



# Engineers India Limited



## Coal to Chemical for Import Substitution

**Vineet Bakshi**

**Presented at Gasification India 2022**

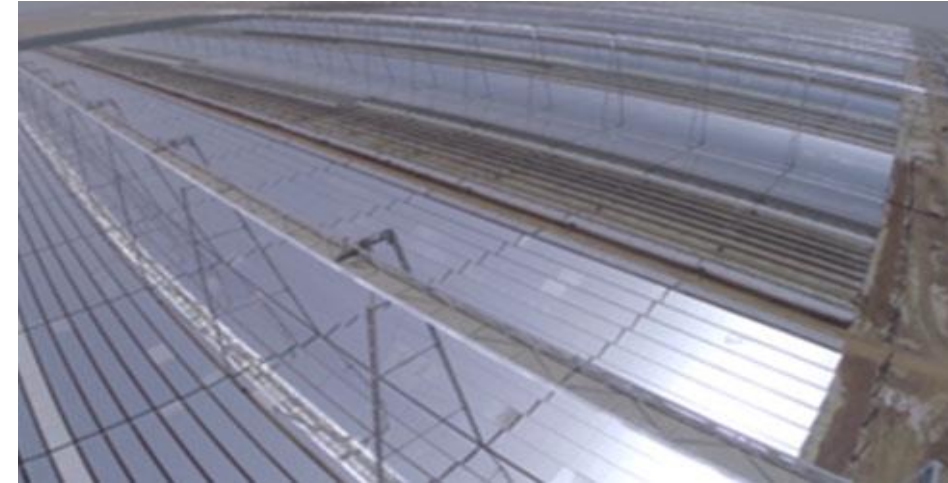


*Delivering Excellence Through People*

# Agenda

- **Coal to Chemical for Import Substitution**

- **EIL Brief & Experience in Gasification**





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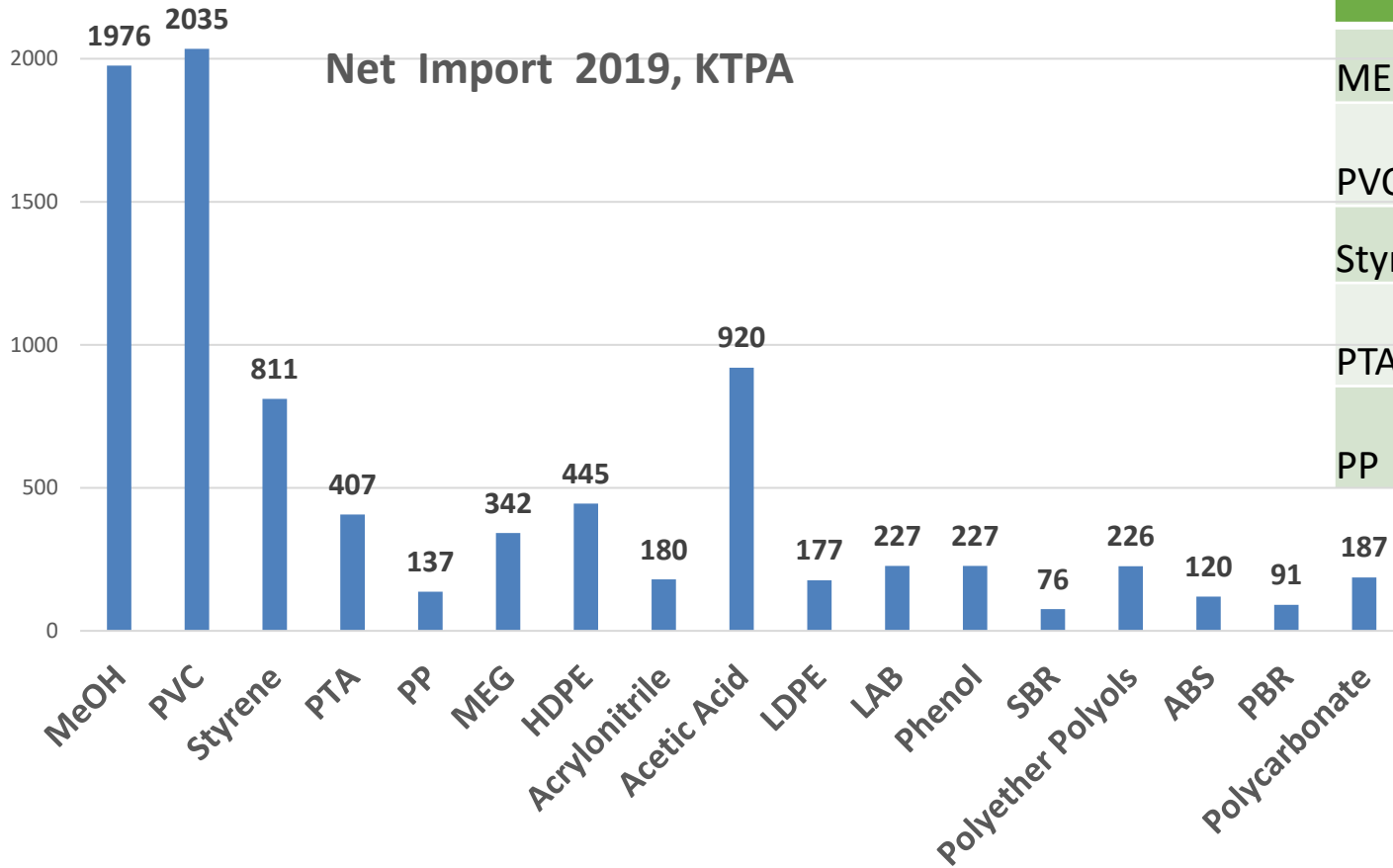
## Coal to Chemical for Petrochemical Import Substitution

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# Petchem Deficit: An Opportunity for Gasification

