Adapting with Coal

What is the issue?

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- Despite the loosing sheen for coal as a power source, it is unavoidable at least for few decades.
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- Given this, the new methodology of power generation with coal gains significance in environmental perspective.
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How is coal's importance at present?

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- Coal, as a source of energy, is firmly becoming out of favour.
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- The climate change considerations have contributed to this change.
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- Most countries have plans to phase out coal in the next few decades.
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- India has officially announced that it would not set up any new coal-fired power plants after 2022.
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Why is coal unavoidable now?

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- There is rapid increase in power generation from renewable sources like wind and solar.
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- But still, over 60% of India’s electricity is generated in thermal power plants.
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- It is estimated that coal would continue to be the mainstay of India’s energy

mix for at least three more decades.
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How should it be dealt with?

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- Efforts are on to ensure that pollution emanating from coal is at least reduced a bit in these intervening years.
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- A variety of “clean coal technologies” is being deployed or experimented with.
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- The modern “super-critical” power plants also emit lesser pollutants.
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How do thermal power plants work?

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- Most thermal power plants burn coal to generate heat.
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- The heat is used to convert water into steam.
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- The pressure of the steam is then used to move turbines that produce electricity.
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- The quality of coal is an important factor in deciding the efficiency of the plant.
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- It refers to the amount of electricity generated per unit of coal burnt.
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- It also takes into account the waste that is released.
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- Typically, coal power plants release a lot of carbon dioxide (CO_2), a dangerous greenhouse gas.
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What is the complexity?

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- Coal is cheaply available in India in very large quantity.
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- But it is not preferred due to the high ash and low energy content.
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- Burning coal in the conventional pulverised mode results in the release of a lot of fly ash.
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- This is a major contributor to air pollution and a health hazard too.
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- Several techniques in place to capture fly ash, after it is produced, are not very efficient.
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- Alternatively, coal is passed through an extensive “pre-processing” process called “washing”.
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- The aim is to remove some of the ash content before it is burnt.
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- This has also not been very effective.
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What is the new finding?

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- A new, more effective way of managing the problem ensures that the ash is removed as chunks from the reactor bed itself.
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- Also, the procedure reduces the formation of CO2.
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- It instead generates synthetic gas (syngas).
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- This is a mixture of clean fuel gases like carbon monoxide and hydrogen, as by-products.
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- These can then be put to a variety of uses.
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How does it work?

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- A well-known coal gasification technique is used.
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- Here, coal is only partially burnt with a very limited supply of oxygen.
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- It is done in the ‘bubbling fluidized bed gasification reactor’.
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- At about 100°C, all moisture from the coal is drained out.
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- At higher temperatures (300°C - 400°C), gaseous fuels trapped inside coal are released.
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- These include gases like nitrogen, methane and a mixture of many other hydrocarbons.
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- At temperatures 800-900°C, the carbon in the coal starts reacting with oxygen in the air.
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- It also reacts with the steam supplied along with air.
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- It then forms carbon monoxide (CO), hydrogen and carbon dioxide (CO_2).
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How does it help?

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- Controlling the amount of air and steam ensures that significant amounts of carbon monoxide (CO) and hydrogen (H_2) are formed.
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- By this way, production of CO_2, which is a greenhouse gas, can be minimized.
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- Careful systematic studies have been conducted to arrive at the regime of operation, air to coal and steam to coal ratios.
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- It has been found that the addition of steam becomes **favourable in the case of high-ash Indian coals.**
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- In fact, this technique can be extended to produce syngas of high calorific value.
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- This can be done by enhancing the oxygen content in the oxidizer.
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- Besides, adding biomass, like rice husk along with Indian coal imparts catalytic effect.
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- It improves the gasification performance significantly.
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What is the way forward?

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- The process would improve the attractiveness of Indian coal for use in power plants.
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- It could help significantly in the transition period to renewables.
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- Existing power plants will have to replace their traditional reactors with gasification reactors for this.
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- In Indian coal mine mouths, such gasification reactors can be established to take care of rural power needs.
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Source: Indian Express

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