

# **HONEYWELL UOP** **PSA PRODUCT LINE REVIEW**



U O P

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07 February 2024

**Honeywell**  
UOP



# HONEYWELL OVERVIEW

NASDAQ: HON | ~750 sites | ~99,000\* employees | Charlotte, NC headquarters | Fortune 500

## Aerospace



Our products are used on virtually every commercial and defense aircraft platform worldwide and include aircraft propulsion, cockpit systems, satellite communications, and auxiliary power systems.

## Honeywell Building Technologies



Our products, software, and technologies are in more than 10 million buildings worldwide, helping customers ensure their facilities are safe, healthy, energy efficient, sustainable, and productive.

## Performance Materials and Technologies



We are positioned to serve customers with high-quality performance chemicals and materials, process technologies, and automation control. By supporting the global transition towards renewable energy and a low-carbon economy, we're accelerating a more sustainable future and changing the world.

## Safety and Productivity Solutions



We develop and deploy an innovative range of solutions, software, and services that help keep people healthy, workers and workplaces safer and more productive, and supply chains and assets more efficient, accurate, and reliable.

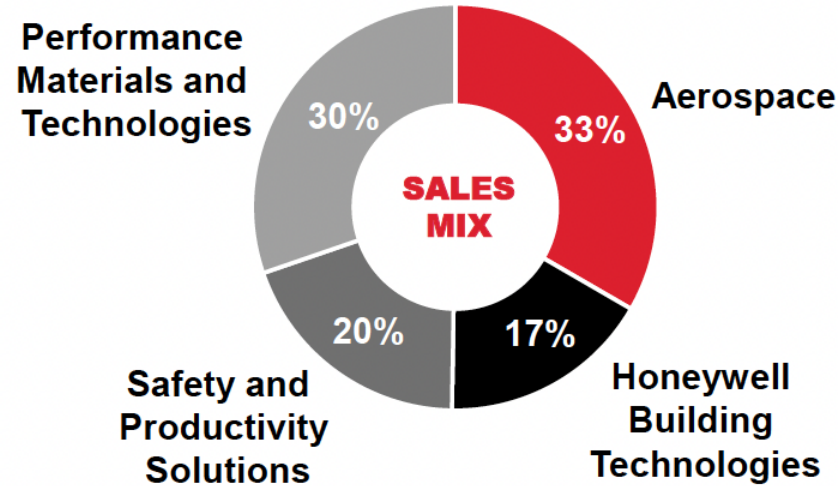
## Honeywell Connected Enterprise

Across our segments, we accelerate our customers' digital transformation via our enterprise performance management solution, Honeywell Forge, which brings together the data, processes, and systems into a cloud-based solution to help customers make sense of it all, creating the OT system of record. HCE's focus is software development, from the gateway to end-user applications, bringing scale and capability across all of Honeywell.

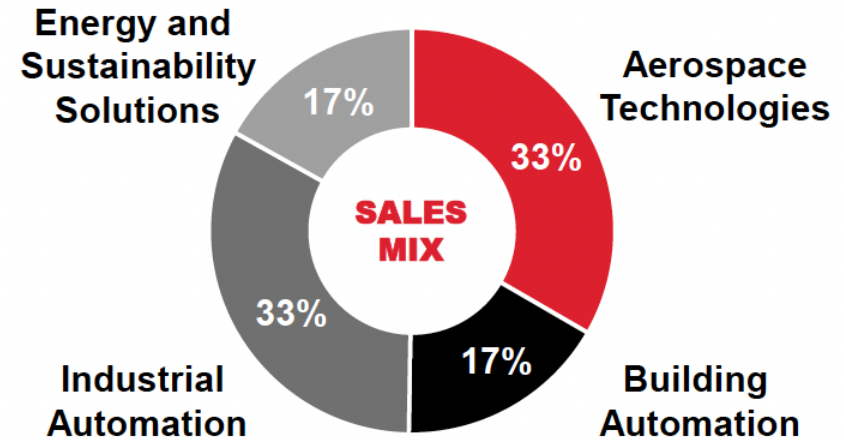
Shaping the Future Across Industries

# HONEYWELL REALIGNMENT-WHY IT MATTERS

## HONEYWELL - CURRENT STRUCTURE



## HONEYWELL - NEW STRUCTURE AS OF 1Q24



- Aligns business structure with distinct, compelling megatrends
- Positions Honeywell to better address the world's toughest challenges
- Enables a simpler, stronger strategic focus and clearly defines Honeywell's value proposition
- Creates a more focused framework for M&A; bolt-on acquisitions and select dispositions to align to themes

Based on 2022 revenue. New structure percentages represent 2022 revenue, realigned to new reporting structure effective beginning first quarter 2024.

