

Block 2: Refining, Transportation and Petrochemistry

Forum Title: F08 - Integration of the Refining and Petrochemical Industry

INTEGRATION OF REFINERY AND PETROCHEMICALS WITH “OVER THE FENCE” SUPPLY OF GAS UTILITY MOLECULES

Prasad K Panicker

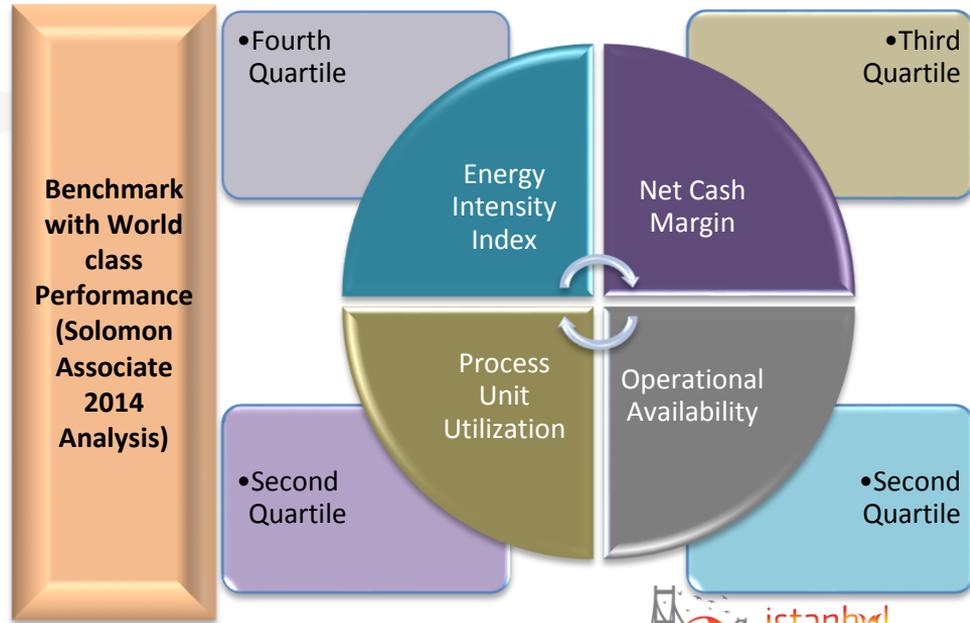
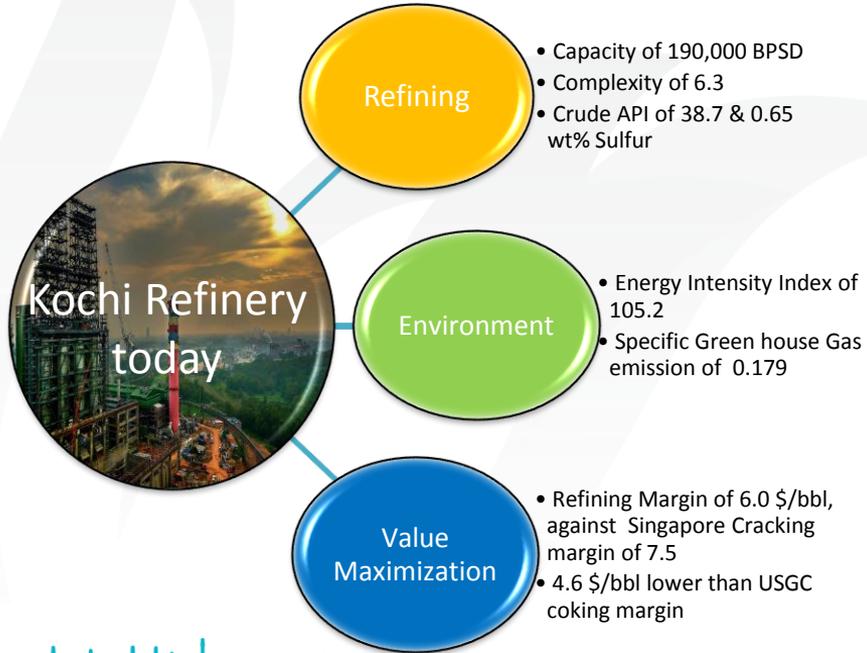
Executive Director

