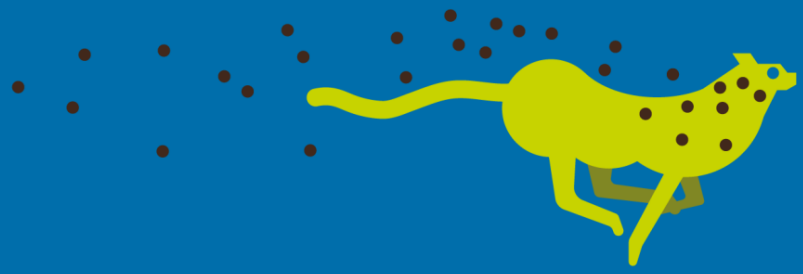
Axens
IFP / Group Technologies



AXENS' IRAN SEMINAR
TEHRAN - 28 TIR 1396 (19 JULY 2017)

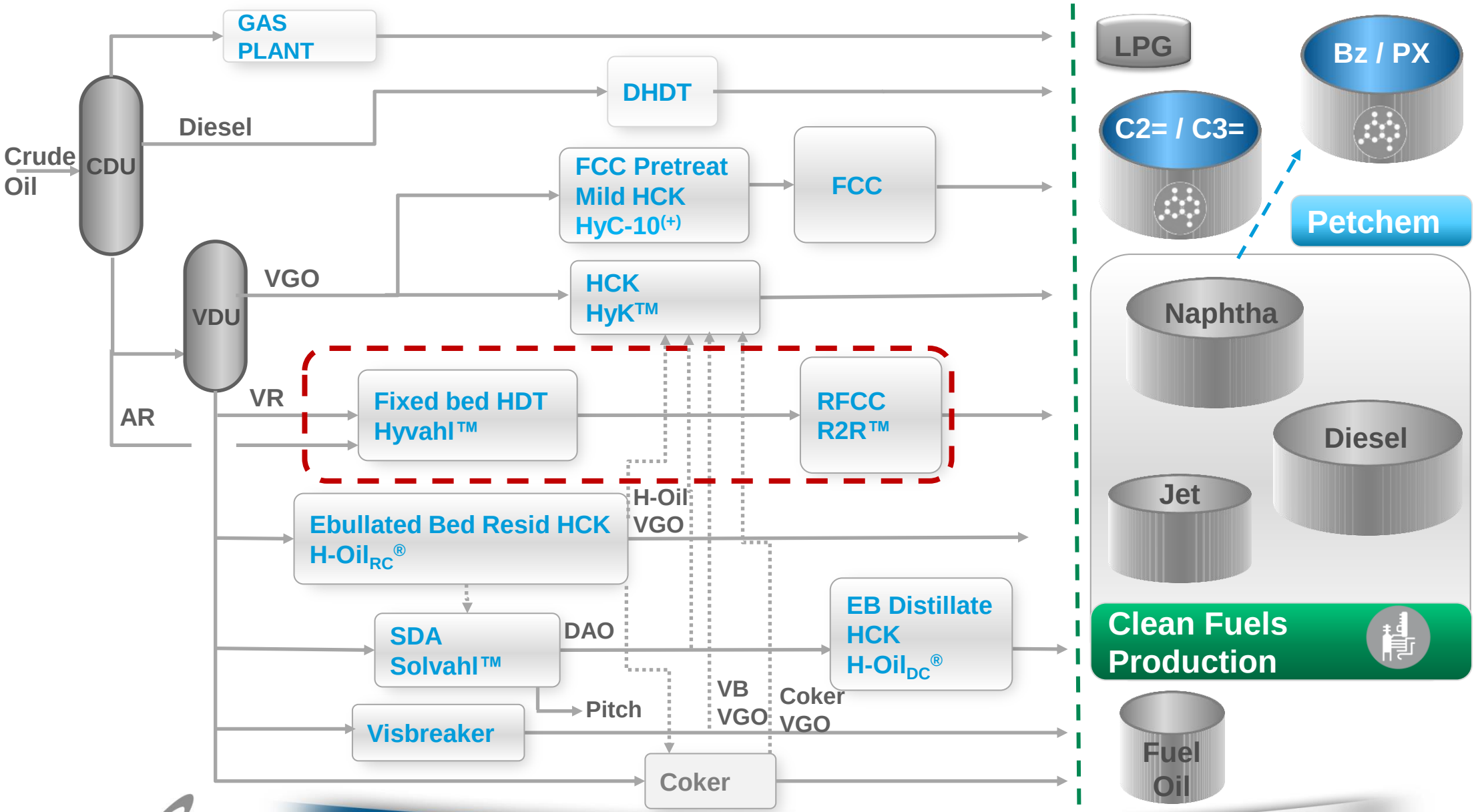