**Syngas from Coal Gasification could Cut down this Petchem Deficit**

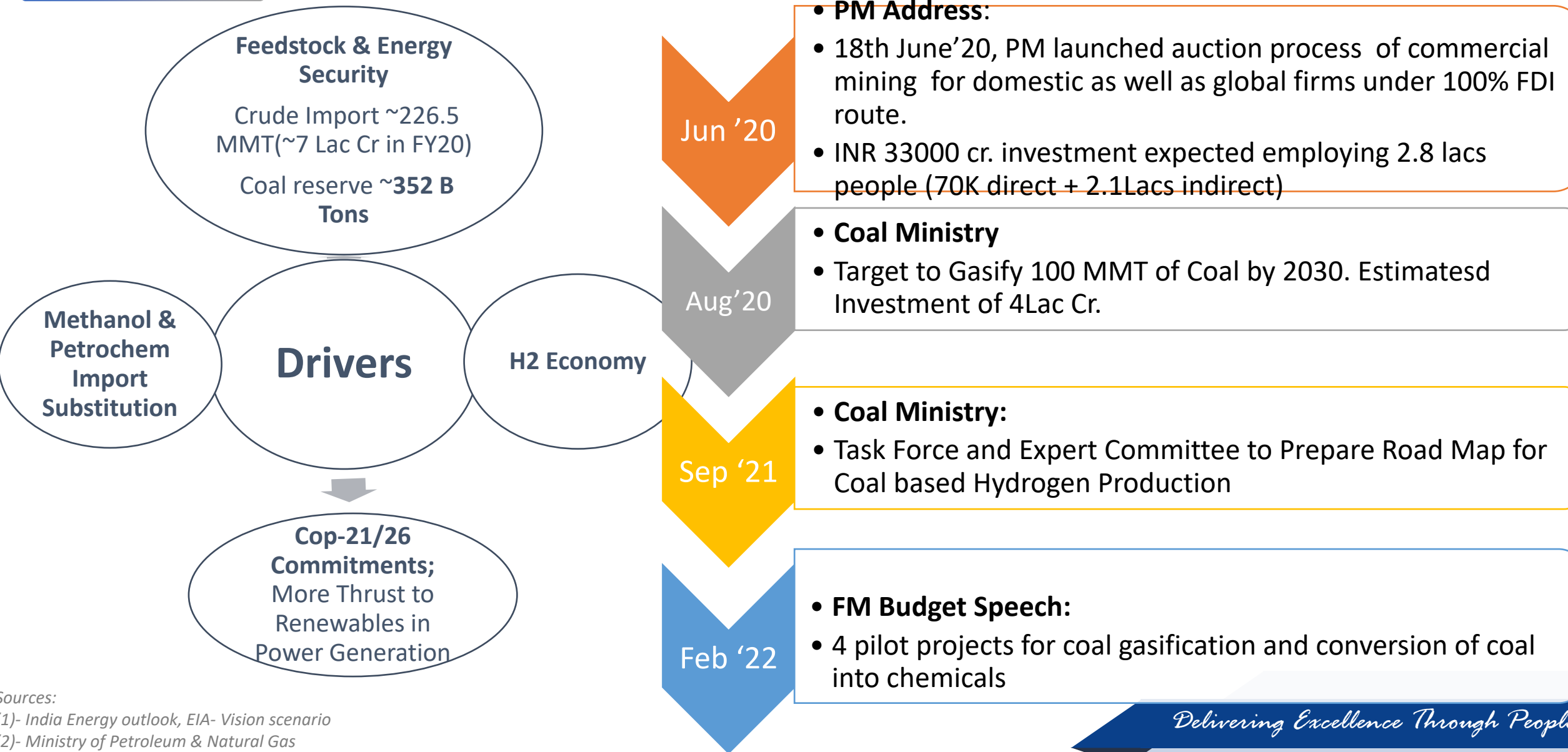


Petchem	US \$ Million	Petchem	US \$ Million	Petchem	US \$ Million
MEOH	737	MEG	280	Acrylonitrile	344
PVC	1932	HDPE	725	Polyether Polyols	439
Styrene	1053	LDPE	254	Phenol	294
PTA	348	LAB	299	SBR/PBR	162/176
PP	343	ACETIC ACID	588	Polycarbonate	176

#chemicals & petrochemicals  
(excluding pharma & fertilizers)

Source: DOC&P-GOI/ EIL Analysis

# Drivers & Gov Policy Push & Announcements



Sources:  
 (1)- India Energy outlook, EIA- Vision scenario  
 (2)- Ministry of Petroleum & Natural Gas  
 (3)- Press Information Bureau- Ministry of Coal