Bharat Petroleum Corporation Limited-Kochi Refinery, India

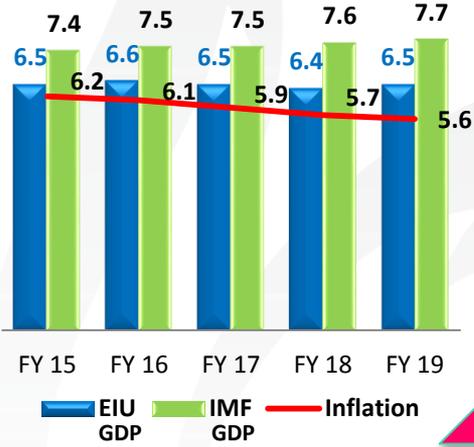
Chacko M Jose, Bharat Petroleum Corporation Limited, India



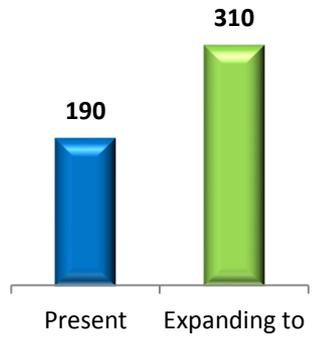
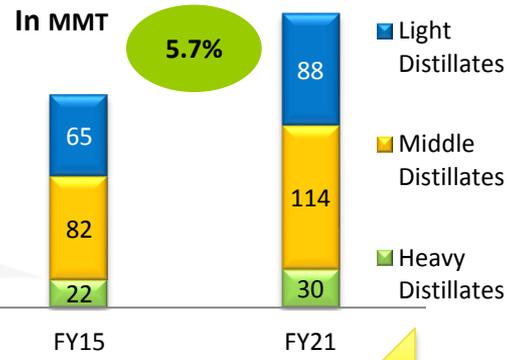
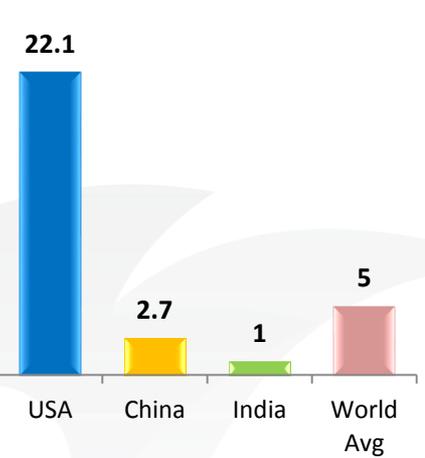
BHARAT PETROLEUM CORPORATION LIMITED - KOCHI REFINERY



THE NEED FOR AIMING HIGH..



Oil Consumption Per capita, bbls



Indian Economy shifting to a higher growth path

Indian Oil demand to grow more

Growth of Petroleum products

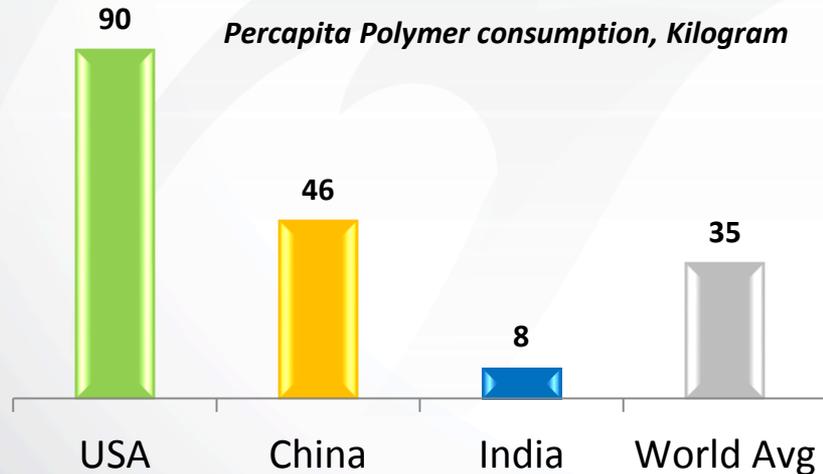
Market study suggested 120,000 BPSD capacity expansion

THE TRIGGERS..