Hyvahl™ & RFCC Synergy

Sonia PLANTIER

Agenda

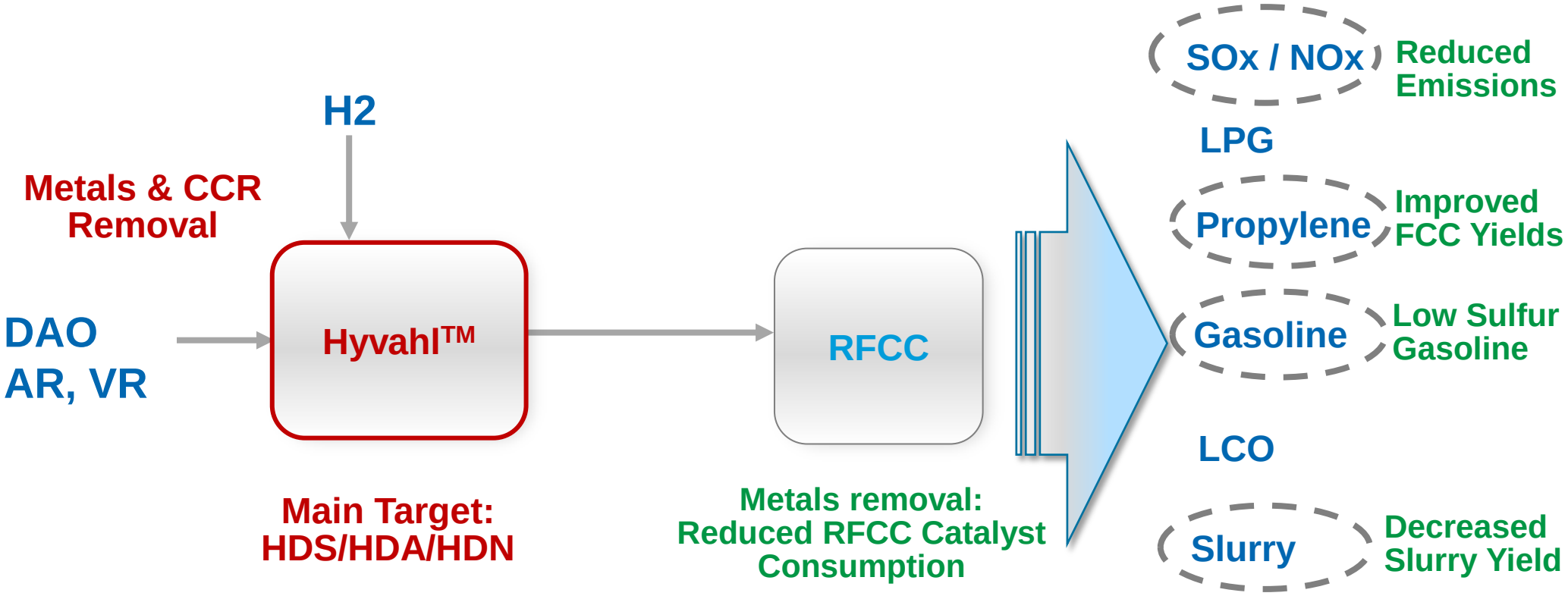
- Synergy
- Focus on Hyvahl™ Technology
- Focus on (R)FCC Technology
- Conclusion

