Road Ahead for Coal Gasification in India

Investors’ Meet on Coal Gasification: Way Forward

6th May 2022

Deloitte.

Agenda

- Surface Coal Gasification – Relevance in the Indian Scenario
- Potential Products from Coal Gasification
- Market Potential – Key Products
- Recent Policy Interventions for SCG Projects
- Key Stakeholders in the Indian Scenario
- Coal India Limited as a Potential Partner for SCG Projects
- Snapshot of SCG Projects of CIL
- Key Enablers for SCG Projects
- Potential Models – way forward

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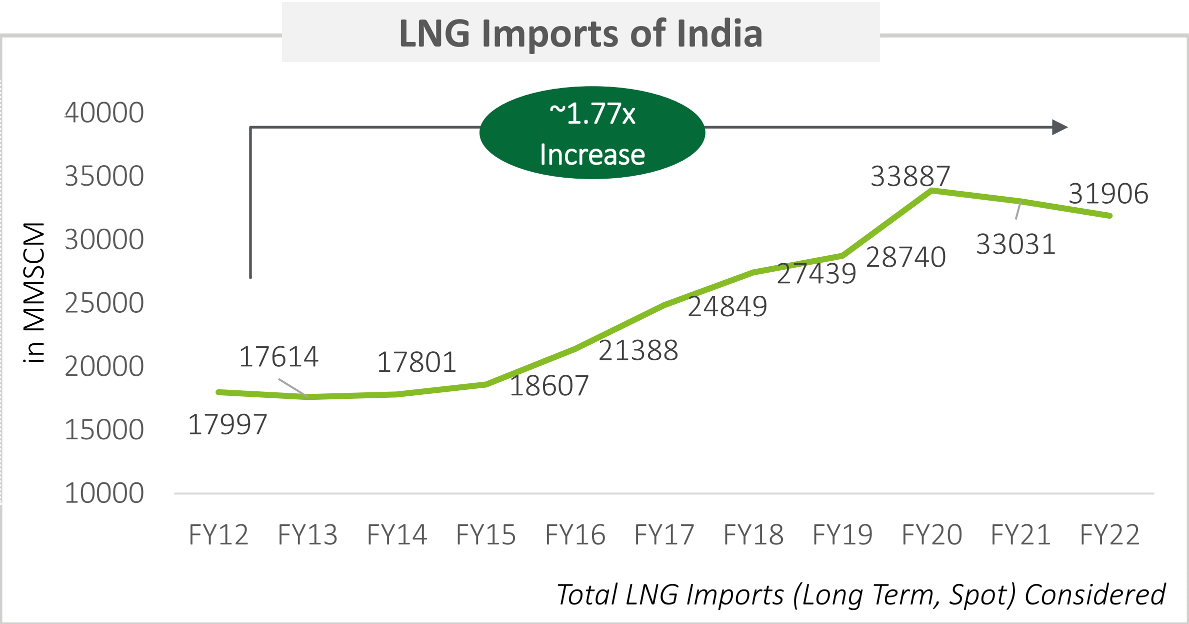
Surface Coal Gasification – Relevance in the Indian Scenario



Atmanirbhar Bharat: Import Substitution

- Natural gas imports grew at an CAGR of ~5.89% in the last decade
- Potential for liquid fuels (methanol), DME, SNG, chemicals, fertilizers, API & Steel making from coal gasification
- Downstream & other co-development in eastern India

300+ Billion Tonne

Cumulative total reserves making it the most abundant fuel resource in India

Coal Production

FY21: ~716 MT

FY22: ~777 MT

Coal represents **more than 50%** of the total installed capacity for power in India along with lignite

100 Million MT

Coal gasification vision by 2030 by the Hon'ble PM Shri Narendra Modi & the Ministry of Coal