Accelerated Global demand for fuels

Changes in Marine Fuel sulfur specifications

Growing market demand for Petrochemicals in India



- Indian Petrochemicals demand increased by 7 % CAGR over 2011-16 vis-à-vis GDP of 5.5%.
- Value of Net import of petrochemicals increased from 1.63 Billion USD in 2007-08 to 8.25 Billion USD in 2015-16 .

WHY KOCHI REFINERY..



Land availability



Close to international maritime route and port infrastructure



Single Point Mooring facility, which can support up to 15.5 MTPA



Excellent product evacuation facilities



Higher demand of products in Southern region of India



Natural Gas availability



FINDING A PERFECT CONFIGURATION..



Configuration Study

Secondary Processing Options

- Full Conversion Hydrocracker.
- Once-through Hydrocracker with High Conversion FCCU.
- Conventional FCCU with downstream treatments.

Residue Upgradation Options

- Slurry Hydrocracker.
- Delayed Coker.
- Flexi-coking.
- Solvent De-asphalting.

Final Selection

- **Delayed Coker Unit**, ranked second on margins, selected for residue up-gradation. Slurry Hydrocracker was not preferred,
 - high capital cost
 - expected difficulties in operation including disposal of pitch
- Diversification of value added petrochemicals gave edge to **Once-through Hydrocracker with High Conversion FCCU**.



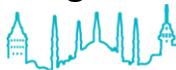
HIGHLIGHTS OF THE PROJECT..

- Capacity Expansion from 1,90,000 bbl/day to **3,10,000 bbl/day (15.5 MMTPA)**.
- Meeting Auto Fuel compliant to 100% BS-IV and part BS-VI grade.
- Flexibility to process crude oils with 30 – 38 API.
- Facility for bottom up gradation and diversification to Petrochemicals.
- Production of 0.5 MMT of propylene and 1.3 MMT of Petcoke.
- Hydrogen demand is 16.4 TPH & Syngas requirement for Petrochemical plant is 14 TPH.
- Capital cost of 3 billion USD for Refinery expansion, 700 million USD for Petrochemical plant & 400 million for Utility gas molecule complex.



Synthesis gas

$\text{CO} + \text{H}_2$
(syngas)



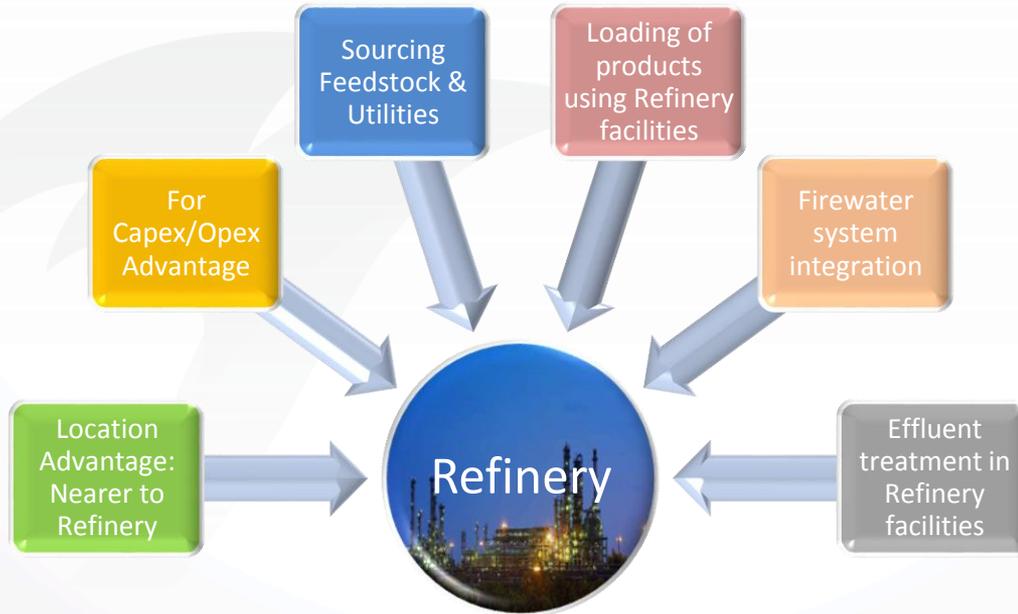
PROPYLENE DERIVATIVE PETROCHEMICAL PROJECT (PDPP)..