# Options to Monetize Coal & Exploit the Chemical Value

## Option-1 : Gasification product sale: Fuel & Fertiliser

Hydrogen

Methanol

Urea

SNG/ C1 Rich  
gas to Grid

Gas for DRI



## Option- 2: Fuel, Fertilizer & Petrochemicals : High Value-add

Set up Integrated MTO

Target Polymers/ Derivative Petchem



## Option-3: Coal to PVC via Pyrolysis Route

Non Gasification Route

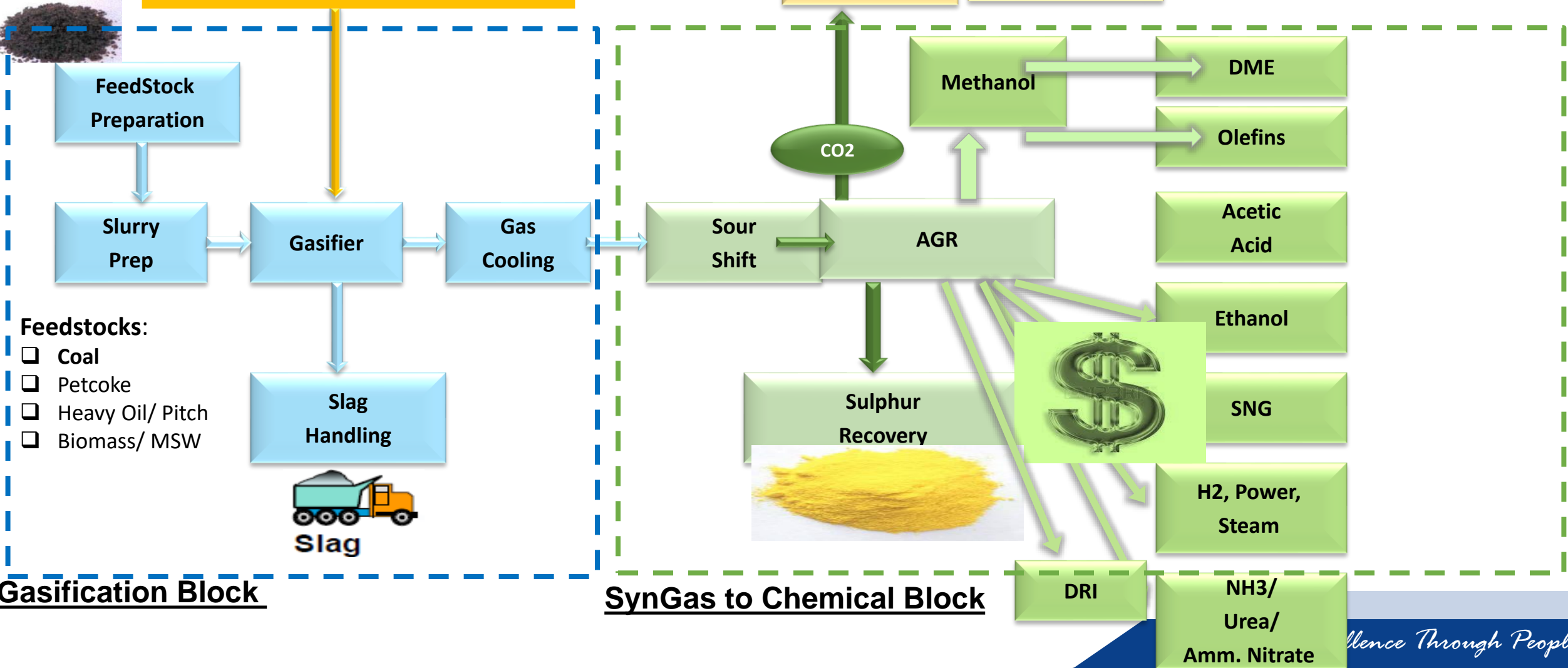
Target Polymers/ Derivative Petchem

Typical property of Indian coal considered for Case Study :

- ✓ Ash: 2-7% for Lignite & 5 to 50% for Coal 35-45%
- ✓ GCV: 3300 kcal/kg
- ✓ Sulphur: 0.5%
- ✓ Ash Fusion Temp (AFT): 1200- 1400Cdeg C

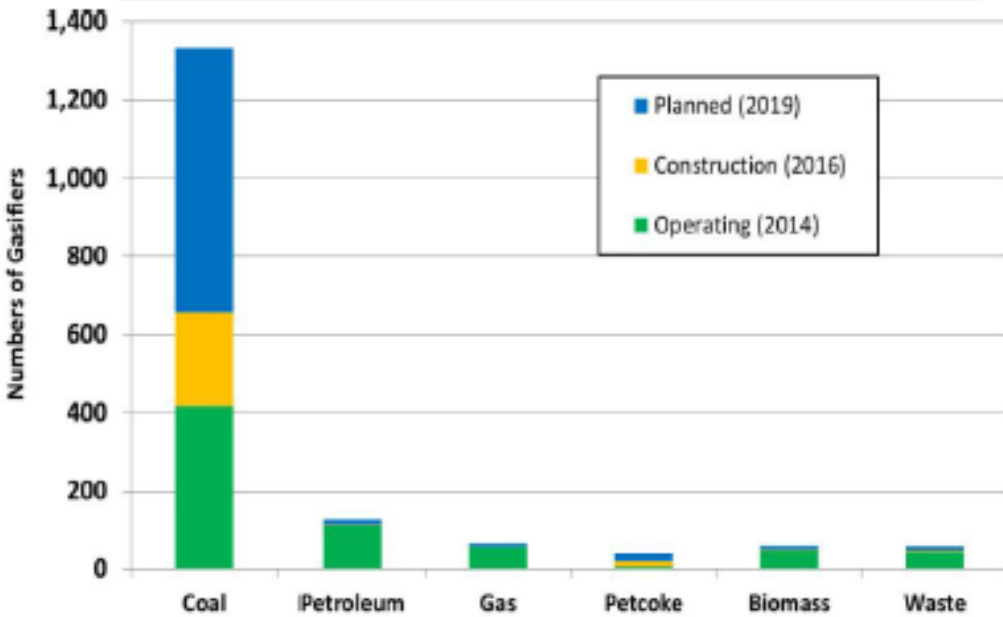
# Coal to Chemicals via Gasification: Typical Configurations