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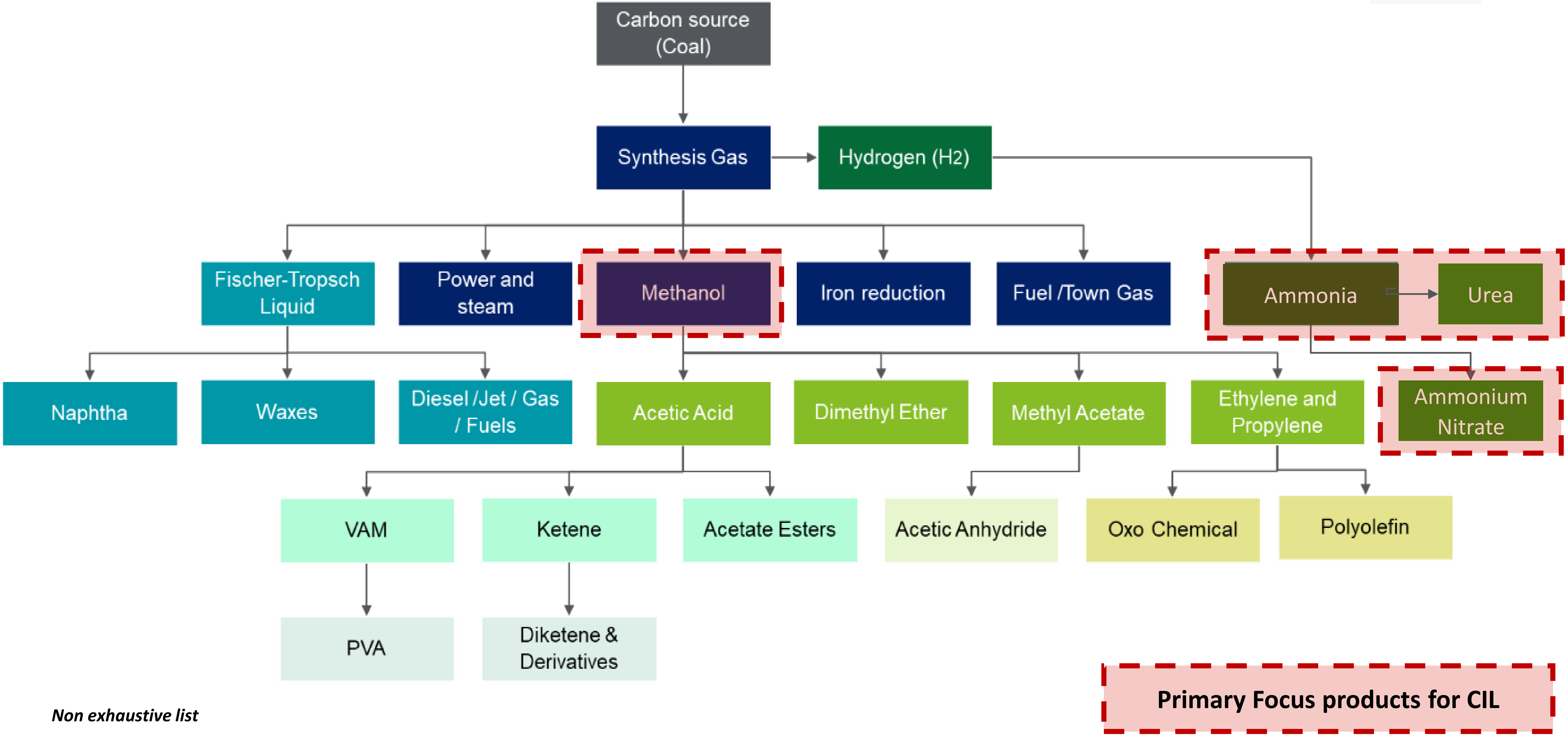
Source: Petroleum Planning and Analysis Cell, Ministry of Power, Ministry of Coal

Potential Products from Coal Gasification



Non exhaustive list

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Market Potential – Key Products

Methanol

- India typically **imports more than 92% of its consumption**
- **Diverse end use for second derivative products**, mainly olefins, Formaldehyde, acetic acid, MTBE, and potential gasoline blending application

CAGR growth of imports over last decade ~15%

Ammonia

- India **imports ~22% of its consumption**, for diverse application across fertilizers, ammonium nitrate (explosives) and nitric acid among others

CAGR growth of imports over last 5 years ~4%

Ammonium Nitrate

- India **imports ~22-23% of its consumption**, with top trade partners being Turkey, Russia & Bulgaria. Recent global events indicate a need for development of indigenous capacities

demand is expected to grow at ~4.8% CAGR to reach ~1.5 Million Tonnes per Annum

Note: The products indicated here are for illustrative nature & are non-exhaustive in nature

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Source: CMIE Industry Outlook, Various Analyst Reports, Petroleum Planning and Analysis Cell

Key Policy Interventions

Recent interventions indicate the Ministry of Coal's strong push towards coal gasification, with a plethora of thrust areas envisaged for successful implementation of SCG projects

Gasification Mission

- The *National Coal Gasification Mission* (100 MT by 2030) document was released by MoC in Sep 2021 which acts as roadmap for SCG projects in India

Preferential Auction Policy

- The MoC has provided a ***50% rebate in revenue share in commercial coal block auctions*** for certain projects of coal gasification.