- Entry of BPCL into the field of Propylene based Petrochemicals.
- PDPP taken up as a BPCL Project, a '***Make in India***' initiative as envisaged niche petrochemicals are predominantly imported.
- Production of Niche Petrochemicals utilizing 250 TMT out of 500 TMT of Polymer grade Propylene available post IREP.
 - Acrylic Acid
 - Acrylates : Butyl Acrylate, 2 Ethyl Hexyl Acrylate
 - Oxo Alcohols : Normal Butanol, 2 Ethyl Hexanol, Iso Butanol
- Total project cost : 700 Million USD.



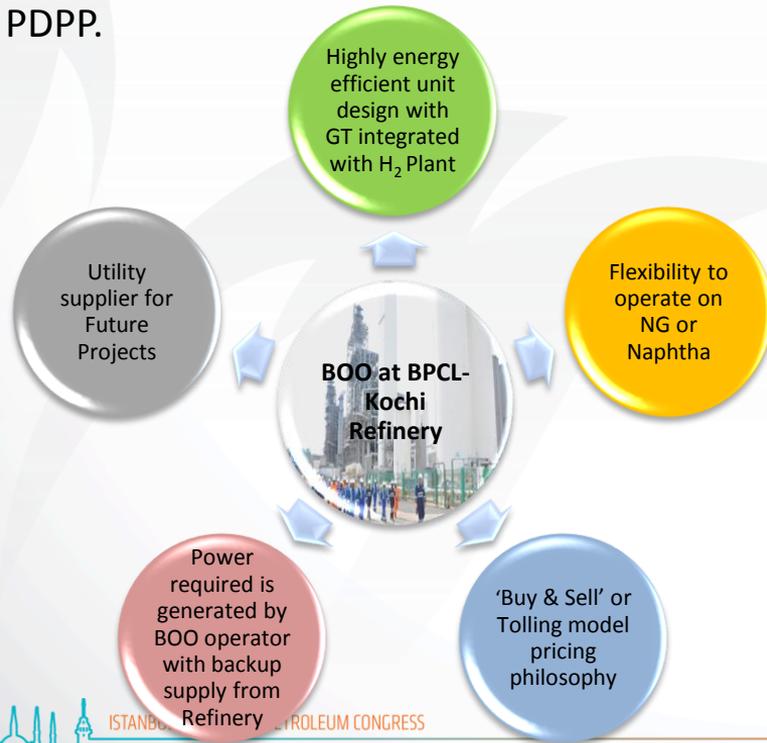
PDPP - INTEGRATION WITH REFINERY..

- Technology selection was done with the objective of maximizing the net present value from the entire life cycle of the unit.
- Syngas, Hydrogen and Nitrogen to be sourced from Build-Own Operate (BOO) facilities being installed as part of IREP.



'OVER THE FENCE' GAS UTILITY SUPPLY..

- The operational synergy between IREP & PDPP made sense to outsource Industrial Gases required for both.
- The selection of Build-Own Demand (BOO) would minimize the capital required for IREP & PDPP.

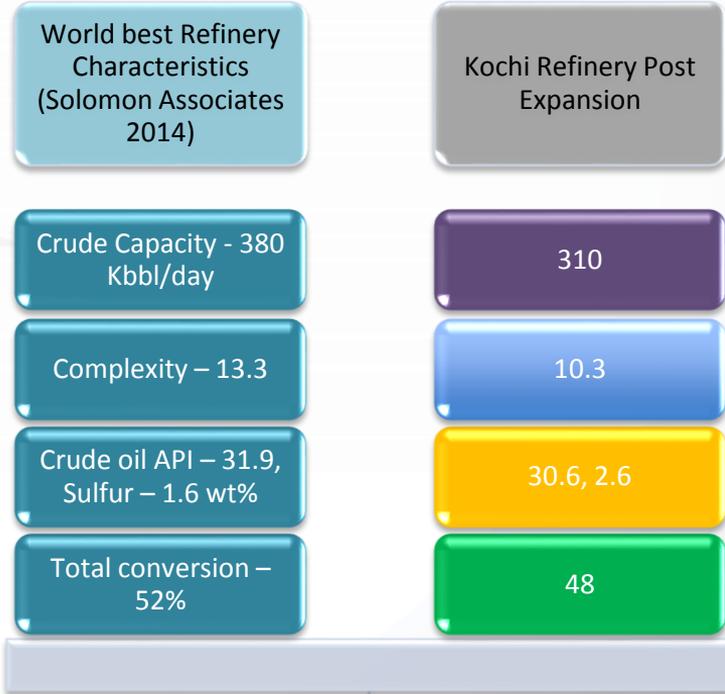
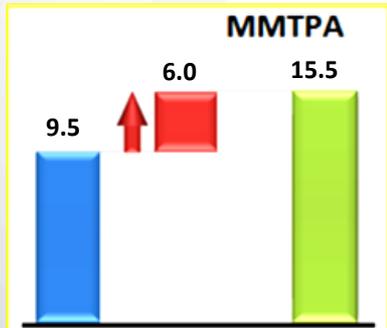
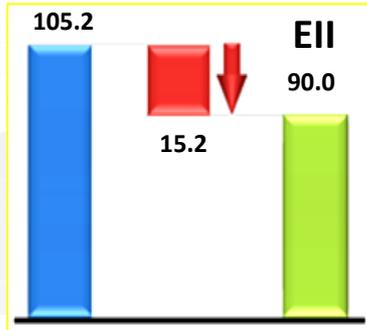


