

# **INNOVATIVE PATHS TO CLEANER SKIES**

## **2025 HONEYWELL APAC SAF CONFERENCE**

**MAXIMIZING SAF PRODUCTION WITH  
HONEYWELL UOP IN DYNAMIC ENVIRONMENT**

**SYED ALI  
DIRECTOR, CATALYSTS FOR RENEWABLES**

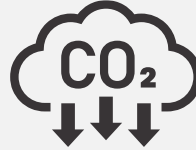
**Honeywell**

# GLOBAL POLICIES DRIVING INVESTMENTS IN SAF



## Mandates growing in EU and USA<sup>1</sup>

- US DOE targeting **3B gallons SAF (>200k BPD) by 2030**, 35B by 2050
- US Inflation Reduction Act (IRA) blender tax credits (BTC) & clean fuel production tax credit (CPTC) up to \$1.75/gallon through 2027 in US
- “Fit for 55” proposal in EU requires 2% 2025, 6% 2030, 70% 2050<sup>1</sup>
- **ReFuelEU eSAF requirements:** 1.2% 2030, 35% 2050<sup>1</sup>, w/ sub-mandate for eSAF



## ICAO CORSIA international program 50% reduced aviation CO<sub>2</sub> by 2050<sup>2</sup>

- International Civil Aviation Organization – UN agency with **193 countries**
- Carbon Offsetting and Reduction Scheme for International Aviation
- Voluntary today, **mandatory in 2027** for all ICAO Member States
- **SAF - primary emission reduction method** without an engine change



## Aviation fuel demand growing 100 Bgal (2024)<sup>3</sup> to ~150 Bgal (2050)<sup>4</sup>

- **Early 2025, SAF production increased to from 20K BPD to 90K BPD worldwide**, with potentially 10K+ BPD online by end of 2026
- SAF forecast ranges up to 3+ MM BPD by 2050
- Increasing voluntary commitments to use SAF by 2030 from airlines and logistics companies<sup>4</sup>

**SAF is the #1 focus in renewable fuels projects**

<sup>1</sup>EU countries with legislated mandates include Norway, Sweden and France