Separate Window

- The Ministry has also created a ***separate window for auction of coal on long term basis*** (15 years) for both the private and public sector.

Budget Announcement

- The *Union Budget of India, 2022, proposed four (4) pilot projects* for coal gasification and conversion of coal into chemicals to evolve technical and financial viability

Stakeholder Involvement

- The MoC organized a ***post-budget webinar on coal gasification*** which involved a wide range of stakeholders from the industry, academia, research and engineering consultants

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Key Stakeholders in the Indian Scenario

Players in the coal gasification value chain can be classified into four inter-dependent categories based on roles assumed by the stakeholders

Raw Material Supplier/ Potential Project Owners

End-Users/ Downstream Players

Consultants & Project Implementors

Technology Providers

<u>Note:</u> In some cases, some players have been categorized as both Raw Material Supplier/ Potential Project Owners & End-Users/ Downstream Players based on potential forward/backward integration. The list is for illustrative purposes and is non-exhaustive in nature

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Coal India Limited as a Potential Partner for SCG

Coal India has identified Surface Coal Gasification as a diversification opportunity for 2030 due to significant competitive advantage

~53 Bn USD	**Outflow of Forex** for Chemicals & petrochemicals products in India	Developing coal-to-chemicals industry in India shall be instrumental towards **the goal of 'Atmanirbhar Bharat'**	100 MT	Coal gasification **Vision by 2030 by the Hon'ble PM**

Coal gasification is a cleaner method of burning coal and shall aid in **achieving India's INDCs**

How can Coal India create value in Coal to Chemical sector and Coal to Chemical business create value for Coal India?

Forward integration

Potential to generate additional annual revenue stream from SCG projects

Offers self consumption potentials

Develop products like Ammonium Nitrate for explosives and self-consume for mining operations

Monetize existing coal assets

Raw material security through captive coal production

Cost of capital and equity investment

Investment in SCG projects is significantly high, requires access to cheaper capital and strong balance sheet

Leverage Maharatna status

Opportunity to attract the best partners and talent available in the market

Leverage core mining competency

Opportunity to leverage coal mining competency to be cost effective

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Source: Chemicals & Petrochemicals Statistics at a Glance, Ministry of Chemicals & Fertilizers

Snapshot of SCG Projects of CIL

SECL
- Product: Ammonia
- Capacity: 0.72 MTPA
- Coal Required: 1.35 MTPA
- Mine: Mahamaya

ECL
- Product: Methanol
- Capacity: 0.66 MTPA
- Coal Required: 1.35 MTPA
- Mine: Sonepur – Bazaari

MCL**
- Product: Ammonium Nitrate
- Capacity: 0.66 MTPA
- Coal required: 1.2 MTPA
- Mine: Lakhanpur

WCL
- Product: Ammonium Nitrate
- Capacity: 0.66 MTPA
- Coal required: 0.8 MTPA
- Mine: Niljai

TFL
- Product: Urea
- Capacity: 1.27 MTPA
- Coal required: 2.5 MTPA
- Mine: MCL linkage

Project Locations

- ** PFR for MCL SCG project is under progress
- TFL – CIL, GAIL, RCF & FCIL
- Apart from CIL, **NLCIL is developing Lignite to Methanol 1200TPD plant at Nayveli, TamilNadu**

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Key enablers for SCG Projects

1. Introduction of a robust and time bound fiscal incentive policy
2. Allocation of ear-marked land for development of pit-head surface coal gasification projects for both public and private sector players
3. Policy for Methanol blending program (M15, M85 & M100), differential pricing for M15 blend, Methanol subsidy program in line with ethanol program (EBMS)
4. Assured off-take of coal-based chemicals by end-users and incentivizing domestically produced coal-based methanol
5. Incentives in revenue share of coal block auctions
6. Separate auction window of coal from CIL

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Potential Models – way forward

Deliberations in multiple forums including the post-Budget webinar on SCG have indicated the MoC's push towards introduction of a PLI scheme which shall provide financial assistance