**Integrated Utility & Offsite(U&O)  
Including ASU (BOO)**

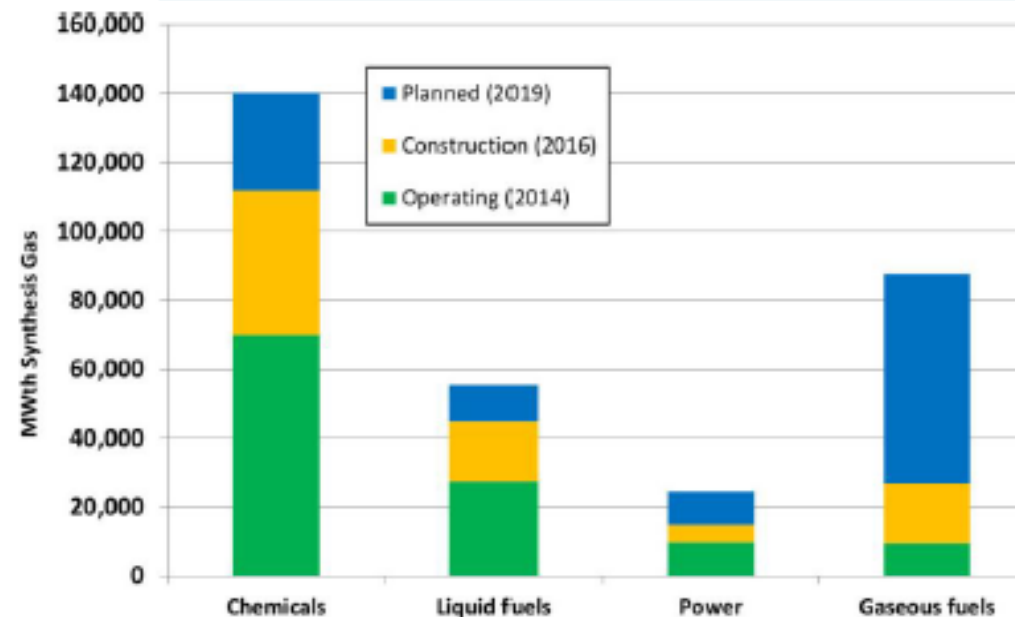


# Proven Technology: Global Feedstock & Application

**Number of Gasifiers By Primary Feedstocks**

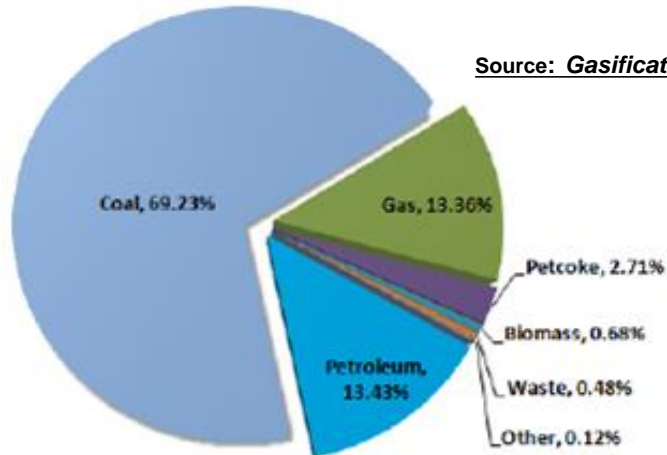


**Gasification By Application**



Source: *Gasification Technology Council*

Source: GTC Database and Higman Consulting GmbH

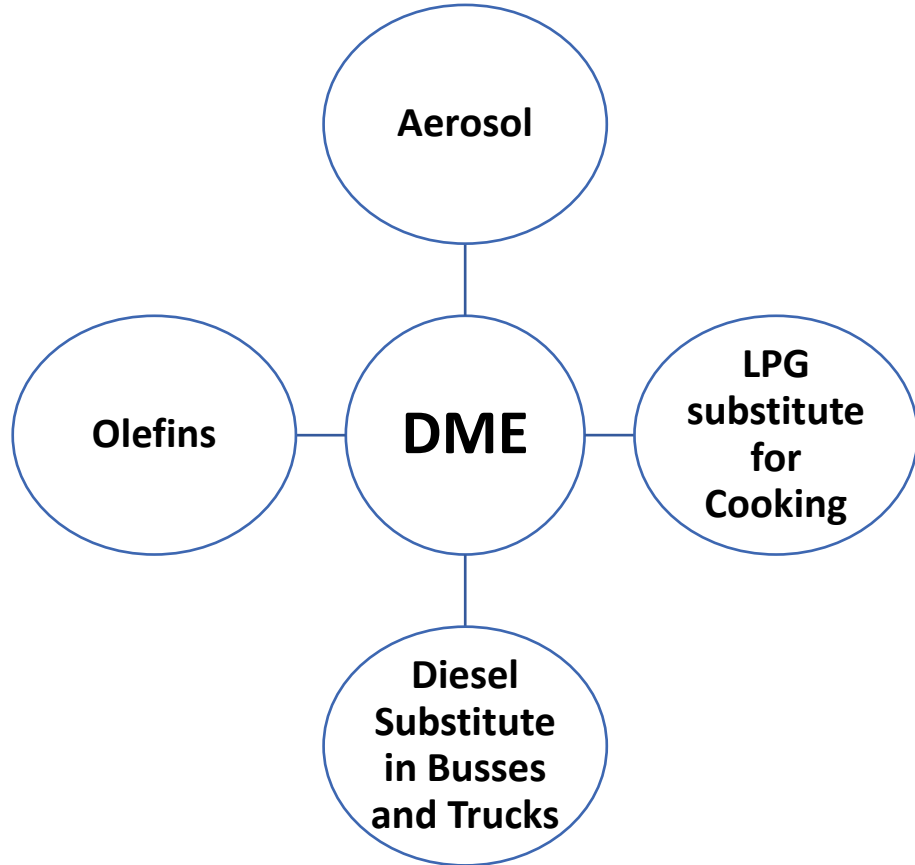


- 618 operating gasifiers & will increase to 1740 by 2021
- ~ 35% of Methanol & ~ 25% of Ammonia produced through coal gasification route



# Di-methyl Ether(DME) Scenario

Methanol → DME; most logical route



1.6 Kg of DME is equivalent to 1 Kg of LPG

1.25 m3 of DME is equivalent to 1 m3 of LPG

0.8 m3 of DME is equivalent to 1.0 m3 of Diesel

DME is not commercially produced in India, however there is strong advocacy for the usage

Anticipated potential based on 20% Diesel and LPG blending only DME expected demand is 51MMT by 2030 (Source: Wood Mackenzie/Deloitte)

- ❑ DME or Methoxy methane, is a colourless and odourless gas. Can be liquified at 5bar only
- ❑ China uses DME for cooking and as Fuel
- ❑ DME is a clean fuel of high cetane number, excellent combustion characteristics and extremely low toxicity.
- ❑ CSIR-NCL has developed nation's first kind of DME pilot plant with 20-24Kg/day capacity.
- ❑ CSIR- NCL has fully designed and fabricated a new burner for DME, DME -LPG blended mixtures and LPG combustion.
- ❑ Strong advocacy on exploring the options of setting up a RSEZ for Methanol and DME in Iran or Qatar or Mozambique

# Coal to H2 Scenario

## Centre constitutes task force and expert committee on coal-based hydrogen production

ETGovernment • September 08, 2021, 12:07 IST

### Coal Ministry on Sep'21

- ❑ Ministry of Coal Constitutes Task Force and Expert Committee to Prepare Road Map for **Coal based Hydrogen Production**
- ❑ Production of hydrogen from coal will have challenges in terms of high emissions and CCUS will play an important role.