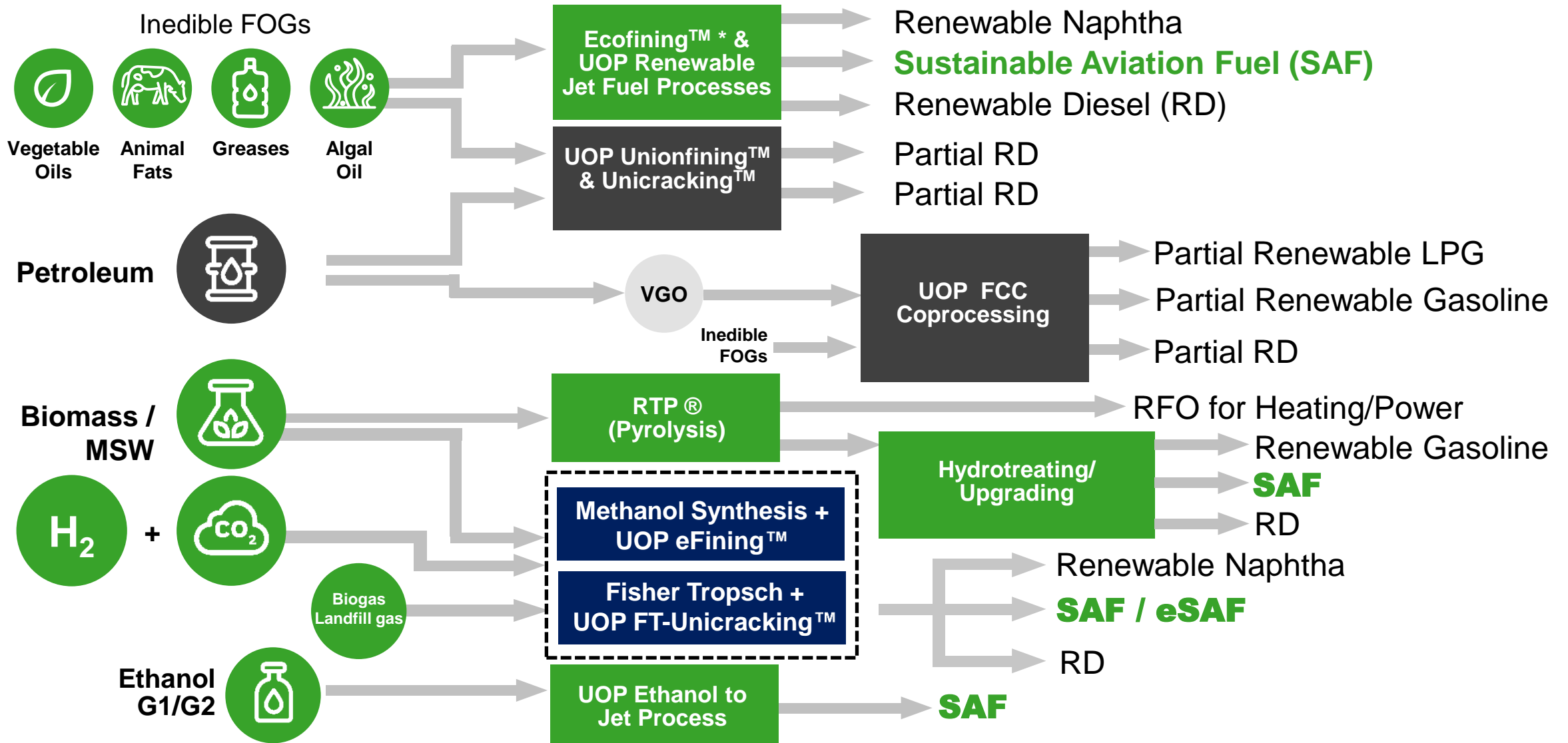
<sup>2</sup>ICAO CORSIA Program

<sup>3</sup>National Renewable Energy Laboratory

<sup>4</sup>S&P Global Commodity Insights

<sup>5</sup><https://www.iea.org/reports/aviation>

# HONEYWELL UOP PATHWAYS TO RENEWABLE FUELS



\* Ecofining technology produces renewable diesel, SAF, and other renewable products from biogenic feed sources. The technology was developed and commercialized jointly by UOP in collaboration with ENI



# ECOFINING™ WITH 100% RENEWABLE FEED

## 11 OPERATING UNITS FOR BOTH RD & SAF



**Diamond Green Diesel #1**  
900 kMTA (18,000 BPD)  
First New Ecofining Unit  
Norco, LA, USA



**ENI Venice**  
360 kMTA (7,200 BPD)  
1<sup>st</sup> retrofit; Expanded to  
560 kMTA (11,200 BPD)  
Venice, Italy



**World Energy**  
150 kMTA (3,000 BPD)  
1<sup>st</sup> New UOP Renewable Jet  
Paramount, CA, USA



**ENI Gela**  
750 kMTA (15,000 BPD)  
2<sup>nd</sup> ENI refinery Retrofit  
Additional SAF Planned  
Gela, Sicily, Italy



**Diamond Green Diesel #2**  
1,500 kMTA (30,000 BPD)  
Additional Capacity  
Norco, LA, USA



**Pertamina Cilicap Phase 1**  
First 900 kMTA (18,000 BPD)  
New Ecofining Unit  
Cilicap, Java, Indonesia



**Diamond Green Diesel #3**  
1,790 kMTA (35,000 BPD)  
Brings DGD to 83,000 BPD  
Port Arthur, TX, USA



**St. Bernard Renewables**  
1,000 kMTA (20,000 BPD)  
Revamp to Single Stage  
Renewable Diesel  
Chalmette, LA, USA



**ST1**  
200 kMTA (4,000 BPD)  
SAF Focused with Flexibility to  
Renewable Diesel  
Gothenburg, Sweden



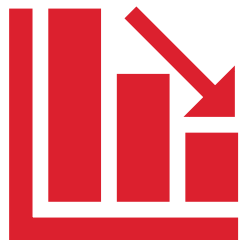
**Jiaao Enprotech**  
500 kMTA (10,000 BPD)  
World's First Max SAF Unit