- **Pricing** of Hydrogen, Syngas & Steam depends on operating efficiency at varying capacities.
- Pricing model arrived was each product from BOO shall attract a Fixed monthly charge and Variable Charge based on actual consumption.
- The Variable Charge calculation was based on 12 windows of operation.



TRANSFORMATION TO A WORLD CLASS GREEN REFINERY..

- Routine expansion project in a growing economy has been turned into well thought out plan for efficiency improvement, value addition, risk reduction and transformation as a modern industrial complex with World Standards.



THANK YOU



ISTANBUL 22nd WORLD PETROLEUM CONGRESS

JULY 09-13, 2017



HIGHLIGHTS OF THE PROJECT – UNIT CAPACITIES & PRODUCT PATTERN..

Process Units	Present Capacity, MMTPA	Additional Capacity, MMTPA
CDU/VDU	5 + 4.5	10.5
DHDT	2.54	4.3
VGO HDT	1.7	3.0
FCCU	1.45	2.2
NHT/Isom (Revamp)		0.37
DCU		3.8
HGU	18,000 TPA	130,000 TPA
SRU	3 X 72 TPD	2 X 340 TPD

Product	Pre-expansion, TMT/Anm	Post expansion, TMT/Anm
Propylene	50	540
Gasoline	480	1109
LPG	1115	2209
SKO	360	240
HSD	4384	8112
ATF	400	600
Naphtha	392	451
Bitumen	250	250
FO/ LSHS	1400	0
Sulphur	33	303
Petcoke	0	1337



HIGHLIGHTS OF THE PROJECT – PROJECT ENORMITY..



Item Description

Quantity

Piling

21,000 Numbers

Structural Erection

60,000 MT

Above ground Piping Work

7,300,000 Inch Meter

Equipment erection

2062 Numbers / 41,000 MT

(250+ Over Dimensional Consignments)

