Innovative Challenges on TAIF-NK VCC Project

November 2022

Agenda

- VCC Project Outline
- Technology Innovation in Residue Conversion
- TAIF-NK VCC Flow Scheme and Operational Parameters
- TAIF’s great challenges for innovative solutions
- Improve Refinery Margins via VCC Integration
- Significant boost in TAIF-NK operation by VCC

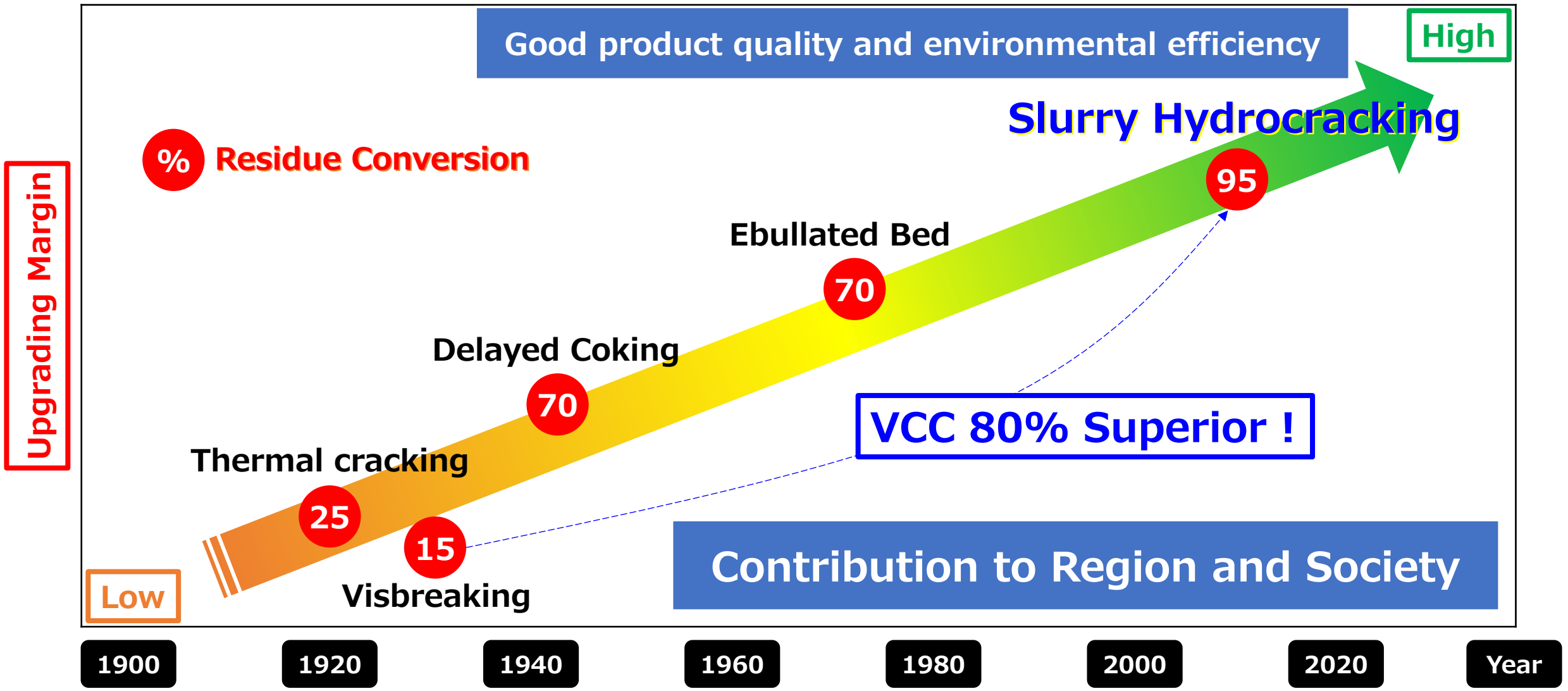
1. TAIF-NK VCC Project Outline

- Owner: TAIF-NK JSC
- Location: Nizhnekamsk, Tatarstan, Russia
- Plant: Heavy Residue Conversion Complex (HRCC)
- Capacity: 71,000 BPD (Refinery Residue Feed, VGO:VR=3:7)

Vacuum Gas Oil (VGO)	1.0 Million ton/annual (21,000 BPD)
Vacuum Residue (VR)	2.6 Million ton/annual (50,000 BPD)
Residue Total (VGO+VR)	3.6 Million ton/annual (71,000 BPD)

- Licensor: KBR USA **Veba Combi Cracker (VCC)**
  Slurry Phase Hydrocracking (unique technology)
- Engineering & Procurement:
  (Lump Sum E.P. + TSA)
- Schedule: March 2013 Detail engineering start
  End of 2019 Completion of Project

