Personnel Challenges**
   - Faster onboarding
   - Building and sustaining expertise
   - Ensuring safety & compliance

4. **Reduce Energy and Emissions**
   - Sustainability Goals
   - Emission standards
   - Energy reduction

KEY COMPONENTS | PREMIERPLUS PERFORMANCE SERVICES




CONTINUOUS MONITORING

Comprehensive, near real-time health and performance diagnostics

Process Monitor
(PM) & Global Solutions Command & Control Center L1-L4 dashboards
297+ units connected
100+ customer sites

KPI TRACKING & ALERTS, IMPROVEMENT OPPORTUNITIES

Trend visualization, machine learning models, analysis to identify bad actors and associated events, opportunities insights

Exception Based Alerts
(EBAs)
&
Benchmarking
(minimum 5 units)

KNOWLEDGE CAPTURE & GUIDED ANALYTICS

Embedded process know-how, models to support optimization & operations with actionable insights

Process Technology Analytics
(PTAs)
CCR Platforming - deployed
Penex – deployed
PSA – deployed internally
Oleflex – deployed, strengthening Q4 2023
FCC – Q1 2024
Ecofining – Q1 2024

COLLABORATIVE DISCUSSIONS WITH TECHNOLOGY EXPERTS AND PERFORMANCE MANAGERS

SMEs, Process Engineers, Operations, Planning, and reliability personnel discuss issues and actionable insights with UOP technical experts in the context of constraints, objectives, priorities

Consultation & Site Visits
Web-based & Classroom
Blended Learning
Connected Competency Offerings

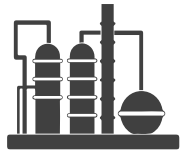
PROACTIVE RECOMMENDED AND SUPPORTED ACTIONS

Evaluate and execute operational or technology changes and realize benefits

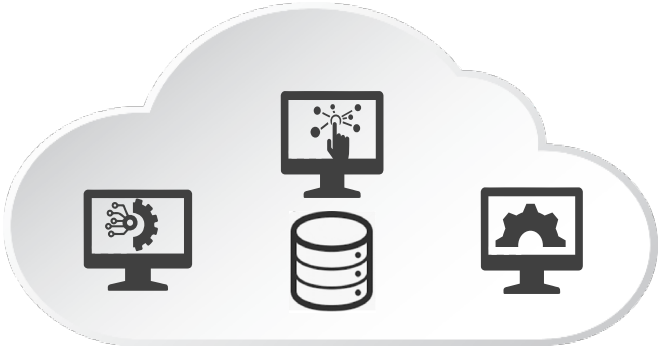
Performance Reviews

MODEL | PREMIERPLUS PERFORMANCE SERVICES

1 DATA



Customer connects
to UOP Process Monitor



Operating platform leveraging
Honeywell Forge with UOP inside

2 INSIGHTS

Global Solutions Command & Control Center & Tools

- Process Monitor
- Exception Based Alerts
- Benchmarking
- Process Technology Analytics
- Asset Performance Management
- Workbench & Performance Hub

Extend catalyst life, higher yields, improved selectivity & conversion, higher throughput & production, increased equipment reliability, reduced utilities & emissions, make next turnaround

4 ACTION

Implement best actions to quickly solve issues, improve reliability & profitability $

Direct usage and interaction with digital tools

ALERTS & INSIGHTS

Customer Process Engineers, SMEs, Operations, Planning, Reliability, Management

Constraints, objectives, priorities, Information not transmitted (corrosion, downstream upsets, upstream changes, final product issues)

Collaboration and support for priority best actions

UOP Technology Experts
(Service, Engineering, R&D)
& Performance Managers

Technology expertise, recommendations, value generators, and support

3 KNOWLEDGE 1 + 1 > 2

Vetted alerts, insights, troubleshooting, reliability and profitability enhancement recommendations

Digitally Enabled Proactive Services – Better, Faster, Higher Value Services $1M - $5M+ / year