Potential Options

Model #1	Model #2	Model #3
Capital Grant	Operational Grant	Hybrid Model
Option 1 - BOO / BOOT Mode: • Grant provision with tripartite escrow arrangements **Option 2 - EPC / LSTK Mode:** • Grant provision over implementation/ construction phase	**BOO / BOOT Mode:** • Ascertaining a minimum viable cost w.r.t to average international sales price for each specified products • Disbursement during periods of unviability only	**BOO / BOOT Mode:** • Combination of Capital as well as Operational grants based on pre-defined criteria • Disbursement in staggered form based on projects milestones

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Note: Potential Models are based on deliberations with multiple stakeholders and is non-exhaustive as well as consultative in nature

Thank you

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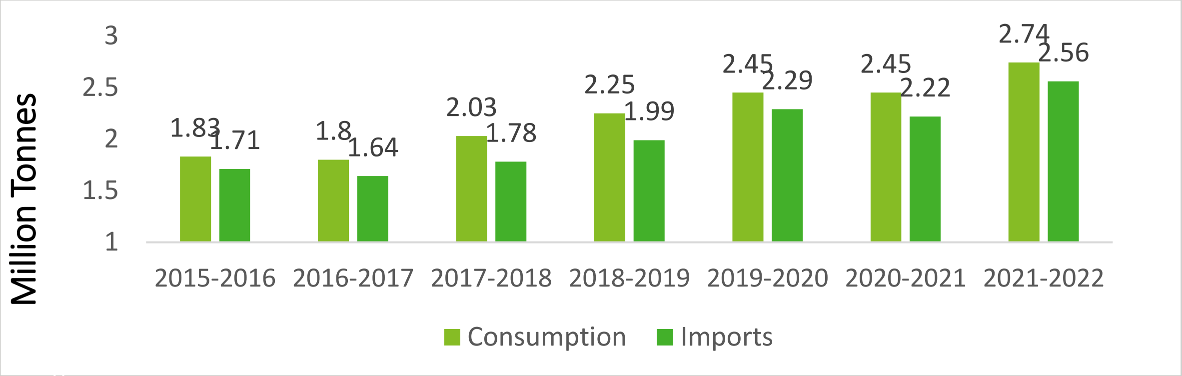
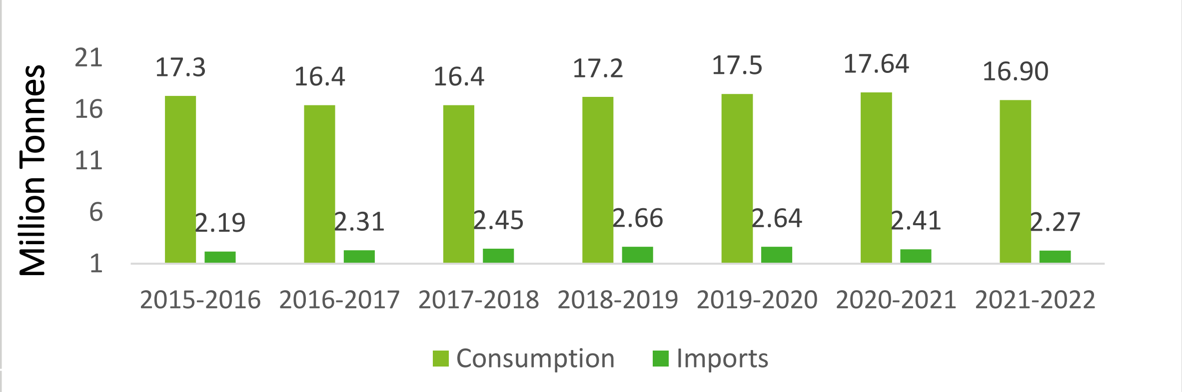
Market Outlook

