

Refinery Configurations for Maximizing Crude Oil to Chemicals Production

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Abstract

There is a growing consensus across the global energy and chemicals industry that in the coming years, crude oil refineries will be configured for significantly higher conversion of crude to chemicals than has been done in the past. This has been driven by the relatively slower growth rate in global demand for refinery fuels such as diesel, jet, and gasoline relative to petrochemicals. Refinery margins have been poor and are increasingly at the mercy of crude oil price fluctuations and geopolitics. Margins of integrated refinery-petrochemical complexes are expected to be higher and more predictable in the coming decades.

Several large projects have recently been commissioned or are in conceptual/feed engineering/construction stage that have configured the traditional crude oil refinery to increase chemicals production for eventual production of petrochemicals. These complexes plan to use a mix of medium and heavy crude oils and employ various combinations of bottoms upgrading process technologies to increase feedstock conversion to light olefins and naphtha range products. Naphtha thus produced are used to feed steam cracker and aromatics complexes for conversion to light olefins and BTX aromatics. Gasoline, jet, diesel, and fuel oil productions from such complexes are significantly reduced from that in traditional fuels producing refineries.

In the report, PEP provides a brief overview of refinery configurations for fuels production and discuss the major routes that are being used to reconfigure fuels refineries globally to make more chemicals. Global and regional trends using various types of refinery conversion units and overall refinery integration levels are presented.

The core of the report evaluates three mega refinery-petrochemical projects that are prime examples of refinery reconfiguration for chemicals production. The first is Reliance's Jamnagar India based COTC project that plans to more than double crude conversion to chemicals at the world's largest refinery. The project will convert the sites entire FCC capacity to Petro-FCC, and will add large naphtha catalytic cracking, steam cracking, and aromatics blocks to raise chemicals conversion to over 35% for the Jamnagar supersite.

The second project PEP evaluated is S-OIL Ulsan (S.Korea) RUC-ODC project that has recently built the world's first commercial high severity FCC (HS-FCC) unit coupled with heavy oil hydrodesulfurization and associated units to reduce high sulfur fuel oil production at the world's fifth largest crude refinery. The project has raised crude conversion to chemicals from 8% to 13% for the refinery.

The third project evaluated is Kuwait KNPC/KIPIC Al-Zour Refinery and Petrochemicals. The refinery is presently under construction while the PRIZe petrochemicals project is in FEED engineering stage. The original refinery was designed to be a purely fuels producing refinery. However,

the subsequent reconfiguration and PRIZe projects will allow the complex to convert 13.5% of its 615,000 BPD crude capacity into chemicals.

For each of these projects, PEP presents its understanding of the refinery configurations that have been built or are planned with detailed unit level block flow diagrams, description of each of the major process units and technology used, unit level and overall complex product yields, hydrogen and utility balances, ISBL and OSBL investment costs, production economics, and margin analysis.

Contents

| | | |
|----------|--|-----------|
| 1 | Introduction | 9 |
| | Terminology | 12 |
| 2 | Summary | 13 |
| | Reliance COTC | 14 |
| | S-OIL RUC-ODC project | 16 |
| | KIPIC Al Zour refinery and PRIZe project | 18 |
| | Sensitivity to crude price trends | 21 |
| 3 | Refinery configurations | 23 |
| | Configurations for fuels production | 23 |
| | Carbon rejection | 25 |
| | Hydrogen addition | 26 |
| | Configurations for chemicals production | 28 |
| | Integration with steam cracking | 29 |
| | Integration with aromatics complex | 31 |
| | Full integration | 34 |
| | Economic drivers for COTCs | 35 |
| | Global refining capacity and trends | 37 |
| | Global refinery integration levels in 2019 | 41 |
| | Crude to chemicals price margins | 44 |
| 4 | Reliance Jamnagar COTC project | 47 |
| | Existing refinery configuration | 49 |
| | Refinery complex | 49 |
| | Crude distillation (CDU) | 52 |
| | Saturated gas conditioning (SGCU) | 52 |
| | Vacuum distillation (VDU) | 53 |
| | Delayed coking (DCU) | 53 |
| | Gasoil hydrotreating (GOHT) | 54 |
| | Fluid catalytic cracking (FCCU) | 55 |
| | Refinery hydrogen | 56 |
| | Petcoke gasification complex | 57 |
| | Refinery off-gas cracker (ROGC) | 59 |
| | COTC project | 61 |
| | FCC revamp | 62 |
| | Naphtha catalytic cracker | 65 |
| | Mixed Feed Steam Cracker (MFSC) | 66 |
| | Aromatics block | 67 |
| | CCR reforming | 67 |
| | BTX extraction | 68 |
| | Paraxylene | 68 |
| | Diesel/LCO hydrocracker revamp | 68 |
| | Alkylation and butamer | 69 |
| | Complex ethylene and propylene balances | 69 |
| | COTC refinery hydrogen balance | 69 |
| | Utility consumptions | 70 |
| | COTC project economics | 71 |
| | ISBL and OSBL capex | 72 |
| | Production economics | 73 |
| | Existing refinery gross refining margin | 77 |
| | Sensitivity to crude price trends | 77 |

