Coal Resources in India & Coal as Major Source of Energy Mix

- **326 Billion Tons** of coal resources is estimated by the GSI up to a depth of 1200 meter.

- **G9 – G14 grade** coal resource is around **170 Billion Tons**.

- In the current financial year (**April – January 2022**), total production of coal in India is in tune of **672 Million Metric Tons**.

- As per BP Energy Outlook, **Coal will dominate with 48%** in the projected share in the **primary energy consumption in 2040**.

- According to the **NITI Aayog's anticipated coal demand projection** for 2030, coal usage will be **1192–1325 MT**.
Products from Coal, Coal Resources, Ash and Byproducts

1. Coal can be used to produce number of products using clean coal technologies

   1. Hydrogen
   2. Methanol
   3. Fertilizers
   
   Through Coal Gasification

   4. Carbon Fibers
   5. Plastic composites
   6. Carbon Nanomaterials

   Using ash/residue of the coal power plant/gasifier

2. The shale clay mine drainage and sludge leachate can be utilized to extract

   1. Rare Earth Elements
   2. Critical Minerals
   3. Quantum Dots
Clean coal technologies are a key step towards near zero emissions from coal

- Focus on technologies to reduce both Green House Gases and Non-Green House Gases (Nox, SO2, Particulate Matter) emissions

**Technologies for Cleaner Coal Generation**

- Reducing coal consumption
  - AUSC & IGCC
- Reducing Non-GHG Emissions
  - Coal Gasification
- Carbon Capture and Storage
  - CO2 Utilization for production of Chemicals, Methanol
Major problems associated with the current coal based technologies are lower efficiency, environmental loading and consequent damages thereof.

Clean coal technologies are becoming popular due to high efficiency and lower environmental impacts.

Coal gasification has been internationally accepted as one of the most viable and effective clean coal technology for production of synthetic fuels, chemicals, various thermal applications & power generation. It also offers a practical means of utilizing coal for meeting stringent environment requirements.

Bulk coal reserves in India (about 73%) are of inferior grade non-cooking coals, with ash contents 45-50%, having moderately high reactivity & high ash fusion temperature. These coals can be successfully utilized for gasification.
COAL GASIFICATION

SYN GAS (USE AS FEED/FUEL)

- UREA
- STEEL
- CHEMICAL
- REFINERY
- PETROCHEMICAL
## Types of Gasifiers

<table>
<thead>
<tr>
<th></th>
<th>Fixed Bed Gasifiers</th>
<th>Fluidized Bed Gasifiers</th>
<th>Entrained Flow Gasifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantage</strong></td>
<td>• Flow of solids is independent of the flow of gas</td>
<td>• Uniform Particle Mixing</td>
<td>• Ability to handle practically any feed</td>
</tr>
<tr>
<td></td>
<td>• Minimal pretreatment of feed coal</td>
<td>• Uniform Temperature Gradients</td>
<td>• Syngas is free of oils and tars</td>
</tr>
<tr>
<td></td>
<td>• High thermal efficiency</td>
<td>• High char recycling rate</td>
<td>• Low methane production, suitable for synthesis gas products</td>
</tr>
<tr>
<td><strong>Disadvantage</strong></td>
<td>• Product gas contains Tars, oils, and heavy hydrocarbons</td>
<td>• Particle Entrainment</td>
<td>• High energy consumption</td>
</tr>
<tr>
<td></td>
<td>• High methane content in Product gas.</td>
<td>• Lack of Current Understanding</td>
<td>• High temperature and pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pumping Requirements and Pressure Drop</td>
<td>• Slagging - maintenance shutdown of units</td>
</tr>
</tbody>
</table>
WHY FLUIDIZED BED GASIFIER IS SUITABLE FOR INDIAN COALS?

