



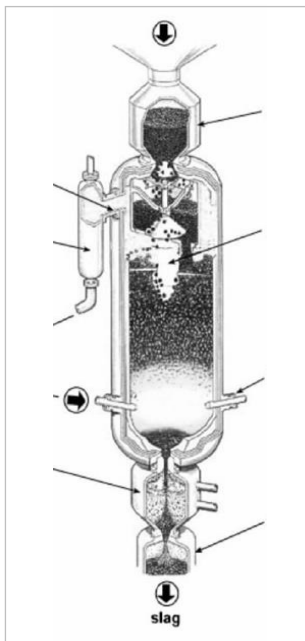




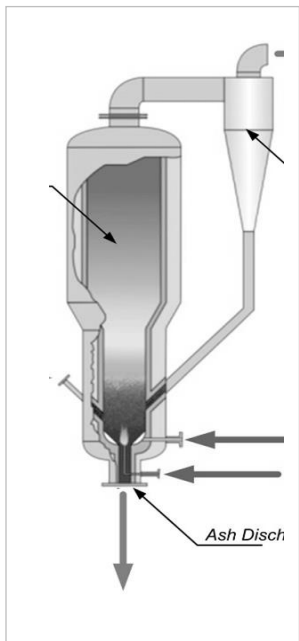
Pathways to achieve 100 mtpa Coal Gasification by 2030

4th March 2022

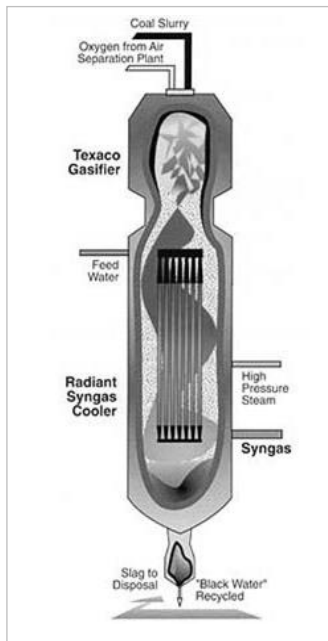
- 01 Technology & scale of operations 
- 02 Flexible design to switch product capacities in response to market 
- 03 Hedged multiple product portfolio 
- 04 Appropriate market making model for reaching the 100 mtpa goal 



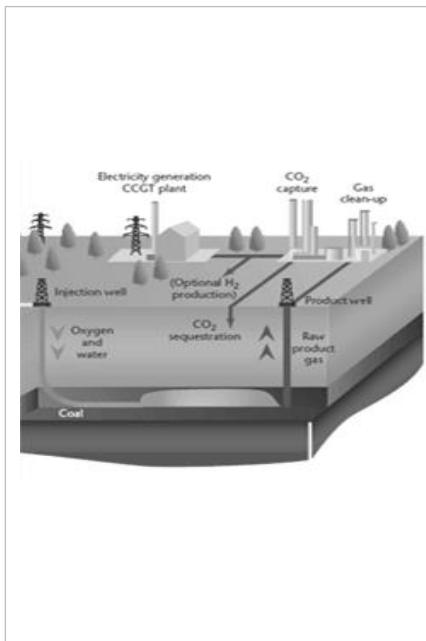
Moving bed reactor



Fluidized bed reactor



Entrained flow reactors



Underground Coal Gasification

Matching Gasifiers to Coal or Coal to Gasifiers

- › Proximate (moisture, ash, volatile and fixed carbon)
- › Ultimate analysis (C, H, N, S)
- › CO₂ gasification reactivity
- › Particle size distribution
- › Thermal fragmentation
- › Caking properties and swelling
- › Ash melting properties
- › Ash composition
- › Ash viscosity
- › Trace elements

Fixed bed gasification +++

Fluidized bed gasification

Entrained flow gasification

Fluidized Bed (FB) Gasification best suited for Indian coal having avg. ash of >35% and AFT > 1500 °C

