HPS INTRODUCTION, MARKET OVERVIEW AND TECHNOLOGY UPDATE

Honeywell Oil & Gas Technologies Symposium – Cairo, Alexandria
**Agenda**

- Honeywell Process Solutions Overview
- HPS activity
- Market update & Trends
- Technology Trends
- Honeywell Technology update – summary
  - Innovation
  - LEAP
  - Joint HPS-UOP Solutions
  - IIoT
HPS - Serving Process Industries

Our solutions are installed at more than 10,000 sites around the world

- Refining & Petrochemical
- Chemicals
- Minerals, Metals & Mining
- Oil & Gas & Midstream
- Power Generation And renewables
- Pulp & Paper
- Specialty / Batch Chemicals, Pharmaceuticals, Food, Water
HPS Egypt activity - examples

**EXAMPLE ALEXANDRIA & WEST DESERT CUSTOMERS**
- **ALEXANDRIA PETROLEUM CO. (APC)** (Refining)
- **ALEXANDRIA MINERAL OIL (AMOC)** (Refining)
- **SIDI KERIR PETROCHEM CO. (SIDPEC)** (Petrochemical)
- **AMREYA PETROLEUM REFINING CO.** (Refining)
- **EGYPTIAN PETROCHEM CO. (EPC)** (Petrochemical)
- **ABU QIR POWER STATION** (Power)
- **MISR PETROLEUM CO. (MPC)** (Refining)
- **KHALDA PETROLEUM CO. (KPC)** (Up Stream)
- **MIDOR Refinery** (Refining)

**EXAMPLE CAIRO & EAST & SOUTH OF EGYPT CUSTOMERS**
- **PETROBELL (Up Stream)** (ENPPI)
- **SUEZ MEDITOR. PIPE LINE CO. (Pipe line)** (SUMED)
- **IDEAL STANDARD (Ceramic Manufacturing)**
- **ABU SULTAN POWER STATION** (Power)
- **PROCTER AND GAMBLE (Chemical)** (P&G)
- **ORIENTAL PETROCHEM CO. (OPC)** (Petrochemicals)
- **QUENA PAPER CO. (P&P Manufacturing)**
- **SUGAR INTERATED INDUSTRIES CO. (Sugar Manufacturing)** (SIIC)
Market Update - Oil

• Oil price medium term in $50-60/bbl range
  - IHS sees longer term $80/bbl
  - Constrained by growing US production and any recovery in challenged areas – Nigeria, Libya

• MARPOL regulations change
  - 500KB/D shift HSFO to Marine Diesel
  - LSFO – HSFO differential widens to $40/Bbl
  - LNG pick up as ship’s fuel for near shore areas – limited penetration globally
  - Shippers can opt to scrub on-board ship – leads to return of HSFO volumes to 2030
  - Refiners in choices on whether to tackle deeper desulfurization
    ▪ Refining margins spike in the implementation period and then settle
    ▪ Significant advantage to higher conversion refineries during the ‘scramble’
Market Update - Gas

- Gas and LNG production globally increasing – committed projects
  - Pacific basin will be in excess, push to Atlantic basin
  - American LNG making its way to Europe
  - China’s reaction to pollution concerns can have a significant impact
- Crude oil price link, where exists – increasingly challenged
  - Short term & Spot LNG puts pressure long term contracts
- LNG consuming markets diversifying
  - Infrastructure for logistics is growing
- Prices remain subdued – price growth, modest over coming years

![Henry Hub natural gas price graph](image)
Market Update / Trends - Refining

- Ongoing, broad move to Euro VI / equivalent specs – globally
  - E.g. India projects
- Maximize operating rates / crude runs
- Combining with Petrochemicals
- Reliability – uptime focus – initiatives
- Energy / Emissions Management
- Maximizing yields from operations
- Process Safety practices, Personnel Safety & Security
- Longer term diesel disfavour in Europe – for passenger cars
- Egypt –
  - Gasoline consumption growing 4.5%, Diesel 2% annually, LPG 4.2% - IHS
  - IMF sees 6%+ GDP by 2025; IHS sees <5%
  - Refinery configuration / demand profile – some adjustment
  - Pipeline & storage, import terminals/ infrastructure – some constraints
  - Subsidy reform will help
  - MARPOL response
Gartner Predictions – persistent themes over recent years

Dashboards
Situational Awareness

Big Data
Leverage the storage

Analytics
Reporting to predictive

Collaboration
Reflect social media

Mobility…
BYOD & connections

Cloud Computing
Moving to complex service models

2017 Trends
• Trend No. 1: Artificial Intelligence and Advanced Machine Learning
• Trend No. 2: Intelligent Apps
• Trend No. 3: Intelligent Things
• Trend No. 4: Virtual Reality and Augmented Reality
• Trend No. 5: Digital Twins
• Trend No. 6: Blockchains and Distributed Ledgers
• Trend No. 7: Conversational Systems
• Trend No. 8: Mesh App and Service Architecture
• Trend No. 9: Digital Technology Platforms
• Trend No. 10: Adaptive Security Architecture

