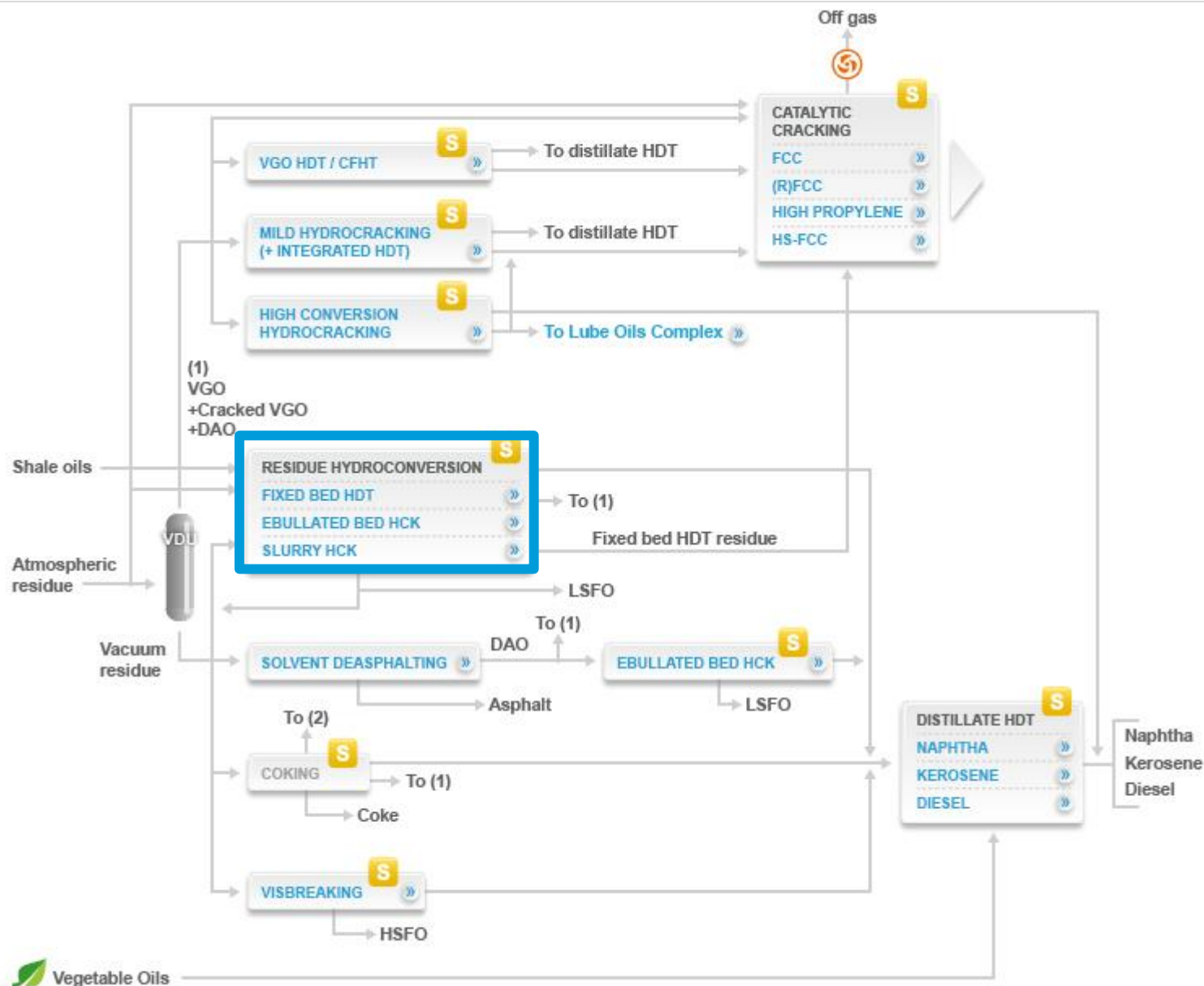


Residue Upgrading Technology selection



Delphine Le Bars

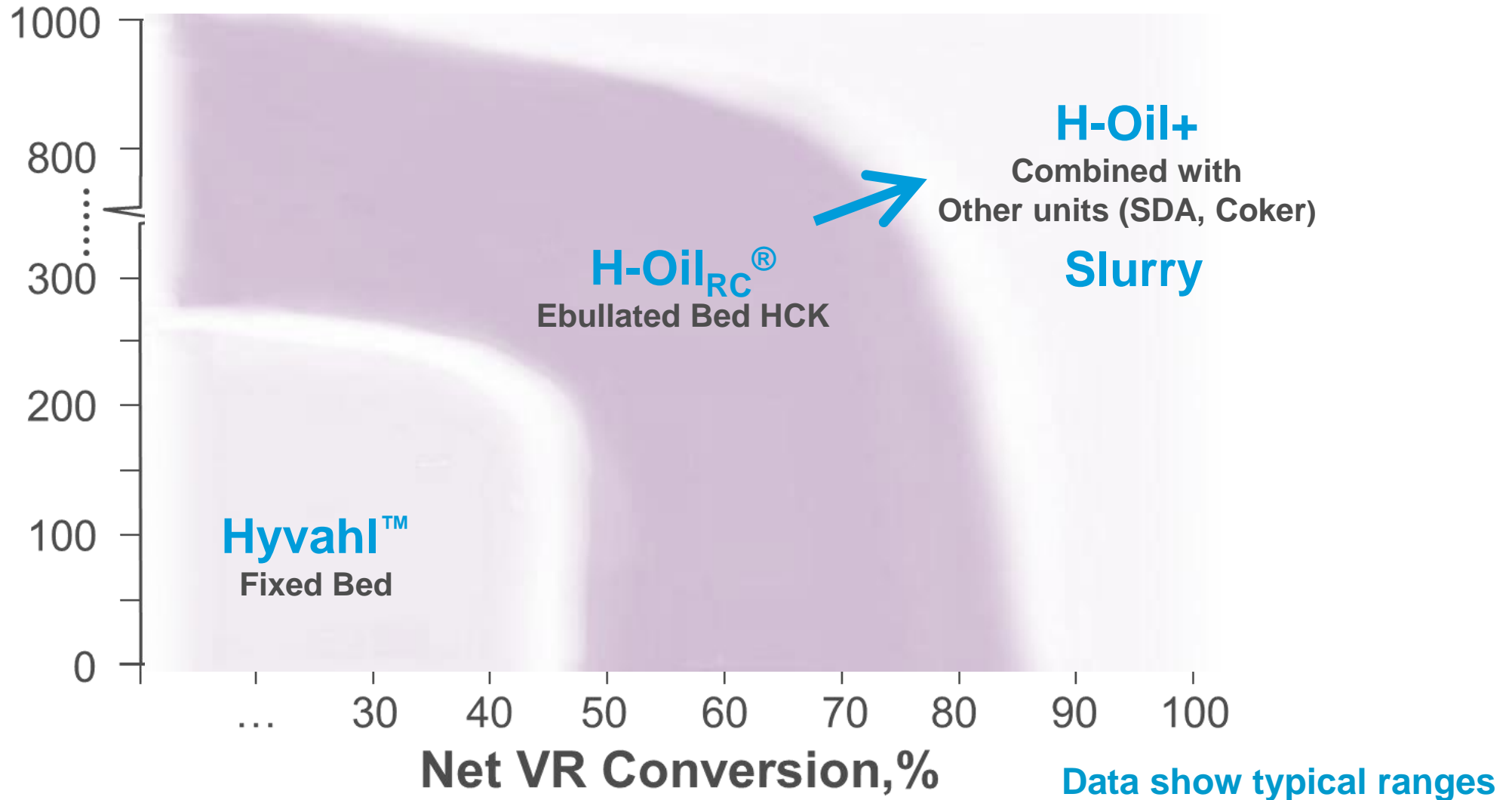
Bottom of the Barrel Axens Offer



DRYING & PURIFICATION
 SULFUR RECOVERY