| | | |
|----------|--|------------|
| 5 | S-OIL Ulsan refinery and petrochemical complex | 79 |
| | S-Oil refinery prior to RUC/ODC project | 80 |
| | Crude distillation (CDU) | 81 |
| | Saturated gas plant (SGU) | 82 |
| | Vacuum distillation (VDU) | 83 |
| | Distillate hydrotreating | 83 |
| | Hydrocracking (HYC) process | 83 |
| | Residue hydro desulfurization (RHDS) | 84 |
| | Solvent deasphalting (SDA) | 84 |
| | Resid fluid catalytic cracker (RFCC) | 84 |
| | Lube base oil plant | 85 |
| | Aromatics No.1 | 85 |
| | Aromatics No.2 | 85 |
| | MTBE | 86 |
| | Alkylation | 86 |
| | Product blending | 86 |
| | Light naphtha | 86 |
| | Gasoline | 86 |
| | Kerosene/Jet fuel | 87 |
| | Diesel | 87 |
| | Fuel oil | 87 |
| | Light ends | 87 |
| | RUC/ODC project | 88 |
| | Heavy oil hydrodesulfurization (HDS) | 89 |
| | High Severity FCC (HS-FCC) | 91 |
| | Downstream processes | 93 |
| | HS-FCC C4s processing | 96 |
| | MTBE | 98 |
| | Super fractionation | 98 |
| | Polypropylene (PP) | 99 |
| | Propylene oxide (PO) | 99 |
| | Complex hydrogen balance (Post RUC-ODC) | 100 |
| | Sulfur block (Post RUC-ODC) | 100 |
| | Utility consumptions | 101 |
| | Phase 2 revamp | 101 |
| | RUC-ODC project economics | 102 |
| | ISBL and OSBL capex | 102 |
| | Production economics | 103 |
| | Sensitivity to LSFO-HSFO spread | 108 |
| 6 | KIPIC Al-Zour refinery and petrochemicals complex | 109 |
| | Al-Zour refinery project | 109 |
| | Crude distillation (CDU) | 110 |
| | Atmospheric residue desulfurization (ARDS) | 111 |
| | Diesel hydrotreating | 112 |
| | Kero hydrotreating | 112 |
| | Light naphtha hydrotreating | 112 |
| | Sat-gas plant | 112 |
| | Hydrogen production | 113 |
| | Sulfur block | 113 |
| | PRIZe petrochemical refinery integration project | 114 |
| | Resid fluid catalytic cracking | 114 |
| | Heavy naphtha hydrotreating | 115 |
| | Catalytic reforming | 115 |
| | Aromatics complex | 115 |

| | |
|--|------------|
| Mixed Feed Steam Cracker | 116 |
| Propylene via ethylene metathesis (OCT) | 116 |
| Polyethylene | 117 |
| Polypropylene | 117 |
| MTBE and alkylation | 117 |
| Utility consumptions | 118 |
| Al-Zour–PRIZe overall project economics | 119 |
| ISBL and OSBL capex | 120 |
| Production economics | 120 |