The Place of the Hyvahl™ / RFCC in the Conversion Scheme



Hyvahl™ Process: Prime Objectives

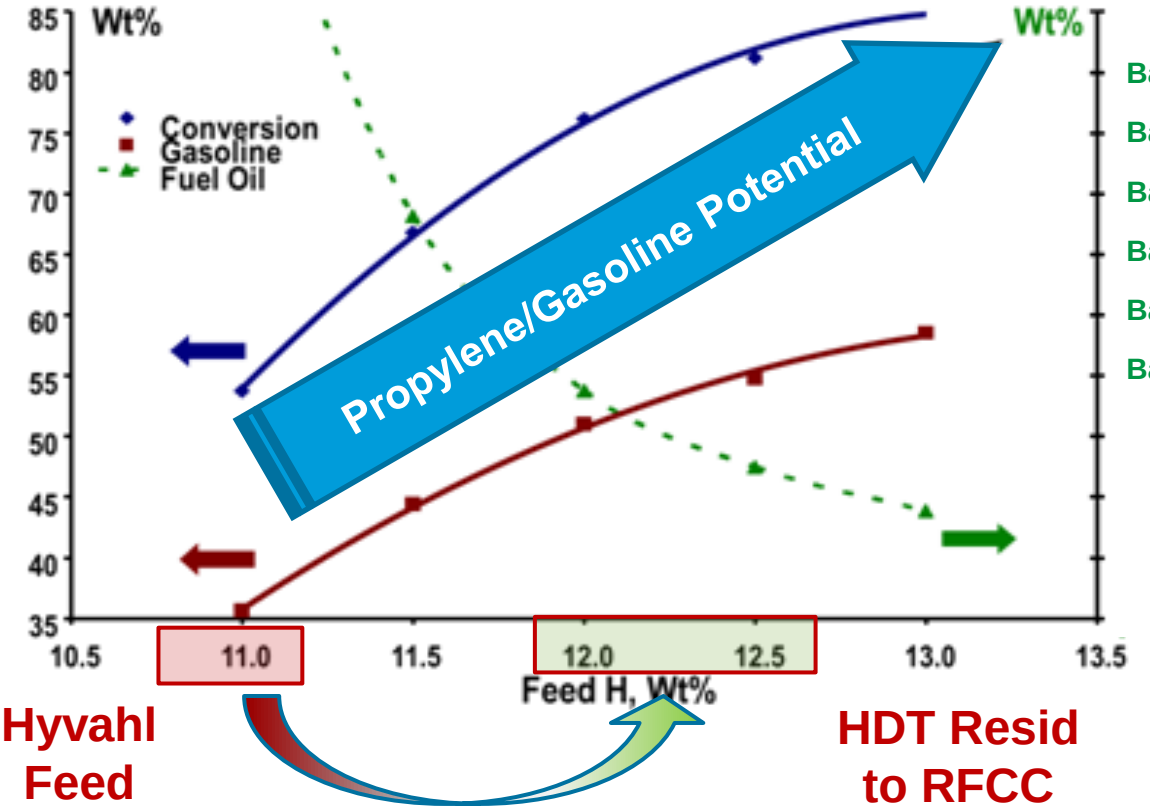
Hyvahl™ prepares the feed to the RFCC unit