- Suitable for high ash Indian coals.
- Better heat and mass transfer in the bed.
- The amount of tar and phenol formation is low or negligible.
- A large variety of fuels can be handled.
- The technology does not involve moving parts.
- Moderate gasifier temperatures: low Heat loss through bottom ash.
- The large fuel inventory provides safety, reliability, & stability of the process.
- Product composition is steady due to uniform conditions in the bed.
- Better turn down ratio.
- Due to in situ sulphur capture, FBG is futuristic efficient clean coal technologies.
**Research and Development Activities in development of Indigenous Technology for gasification of high ash Indian Coal**

<table>
<thead>
<tr>
<th></th>
<th>BHEL R&amp;D, Hyderabad</th>
<th>IIT Delhi &amp; Thermax Ltd., Pune</th>
<th>CSIR-CIMFR, Dhanbad</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Gasifier</strong></td>
<td>Advanced Pressurized Fluidized Bed Gasification</td>
<td>Oxy Blown Gasifier</td>
<td>Oxy Blown Pressurized Fluidized Bed Gasification</td>
</tr>
<tr>
<td><strong>Gasification Pressure</strong></td>
<td>3 Bar</td>
<td>4 – 6 Bar</td>
<td>10 Bar</td>
</tr>
<tr>
<td><strong>Gasifier Coal Handling Capacity</strong></td>
<td>1.2 TPD</td>
<td>3 – 4 TPD</td>
<td>1.5 TPD</td>
</tr>
<tr>
<td><strong>Methanol Production Capacity</strong></td>
<td>0.25 TPD</td>
<td>1.0 TPD</td>
<td>0.25 TPD</td>
</tr>
<tr>
<td><strong>Status</strong></td>
<td>Operational for more than 10000 hours</td>
<td>Methanol production started. Testing going on</td>
<td>At TRL 6 stage</td>
</tr>
</tbody>
</table>
Talcher Fertilizer Limited

- New Coal based Ammonia-Urea Complex as a Joint Venture Company (JVC) promoted by GAIL, CIL, RCF and FCIL with a total estimated CAPEX of INR 13,277 cr

- The project will have an output of 1.27 MMTPA of ‘Neem’ coated prilled urea using coal as feedstock.

- The unit will utilize about 2.5 MMTPA coal from Talcher Mines

<table>
<thead>
<tr>
<th>Subsidiary</th>
<th>CIL</th>
<th>ECL Sanctoria</th>
<th>WCL Nagpur</th>
<th>SECL Bilaspur</th>
<th>CCL Ranchi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mines/Location</td>
<td>Dankuni Coal Complex</td>
<td>Sonepur Bazari Mine</td>
<td>Niljai Mines</td>
<td>Mahamaya Mines</td>
<td>Ashoka Mines</td>
</tr>
<tr>
<td>Product</td>
<td>Methanol (0.67 MMTPA)</td>
<td>Methanol (0.66 MMTPA)</td>
<td>Ammonium Nitrate (0.66 MMTPA)</td>
<td>Ammonia (0.72 MMTPA)</td>
<td></td>
</tr>
<tr>
<td>Coal (MT)</td>
<td>1.5 MMTPA</td>
<td>1.35 MMTPA</td>
<td>0.8 MMTPA</td>
<td>1.35 MMTPA</td>
<td></td>
</tr>
<tr>
<td>PFR Status</td>
<td>Approved.</td>
<td>Approved</td>
<td>Approved</td>
<td>Approved</td>
<td>**Under Preparation</td>
</tr>
</tbody>
</table>
**Way Forward**

1. Setting up demonstration plants to scale up Indigenous technology

   1. Promoting public private partnership with provision of VGF for production of methanol, ammonia and hydrogen
   2. Setting up plants to produce methanol in tune of 300–500 TPD.
   3. Introducing PLI scheme for setting up Coal Gasification Plants

2. Accelerate the projects planned by the Coal India Limited and subsidiaries preferably through EPC approach for production of chemicals & fuels.

3. Accelerate the project by NLC India for lignite gasification (2 x 2400 TPD gasifier) for production of 1200 MTPD methanol.

4. Rationalizing the pricing of coal for gasification on the following parameters:

   1. Taxations
   2. State Cess
   3. Transportation and handling charges