**Saffaire Sky Energy**  
Set to Produce 30 Million  
Liters of SAF per Year  
Osaka, Japan

71 licensed, 11 operating with >30 years of combined experience

# CONTINUOUS INNOVATION CATALYST AND ENGINEERING



## Industry Headwinds

### Regulatory uncertainty

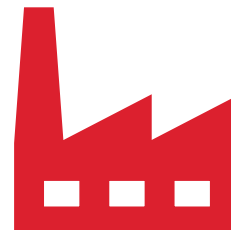
- In US, RINs and LCFS crashing due to oversupply and slow timing for other parts of country to adopt LCFS-type programs
- HVO mandates slashed in Sweden

### Higher interest rates leading to higher cost of capital

- Hurdle rates required for FID are increasing

### Feed stock availability not keeping pace with new project activity

- Production capacity has increased
- Europe limiting feedstock to nonfood based only



## Industry Needs

Lower CAPEX in needed to ensure projects secure financing (target 20% reduction)

Improved OPEX – increased operating cycles, lower utility consumptions

Improved CI to enable high product value

Enable processing wider range feedstocks

**Headwinds result in clear industry needs**

# UOP ENGINEERING INNOVATION



Leveraging +40 years commercial operating experience to lower CAPEX



Built on UOP catalyst solution



Innovative flow schemes



Metallurgy Improvement



Reducing OPEX & Carbon Intensity

# CATALYST INNOVATION

Industry Need: Catalyst enabling lower cost production

## Longer Cycle Lengths

Increase catalyst activity

## Lower Fill Costs

Higher activity catalysts with optimized manufacturing costs

## Enabling Broader Range of Feedstocks

Increased metals & contaminate capacity



Activity



Selectivity



Metal Pickup



CCOP



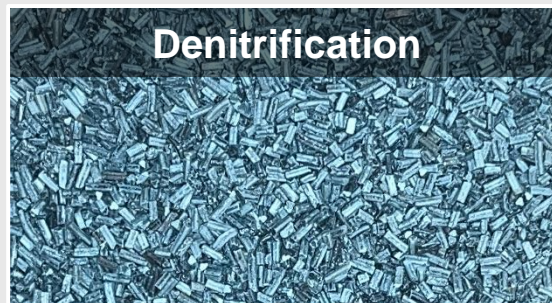


# CATALYSTS FOR RENEWABLE FUELS—100% RNW FEEDSTOCKS



**Guard Bed/Deoxygenation**

Catalysts to remove metals and promote HDO reactions.



**Denitrification**

Catalysts to complete HDN reactions, with flexibility to handle a broad range of feedstocks and contaminants.



**Isomerization**

Catalysts to dewax products to adjust diesel cloud point with minimal yield loss of distillate, with flexibility to shift product mix between diesel and jet.

## *sweet and sour service*

### **BGB-300**

- Successful operation in 9 units in 2022-2025 – NA, EU, AP
- Sold for loading in 5 units in 2025 – AP, EU

### **BGB-350**

- Successful operation in 9 units in 2024-2025 – NA, EU, AP
- Sold for loading in 5 units in 2025 – AP, EU

### **BGB-600 *\*new product\****

- Sold for loading in 1 unit in 2025 – NA

### **NG BGB**

- Commercially available end of 2025

## *sweet and sour service*

### **BGB-400**

- Successful operation in 10 units in 2022-2025 – NA, EU, AP
- Sold for loading in 4 units in 2025 – AP, EU

### **NG BDO**

- Commercially available end of 2025

## *sour service*

### **BGB-500/BDO-550**

- Successful operation in 3 units in 2023-2025 – NA
- Sold for loading in 1 new unit in 2025 – EU