OFFERING | PREMIERPLUS PERFORMANCE SERVICES

PREMIERPLUS

- **Fully customized, proactive & digitally enabled service to increase customer reliability and profitability**
- Top priority for UOP service proactivity and response
- Performance Manager and Technical Specialists' visits focused on improvement advice and action support ($)
- Performance Reviews with improvement action recommendations ($)
- Customized consulting time & other services – troubleshooting, Q&A
- Lowest service rates for additional services (inspection, training, field)
- More insights and recommendations to increase profitability via digitally enabling our experts and customers directly with selected tools …
  - Process Monitor included w/ 24/7 UOP monitoring
  - Exception Based Alerts (EBA)
  - Benchmarking
  - Process Technology Analytics
  - Connected Competency / Training
  - Workbench - developing
  - Performance Hub - developing

Customized Connected Proactive Partnership

WHAT'S NEW?

Data

- **Connected** - current data always readily available and used
- Shared data access available to both parties
- Removing delays in data transmittal and analysis

Tools **(select scope to subscribe to above Process Monitor base)**

- Direct customer access to analytics (PTAs)
- KPI Exception Based Alerts (EBA) and Benchmarking
- Automated insights with support for actions

Process

- Proactive 24/7 monitoring and services
- Focused on generating & supporting value-added actions
- **Enhanced collaboration for action**

Roles

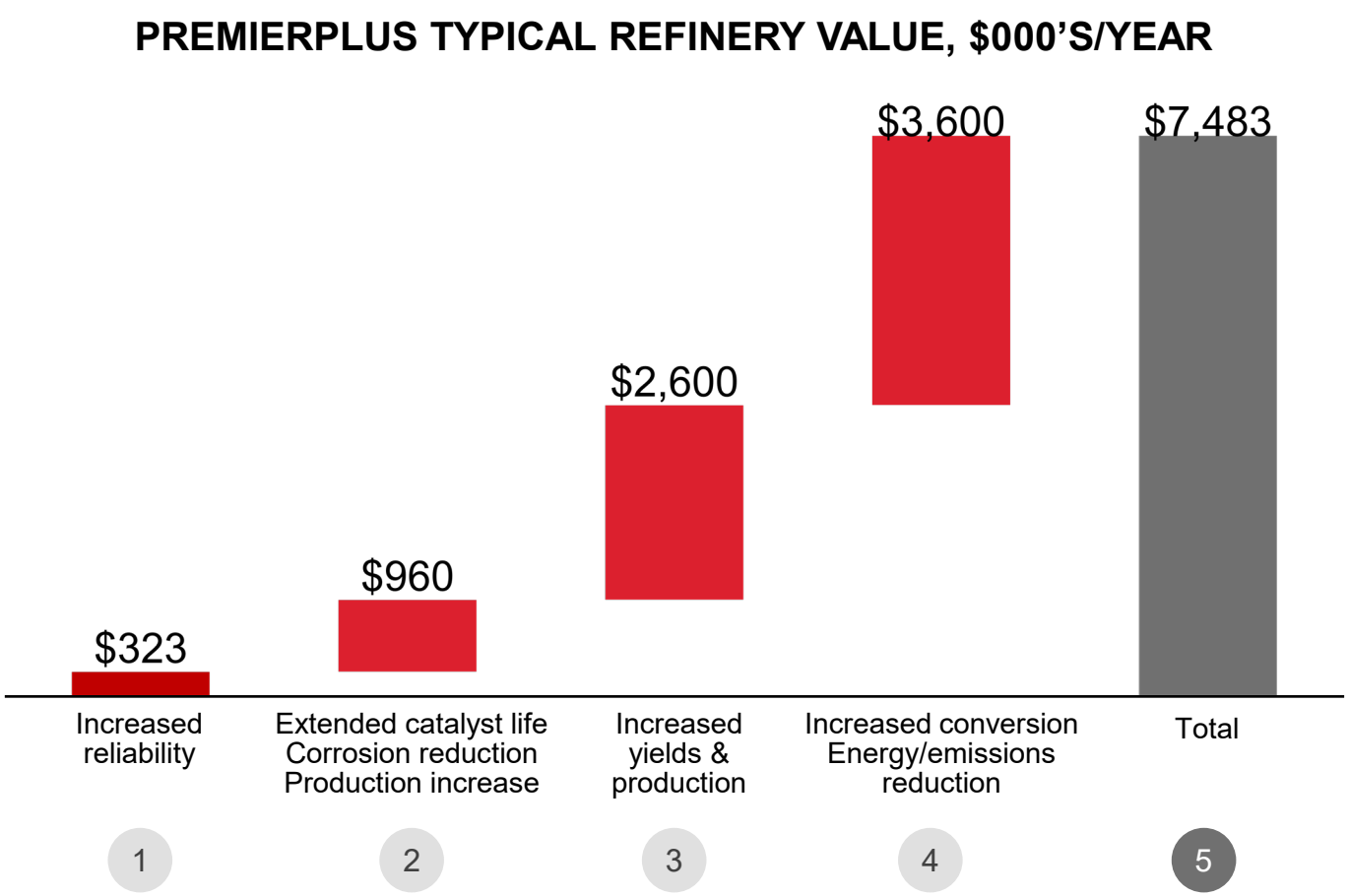
- **Performance Manager** – ensures UOP service to provide value, communicating value; **supporting key action follow-through**