**New Structure Enhances Organic and Inorganic Growth Strategies**

# ESS STRATEGY

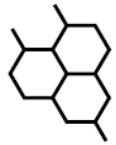
As a global technology leader, Honeywell Energy & Sustainability Solutions (ESS) enables the energy evolution, provides solutions that reduce emissions, and delivers innovative sustainable materials to our customers across industries

## STRATEGIC FOCUS



### Energy Transition

*Supporting traditional oil and gas production while enabling the transition of clean energy by delivering decarbonization, sustainable heating, energy storage, & sustainable fuel solutions to drive energy transition*



### Sustainable Materials & Advanced Chemistry

*Creating sustainable solutions and innovative new materials & molecules through advanced chemistry and deep R&D capabilities*



### Petrochemicals

*Improving efficiency of petrochemical processes to enhance quality with lower energy consumption and enabling the circularity economy*

## STRATEGIC GROWTH ENABLERS



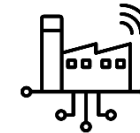
Significant market size and growth potential in clean energy and sustainable solutions



Large install base and ability to accelerate new innovation



Energy Transition dynamics create growth in both traditional and new technology solutions



Connected plants provide opportunity for digitalization enabling software and services revenue



Core legacy technologies provide a stable revenue source



Novel materials designed to solve customer problems and drive outsized profitable growth

## COMPETITIVE ADVANTAGE



**2500+**

Technologists and Engineers



**10K**

Active Patents and Applications



**7,000+**

Employees Globally



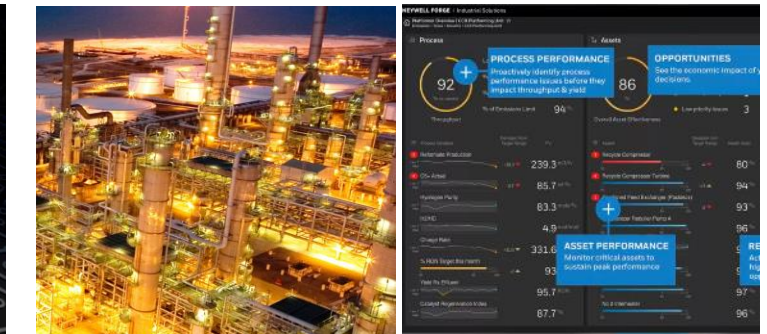


**100+ years**

Chemistry & Technology Innovation



# ESS CORE OFFERINGS

Portfolio Focus	Energy Transition	Sustainable Materials & Advanced Chemistry	Petrochemicals
			
Offerings	<ul style="list-style-type: none"> <li>• Renewable Fuels</li> <li>• Carbon Capture</li> <li>• Blue Hydrogen</li> <li>• LNG</li> <li>• Green Hydrogen</li> <li>• Hydrogen Transport</li> <li>• Heat Pumps</li> <li>• Energy Storage</li> </ul>	<ul style="list-style-type: none"> <li>• Low Global Warming Potential Refrigeration</li> <li>• Thermal Management</li> <li>• Electronic Metals and Polymers</li> <li>• Battery Materials</li> <li>• Adsorbents</li> <li>• Advanced Armor</li> <li>• Specialty Additives</li> <li>• Healthcare Packaging</li> <li>• Lab Chemicals</li> </ul>	<ul style="list-style-type: none"> <li>• Petrochemical and Refining &amp; Catalysts</li> <li>• Gas Processing</li> <li>• Methanol to Olefins</li> <li>• Connected &amp; Outcome Based Solutions</li> <li>• Aftermarket Services</li> </ul>
Value Prop	<p><i>Reducing GHG emissions through innovative technologies to support customer decarbonization in hard-to-abate sectors</i></p>	<p><i>Innovative approaches to material science, focused on diverse applications and pioneering technologies aligned to high growth megatrends</i></p>	<p><i>Improving the efficiency of petrochemical processes to enhance quality with lower energy consumption and enabling the circularity economy</i></p>