- ❑ India H2 demand for 2021 was ~6.8 MMT and it will be 12 MMT by 2030 and 28MMT by 2050(#1)
- ❑ 40% (~ 5 MMT) of H2 by 2030 will be green H2, and by 2050, nearly 80 per cent of India's hydrogen is projected to be 'green'(#1)
- ❑ In India, 80% of H2 consumption centers include Ammonia production in the fertilizer industry and desulfurization of fuel in refineries, primarily using natural gas through steam methane reforming. India's refining sector consumes ~ 2 MMT of grey H2 annually(#2).
- ❑ The other major source of H2 demand in India is from direct reduction of iron (DRI) in steel production. DRI route accounts for 35% of India's steel production and 85% of DRI route utilizes syngas from coal gasification
- ❑ Massive potential exists to make Brown Hydrogen through Coal gasification route competitively.
- ❑ Given the right price of coal, the Cost of Hydrogen produced from coal can be cheaper and less sensitive to imports when compared with hydrogen production through electrolysis and Natural Gas respectively

#1 as per National Hydrogen Mission document./ Argus

#2 as per IOCL

# Coal to SNG

India Imported 25.4MMT of LNG amounting to ~ **9.5Bn USD** in 2020-21

SNG, ~ 96% Methane, and is viable alternative to Imported LNG if produced competitively, and fillip honorable PM's Ujjawala Yojna

~ **5 MMT of SNG** generation can lead to saving of **15000 Cr INR (2.05Bn USD)** of **Import Bill(#1)**

SNG produced can simply be hooked up to nearby NG pipeline

CCUS needs to be addressed suitably in order to ensure SNG produced is sustainable

(#1) Considering LNG Price of 10USD/MMBTU, in house data



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## EIL's Brief & Experience in Gasification

# The Company

- **EIL's Vision is to be a Global Leader offering Total Energy Solutions for a Sustainable Future.**
- Over 7000 assignments and Project worth over \$ 200 Bn executed
- Significant track record across entire oil & gas value chain with experience of landmark projects
- **International presence** : *Middle East, Africa, South Asia & Central Asia*
- Around 2,800 employees
- **Focused diversification:** *Infrastructure, Strategic crude oil storage, Fertilizer, Gasification, Ports, LNG, Non-ferrous Metallurgy, Water & Waste Water Management*
- EIL's has been instrumental in optimizing the Project Cost by Indigenization. Today **Refinery Sector** in India achieved **95% Indigenization** and **Petrochemical Sector** has achieved **60-65% Indigenization**
- EIL is also present in Russia as part **Bharat Energy Office** at Moscow

## Marquee Projects

Dangote Refinery  
&  
Petrochemical



GGSR Refinery  
& Cracker



HRRL Integrated  
Refinery Complex



Indian Strategic  
Petroleum Reserve Ltd



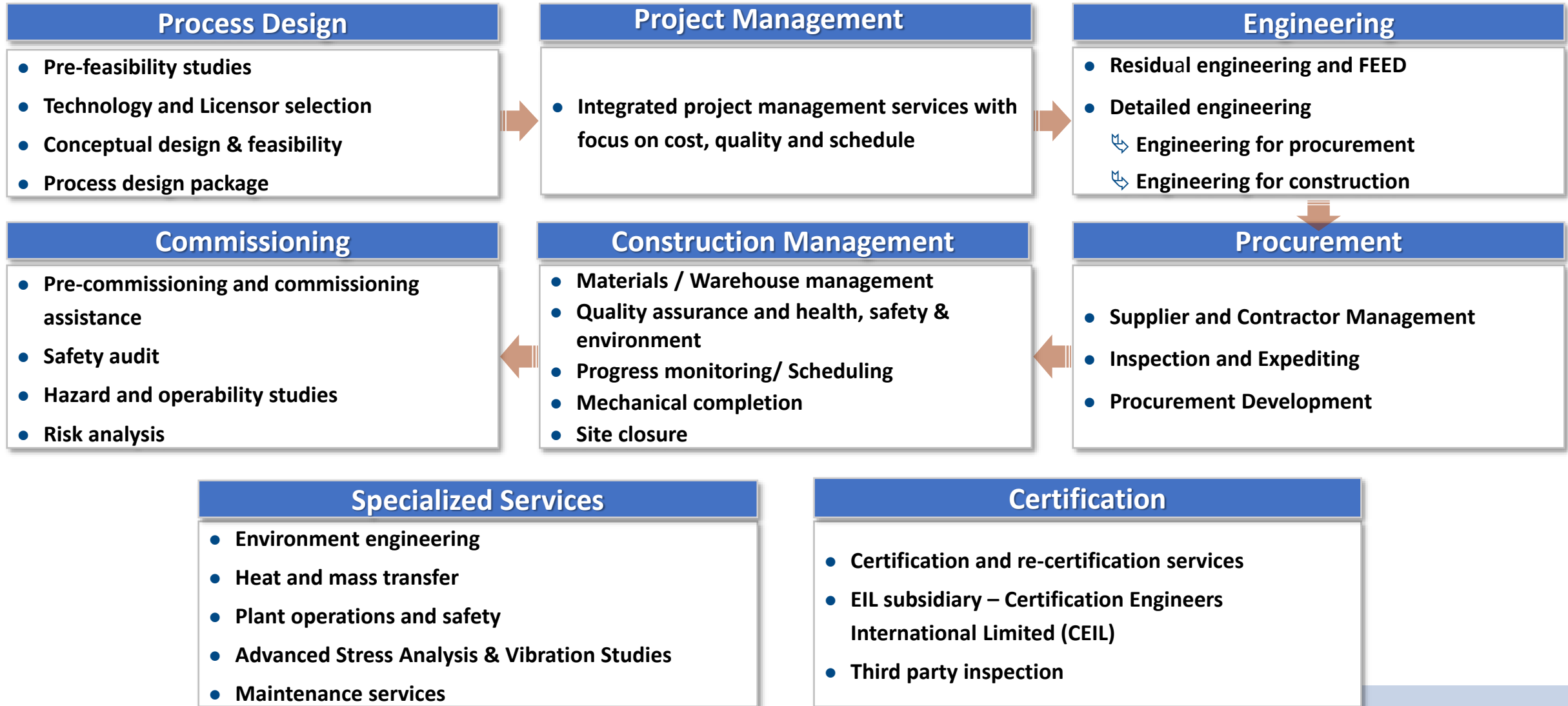


# Diversified Lines of Business



**Diversified Portfolio: Involved in Nation Building since Inception**

# Service Offering - From Concept to Commissioning



# SPECIALIST SERVICES

## Specialist Materials & Maintenance Services

- Residual Life Analysis
- Refractory & Non Metallic
- Maintenance & Inspection
- Materials & Corrosion
- Cathodic Protection