Example from Honeywell OneWireless Technology
& Plant Wireless..
IIoT Solutions & Smart Plant Manufacturing

Convergence of Key IT Trends into IIoT
### Egypt - Modernization Program Initiatives

<table>
<thead>
<tr>
<th>Organization Health</th>
<th>Investment Attraction</th>
<th>Streamline current concession processes and expand concession agreement portfolio</th>
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</thead>
<tbody>
<tr>
<td>Structuring Reform</td>
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<td>Create single SOE coverage across the value chain, and rationalize portfolio of both operations and companies involved in the Egyptian industry</td>
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<tr>
<td>People Agenda</td>
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<td>Introduce comprehensive talent management system and redeploy people to drive efficiency</td>
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<tr>
<td>Performance</td>
<td>Downstream</td>
<td>Optimize downstream and petrochemical sourcing, output and mass balancing. Drive operations performance transformation</td>
</tr>
<tr>
<td></td>
<td>Upstream</td>
<td>Drive operations performance transformation</td>
</tr>
<tr>
<td></td>
<td>Regional Oil &amp; Gas Hub</td>
<td>Optimizing and leveraging existing oil and gas transport and storage infrastructure</td>
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</tbody>
</table>

The country’s vision is for the oil and gas sector to continuously unlock the sector’s full value chain potential as a growth and a sustainable development engine for Egypt to achieve financial sustainability, become regional oil and gas hub and a role model for the future of modernized Egypt by 2021.

**Fits with Honeywell focus**

Accelerating the pace of action
Accelerating projects
Capturing more value sooner
Example - Refining Margin walk

- Crude Oil Transport Cost
- Crude Oil Cost
- Refinery Configuration effect
- Operating Expenses
- Net Cash Margin

$ / Barrel

Plan & Purchase Matching Refinery Capability Cost Profile Demand Profile Sell & Distribute

Manage Performance

Refinery Units, Assets, Blending People, Skills, Safety, Environment, Maintenance, Energy / Power & Utils

Finished Product Value

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Refinery Capability & Performance Management: Maximizing Utilization / Minimizing Costs

- Higher on-stream factors
- Better constraint management
- Unit & Multi-Unit optimization
- Reduce product giveaways
- Reduction in energy usage
- Reduction in utility consumption
- Faster response to changing crude slates
- Better scheduling and blending decisions
- Reduction in maintenance costs
- Lower production losses
- Less equipment damage from repeated shutdowns
- Lower compliance costs
- Fewer incidents
- Less unplanned shutdown time

Value potential – 25-75¢/Bbl

Priorities: individual to each refinery – how to focus?
Refinery Capability: solution space

Access Control
Digital Video

Offsites Movements mgmt

Terminal mgmt & product loading

Wireless network & solutions

Corrosion Detection and Monitoring

Asset Health basic diagnostics (instruments, valves)

UOP Process Units licenses, equipment & catalyst

Training Simulators

Personal Protective Equipment, incl personal gas detectors

Field Instruments

Power & Electrical
SCADA

Abnormal Situation Management

Safety Instrumented System

Process Design Simulations

Site Secure, Perimeter & Process Video

Rotating Machine control

Fire & Gas Detection Systems

Site Security & Perimeter Monitoring, Intrusion Detection

Alarm Management

Control System

Personal Protective Equipment, incl personal gas detectors

Wireless network & solutions

Crude Oil Transport Cost

Crude Oil Cost

Refinery Configuration effect

Operating Expenses

Net Cash Margin

Finished Product Value

Power & Electrical SCADA

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Performance Management: solution space

Business processes that underlie each of these functions are typically organized by groups of similar & related activity.
Refining Value Chain – ties in to Terminals & oil & gas: Mid-stream activity

- Maximize throughput and yields
- Reduce operating costs
- Improve uptime & reliability

- Reduce feedstock cost
- Optimize feedstock mix
- Minimize operation changes
- Optimize feedstock rate

- Optimize production
- Reduce blend giveaway

End User

- Optimize allocation
- Minimize distribution costs

Retail

Crude Supply

What to Feed

Crude Depots

How to Mix

Process

Sequence Controllable Activities

How / When to Blend

Blend & Movement Automation

Distribution

- Optimize production
- Reduce blend giveaway

Product Depots

Refined Product Value

+ -

Crude Oil Transport Cost

Crude Oil Cost

Refinery Configuration effect

Operating Expenses

Net Cash Margin

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Honeywell Process Solutions: Holistic and Integrated Approach – Technology Platform

Best in class solutions with operational integration

- Improve business agility
- Improve process throughput & energy efficiency
- Operate safely & reliably
- Design the process correctly

Ensuring that resulting Plant performance can be captured, understood and improved; Business Results captured

Ensuring that Plant capability is actually usable AND used from DAY ONE.