Hyvahl™ Process: RFCC Gains

- Know-how of RDS + RFCC synergy

➔ Key for Global Profitability Optimization



Hyvahl Feed

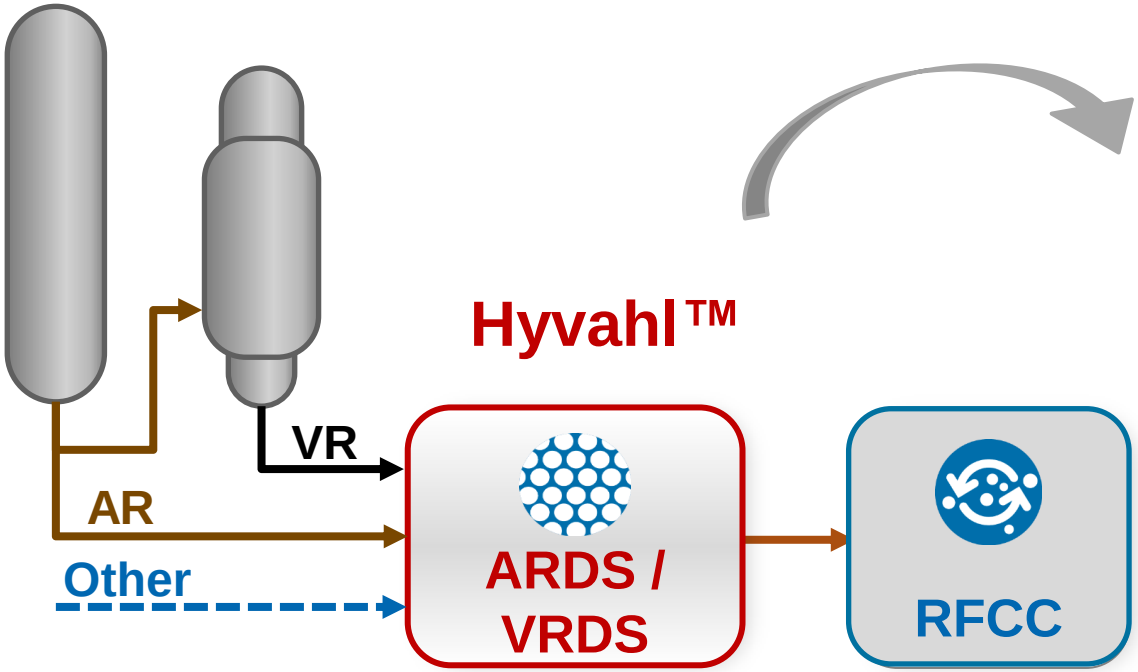
HDT Resid to RFCC

RFCC C3= or gasoline yield gain

Hyvahl™ unit profitability: RFCC product slate improvement

ARDS / VRDS: Hyvahl™ Technology

- **Hyvahl™: Fixed bed process with HDM and HDS Sections in series**



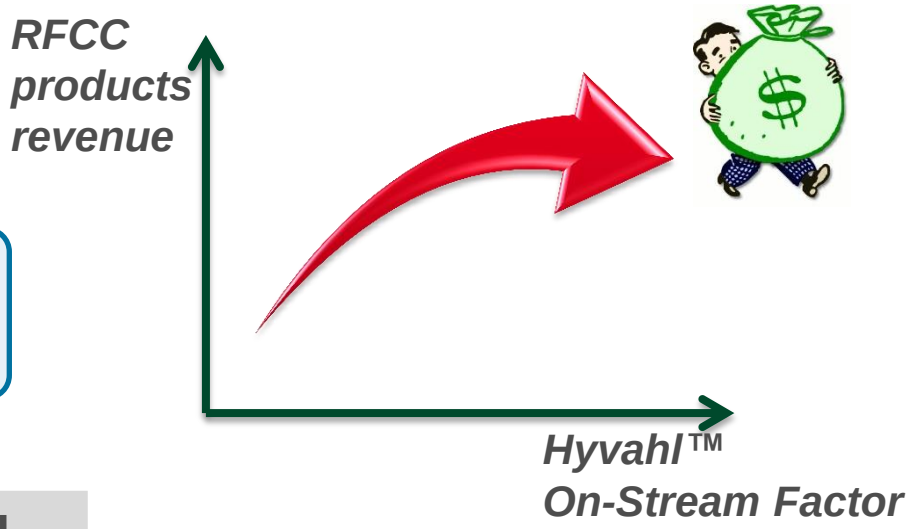
Main operating parameters:

- Total pressure ~ 100 to 200 bar
- LHSV ~ 0.4h^{-1} down to 0.1h^{-1}
- Op. Temp ~ 350°C up to 410°C

RFCC Project Profitability… linked to Hyvahl™ stream factor

- Frequent shutdowns = loss of production
- Hyvahl™ reliable operation is a must

Key factor to maximize profitability:
Hyvahl™ on-stream factor



AR 360°C+	AL	AH	IL	IH
Sulfur, wt%	3.4	4.5	2.3	3.2
Nitrogen, ppmwt	1954	3074	2826	4809
Ni+V, ppmwt	39	148	92	269
CCR, wt%	9.5	14.0	8.4	12.9
C7 asphalt., wt%	3.4	7.1	1.4	4.5

Iranian crudes :