Tables

| | |
|---|----|
| Table 1.1 Grassroots COTC projects—recently completed and planned | 11 |
| Table 2.1 Reliance refinery product slate before and after COTC project | 15 |
| Table 2.2 S-OIL Ulsan refinery product slate before and after RUC/ODC project | 18 |
| Table 2.3 KIPIC Al Zour-PRIZe refinery product slate | 20 |
| Table 2.4 Project summary—Crude barrels upgradation approach | 22 |
| Table 2.5 Project economics summary | 22 |
| Table 3.1 Feed crude oil characteristics | 24 |
| Table 3.2 World's largest refineries with over 10% integration to chemicals | 42 |
| Table 4.1 Reliance Jamnagar refinery process units with capacity | 50 |
| Table 4.2 Reliance Jamnagar refinery product distribution | 50 |
| Table 4.3 Reliance J1J2 combined CDU feed and product characteristics | 52 |
| Table 4.4 Reliance J1J2 combined VDU feed and product characteristics | 53 |
| Table 4.5 Reliance J1J2 DCU feed and product characteristics | 54 |
| Table 4.6 Reliance J1J2 Gasoil hydrotreating unit(s) feed and product characteristics | 55 |
| Table 4.7 Reliance J1J2 FCCU(s) estimated feed and product distribution | 56 |
| Table 4.8 Reliance existing refinery hydrogen balance | 57 |
| Table 4.9 FCC revamp to PetroFCC—estimated feed and product distribution | 64 |
| Table 4.10 FCC unsat gas plant balance (with Coker gases) | 65 |
| Table 4.11 Naphtha catalytic cracker feeds and product yields | 66 |
| Table 4.12 Mixed Feed Steam Cracker (MFSC) feeds and product yields | 67 |
| Table 4.13 RIL COTC ethylene and propylene balance | 69 |
| Table 4.14 COTC refinery hydrogen balance | 70 |
| Table 4.15 Utilities consumption RIL COTC project | 71 |
| Table 4.16 ISBL capex estimation of individual units in COTC project (third quarter 2019 USGC) | 73 |
| Table 4.17 ISBL, OSBL, and total fixed capital estimated for the RIL COTC project | 74 |
| Table 4.18 Reliance COTC variable costs and production costs (India third quarter 2019) | 76 |
| Table 4.19 Reliance existing refinery gross refining margin estimation (India third quarter 2019) | 78 |
| Table 5.1 S-OIL Ulsan refinery major process units prior to RUC-ODC project | 80 |
| Table 5.2 S-Oil feed and product state (pre-RUC/ODC) | 81 |
| Table 5.3 Crude and condensate processing facilities | 81 |
| Table 5.4 CDU feed and product characteristics | 82 |
| Table 5.5 CFU feed and product characteristics | 82 |
| Table 5.6 VDU feed and product characteristics | 83 |
| Table 5.7 Gasoline blending | 87 |
| Table 5.8 Main units in RUC/ODC project | 88 |
| Table 5.9 Primary products from RUC/ODC project as announced by S-OIL | 89 |
| Table 5.10 S-OIL Ulsan refinery feed and product state (post-RUC-ODC project) | 89 |
| Table 5.11 RUC HDS feed and product distribution estimate | 90 |
| Table 5.12 Typical HS-FCC and conventional FCC operating conditions | 92 |
| Table 5.13 HS-FCC operating parameters and yields for various feed types | 93 |

| | |
|--|-----|
| Table 5.14 HS-FCC commercial design parameters | 94 |
| Table 5.15 HS-FCC feed and product distribution estimate | 95 |
| Table 5.16 HS-FCC C4s composition estimate and flows | 98 |
| Table 5.17 Complex H ₂ balance | 101 |
| Table 5.18 Utilities consumption S-OIL RUC-UDC project | 102 |
| Table 5.19 ISBL capex estimation of individual units in S-OIL RUC-ODC project (third quarter 2019 USGC) | 104 |
| Table 5.20 Total project fixed capital investment (USGC and S. Korea) | 105 |
| Table 5.21 S-OIL Ulsan refinery gross refining margin before RUC-ODC project implementation. | 106 |
| Table 5.22 S-OIL RUC-ODC variable costs and production economics (S. Korea third quarter 2019) | 107 |
| Table 6.1 Al-Zour refinery and PRIZe project major process units and capacity | 110 |
| Table 6.2 Al-Zour refinery CDU feed and product flows and properties (total) | 111 |
| Table 6.3 ARDS product yields | 111 |
| Table 6.4 Diesel hydrotreater yields | 112 |
| Table 6.5 Complex hydrogen balance | 113 |
| Table 6.6 PRIZe RFCC feed and product yields | 115 |
| Table 6.7 PRIZe heavy naphtha hydrotreating feed and product yields | 115 |
| Table 6.8 Mixed Feed Steam Cracker (MFSC) feed and product yields | 116 |
| Table 6.9 Complex C4 balance | 118 |
| Table 6.10 Utilities consumption Al Zour and PRIZe project | 119 |
| Table 6.11 ISBL capex estimation of individual units in Al Zour and PRIZe projects (third quarter 2019 USGC) | 122 |
| Table 6.12 Al Zour and PRIZe project fixed capital investment (USGC and Kuwait) | 123 |
| Table 6.13 Al Zour PRIZe variable costs and production economics (Kuwait third quarter 2019) | 124 |