**ESS' portfolio of specialized offerings, IP & applied material sciences provides a differentiated growth path in the market**

# HONEYWELL UOP AT A GLANCE

## 100+ Years of Global Expertise and Leading Technology Development



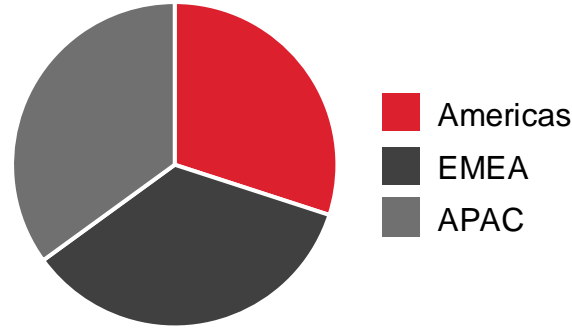
### UOP TECHNOLOGY POWERS

- 90% of biodegradable detergents
- 70% of the world's polyester
- 60% of the world's gasoline
- 60% of the world's on-purpose propylene
- 60% of the world's paraxylene
- 50% of the world's renewable fuels
- 40% of LNG processed
- 15 tons of captured CO<sub>2</sub>



### GLOBAL REACH

Diversified regional presence that can effectively react to changes in demand



### NEW TECHNOLOGIES

Honeywell UOP creates new technologies that convert oil and natural gas into transportation fuels, energy, and petrochemicals



### EXPERTISE

Broadest range of downstream refining and petrochemical technologies; leading process technology licensor



**2,000**

Engineers and scientists



**5,500**

Active patents and applications



**LARGEST**

process licensing organization  
**in the world**

**31** out of **36**

refining technologies in use today were developed by  
**UOP**

# HONEYWELL UOP GLOBAL LOCATIONS

## Sales & Service



### Americas

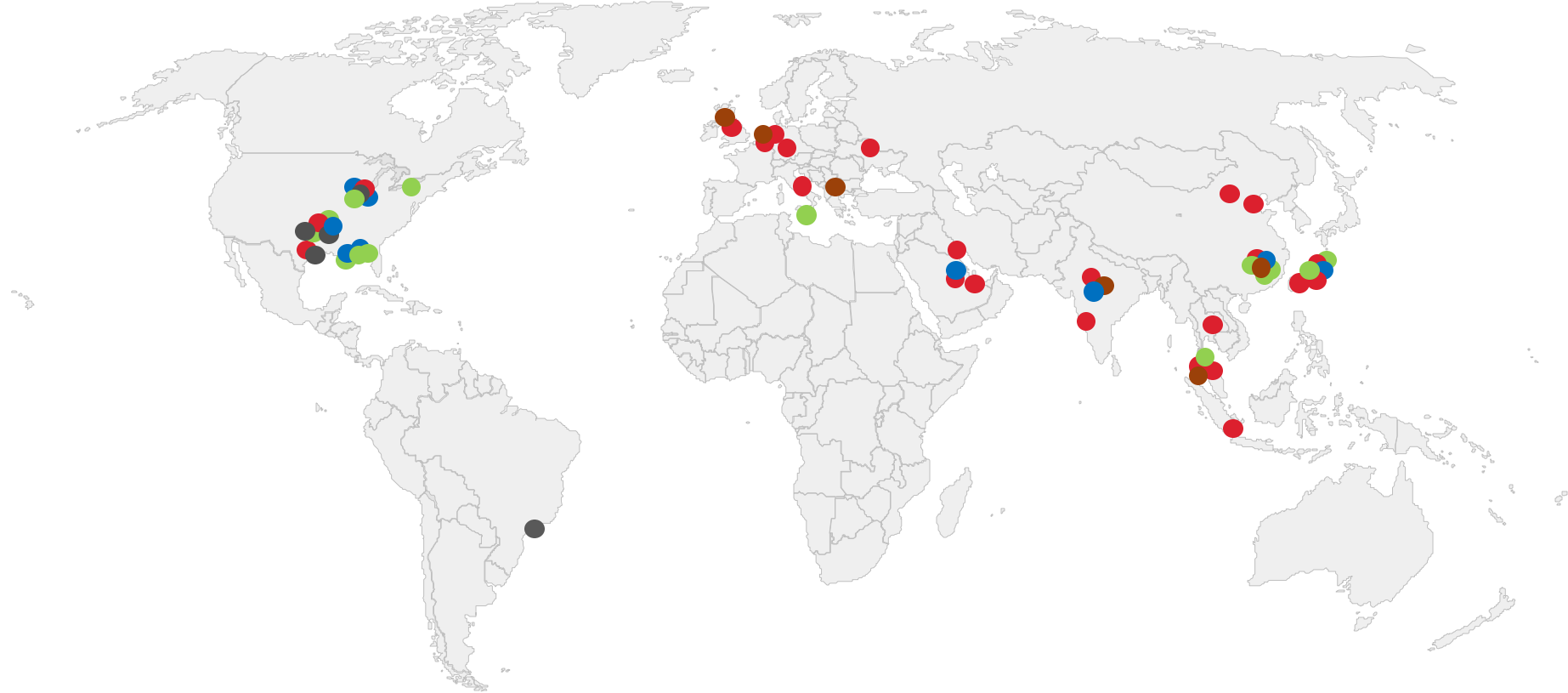
Des Plaines, IL  
Houston, TX  
Tulsa, OK  
Mexico City, Mexico  
Buenos Aires, Argentina