- High metal content
- Refractory feedstock

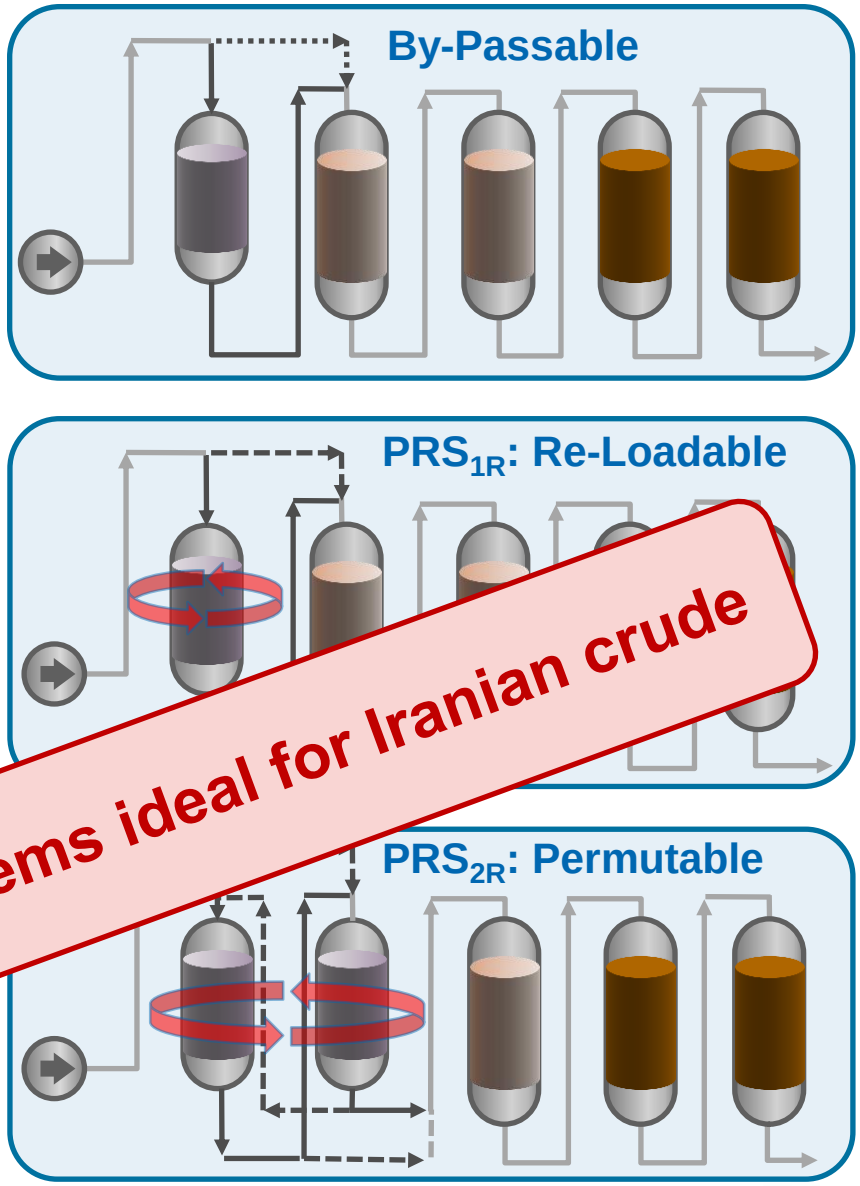
Reliable operation thanks to Axens' Patented PRS™ Technology

Hyvahl™ Reactor Configurations

- **By-Passable Reactors**
  - 1st Reactor bypassed if dP increases
  - Not possible to add catalyst to the system
  - **Minimum CapEx option**

- **PRS_{1R}: Re-Loadable Reactors**
  - 1st reactor can be bypassed and reloaded while unit in operation
  - Good protection from metals/dP issues
  - **Compromise between cost and cycle gain**

- **PRS_{2R}: Permutable Reactor S**
  - 2 first reactors can permutate in
  - Well suited for high metal conten
  - **Complete protection from metals/dP issues**