## Environmental Water and Safety Services

- Entire range of Environment Pollution Assessment, Control and Management related services under one roof
- Water/ Wastewater projects in Industries & Municipalities
- EIA/EMP, Specialized Environmental & Safety Studies

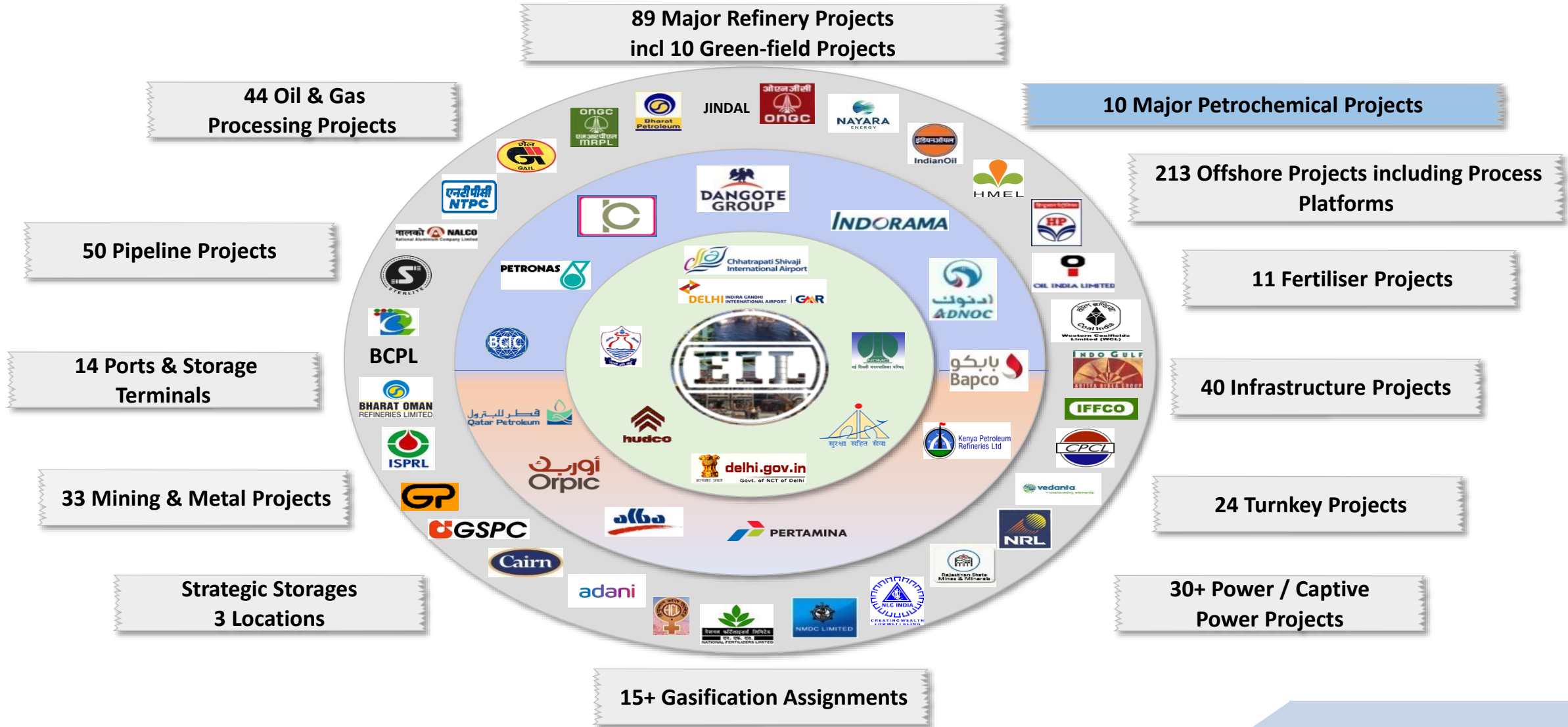
## Specialized Safety Services

- HAZOP/HAZAN/SIL/LOPA/SIMPOS/RRA/QRA/VDAS
- Fire & Gas Mapping Studies, Root Cause Analysis
- Safety Audits , Pre-commissioning safety audits(PCSA), Pre-start up safety review(PSSR)

## Energy Efficiency & Emission Reduction

- Energy Efficiency Improvement study of 15 Indian PSU refineries done by EIL has led to savings of ~20,08,00,000 Gcal/ annum.
- Baseline Energy Audit for 8 petrochemical plants. All these audits lead to fuel savings and eventually Co2 & GHG reduction

# Strong Track Record With Diverse Client Base



# EIL's Strategic Approach.....Future Ready

## Sustainable Green Energy, Decarbonization & Renewable

### Sunshine Areas



#### GREEN H2/ AMMONIA

Futuristic & Zero emission fuel and will decarbonise Industry

Integrate GH2 in Refinery, Fertilizer, CGD, Steel

Leverage experience of more than 25 H2 and Ammonia Units

Already engaged in several green H2 assignments



#### BIO FUELS

Key for Fossil Fuel Import Reduction

20% Ethanol in MS by 2025  
5% Bio-Diesel in Diesel by 2030

Agreement with Chempolis (2G), CSIR and DBT-ICT

*EIL is Implementing first of its kind Bio-Refinery project – ABRPL*



#### TOWARDS NET – ZERO

CCUS: CO2 from FG

Waste Plastic to Fuel

Technology Assimilation & Absorption

*Onboarded for R&D with Norwegian Geological Institute (NGI) for subsurface CO2 storage*