Reports

- **Performance Review** vs. Data Review

Deliver More Value With Our Partners Enabled With Digital Tools

USE CASES & VALUE | PREMIERPLUS PERFORMANCE SERVICES



1. 10 bed **PSA** valve analytics PTA increase H2 production valued at $3.08/kg at 99.8% on-stream time – preventative maintenance
2. 20kbpsd **Penex/DIH** with 3 year catalyst life, replacement of regen condenser every 3 years, value of $0.40/octane bbl via temperature & DIH recycle optimization and R/F change on stabilizer
3. 30kbpsd **CCR Platforming** reactor temperature optimization with feedstock changes, changes in objectives – produce more LN & raffinate due to small benzene to naphtha spread, faster line out after restart
4. 45kbpsd **RFCC** reactor outlet temperature recommendation with more difficult feed, feed nozzle change, reduced stripping steam
5. **$7.5M +** Hydrocracking, Hydrotreating, Catalytic Condensation, HF Alkylation, Merox…

   …Oleflex PTA alone example $11M max production to turnaround, Aromatics, Detergent plants production increases

CUSTOMER VALUE

For a typical PremierPLUS customer with 3 or more UOP units, we can deliver recommendations and support actions to **help customers increase their profitability by $1M to $5M+ / year on average – must take the actions**

OFFERING | PREMIERPLUS PERFORMANCE SERVICES

A powerful, comprehensive, digitally-enabled services offering, UOP creates and collaborates with our customers to drive opportunities for value out of online process models. & our combined knowledge. Insights into process constraints, optimal operating points, and capabilities for in-depth monitoring, troubleshooting, and evaluation are turned into actions to increase our customer's profitability. It also allows users to try out scenarios in a virtual environment as well as have a more consistent and up-to-date view of the plant's capabilities.