Methanol



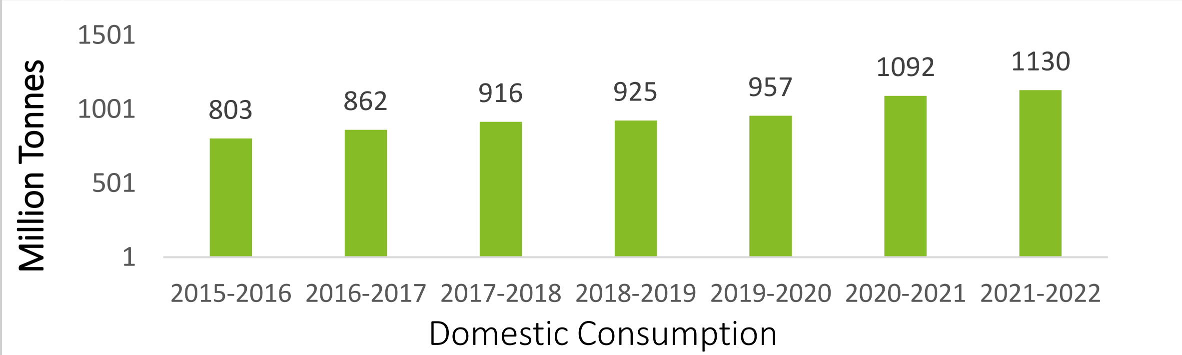
India's consumption of methanol is largely met by imports (~90%) with major demand being driven by formaldehyde, acetic acid and other industrial chemical production

Ammonia



Although India is net importer of ammonia, India exports highly purified ammonia to Singapore, Sri Lanka, Cameroon, Malaysia Nepal, Kenya and Philippines etc. for various industrial application in a very small amounts (18.6 kTPA in FY20)

Ammonium Nitrate



Consumption of ammonium nitrate is **highest in the coal mining industry** accounting for **~67%** of the domestic demand

Sector	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Coal Mining	497 MT	512 MT	551 MT	551 MT	560 MT	~600 MT	~600 MT

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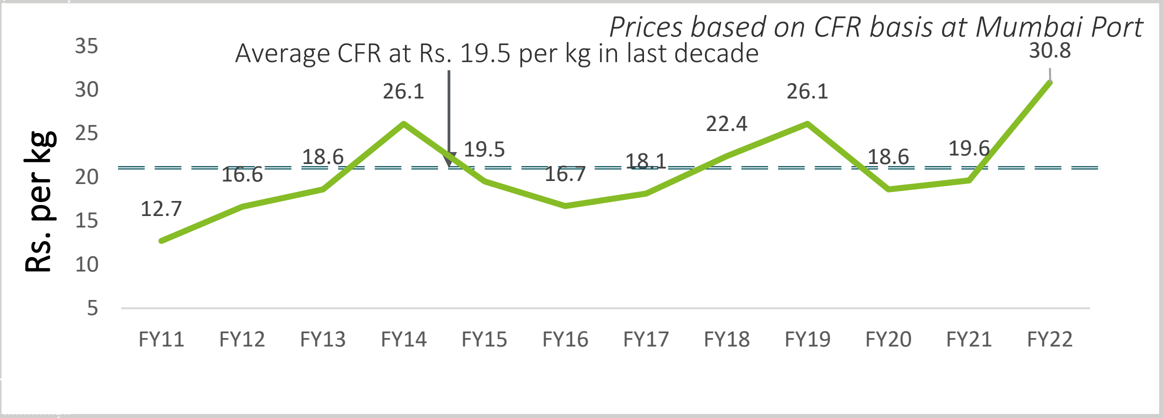
Source : CMIE Industry Outlook, Annual Reports, Analyst Reports, Monthly Bulletins – Dept. of Fertilizer, Ministry of Commerce, Coal Controller Reports, Secondary Research, CIL Explosives Rate List