 RENEWABLES

Residue Conversion Mapping

Ni + V in the Feed, wppm

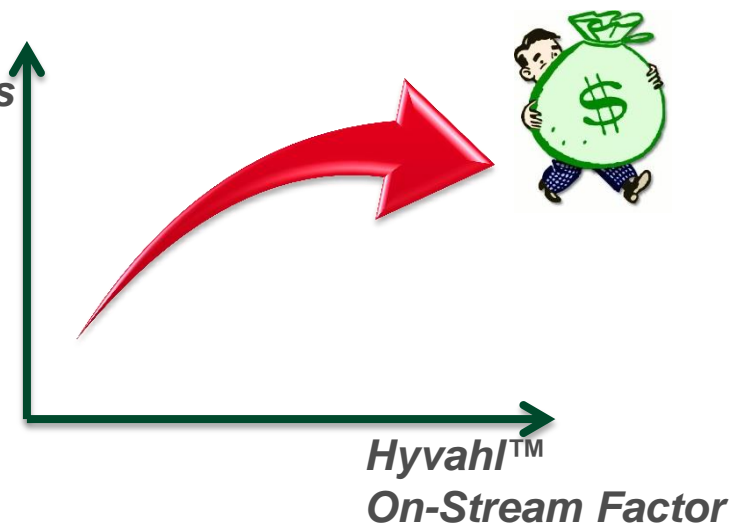


Iranian Crude

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

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