Electrical/Instrument cable laying

7,000 Km



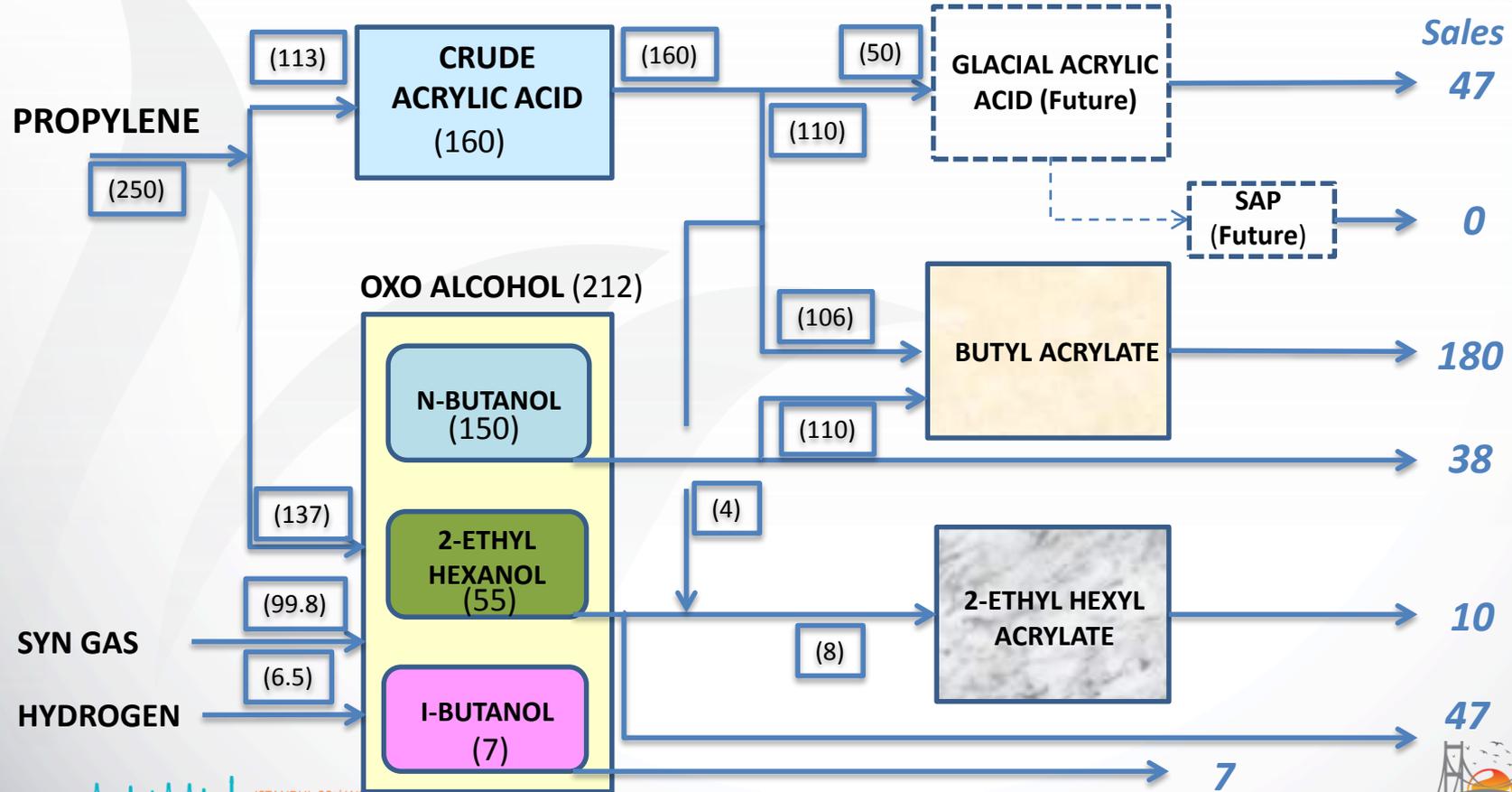
ENERGY EFFICIENCY DRIVERS & ENVIRONMENT FRIENDLY CONCEPTS..

- **Hot Water Belt(HWB)** system at Petro-FCCU.
 - Total heat recovered will be **84.3 MMKCal/hr.**
- **Power Recovery Expander (PRE)** at Petro-FCCU
 - PRE receives flue gas from Regenerator and produce **11 MW of power.**
 - Considering this, PFCCU is a net-exporter of power.
- **Electrostatic Precipitator** at Petro-FCCU.
 - Ensures Suspended Particulate Matter in the flue gas is less than **50 mg/NM³**
- Back Pressure Turbines with VHP steam.
- Sulfur Recovery Units with Tail Gas Treaters ensure **99.9% sulfur removal** and emissions well below the norms of 1518 Kg/hr.
- Coke handling system in DCU.
- Reverse Osmosis based De-mineralized water plant.