#### COAL TO CHEMICALS

GoI Mission to gassify 100 MMT of Coal

Several Feasibilities & Project implementation job underway

EIL's own Pilot plant for Coal gasification & Syngas Cleaning

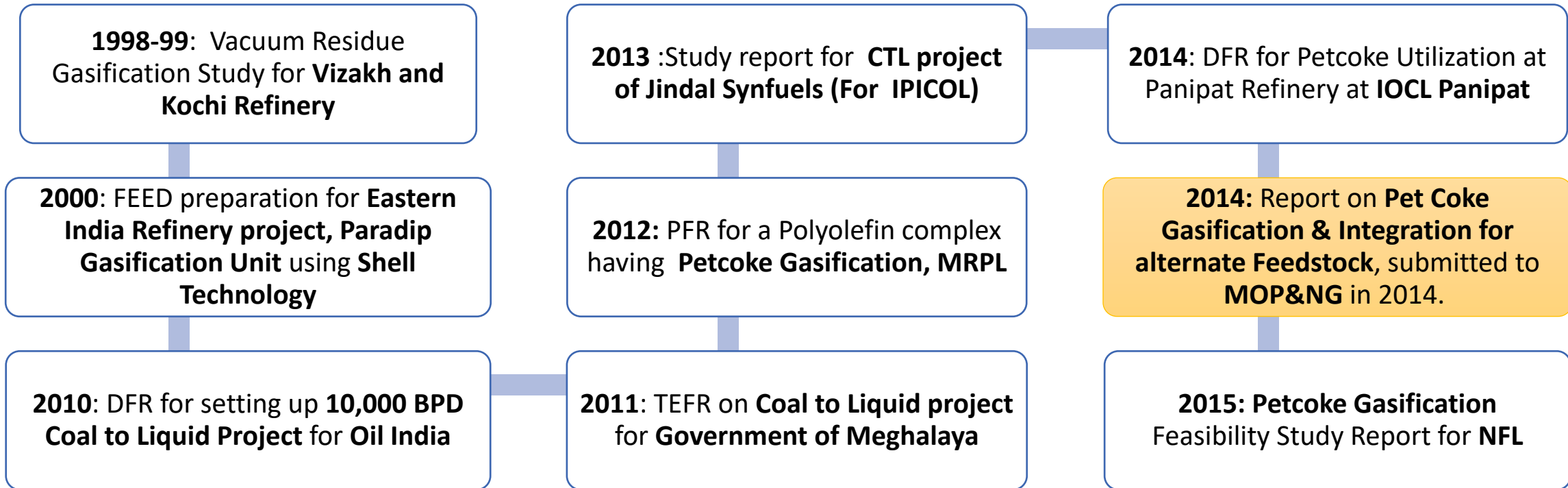


# EIL's Offering

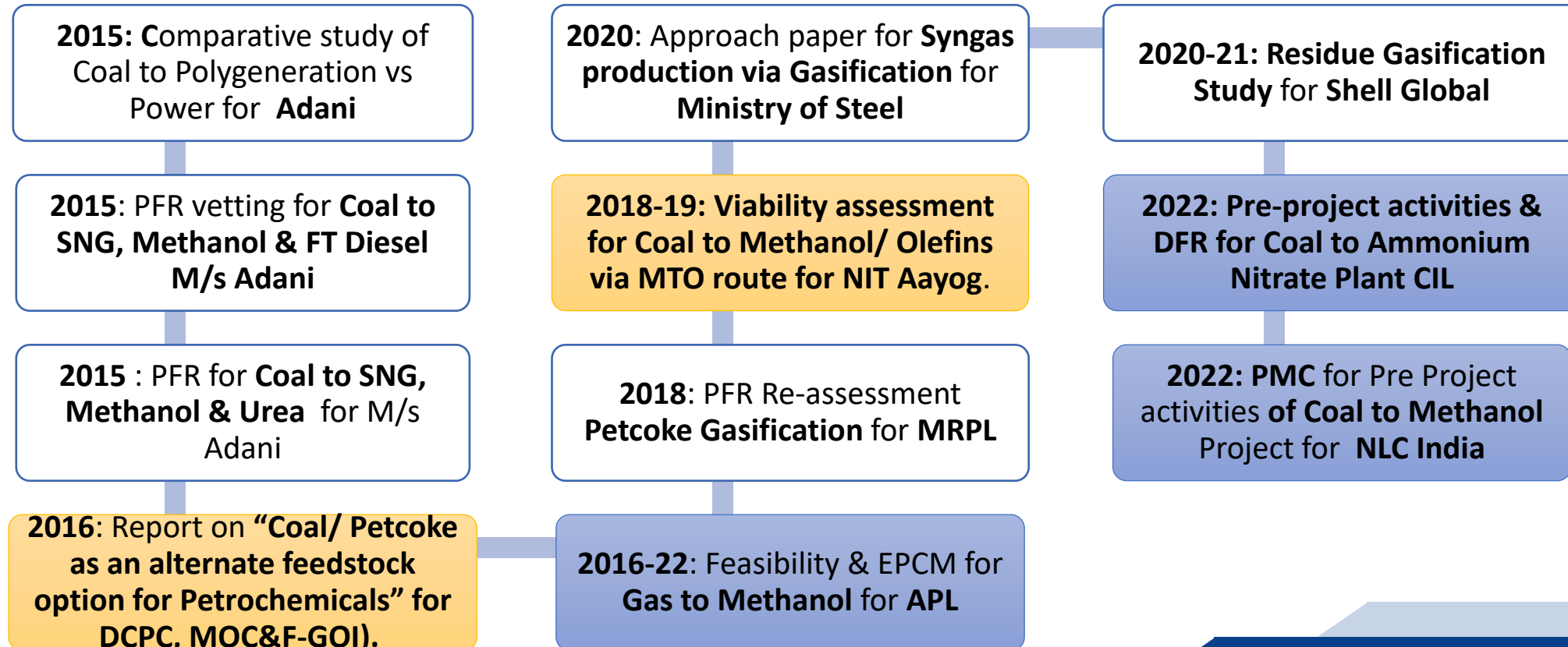
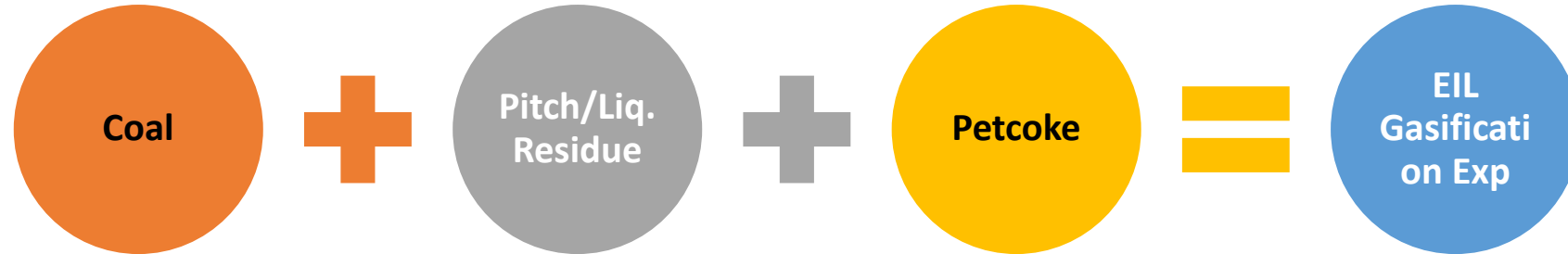
- ❑ Preparation of PFR/ DFR.
- ❑ Global tendering for invitation of bids from prospective licensors/ EPC contractors
- ❑ Techno-commercial evaluation of process licensors/ EPC bidders.
- ❑ Vendor Development for supply of equipments
- ❑ Analysis of Project Capital Cost and Operating Cost of the plant (CAPEX and OPEX) including sensitivity analysis.
- ❑ **Provide EPCM/PMC/ Owner's engineers using various technologies**