## *sweet service*

### **DI-100**

- 12 years – NA (3 units); 11 years – EU (3 units); 2024 – AP (2 units)
- Sold for loading in 3 units in 2025 – AP, EU

### **DI-200**

- Successful operation in 7 units in 2022-2025 – NA, EU, AP
- Sold for loading in 2 new units in 2024/2025 - AP

### **DI-300 *\*new product\****

- Successful operation in 1 unit in 2024 – NA

### **NG DI sweet**

## *sour service*

### **DI-211**

- Successful operation in 2 units in 2023-2025 – NA

### **DI-311 *\*new product\****

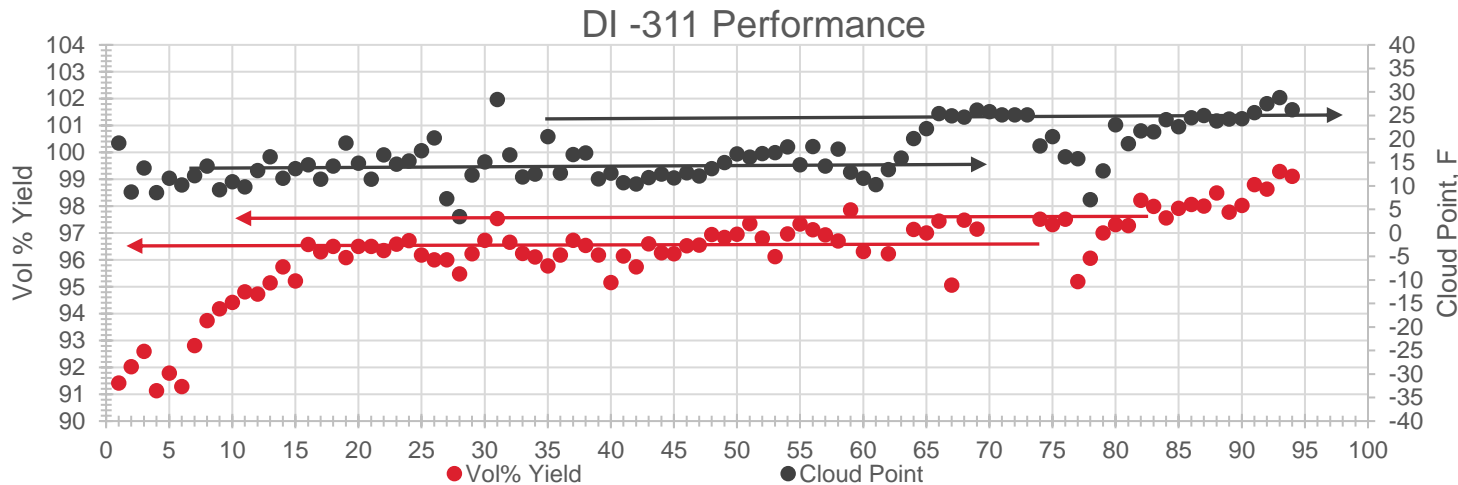
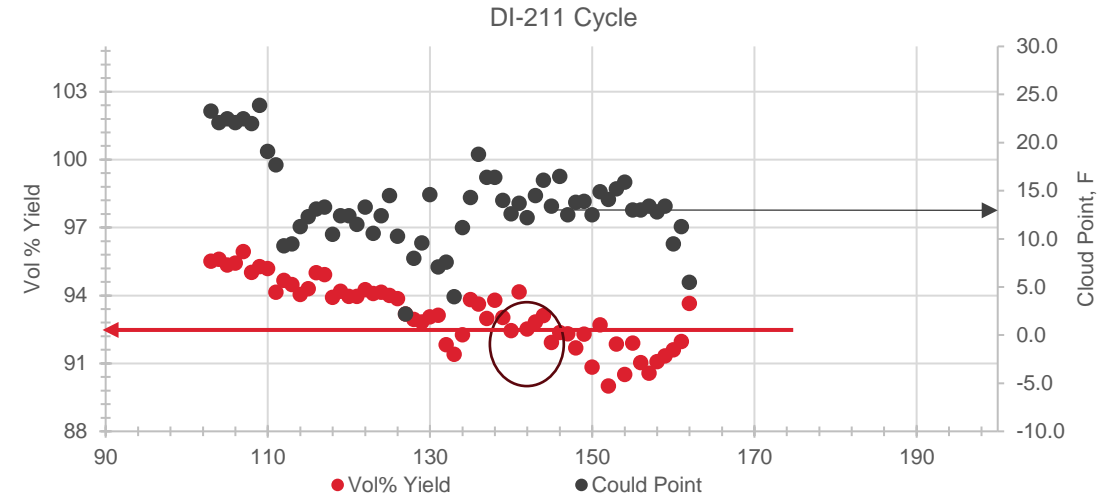
- Successful operation in 2 units in 2024-2025 – NA
- Sold for loading in 2 new units in 2025 – NA, EU