### Europe

Erkrath, Germany  
Bracknell, UK  
Assago, Italy

### Asia/Middle East

Delhi, India  
Chonburi, Thailand  
Singapore  
Seoul, South Korea  
Tokyo, Japan  
Beijing, China  
Shanghai, China  
Kuala Lumpur, Malaysia  
Jakarta, Indonesia  
Baghdad, Iraq  
Dubai, UAE



## Research & Development



### North America Middle East

Baton Rouge, LA  
Beggs, OK  
Des Plaines, IL  
Mobile, AL  
Houston, TX  
Riverside, IL  
Shreveport, LA

Dhahran, KSA

### Asia

Gurgaon, India  
Luoyang, China  
Zhangjiagang, China

## Manufacturing



### North America

Baton Rouge, LA  
Catoosa, OK  
McCook, IL  
Mobile, AL  
Shreveport, LA  
Tonawanda, NY

### Europe

Reggio Calabria, Italy

### Asia (and JVs)

Shanghai, China  
Zhangjiagang, China  
Penang, Malaysia  
Hiratsuka, Japan  
Yokkaichi, Japan

## Engineering Centers



### North America

Des Plaines, IL  
Houston, TX  
Midland, TX  
Tulsa, OK

### Europe

Bracknell, UK

### Asia

Delhi, India  
Kuala Lumpur

# UOP: THE PSA INNOVATION LEADER

UOP invented & patented the  
**5-STEP**  
PSA cycle

more than **1,180**  
PSA units designed & commissioned  
into commercial operation worldwide