Due to our project conceptualization & implementation capability, working relation with all the major technology licensors, robust database of vendors, Contractors & cost information, the Project Cost estimates & Financials worked out by EIL during the Feasibility studies are accurate.

# EIL's Gasification Experience



# EIL's Gasification Experience



# EIL's Fertilizer & Methanol Complex Experience



S. No.	Description	Client	Location	Year
1	Crest Strategies Limited (CSL), British Virgin Islands (BVI)	Ammonia Urea Complex	Papua New Guinea	2007
2	EPCM Services for Brown Field Fertilizer Plant at Panki, Kanpur, 2200 TPD Ammonia/3850 Urea	Jaiprakash Associates Ltd.	India	2011-13
3	Development of facility to produce Fertilizer products in Port Harcourt, River State, Nigeria. 2300 TPD Ammonia	Indorama Eleme Fertilizers and Chemicals Ltd.	Nigeria	2014-18
4	Consultancy Services for Implementation of Shahjalal Fertilizer Project, 2200TPD	Bangladesh Chemical Industries Corporation	Bangladesh	2013-15
5	PMC Services for 1,900 TPD Ammonia Plant in Central Sulawesi, Indonesia	Panca Amara Utama	Indonesia	2013-16
6	Gujarat State Fertilizers & Chemicals Ltd. (GSFCL)	Ammonia Storage Tank	Vadodara	
7	Project Management Consultancy (PMC) Services for 2200TPD Ammonia, Urea & Methanol Project	Brass Fertilizer Company Ltd.	Nigeria	2014-18

# EIL's Fertilizer & Methanol Complex Experience

S. No.	Description	Client	Location	Year
8	Global Steel Holdings Limited	Ammonia & Urea Complex at Russia	Russia	Ammonia Urea
9	IndoGulf	Fertilizer Project	Jagdishpur, UP, India	Ammonia Urea
10	LEPCM Services for 500 TPD Methanol & 200 TPD Acetic Acid Plant	Assam Petrochemicals Limited	India	2015-2021
11	EPCM Services for setting up of 2200 MTPD Ammonia, 3850 TPD Urea and associated U&O facilities for Ramagundam Revival Project	Ramagundam Fertilizers And Chemicals Limited (RFCL)	India	2016-20



# Rich Experience in H2 Economy

Client	End Product	Project
NICDC	Green H2	Conceptual study for setting up Green H2 facility at Dholera-Special Investment Region
GAIL	H2 Blending	H2 Blending Study in NG Pipeline/ CGD Network
GAIL	Green H2	Owners Engineer for Green H2 and /EPCM services for BOP project at Vijaipur
BPCL/BORL	Green H2	LEPC Selection, FS and Basic Design of OSBL for green H2 electrolyser & associated system
ADANI	H2 pipeline	Consultancy Services for Feasibility and Basic Engineering of H2 pipeline (200 km) from Khavda to Mundra

PMC/EPCM for more than 15 Nos. H2 plants

PMC/EPCM for more than 11 Nos. Ammonia plants

# EIL Experience in Bio Fuels

- ❑ HPCL: DFR for 2G Ethanol Plants of 100 KLPD (Kilolitre per day) at Bhatinda, Punjab and Hardoi , Uttar Pradesh
- ❑ BPCL: DFR for 2G Ethanol Plants of 100 KLPD (Kilolitre per day) at Bargarh , Odisha and Bina , Madhya Pradesh
- ❑ IOCL: DFR for 2G Ethanol Plant of 100 KLPD (Kilolitre per day) at Dahej, Gujarat
- ❑ MRPL: DFR for 2G Ethanol Plants of 60 KLPD (Kilolitre per day) at Harihar, Karnataka.
- ❑ BPCL: Technology Selection and DFR Preparation for 2G Ethanol Bio-Refinery at Khamgaon
- ❑ Sunlight Fuels Pvt. Ltd: DFR for Bagasse based processing unit
- ❑ NTPC: Carrying out Feasibility Study for EPCM / PMC Services for India's 2nd Bamboo based bio-ethanol Project
- ❑ Assam Bio Refinery Private Limited: **EPCM Services for India's 1st and world's largest Bio-Refinery** Project at Numaligarh
- ❑ DFR for Biomass to Ethanol via Gasification and Gas Fermentation for Spray Engineering Device Ltd.
- ❑ EIL had carried out Viability Study for ascertaining the economic viability of Bio CNG plants with two scenarios:
  - Bio-CNG Plant (based on 100 TPD Press mud feed)
  - Bio-CNG Plant (based on 165 TPD Rice straw feed)

# EIL Capability in Bio Fuels

- ❑ Detailed feasibility report including Water balances, effluents summary and design basis.
- ❑ Analysis of Project Capital Cost and Operating Cost of the plant (CAPEX and OPEX) including sensitivity analysis.
- ❑ Global tendering for invitation of bids from prospective licensor of Bio-fuels( Ethanol/ SAF/Bio-Gas) technology from various Feedstocks.
- ❑ Techno-commercial evaluation of process licensors for suitable Technology selection.
- ❑ Vendor development for supply of equipment's for Bio- Fuel Plants
- ❑ Provide EPMC/ PMC/Owner's engineers services for Project Implementation



THANK YOU