### **NG DI sour**



# CASE STUDY 1: SOUR SERVICE

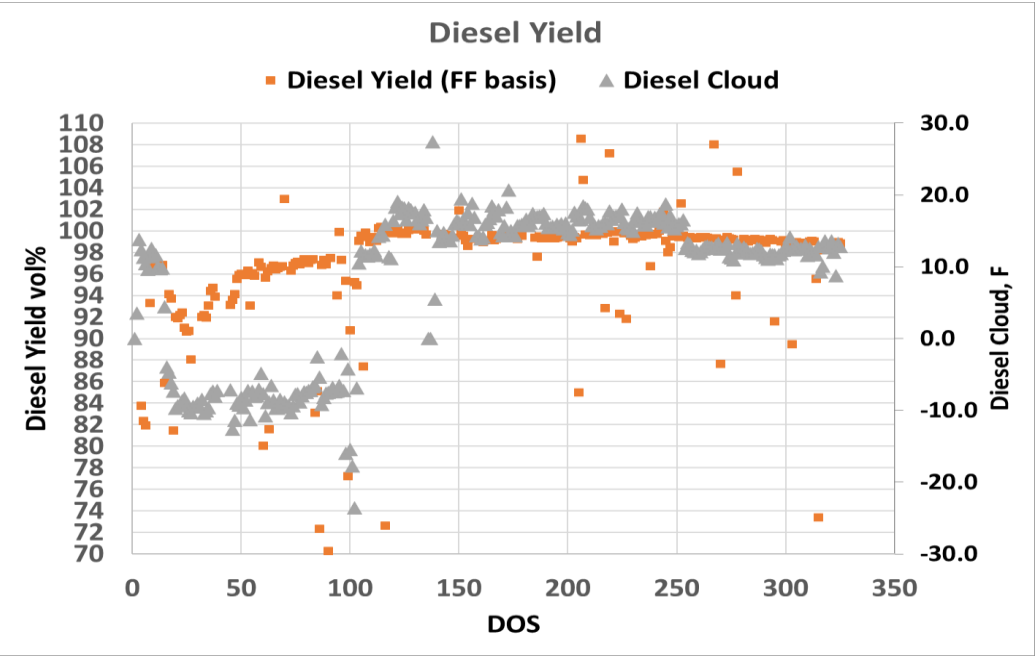
- Competitor catalyst loaded prior to UOP cycles
- UOP Cycles 1&2 - Treating: BGB-300/ BDO-400/BDO-500/BDO-550, Isom: DI-211
  - ❑ Cycle 1 & 2 achieved higher throughput (~15%) and cycle life (~50%) compared to previous catalyst supplier
- Cycle 3 loaded DI-311 with SOR yield and catalyst activity



- Customer is among 1<sup>st</sup> to deploy **Honeywell Performance+ Services** offering, which combines digital tools with the expertise of Honeywell's technical experts, to help customers operate more efficiently, increase equipment reliability, and drive more value out of their existing assets