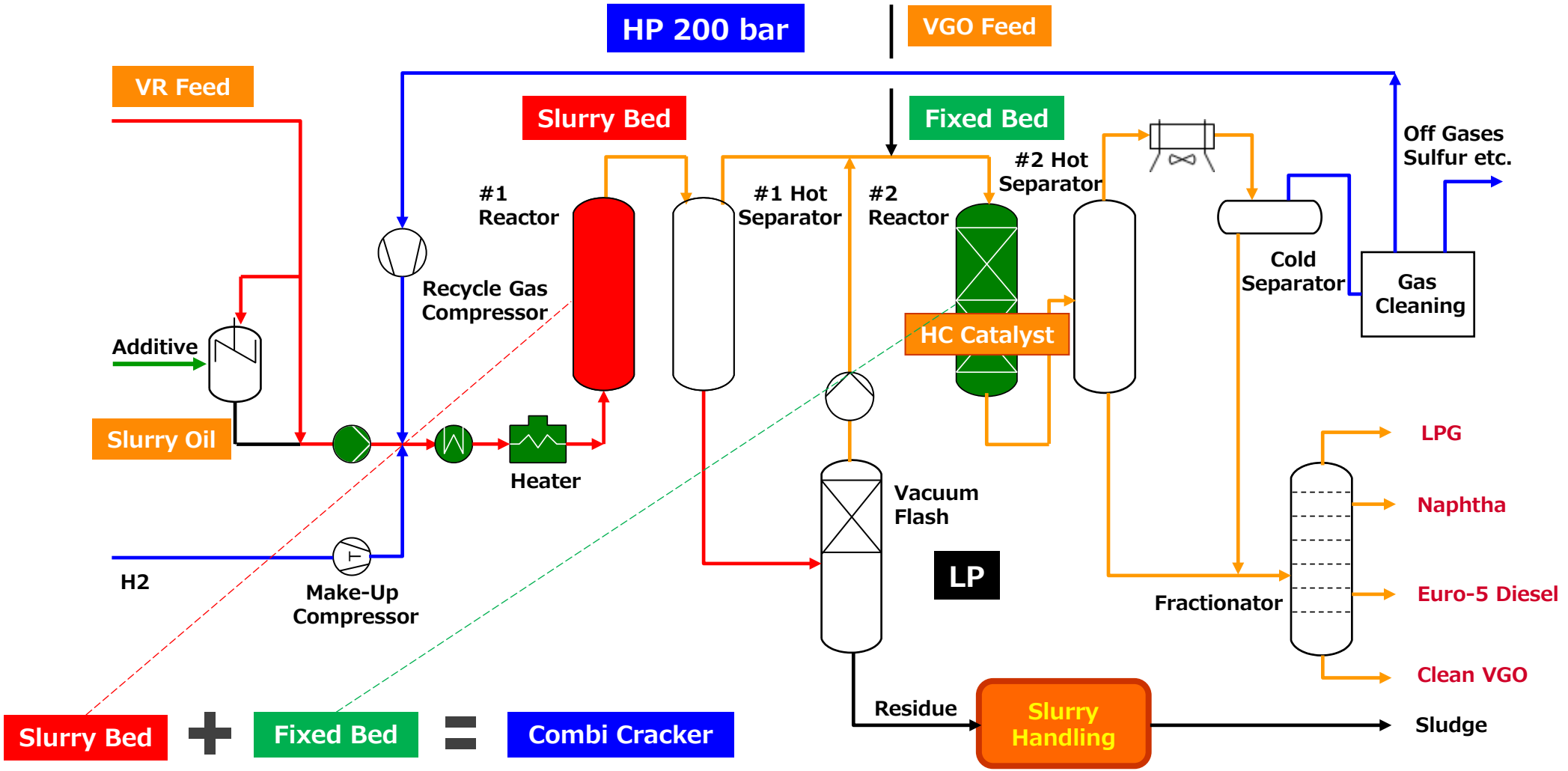
2.1 Technology Innovation in Residue Conversion