PRODUCT DIGITALLY-ENABLED SERVICES

~ $1M - $5 M/yr*

BY OPTIMIZING OPERATIONS AND IMPROVNG RELIABILITY

*Directional estimate based on our customer collaboration

DIGITAL CAPABILITIES

Near Real-time Performance Management

KPIs, anomalies, model and calculation management

Steady State Mass Balance Reconciliation

Flow correction & KPI Calculations

Data Pre & Post-processing Routines

Ensure quality data for and accuracy of the Digital Solutions

Scenario Analysis (What-ifs)

Understand the impact of changes in a secure virtual environment

Process Technology Analytics (PTA`s)

Solving specific problems & giving point solutions

Benchmarking

Understanding the opportunities for improving the performance

ML/AI

Exception Based Alerting

BENEFITS

Improved operational efficiency

- Planning and scheduling can set targets based on current plant capabilities with what-If
- Plant operations can consistently achieve targets

Improved margins

- Improved higher-value product yields
- Operate closer to actual constraints
- Reduce utility usage

Reduced operational risk

- Deeper insights into the process and key constraints with What-If
- Faster root cause and scenario analysis to help prevent or solve issues
- Mitigate risks by leveraging technology experts and experience at the highest priority level

Collaborate To Capture Value From Data To Insights To Supported Actions

PREMIERPLUS | PERFORMANCE REVIEW DISCUSSION

Date: 8/25/23 **Technology:** CCR Platforming **Collaboration Opportunity Entitlement:** $15.1M+

Issue	Cause	Recommendation	Potential Benefit
C5+ Yield below expectations* 2.5 wt% offset	**Poor Platinum Dispersion** H2:Pt = 0.73 **Spent Catalyst Coke > 5%** Typically 6.5%	**Increase Cl in chlorination zone** Average Cl on Catalyst 0.80 wt% -> 1.00 wt% **Increase catalyst circulation rate** from 60% to 100% of design	Increase reformate yield 29 kBPD x 2.5% = 700 BPD @ 101.5 RONC @ GM of $5.26 per Bbl = **13.4 $MM/yr**
H2 Yield below expectations* 0.3 wt% offset	As above	As above	Increased H2 Make 2.7 MM SCF/D = **1.7 $MM/yr product value**
Alumina Phase Change (α=5%, θ=10%)	High burn zone temperatures (>1100°F)	**Lower spent catalyst coke** by increasing catalyst circulation rate.	Extend catalyst life (currently ~8% reduction in active catalyst) **Benefit estimate TBD**

* Improvement in C5+ and H2 yields will result in a reduction in LPG and Fuel Gas

Next: Deep Dive, Discuss Constraints, Objectives & Priorities, Align On Benefit & Action Plan To Achieve

CCR PLATFORMING PTA | PERFORMANCE PREDICTOR

	Functionality	KPI	Value to Customer
Performance Predictor	**Interactive digital analytics for Case Scenarios Evaluations:** Self-serve capability to make changes to specific operating variables to predict new optimum operating conditions, product yields and qualities, and margins on Unit constraints	**Product Yields & Optimal Performance**	Evaluate the Unit Performance vs. the current operations • For changes in Unit Throughput, feed quality • New product octane targets • Variation in Unit operating pressure • Variation in H_2 to hydrocarbon ratio
		Reliability	Insights on available margins on unit constraints while maximizing unit throughput • Heater bridge wall and tube wall temperatures • Reactor pinning • CFE hot-end approach • Regenerator coke make limitation
		Planning & Sensitivity analysis	**Sensitivity dashboard** for key operating variables (reformate octane, feed quality or reactor temperatures) Estimates on utility consumption and profit differentials at the target conditions vs. the current operations.

Testimonials

"For more paraffinic feed, Refinery engineer proactively estimated the optimum WAIT for high-octane operations achieving optimal operations 16-24 hours faster **(Value: ~0.3M$)**"

European Refiner used the PTA for optimal operations

"The tool was a great help to ascertain achievable reformate octane within unit constraints' – Refinery Planner"

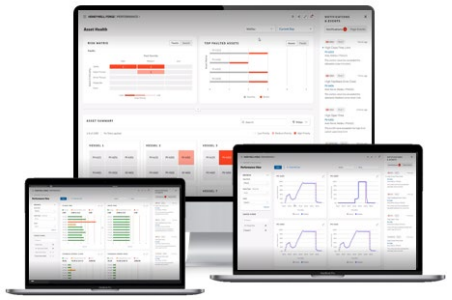
Middle East Refiner actively used PTA for Euro V Fuel Prod Planning