**KIRKPATRICK  
AWARD 1979**  
Presented to UOP for the  
development of Polybed PSA

UOP invented the synthetic molecular  
sieve adsorbents required to obtain the

**99.99+%**

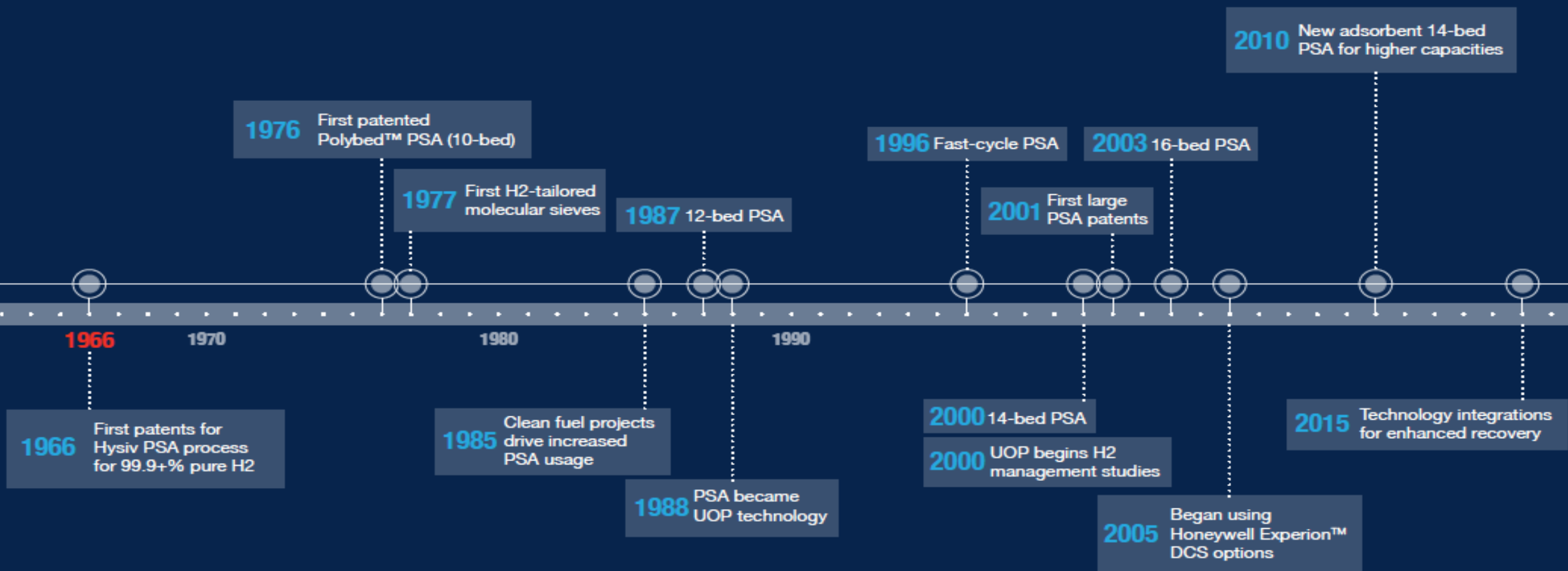
H<sub>2</sub> purity  
required for H<sub>2</sub>  
applications

- **PSA technology and performance leader for 50 years**
- **The first PSA in the world was commissioned in commercial service in 1966**
- **Experience with all sizes of PSA including**
  - The largest single train PSA in the world, which measures 20-beds, and was started in January 2014
  - The largest unit produces more than 253,000 Nm<sup>3</sup>/hr (226 MMSCFD) product from SMR feed gas using a 14-bed system