Ensuring asset, mechanical completion, capability all available from Day ONE.

Experion PKS is an Extendable Solution
Effective Automation Investment - **Completeness of Scope**
Capturing CAPEX and OPEX efficiencies

Innovation and Connectedness are at the core of performance improvements:
Resulting in successful automation investments
Innovation – at the core of HPS activity

- Experion virtualization, Universal I/O, Virtual engineering platform, Cyber Security
- Cloud-based control
- Scalability, remote control, multi-site real time coordination
- Automated device commissioning
- Installed base migration through smooth transitions, including live / on-process changes
- Multi-protocol OneWireless™
- ControlEdge PLC with OPC UA
- Electrical Device control – inside Experion
- Rotating machinery control inside Experion
- MeterSuite™ - Fiscal metering inside Experion; Product Terminal Management inside Experion
- Common Experion platform for Site Security, video, Fire & Gas; Emergency Command & Control
- Process Safety and Personnel safety, including Process Safety Analytics
- Advanced Process Control inside Experion
- Advanced Alarm Management
- Process & Assets Health & Performance Management – Asset model, templates, workflow, advanced analytics
- Operator Training Simulators & Learning management – all virtualised
- Digital Suites for Oil & Gas – Well Performance, Well Testing automation
Achieving Day ONE Readiness

Vision & Concept / Pre-FEED

FEED

Project Execution

Start Up

Ramp up & Operations

First and following years’ operations

Faster to capacity

Faster to Optimum

Operations Ready

Mechanical Completion

Process Ready

Business Ready

Operations

Shorten

Shorten

ASM Graphics
OTS - competence
Alarms – flood free, help documented
Orion/ IRA
FDM, CPM, APC ready
Etc…

UIO, infrastructure

Linkage to RIS project,
Defined Business Processes, application
space, information flows;
Understood plant configuration capabilities;
Engineering surveillance

Capture CAPEX and OPEX efficiency

OPEX profile: sustainability optimization

Linkage to RIS project,
Defined Business Processes, application
space, information flows;
Understood plant configuration capabilities;
Engineering surveillance

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Traditional Project Workflows Overview

Start

PHYSICAL

Define  Design  Manuf

Modpack #1

Design  Manuf

Modpack #2

Define  Design  Manuf  Config

Test  Install

FUNCTIONAL

Finish
LEAP™ - Take Project Execution off the Critical Path

• Cloud Engineering enabled by Controller and IO Simulators in Virtual Machines
  - Project team can be dispersed globally
  - Configuration Acceptance Test (CAT) can be done in a Cloud, VEP
  - Order production hardware late in the project and eliminate a hardware refresh

• Universal Channel Technology removes the requirement for marshalling
  - Standard cabinets, with Hazardous Location and Marine Certifications at the factory
  - Hardware becomes standard and all customization is in the software
  - Automatic Device Commissioning simplifies and self documents late changes

Gain 25% flexibility in your schedule
LEAP – Lean Execution

**Universal Cabinets**
Make late additions and modifications to I/O type with only a soft configuration change with zero external hardware changes

**Virtualization**
Decouple functional automation engineering from physical design while reducing plant hardware requirements

**Cloud Engineering**
Optimize hardware lifecycle by ordering hardware late, and benefit from virtual factory acceptance testing (FAT)
Cloud Engineering

Reduce Travel cost
Virtual – Gradual FAT
Can isolate by process area
‘Late Binding’ hardware ordering

Virtual Engineering Platform

Virtual Controller and IO Simulation

Work Remotely – Work in Parallel – Finish Early
OpenVEP

… Powering our customers

Your Cloud Engineering, by Honeywell
LEAP Enabling Technologies – Benefits summary

- Keep Automation off of the critical path!
- Eliminate activities that generate rework!
- Be virtually free from hardware dependencies
- Reduce travel costs by 50%
- Gain 25% flexibility in your schedule
- Reduce your MAC capital by 30%

Integrated solutions increase value of individual benefits!
HPS- UOP joint Solutions
Unique CAPEX and OPEX value

Startup your Facility Sooner
Project Engineering, Embedded Knowledge

Reach Target Production Sooner
Operator Experience, Embedded Knowledge

Operate at Peak Performance
Optimized Performance, Embedded Knowledge

Constant innovation targeting improved returns.....