RFCC
products
revenue



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 :

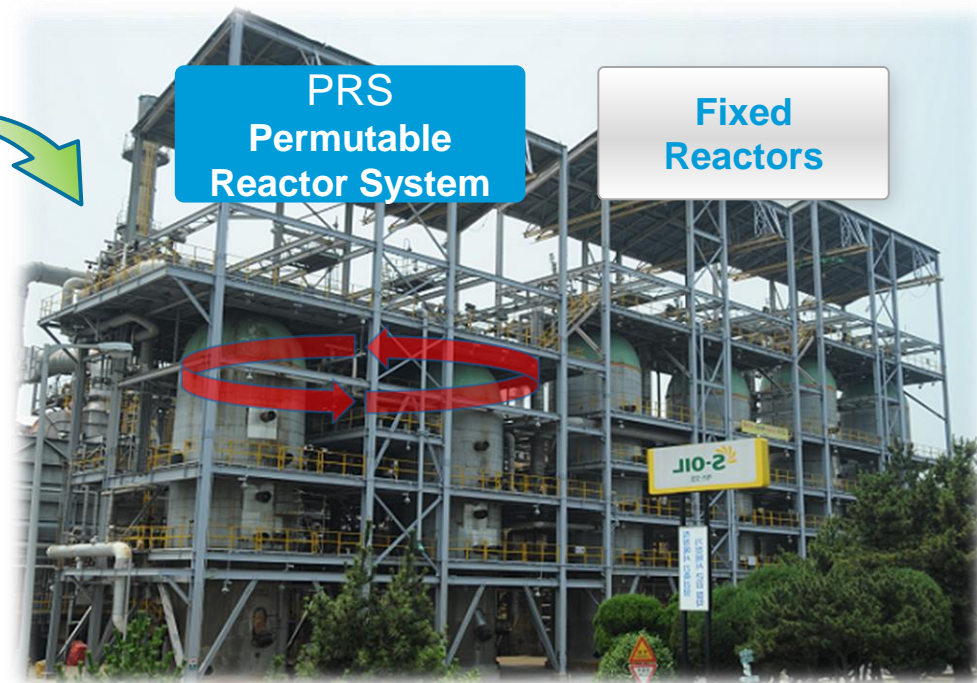
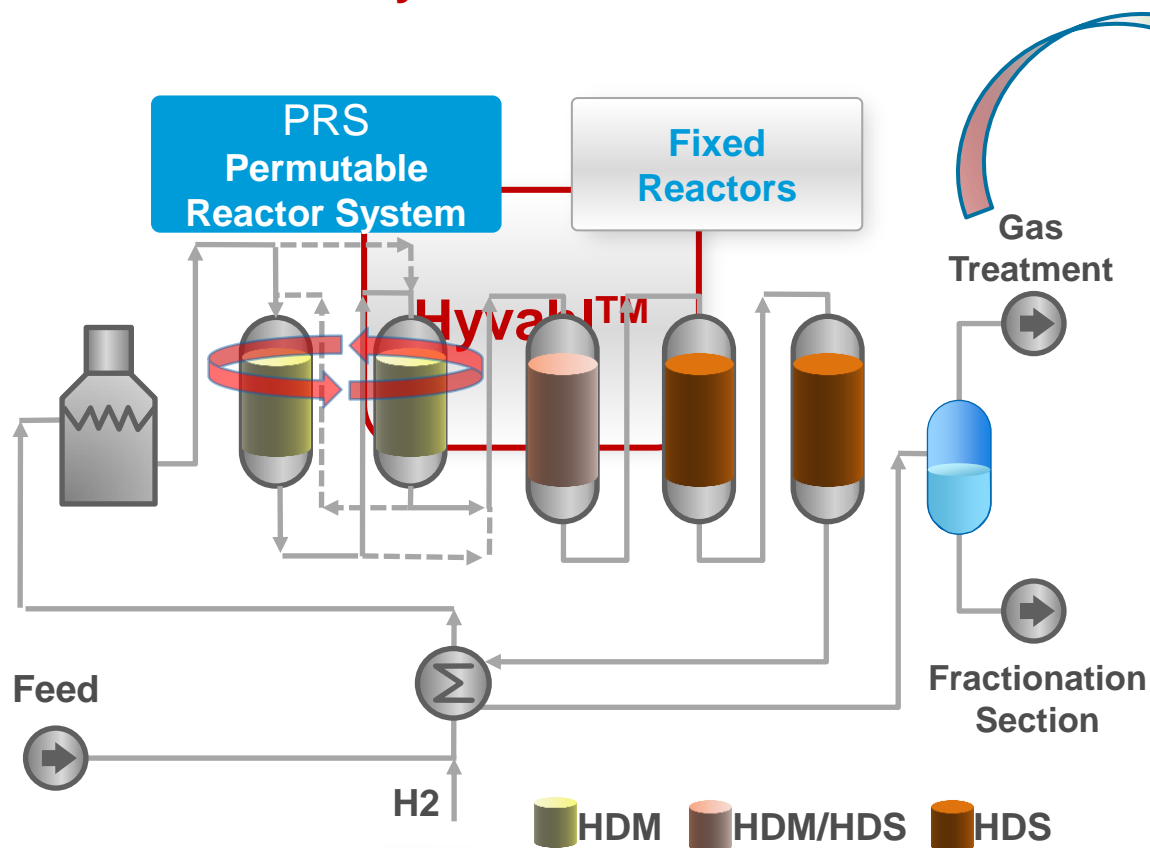
- High metal content
- Refractory feedstock