Powerful Analytics For Proactive Planning and Optimal Operations – 9 / 26 Customers Deployed

PSA PTA | VALVE ANALYTICS

PRODUCTS

HONEYWELL FORGE Performance+ | Honeywell UOP



Built in partnership with Microsoft

CAPABILITIES

Real-time Valve Health Monitoring
Aggregate health data for all valves and prioritize faults

Valve Performance Monitoring
Monitor individual and series valve performance degradation

Guided Diagnostics with Root Cause Analysis
In-depth event investigation, tracking, and recommendations

Analytics for Valve Failures
Prevent valve failures based on UOP process know-how

Pressure Swing Adsorption (PSA) units use beds of solid adsorbent to separate impurities from H_2 streams, allowing the production of high-purity, high-pressure hydrogen. Beds are regenerated by depressuring and purging.

- Valves are tight shutoff control with frequent and rapid cycle times
- Valves often run to fail with limited spares on hand
- Switchovers/shutdowns unexpectedly occur limiting throughput
- Valve degradation can impact hydrogen recovery
- Limited on-site process knowledge and data

Offering: Honeywell UOP Polybed™ PSA Process Technology Analytics*

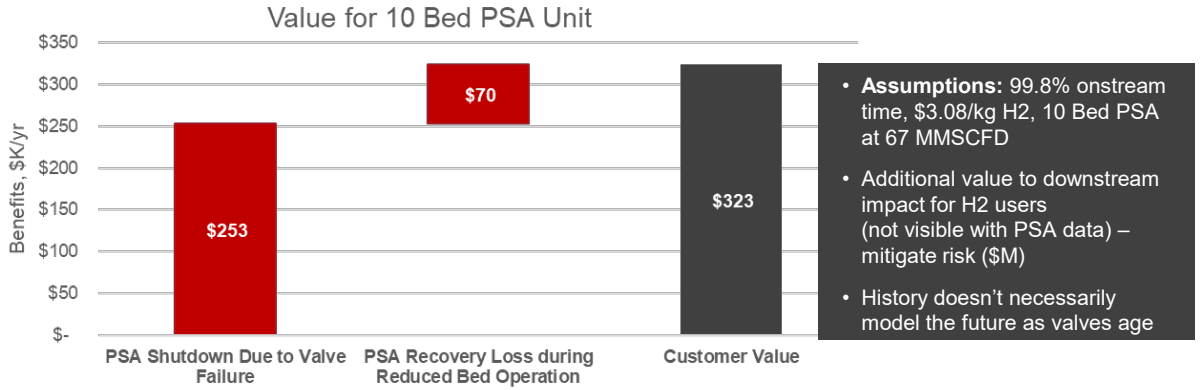
Software solution to increase H2 PSA unit availability by improving the reliability and performance of valves through models, diagnostics, and supported preventive maintenance. **Advises what valves to focus on, why and recommends actions.**

Solves for:

Lower hydrogen production related to valve failures

Do you experience more than 12 hours of downtime per year due to valve failures?
Is there any significant impact/risk for PSA turndown or shutdown to downstream ops?
Do you have or could you get 1 second of data transmitted? (required)