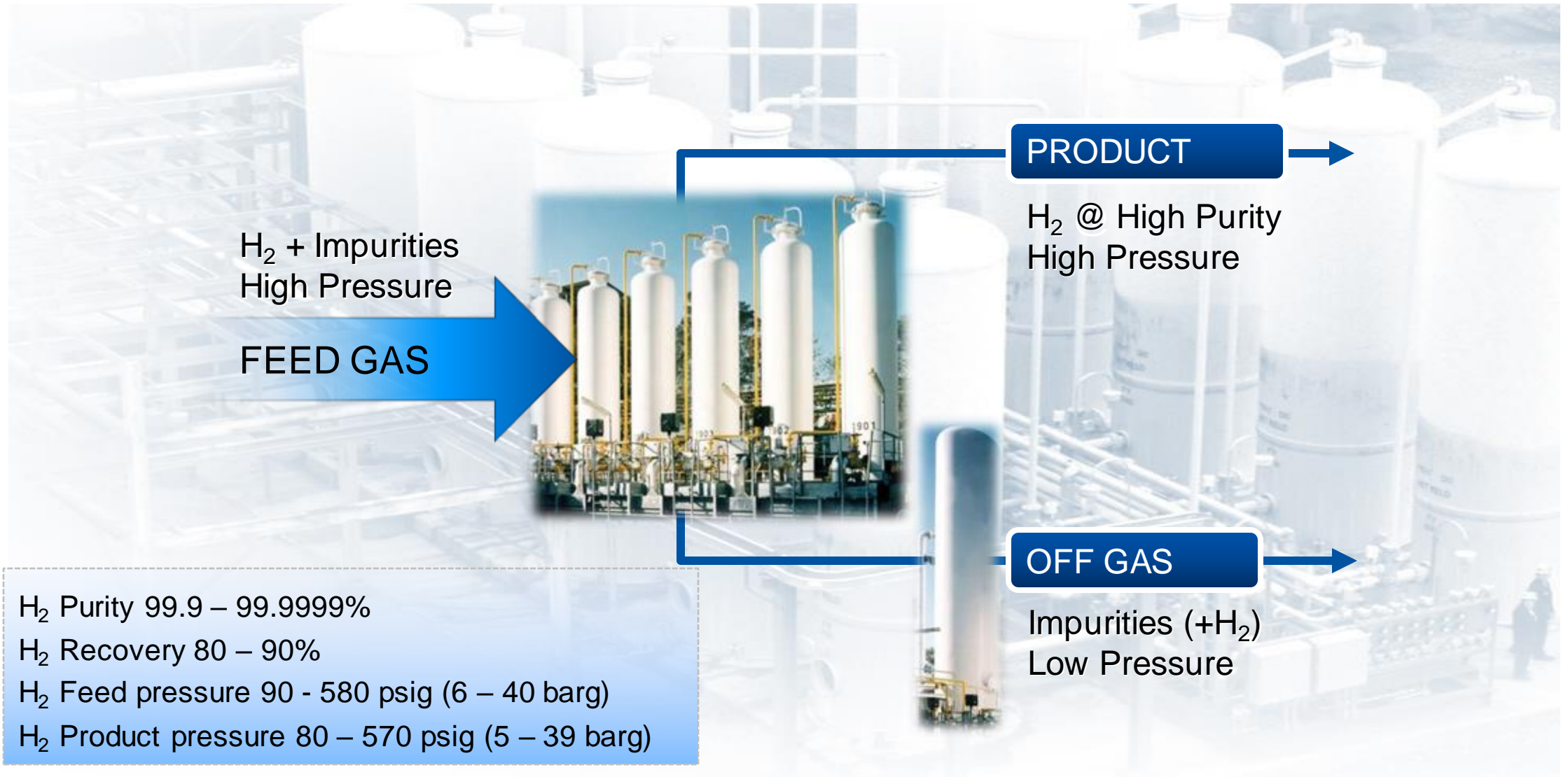
**After Market Revamps  
and Service**



# 50 Years of Innovation



# THE “PSA” PROCESS INVENTOR



# HYDROGEN PSA APPLICATIONS / EXPERIENCE LIST

## 13% Ethylene Off-Gas

No. of Units: 151  
Feed Pressure: .4 – 640 psig  
Feed Flow: 0.08 – 188,385 MMSCFD

## 40% Steam Reformers

No. of Units: 465  
Feed Pressure: 15 – 928 psig  
Feed Flow: 0.12 – 344 MMSCFD



## 22% Specialty Applications

No. of Units 255  
Ammonia Plants  
Coke Oven Gas  
Gasification  
Methanol Off-Gas  
Misc Off-Gas  
Partial Oxidation/Syngas

## 25% Refinery Streams

No. of Units: 288  
Feed Pressure: 20 – 670 psig  
Feed Flow: 0.05 – 203 MMSCFD



> 1,180 Polybed PSA Units UOP Supplied Worldwide



# PSA TECHNOLOGY – DELIVERED AS EQUIPMENT



## Equipment & Fabrication



- Adsorber Vessels
- Surge Tank
- Valve Skid
- Instrumentation & Valves
- Adsorbent
- Control System