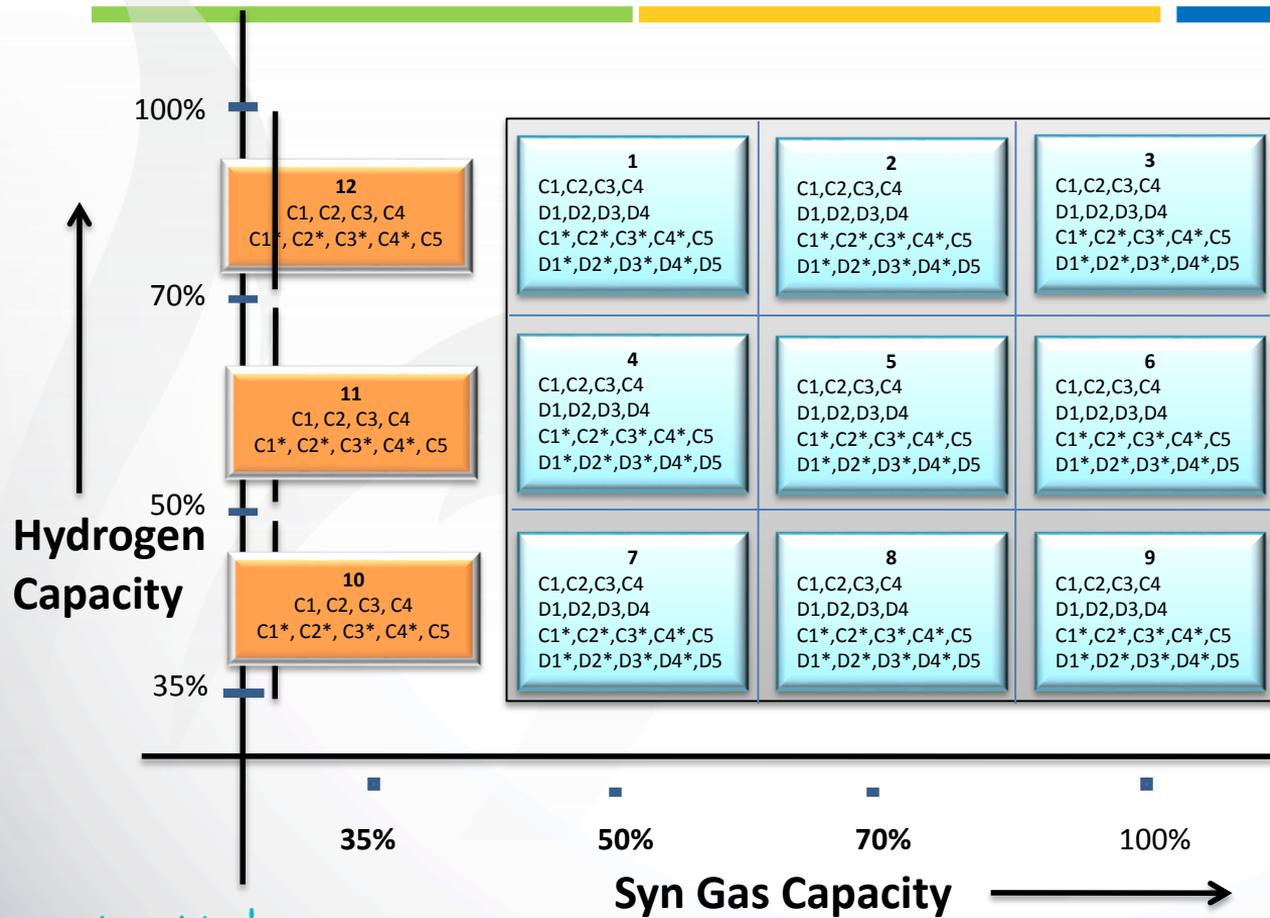


PDPP - PROCESS FLOW..

All figures in '000 TPA



'OVER THE FENCE' GAS UTILITY SUPPLY - PRICING..



➤ Variable charges / Ton of Hydrogen with Natural Gas as Feed/fuel.

Scenario – 1 :With Power from CPP of BOO Operator

$$C1*NG1+C2*DM1+C3*RW1-(C4*ST1)$$

Scenario – 2: With Power from BPCL/Other sources

$$C1**NG1+C2**DM1+C3**RW1-(C4**ST1) +C5*P1$$

➤ For Syngas, all "D" factors quoted by the BOO Operator as per the table will be used for the above two scenarios.



TRANSFORMATION OF SOCIETY ALONG WITH REFINERY GROWTH..

Employment Opportunities

- Workmen from length & breadth of the nation have received employment opportunities.

Gain for Cochin Port

- Increased traffic and revenue for Cochin Port.

Further foray into Niche/Specialty Petrochemicals

- Potential for major Petrochemical plants in the area & resultant employment generation.

Petrochemical Park

- For medium and small scale industries.

Community Development

- Portion of Project expenditure is earmarked for developing nearby community.