Figures

| | |
|--|-----|
| Figure 3.1 Residue upgradation route selection depends on feed crude properties | 26 |
| Figure 3.2 Refinery-petrochemicals integration levels | 29 |
| Figure 3.3 World light naphtha production source and demand by end use | 31 |
| Figure 3.4 Integration of light naphtha steam cracker with refinery | 31 |
| Figure 3.5 Aromatics complex integration with refinery | 33 |
| Figure 3.6 World heavy naphtha production source and demand by end use | 33 |
| Figure 3.7 Full integration of refinery-steam cracker-aromatics complex | 35 |
| Figure 3.8 World fuels and primary petrochemicals demand growth projections | 36 |
| Figure 3.9 World fuels and primary petrochemicals annual demand | 36 |
| Figure 3.10 World and regional refining capacity (2018) | 37 |
| Figure 3.11 Global refinery distillation and conversion unit capacity trends (1990–2018) | 38 |
| Figure 3.12 Global refinery distillation and conversion unit capacity trends (1990–2018) | 39 |
| Figure 3.13 Asia-pacific distillation and conversion unit capacity trends (1990–2018) | 39 |
| Figure 3.14 North America distillation and conversion unit capacity trends (1990–2018) | 40 |
| Figure 3.15 Europe distillation and conversion unit capacity trends (1990–2018) | 40 |
| Figure 3.16 Middle East distillation and conversion unit capacity trends (1990–2018) | 41 |
| Figure 3.17 Global refinery integration levels and nature of integration | 43 |
| Figure 3.18 United States refinery integration levels and nature of integration | 44 |
| Figure 3.19 Price margins of primary chemicals over Arab Medium crude (SEA/APAC) | 45 |
| Figure 3.20 Relative volatility of price margins with Arab Medium crude (SEA/APAC) | 46 |
| Figure 4.2 Integration of petcoke gasification unit with refinery | 58 |
| Figure 4.3 Reliance Jamnagar petcoke gasification complex configuration | 59 |
| Figure 4.4 Block flow diagram of Jamnagar ROGC multi-feed gas cracker | 60 |
| Figure 4.5 Reliance Jamnagar Refinery off-gas cracker (ROGC) estimated yields | 61 |
| Figure 4.8 FCC propylene yield as a function of feed and reactor severity | 63 |
| Figure 4.9 Reliance Jamnagar complex gross refining margins | 77 |
| Figure 5.1 S-OIL Ulsan refinery layout | 79 |
| Figure 5.4 Axens S-Oil refinery configuration with new Hyvahl HDS and HS-FCC | 91 |
| Figure 5.5 Commercial HS-FCC reactor configuration | 94 |
| Figure 5.6 HS-FCC full range naphtha processing scheme | 96 |
| Figure 5.7 C4 and butylene yields in FCCs | 97 |
| Figure 5.8 S-OIL HS-FCC C4s processing configuration | 97 |
| Figure 5.9 Impact of LSFO-HSFO price spread on RUC-ODC project economics | 108 |

Appendix B Figures

| | |
|---|-----|
| Figure 4.1 Reliance existing refinery configuration (J1J2, Gasification, and ROGC) | 131 |
| Figure 4.6 Reliance revamped refinery configuration (J1J2, Gasification, ROGC, and COTC primary conversion units) | 132 |
| Figure 4.7 Reliance revamped refinery configuration (New Reformer and Aromatics block) | 133 |
| Figure 5.2 S-OIL Ulsan refinery configuration prior to RUC-ODC project | 134 |
| Figure 5.3 S-OIL Ulsan refinery configuration after RUC-ODC project | 135 |
| Figure 6.1 Al Zour-PRIZe refinery petrochemicals complex process configuration | 136 |

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