Reliable operation thanks to **Axens' Patented PRS™ Technology**

Hyvah™ Process: General Scheme

- Hyvah™: Fixed beds with **HDM** and **HDS** Sections in series
- **Permutable Reactors System (PRS)** for **difficult feeds** and **longer cycles**
 - **Complete** ΔP build-up **protection**
 - **Flexibility** for heavier feed treatment



Proven and reliable technology

- 30+ cycles
- 70+ permutations
- **Zero issues**

Hyvahl™ Commercial Units

Experience with Iranian Feed



- Esfahan Refinery
- Iranian Light AR/VR
- 2 trains
- PRS™ design

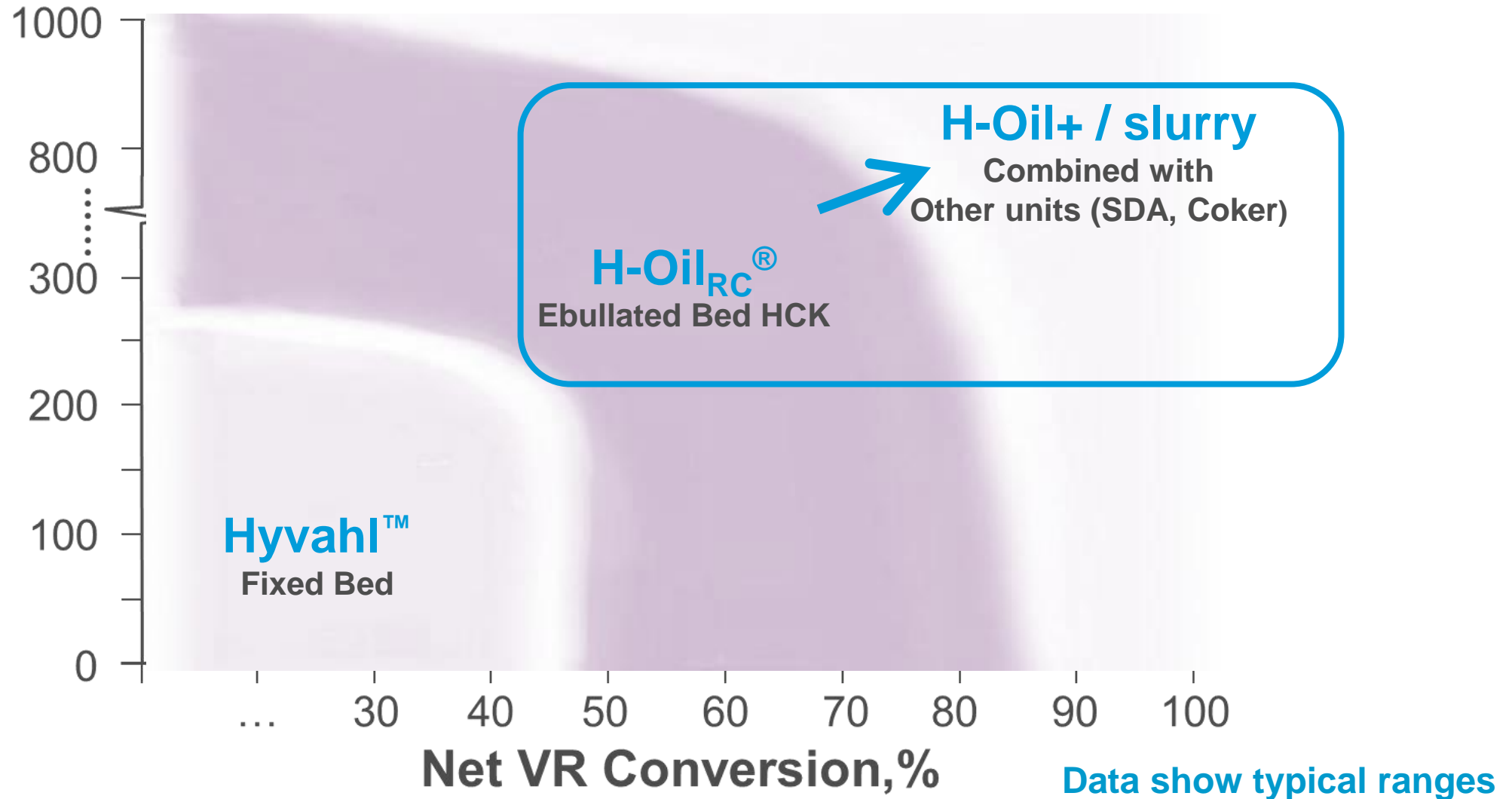
Schedule:

- Basic Design in 2006
- Under Detail Eng.

		Hyvahl™ Unit (81,000 BPSD)	
	Cycle length	11 months	
	Feedstock	Mixed Vacuum Residue + Slop Wax + HVGO + LVGO	
	Properties	Feed	Upgraded Residue
	CCR	17.3 wt%	<6 wt%
	Nitrogen	3420 wppm	<2000 wppm
	Ni+V	132 wppm	<20 wppm
	Sulfur	2.96 wt%	<0.4 wt%

Axens Residue Conversion Mapping

Ni + V in the Feed, wppm



Introduction of the comparison

- For vacuum residue upgrading, there are two types of process achieving high level of conversion:
 - ✓ Ebullating bed technology
 - ✓ Slurry type technology
- As licensor of both types of technologies (H-Oil with Ebullating Bed and HDHPLUS for slurry technology), Axens is in the **unique position** in the world to have the capability to perform and to compare both technologies from technical standpoint as well as on the whole picture of economics evaluation

Take away messages

Fixed Bed

- Pretreatment unit
- Dedicated to feed containing < 250 ppm metals

Slurry & EB

- Hydroconversion units
 - No feed limitation
 - Same reactions
- Products to be further hydrotreated

Slurry

- High conversion claimed
- Limitation in capacity per train
- UCO with very high metals content

H-Oil

- High reliability
- High conversion proven
- Liquid UCO with many valorization
- Developed after the slurry

Take away messages

Fixed Bed

- Pretreatment unit
- Dedicated to feed containing < 250 ppm metals

Slurry & EB

- Hydroconversion units
 - No feed limitation
 - Same reactions
- Products to be further hydrotreated

**Most
advanced
solution with
lot of
perspectives**

H-Oil

- High reliability
- High conversion proven
- Liquid UCO with many valorization
- Developed after the slurry