**Continuous Engagement & Step Change with DI -311**

# CASE STUDY 2: SWEET SERVICE



## First Stage Data

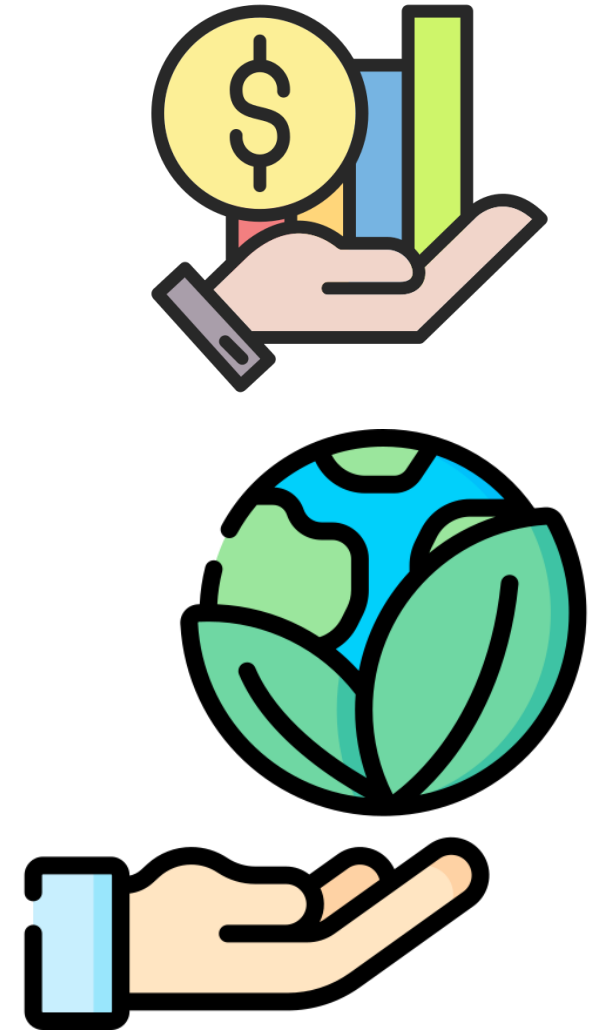
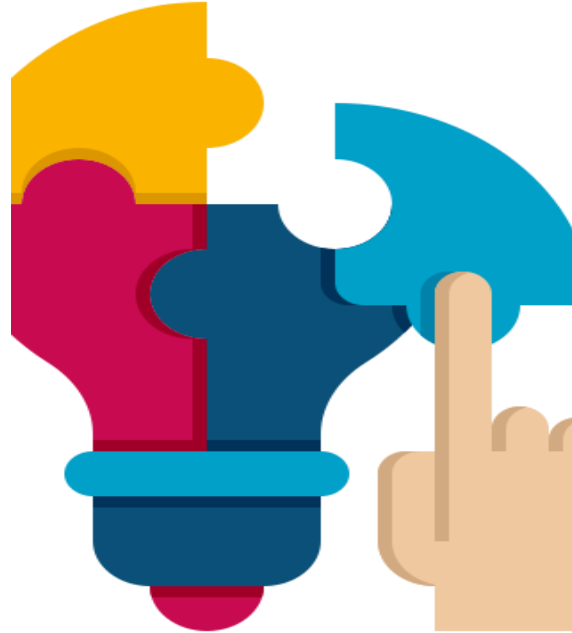
Parameter	Bottoms Sample (Mass %)	HDO Selectivity
n-C15	0.729	
n-C16	16.483	95.8%
n-C17	3.141	
n-C18	65.469	95.4%

## Two Stage/Sweet Service Design Catalyst System (First Commercial Reference):

- Treating: BGB-300/ BDO-400
  - Estimate 2 years cycle length
- Isom : DI-200
  - Estimate 4 years cycle length
- **Competitive bid against 5 vendors**
  - Extensive bidding process with pilot plant testing
- **Met and exceeded expectations – Satisfied customer**
  - Yield : >99 vol% at 15 F cloud, guarantee 98.5 vol%
  - Proven 95%+ HDO selectivity

• **UOP has met and exceeded yields guarantees**

# WHY UOP...



**UOP is a proven Partner for SAF**



# THANK YOU

Honeywell