Value Walk



* Enabled with Honeywell's asset performance management solutions

Tool To Improve Reliability By Minimizing Surprise Valve Failures

REFINING DIGITAL TOOLS

Group	Technology	Process Monitors (13)	EBA (10)	Benchmarking* (1)	PTAs Available (Date of Availability)
Refining	CCR Platforming	**Yes**	**Yes**	**Yes**	**1. Performance Predictor** **2. Coke Laydown**
	Fixed Bed Platforming	**Yes**	**Yes**	Build on Demand	Future
	Penex	**Yes**	**Yes**	Build on Demand	**3. Performance Predictor**
	Par-Isom	**Yes**	**Yes**	Build on Demand	Future
	Naphtha Hydrotreating	**Yes**	Build on Demand	Build on Demand	Future
	PSA	**Yes**	**Yes**	Build on Demand	**4. Valve Analytics**
	Butamer	**Yes**	**Yes**	Build on Demand	Future
	Unionfining	**Yes**	Build on Demand	Build on Demand	Future
	Ecofining	**Yes**	**Yes**	Build on Demand	In Progress (Q1 2024)
	Hydrocracking	**Yes**	Build on Demand	Build on Demand	Future
	FCC	**Yes**	**Yes**	Build on Demand	In Progress (Q1 2024)
	HF Alky	**Yes**	**Yes**	Build on Demand	Future
	Merox	**Yes**	**Yes**	Build on Demand	Future
	Propylene Recovery Unit	In Progress	Build on Demand	Build on Demand	Future

* Benchmarking requires more than 5 similar units connected

28 Refining Digital Tools Available Today

PETROCHEMICALS & GAS DIGITAL TOOLS

Group	Technology	Process Monitors (7)	EBA (3)	Benchmarking* (1)	PTAs Available or (Date of Availability)
Petrochemicals	C3 Oleflex	**Yes**	**Yes**	**Yes**	**1. Process Optimizer**
	PSA	**Yes**	**Yes**	Build on Demand	**2. Valve Analytics** (Oct 2023)
	MTO-OCP (China)	**Yes**	Build on Demand	Build on Demand	Future
	Selexol	**Yes**	Build on Demand	Build on Demand	Future
	Propylene Recovery Unit	In Progress	Build on Demand	Build on Demand	Future
Gas	Gas - Cryo	**Yes**	Build on Demand	Build on Demand	Future
	Gas - Amine	**Yes**	Build on Demand	Build on Demand	Future
	Gas - Benfield	**Yes**	**Yes**	Build on Demand	Future
	Gas - Separex	In Progress	Build on Demand	Build on Demand	Future

* Benchmarking requires more than 5 similar units connected

13 Petrochemicals & Gas Digital Tools Available Today

AROMATICS & DETERGENTS DIGITAL TOOLS

Group	Technology	Process Monitors (9)	EBA (8)	Benchmarking* (1)	PTAs Available or (Date of Availability)
Aromatics	Parex	**Yes**	**Yes**	**Yes**	Future
	Sulfoiane	**Yes**	**Yes**	Build on Demand	Future
	Isomar	**Yes**	**Yes**	Build on Demand	Future
	Tatoray	**Yes**	**Yes**	Build on Demand	Future
	BT Fractionation	**Yes**	Future	Build on Demand	Future
	Xylene Fractionation	**Yes**	**Yes**	Build on Demand	Future
Detergents	LAB Pacol	**Yes**	**Yes**	Build on Demand	Future
	LAB Molex	**Yes**	**Yes**	Build on Demand	Future
	LAB Detal	**Yes**	**Yes**	Build on Demand	Future