Can accept high ash and fine coals

Non-slugging operation

High reactivity of coal favours gasification

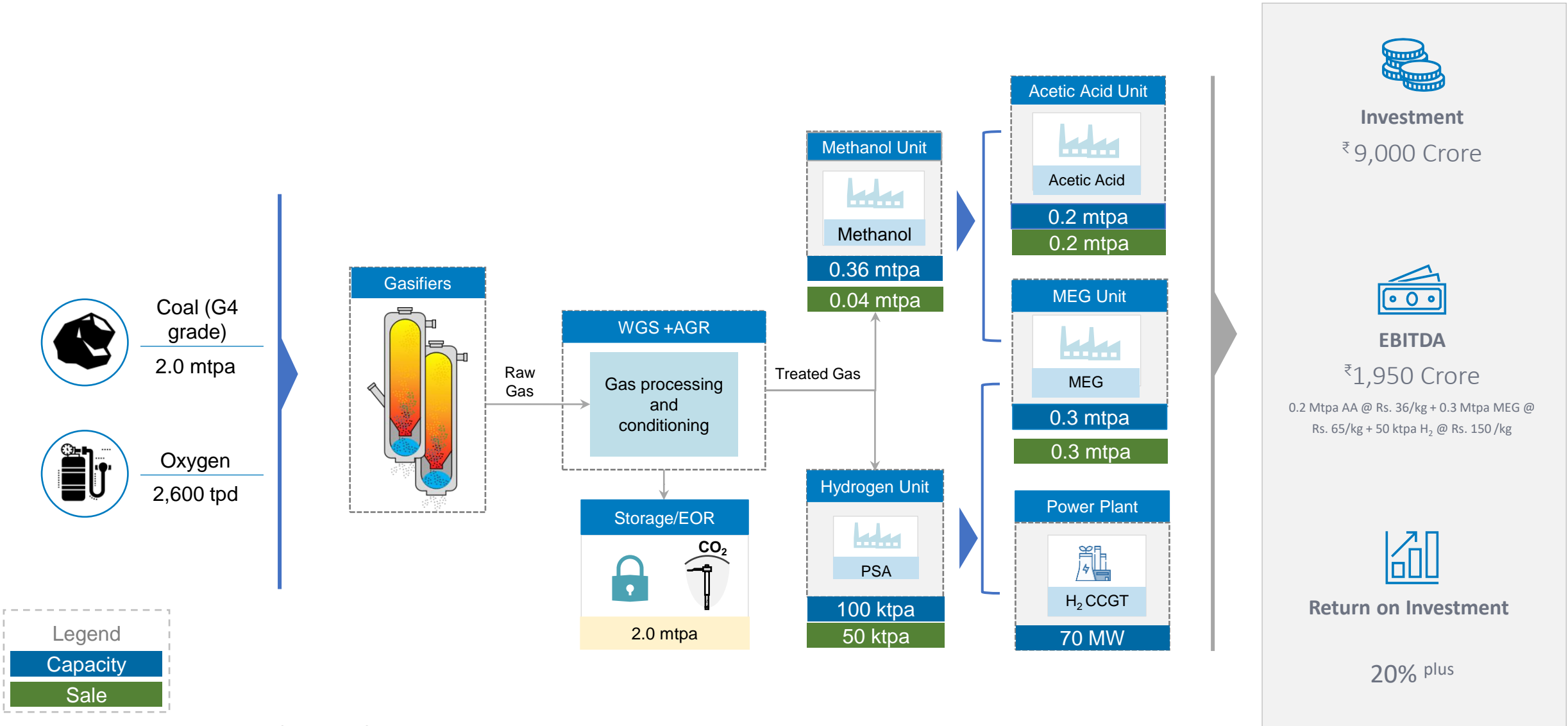
Markets, product portfolio and techno-economics is key to design of gasification projects



* per MWh

Note: All figures correspond to FY 2026 estimate


Schematic of a multi-product driven flexible gasification model





* 40-45 MW power generated from gasifier steam

Blue Hydrogen is equally competitive; however, CO₂ utilization (in forms of Chemicals and Carbonated Aggregate) and Sequestration are critical for sustainable operations