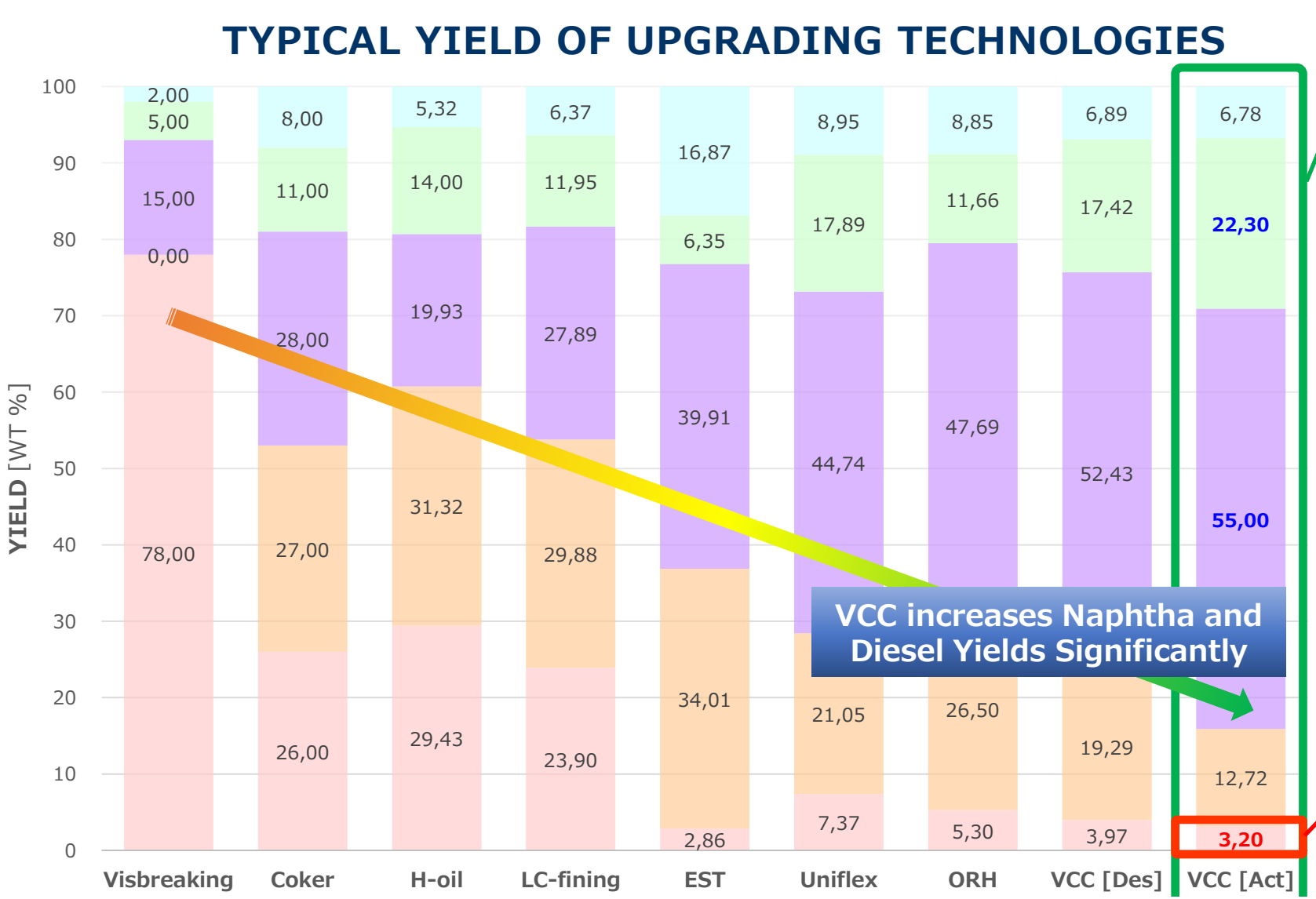
2.2 Commercial Hydrocracking Technologies

Reactor Type		**Fixed Bed**	**Moving Bed**	**Ebullated Bed**	**Slurry Bed**
Major Licenser (Process)		CLG, ExxonMobil, Axens, UOP, Shell	CLG (OCR)	Axens (H-Oil), CLG (LC-Fining)	**KBR (VCC)**, UOP (Uniflex), Eni
Pressure	(barG)	100 ~ 200	100 ~ 200	100 ~ 200	100 ~ 300
Temperature	(°C)	380 ~ 420	380 ~ 420	400 ~ 440	420 ~ 480
Max. Conversion to 550 °C	(wt. %)	50 ~ 70	60 ~ 70	70 ~ 80	80 ~ **95**
Tolerance for impurities		Low	Average	Average	High
Unit Operability		Easy	Medium	Medium	Difficult
Residue Stability (Asphaltenes)		Good	Good	Medium	Bad
Fouling		Medium	Medium	Difficult	Better
OpEx		Low	Medium	Medium	Medium
CapEx		Low	Medium	High	High
Max. Ni+V in feed	(wt. ppm)	50 ~ 250	500 ~ 700	100 ~ 600	> 300
Unit LHSV	(1/h)	0.1 ~ 0.5	0.1 ~ 0.5	0.2 ~ 1	0.2 ~ 1
Unit Cycle Length	(months)	6 ~ 48	Continuous	Continuous	Continuous