* Benchmarking requires more than 5 similar units connected

18 Aromatics & Detergents Digital Tools Available Today

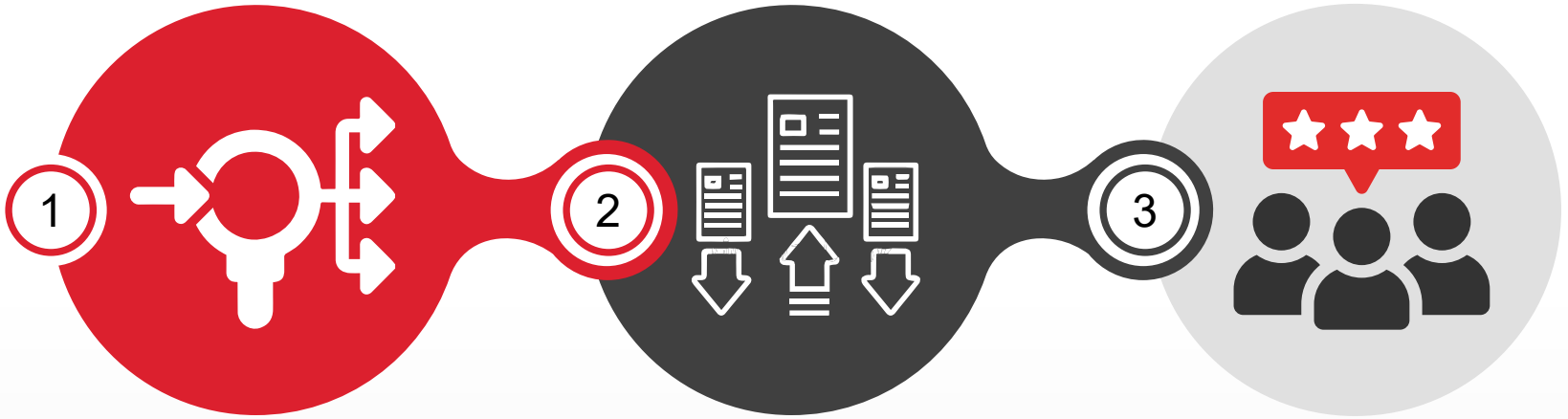
PROCESS MONITOR | OVERVIEW

- **Automated data transfer** of plant data from historian / LIMS to a secure Honeywell cloud
- Calculation steps transform raw data into **KPIs**
- Current **unit performance** is surfaced on dashboards through a secure website
- Customizable **reports and trends**
- Customer and UOP have access to the **same information**
- Subscribe to **Exception Based Alerts and Benchmarking** for proactive support
- Additional value from **Process Technology Analytics** leveraging the connected data

Enables Faster & Better Proactive Support & Problem Resolution

VISION | HONEYWELL UOP DIGITAL SERVICES
HOW ALL OF THIS WILL COME TOGETHER

Inputs/Analysis



- Process Monitor (incl Historian)
- Exception Based Alerting (EBAs)
- Benchmarking
- Process Technology Analytics & APC (Custom per Process Unit)
- HON Custom Tools (APM, Steady State Monitor etc.)
- Digital Twin application
- Customer-specific algorithms

Case Creation and Resolution

- Case Creation (Single Version of Truth)
- Benchmarking (Customer)
- GSCCC Investigation/Technical Services Resolution
- HON Custom Tools (Reactor Performance, UniSim Analysis)
- Digital Twin application
- Customer-specific algorithms

Recommendations & Feedback Learning

- Recommendations to improve customer profitability
- Case Resolution, Resolution Details, Impact Capture, Textual Data Mining
- HON Custom Performance Improvement and Training Recommendations
- Customer-specific Data Mining Tools input

Key Features

- Single version of truth / one stop shop for all process needs
- UOP integrated services approach – Training to Performance Services
- UOP / Customer ecosystem for continuous improvement
- Ability to host external algorithms in addition to UOP built

Customer Value

- Reduced operations downtime
- Improved efficiency of operations
- Connected ecosystem – access to UOP customer tools and knowledge
- Proactive training recommendations and access to custom built performance KPIs

Performance Hub In Progress

WHY HONEYWELL UOP DIFFERENTIATION

1. Software enabled services – additional and better insights from software but action support from experts
2. Broad base of software and digital tools across Honeywell can be brought to bear in solutions
3. UOP modeling for deeper insights into improvement areas and planning of changes
4. Ability to connect units reliably and securely – leveraging Honeywell's cybersecurity & data collection tools
5. UOP large global installed connected base with rapid growth
6. UOP process and catalyst development, design, startup, operations, and troubleshooting expertise
7. Considers the developing and latest technologies to improve customer profitability

Software, Digitization, Process, Equipment And Materials Expertise Help Increase Customer Profits

THANK YOU
FOR YOUR PARTICIPATION