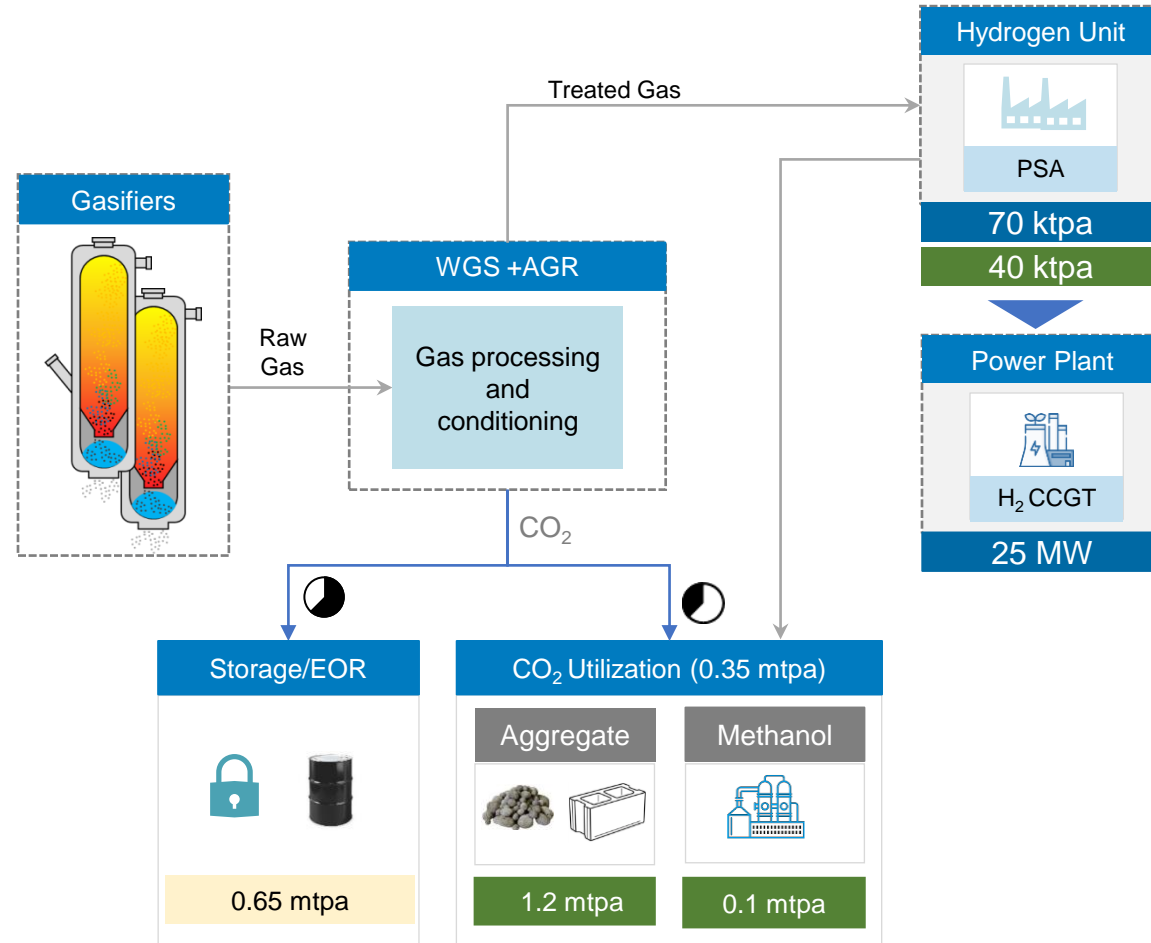
Schematic of a Hydrogen-based Gasification model with CO₂ Utilization & Sequestration

- 

Coal (G4 grade)
0.7-0.8 mtpa
- 

Bio-mass
0.1-0.15 mtpa
- 

Oxygen
1,000 tpd



Legend

- Capacity
- Sale

Investment
₹ 3,500 Crore

Gasification + Gas processing + CCGT+ Methanol + CO₂ pipeline + auxiliaries (excluding CO₂ to mineral aggregates)

EBITDA
₹750 Crore

50 ktpa H₂ @ Rs. 150 /kg + 0.1 Mt Methanol @Rs. 37/kg + 1.2 Mt Aggregate @ 20% premium

Return on Investment
20% plus

* 15-20 MW power generated from gasifier steam

BOO

CIL: Coal quality & quantity

BOO Partner

70 – 100% premium on market price - not sustainable

BOO partner – capital, technology, EPC and O&M


- › Single product
- › Take or pay obligations
- › Limited multi-product flexibility



Coal supply



Investment



Technology



Engg. & Construction



O&M



Market

Govt. Owned Company Operated

CIL: Coal quality & quantity

› Equity – CIL + JV partner	› Technology transfer & indigenization	› Turnkey EPC contractors	› Single operator	› Multi-product flexibility
› International funding for “clean coal”	› Knowledge & experience build-out creating competitiveness	› World class engg. & project mgmt. partner	› Similar to LNG tolling model	› Utility products (H ₂) - stable cash flows
				› Upside of market facing products

← Disaggregating risk → lower risk premiums →



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www.dastur.com

www.dasturenergy.com

Atanu Mukherjee
Atanu.M@dastur.com

Suprotim Ganguly
Suprotim.G@dastur.com