3. TAIF-NK VCC Flow Scheme



4. Key Products Yields of VCC Test Run



Operational Result of VCC Integration Test Run 2020
Residue conversion, 97wt.%
Total distillate yield, 90wt.%

Process	Licensor
Visbreaking	Many
Coker	Many
H-oil	Axens
LC-fining	CLG
EST	Eni
Uniflex	UOP
ORH	TIPS RAS
VCC	**KBR**

Minimum Residue by-product, But address Residue issues encountered in start-up

5. TAIF’s great challenges for innovative solutions

Challenge for innovative VCC plant

➡ Applying modern design tools and practices.

➡ Innovation in Equipment design and manufacturing.

➡ Lessons learned and Development of Testing procedures.

Address for issues encountered in start-up

➡ Obtain knowhow accumulated through operational data

➡ Workout innovative and unique solutions on prototype slurry service for safety and stable operation.

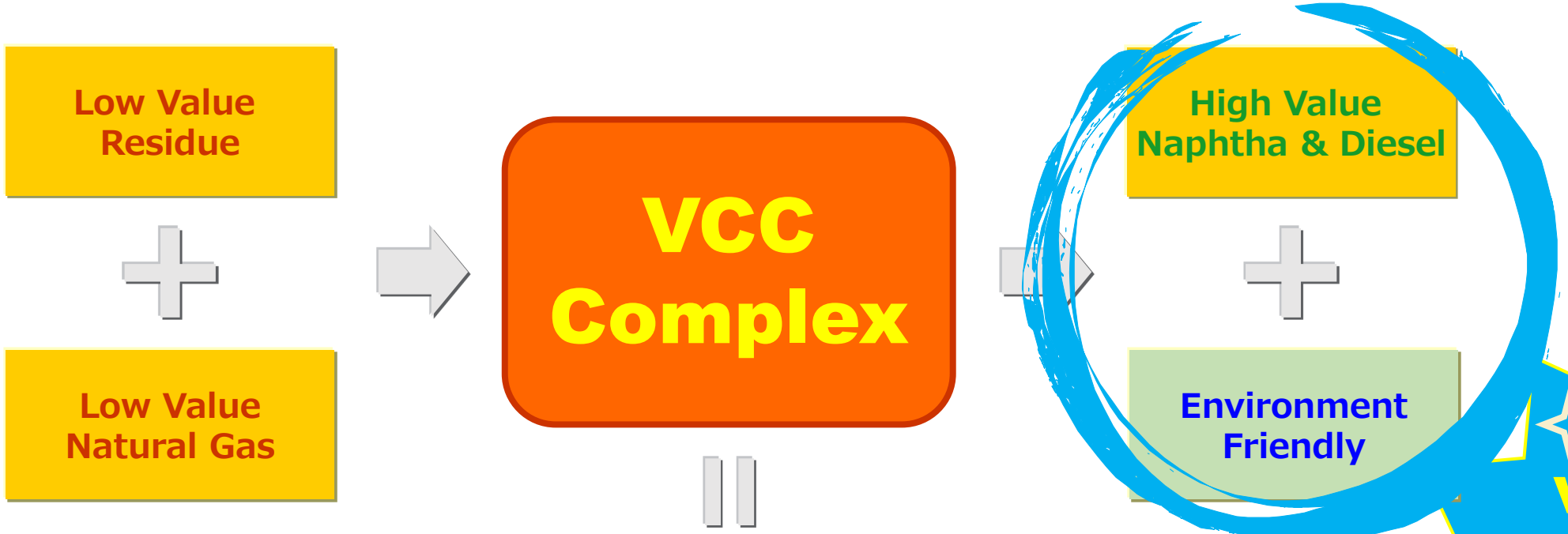
➡ Workout creative ideas/concepts to improve VCC technology.

➡ Carryout comprehensive analysis and calculations to realize and implement into design.

Reduction of potential risks in unique VCC technology

➡ Advanced metallurgy and continuous improvement in mechanical design result in reduction of potential risks for lager capacity of plant for reliable operation.

6. Improve Refinery Margins via VCC Integration



>95 wt% Conversion

96 wt% Products
No Fuel Oil
No coke

Finished Euro-5 Light Products

Good Fit to Russian Residue

FCC Gasoline Yield
48wt % to 57wt%

Good product quality

Vision for the Future New Economics for Russia

7. Significant boost in TAIF-NK operation by VCC