## Engineering & Services

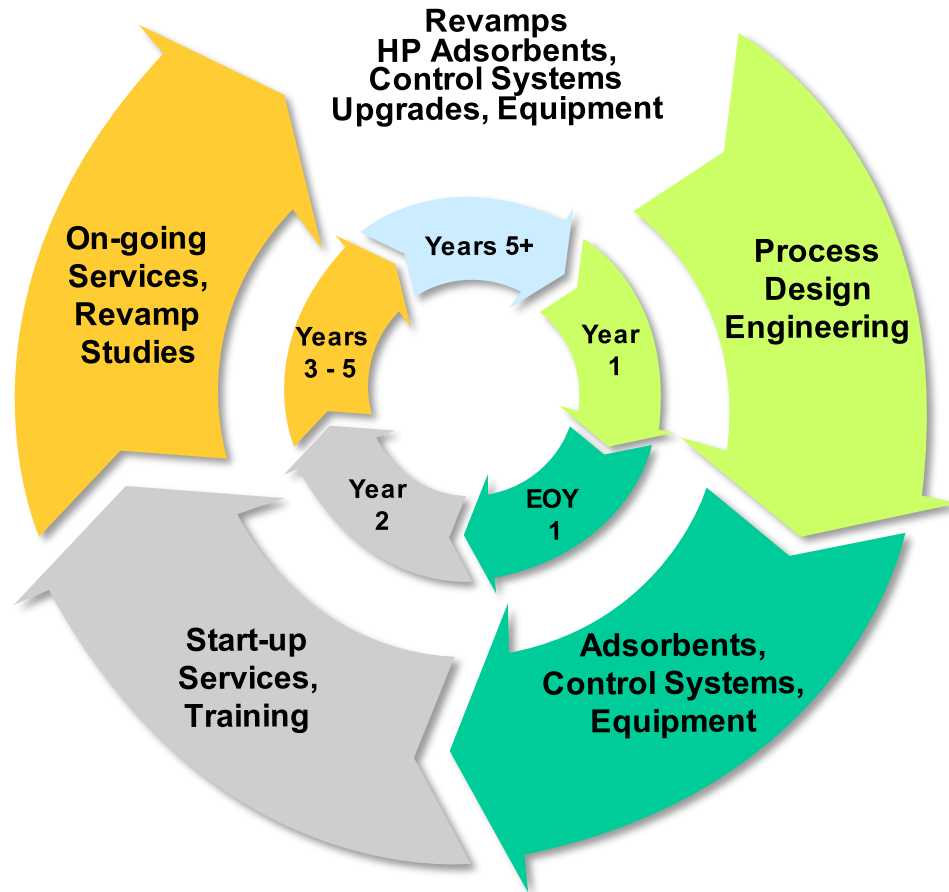


- Process
- Mechanical
- Instrumentation
- Control System
- Project Management
- Quality Control
- Adsorbent Loading Supervision
- Control Loop Testing
- Installation Checkout
- Operator Training
- Unit Start-up



# UOP PSA PROJECT DEVELOPMENT & AFTERMARKET SUPPORT

## Product/Service Delivery Cycle:



## Project Development Phase

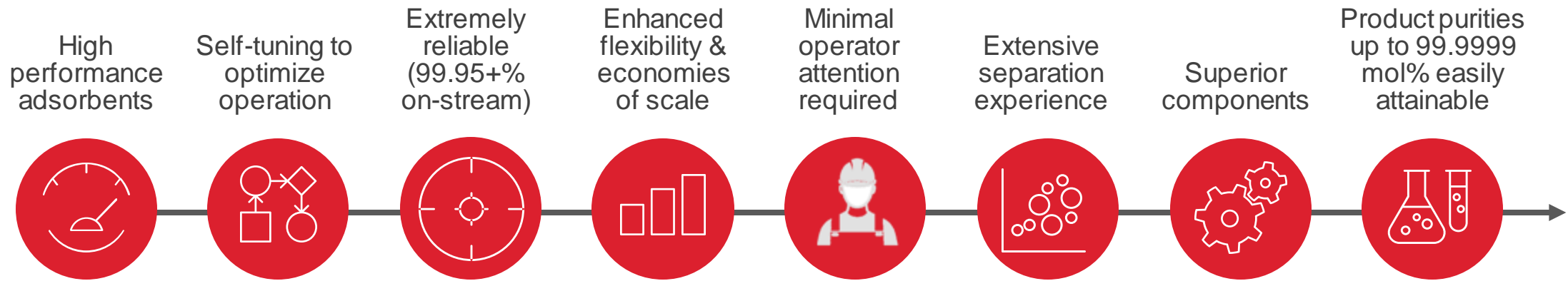
- Project specific designs to meet customer requirements
- Worldwide Sales & Project execution capabilities
- Sub-supplier alliances to ensure high quality products specifically designed for PSA Service
- UOP is ISO-9001 certified since 1994