More Sustainable Value Throughout the Facility Life Cycle
Experion® Solution Suites for UOP

Experion Pre-Integration
for UOP critical control system packages

Operational Knowledge
Interaction requirements based operator displays and console workspaces, embedded operating procedures

Alarm Knowledge
Operator Alarm Help

Control Knowledge
Basic and complex loops, automated sequences

Safety Knowledge
Cause and effect logic, startup / maintenance bypasses and shutdown logic displays

Unlocking Knowledge to Drive World Class Performance
Experion® Solution Suites for UOP

Automated procedures

Structured graphics

Cause & Effect diagrams

Alarm design

+ Critical control applications: e.g. DRCS, CSCS)

Process-specific KPI's
Orion Operator Workspace for UOP Units
Performance / OPEX solutions
Innovation example - Facilities / Plant Process & Assets
Health & Performance - Challenges

- Engineers spending too much time extracting and aligning data from various sources
- Different tools needed for each type of data; different users have access to different tools
- Users constructing isolated and inconsistent analysis tools
- Lack of visibility to real-time performance against business metrics
- Privatized knowledge in privatized spreadsheets
Continuous Calculations & Monitoring, link events to Maintenance & other functions via notifications

**Embedded & Custom Models**
- Turbine
- Pump
- Compressor
- Heat Exchanger

**Calculations**
\[ \text{Head} = 3960 \times \text{HP} \]
\[ \text{Flow} \]

**Fault Models**

**Make Problems Visible**
- Dashboards

**Process Intelligence**

**Single Version of Truth**

**Continuous Trends**

**Rollup KPIs & Dashboards**

**Outputs**
- Alerts & Notifications
- Management Reporting & KPI’s
- Maintenance & Reliability Scorecards
- Downtime Reporting, OEE
- Health Assessment
- Automatic Work Order request Generation

**Continuous Calculations & Monitoring, link events to Maintenance & other functions via notifications**

**Continuously Monitor & Take Action**
Innovation leads to adopting latest approaches: Industrial Internet of Things - IIoT: How Does IIoT Work?

IIoT Elements

1. Smart & Connected Assets and Devices
2. Data Management and Onsite Control
3. Predictive Analytics
4. Smart and Secure Collaboration

IIoT Architecture

- Predictive Analytics
- Prescriptive Decision Making
- Smart Collaboration

Private, Public or Honeywell Secure Cloud

- Enterprise History
- Asset Management
- Operations Management
- Planning & Scheduling
- Mobility Solutions
- Enterprise Dashboards

Private, Public or Honeywell Secure Cloud
Use Case | **Connected Performance Services**

**CPS Architecture and Predictive Analytics**

- **Secure Cloud Collaboration**

- **Customer’s Enterprise**
  - **Plant**
    - **Process**
      - **Connected Devices**
  - **Control Room**
    - **HPS Controls & Process Data**
  - **CPS Dashboard**
    - Solution per Process

- **Remote Expert CPS Services**

**Big Data**

**Analytical Models**

- Optimize process yields
- Maximize mix of feeds to convert
- Lower energy utilization
- Extend useful catalyst lifetime
- Prevent process downtime
- Benchmark site-to-site operations
Summary
## HPS-UOP Solutions Delivering Enhanced Value

<table>
<thead>
<tr>
<th>Solution</th>
<th>How It Helps the Customer</th>
<th>Value Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-built Standard control points, Operator Graphics and Alarms</td>
<td>Reduce risk and take automation out of critical path for start-up</td>
<td>Reduce Project Risk/Operational Readiness</td>
</tr>
<tr>
<td>Pre-built Safety System for the Process</td>
<td>Avoid spurious trips; Shutdown the process in a controlled manner, avoiding damage to equipment or catalyst, consistently and reliably</td>
<td>Reliability/ Availability</td>
</tr>
<tr>
<td>UOP Critical Control Applications (CRCS/DRCS and PSA logic) on Honeywell Platforms</td>
<td>Elimination of black boxes, Better visibility, Alarms, SOE in DCS, Lower maintenance cost</td>
<td>Reliability/ Availability</td>
</tr>
<tr>
<td>UOP and Custom Training Simulators</td>
<td>Train engineers and operators early in a safe environment</td>
<td>Operational Readiness/Reliability/Availability</td>
</tr>
<tr>
<td>Pre-built Supervisory Control System for the Process</td>
<td>Start-up, operate and shutdown the process consistently and reliably</td>
<td>Reliability/ Availability</td>
</tr>
<tr>
<td>Advanced Process Control for the Process</td>
<td>Improve process efficiency (increase throughput, lower energy usage)</td>
<td>Efficiency/Optimization</td>
</tr>
<tr>
<td>Connected Performance Services (CPS)</td>
<td>Remote Monitoring with advanced diagnostics; KPIs and Integrity Windows to make sure process stays within recommended parameters; Open loop optimization</td>
<td>Reliability/Availability/Optimization</td>
</tr>
</tbody>
</table>

**Increased profitability by bringing unit on-line faster & minimizing plant downtime**
Thank You