

About

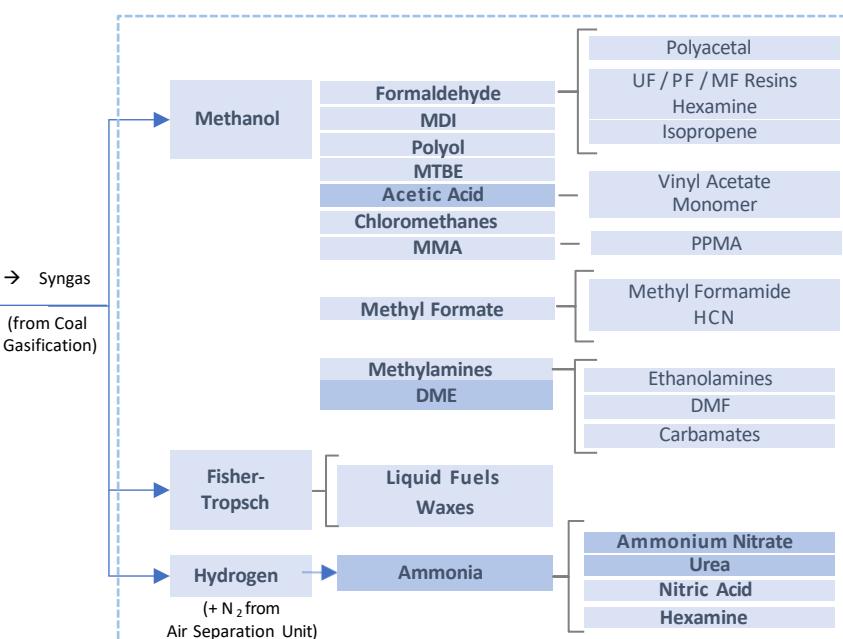
- India's **National Coal Gasification Mission** aims to achieve **100 million tonnes (MT)** of coal gasification capacity by **2030** to start with, transforming domestic coal into clean energy, fuels, and chemical feedstocks. Coal gasification plays a pivotal role in **reducing import dependence**, enhancing **energy security**, and enabling a **low-carbon industrial transition** through syngas-based production of methanol, ammonia, urea, DME, acetic acid and other critical chemicals. This mission focuses towards India becoming self reliant and self sufficient (Atma-Nirbhar Bharat) in low carbon hydrogen production with an aim towards –
 - Minimizing Natural Gas Import
 - Export of energy in the form of hydrogen-based molecules
 - Minimizing subsidies on account of food security
- Amid this national push, our **Hydrogen Catalytic Coal (HCC)** technology - a **US-patented pioneering process** - delivers a next-generation pathway for clean coal utilization. Operating at **moderate temperatures and pressures**, HCC uses a **proprietary catalyst** to enhance **hydrogen yield** by **~15%**, minimize tar formation, and improve overall carbon conversion efficiency. This breakthrough makes **coal-to-chemicals and coal-to-hydrogen** projects more efficient, modular, and environmentally sustainable - supporting India's **100 MT by 2030** gasification vision with **indigenous, high-performance technology**.

Salient Features of the Catalyst

- Catalyst Function:** A proprietary catalyst enhances hydrogen yield by ~15% in the fixed-bed coal gasification process.
- Syngas Composition Impact:** H₂ content rises from 40–45 vol% to ~46–52 vol%, improving the H₂/CO ratio (typically at 1.7–2.0 at temperature of 1050–1100 deg C) ideal for downstream synthesis.
- Reaction Enhancement:** Promotes water-gas shift and steam reforming, reducing CO, tar, and char, thus improving syngas quality and plant uptime
- Operational Benefits:** Enables lower steam-to-oxygen ratio, better thermal balance, and potentially lower operating temperature/pressure.
- Economic Outcome:** Higher H₂ yield boosts methanol and derivative output per ton of coal; marginal catalyst cost is offset by higher efficiency and reduced downtime
- Overall Result:** Delivers cleaner, hydrogen-rich syngas with better process sustainability and energy integration suited to Indian high-ash coal.

Chemical Reactions

Section	Reaction / Description	Equation
1. Fixed Bed Gasifier Reactions	Partial Oxidation	C + 1/2 O ₂ → CO
	Complete Combustion (minor, for heat)	C + O ₂ → CO ₂
	Boudouard Reaction	C + CO ₂ → 2CO
	Water-Gas Reaction	C + H ₂ O → CO + H ₂
	Methanation	C + 2H ₂ → CH ₄
	Water-Gas Shift (in gas phase, equilibrium influenced)	CO + H ₂ O ⇌ CO ₂ + H ₂
2. Catalyst Column (WGS + Hydrogen Boost)	Water Gas Shift (main reaction)	CO + H ₂ O → CO ₂ + H ₂
3. Methanol Synthesis Reactor	Primary Reaction	CO + 2H ₂ → CH ₃ OH
	Secondary Reaction	CO ₂ + 3H ₂ → CH ₃ OH + H ₂ O
4. DMEA Synthesis Reactor	Methanol carbonylation (simplified)	2CH ₃ OH + CO → CH ₃ OCH ₂ OCH ₃ + H ₂ O ₂
	Alternate Route (via methylamine)	
5. Acetic Acid Plant	Methanol carbonylation	CH ₃ OH + CO → CH ₃ COOH
6. Urea Plant	Urea synthesis	2NH ₃ + CO ₂ → NH ₂ CONH ₂ + H ₂ O ₂

Output Streams**Update – Setting up a 120 TPD Plant in Odisha to produce DMEA, Acetic Acid, Urea**

Parameter	Details
Location	Odisha, India (Mahanadi Coalfields / Talcher region)
Feedstock	High-ash Indian thermal coal (~42 % ash, 10.7 % moisture)
Products	Methanol (74 TPD) · DMEA (10 TPD) · Urea (34 TPD) · Acetic Acid (13 TPD)

- In conclusion, incorporating a proprietary catalyst boosting hydrogen yield by 15% into the fixed bed gasifier operating at 10 bar and 900–1100 °C positively shifts syngas composition toward higher hydrogen content (~50 vol% H₂). This improves downstream synthesis efficiency, reduces operational issues from tar, and may allow optimized steam usage, leading to better overall process economics and sustainability under Indian coal conditions.
- The integrated plant's revenue increases annually, driven by 10–20% market price escalation, with methanol (~42%) and DMEA (~34%) dominating contributions; enhanced pricing of urea and acetic acid further strengthens cash flow and project viability.