## After Market Customer Support

- Dedicated customer support organization to address After Market activities
  - Debottlenecking/capacity increases
  - Process performance improvement
  - Upgrading existing hardware
  - Operations training & field support supervision
- User Conferences

Customer Support from Inquiry Stage Throughout the Life of the Unit

# ADVANTAGES OF UOP PSA UNITS



Designs Incorporate Customer Requirements



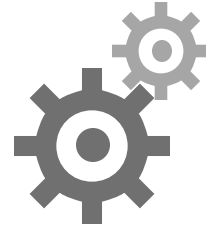
# NEW ADVANTAGES OF UOP PSA UNITS



## New Adsorbents

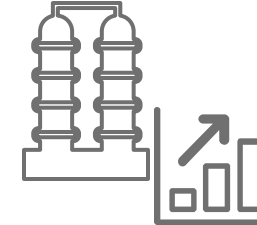
Reloading UOP SMR PSA units with UOP's new high performance adsorbents

- **Increase capacity** by 5-15%
- **Increase recovery** by up to 2%
- **Performance verified** in field



## UOP Process Integration

- Integrating UOP H<sub>2</sub> purification equipment within UOP licensed technology - patented schemes **yielding increased hydrogen** and LPG recoveries
- Available for CCR Platforming, Oleflex, Hydrocracking and hydrotreating technologies; New units and Revamps
- Schemes offer **excellent economics** with system payback < 1.5 years (typ.)



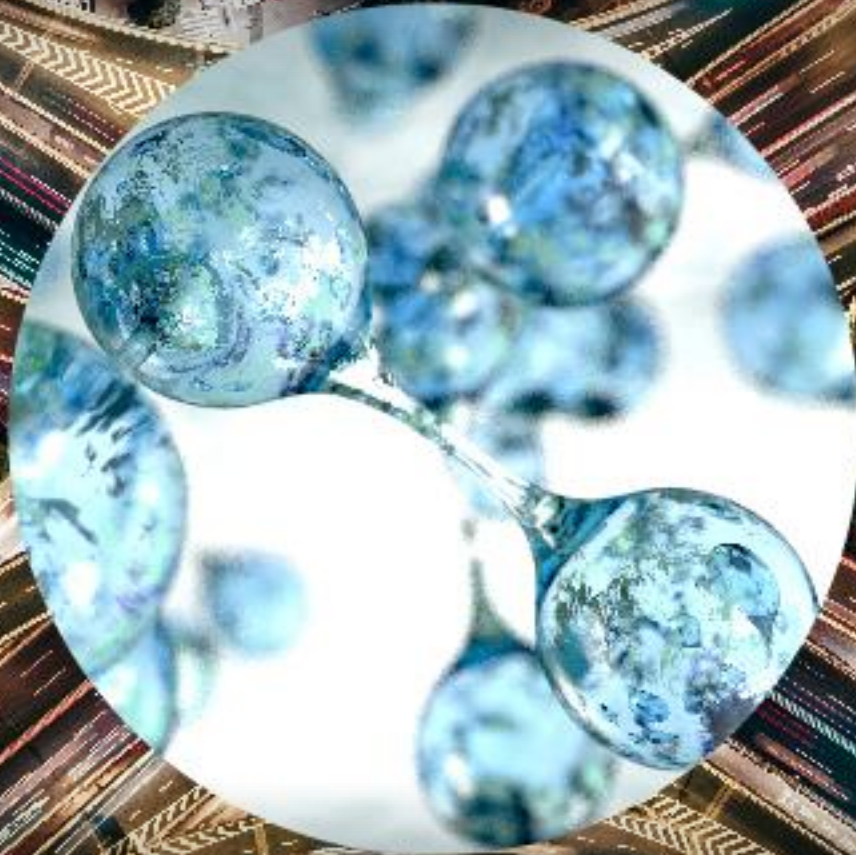
## PSA Technology Valve Analytics

- UOP's newest software solution to **improve** the **performance and reliability** of your UOP PSA unit
- Software solution improves the reliability and performance of valves through models, diagnostics, and supported preventive maintenance. **Advises what valves to focus on, why and recommends actions**



**THANK YOU**

**UOP**



**Honeywell**  
UOP