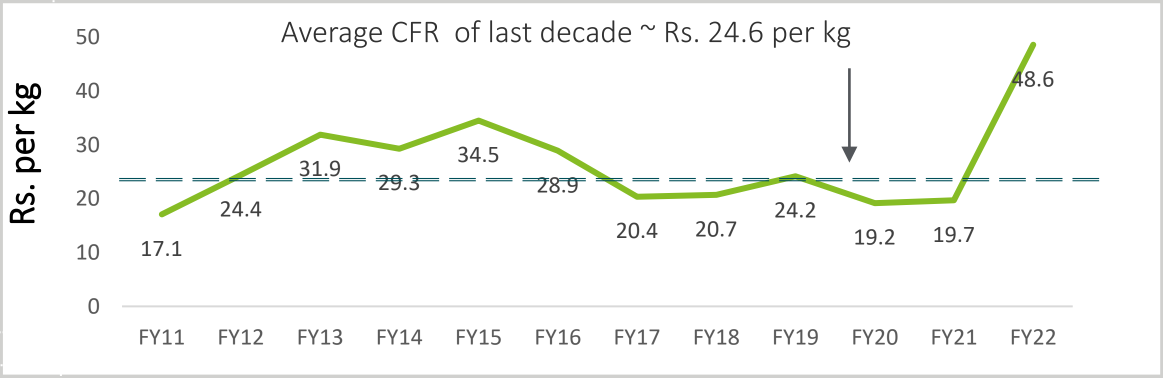
Price Outlook

Methanol



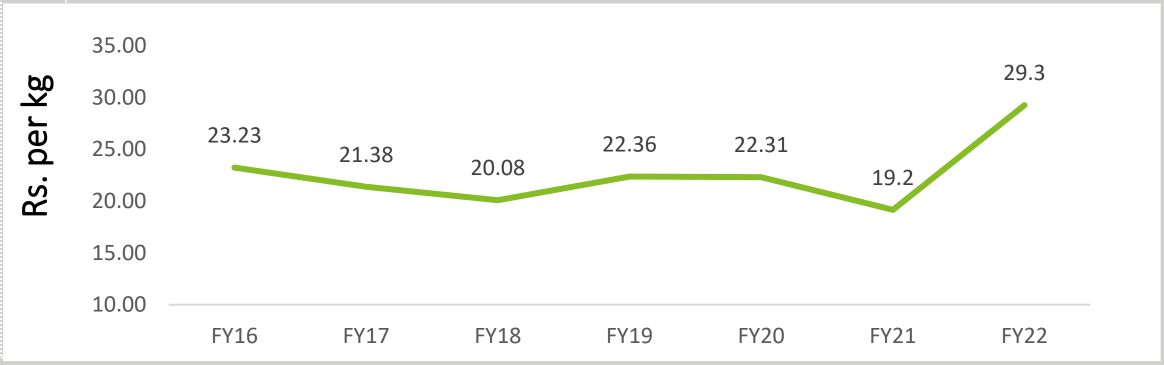
CFR (average of last decade) at ~Rs 19.5 per Kg (adding cost of import duty, insurance, etc. the cost assumed to be about Rs. 22 per kg). The realization price of ECL is expected to be about Rs. 26.68 per kg considering COP price for coal and selling price is about Rs. 30.46 per kg considering notified price of coal for the project.

Ammonia



CFR (average of last decade), at ~ USD 331/MT (~Rs 24.6 per Kg – adding cost of import duty, insurance, etc. the cost assumed to be about Rs. 26 per kg). The realization price of SECL is expected to be about Rs. 28.2 per kg considering COP price for coal and selling price is about Rs. 30.18 per kg considering notified price of coal for the project.

Ammonium Nitrate



- Ammonium nitrate prices are varying from Rs. 20.0 per kg to Rs. 23.2 per kg in the last few years.
- Ammonium nitrate prices are highly dependent on ammonia prices, as it is the major feedstock.
- Average unit realization of Ammonium Nitrate imports from Bulgaria in FY22 stood at ~ USD 390/MT

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Source : CMIE Industry Outlook, Annual Reports, Analyst Reports, Monthly Bulletins – Dept. of Fertilizer, Ministry of Commerce, Coal Controller Reports, Secondary Research, CIL Explosives Rate List

Chinese Coal Gasification Experience – Key Takeaways

1. Policy

- Central controls policy regime for coal gasification as NDRC issued new rules in 2011
- Coal gasification-based plants to be set up near to coal mining area to decrease the cost of transportation
- Develop pipeline infra in order to replace the imported natural gas
- Coal mining related incentives in China

2. Scale & Technology

- The coal-to-chemicals industry accounts for more than 200 MT of China's coal consumption
- Restriction on size of plants to achieve economies of scale
- Existing Chinese technology is flexible in nature consuming coal with high ash content
- Setting up of dedicated research institutions for coal gasification technology

3. Products

- Revamping of business model to include forward integration (e.g. Shenhua group)
- More than 90% of ammonia & 70% of methanol through coal gasification
- Setting standards to usage of raw material for improve optimization (min. energy efficiency, max. water consumption etc.)

4. Future Ambitions

- Achieving a higher share of self-reliant energy supply and lower risk of global oil and gas supply
- China is expected to develop large-scale coal-to-synthetic natural gas (SNG) projects in the near future

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Source: National Energy Technology Laboratory, USA, 6th International Freiberg Conference on IGCC and XtL Technologies, National Coal Gaification Mission, Ministry of Coal