RFCC Challenges in Processing Resid Feed

	VGO	Resid
Sp Gr	0.88 - 0.92	0.90 – 0.95
CCR	< 3 wt%	> 3 wt%
Metals	< 5 wtppm	20-25 wtppm

Poor vaporization → Poor Yields, Coke deposit Rx & Ovhd

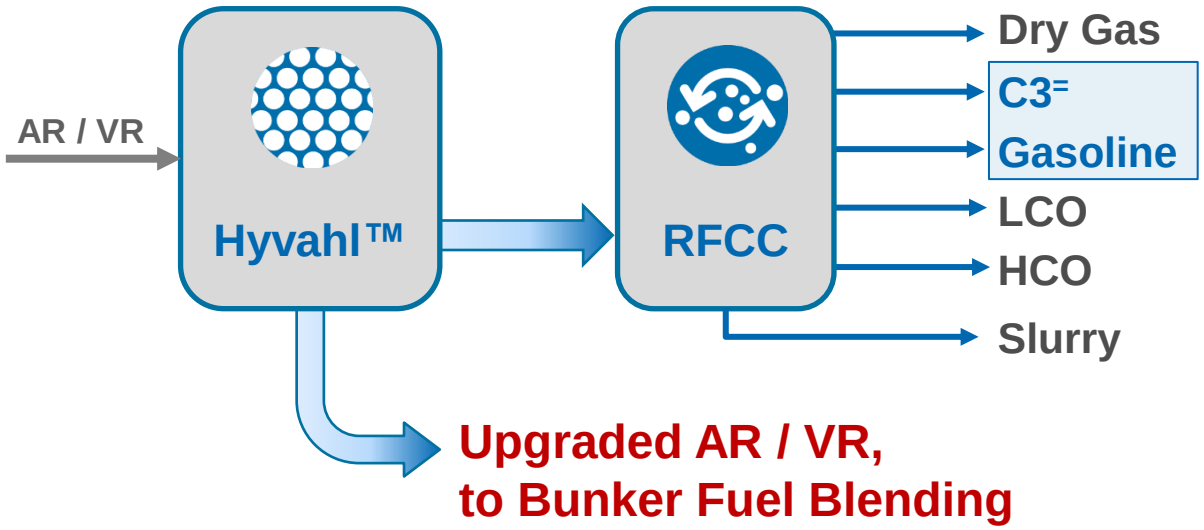
High coke production, High Regenerator Temp. → Poor Yields, Catalyst deactivation, Mechanical reliability issues

High metal content → Detrimental catalyst effect, Catalyst deactivation

Performance Issue
Catalyst Issue
Mechanical Issue

2020 Bunker Fuels: A Way to Boost Profits

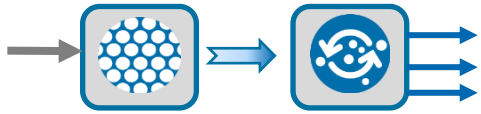
- Take advantage of the 2020 market: **Bunker fuel** production coupled with secure **high-value products**



- **Bunker Fuel** production should be a **means to maximizing profit, not a primary objective**
- **High-value products** from conversion/refining should **remain the focus** of refiners

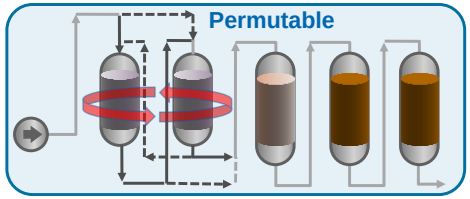
- **RFCC preferable to secure project profitability from bunker fuel price uncertainty**

To conclude…



- **Axens: Licensor of Hyvahl™ and RFCC**
  - Strong Know-how of each technology to provide each customer the optimized solution

- **Hyvahl™**
  - Pretreatment adapted to maximize RFCC yields
  - PRS™ system for smooth operation and long cycles
  - Allows to produce Bunker fuels meeting IMO 2020 spec



- **RFCC**
  - Large experience: leader in processing of resid feed.
  - High performances with reliable and properly selected technology features

FCC ALLIANCE
AXENS • TECHNIP • IFPEN • TOTAL

- **Maximum profitability thanks to Hyvahl™ & RFCC synergy**

Thank you! And see you on Axens' Blog
axens.net/blog