MAJOR USE OF COAL AND LIGNITE IN INDIA

Dr.A.Balukkarasu,
Associate Professor,
Department of Remote Sensing,
Bharathidasan University,
Thiruchirapalli-620 023
Mail id: gsibalu63@gmail.com
balukkarasu.a@bdu.ac.in
Mobile no.94430 67281


Dr.A.BALUKKARASU

Coal Beneficia-tion

Use of Coal

Steel Making

Cement and Paint Industries

Coke production and allied chemicals

Domestic fuel

Transportation ~ in earlier days

New avenues of Non coking coal – Sponge Iron , Coal Dust Injection Corex Process for steel making

In world today

COAL is the popular fuel choice because

World wise “reserves” could last one/two centuries

Wide distribution throughout the world

~ abundant ~ inexpensive

~ helps to keep prices low and stable

~ energy prices has significant impact on economy

Coal Industry employs more workers than other energy resources

Renewable energy is important in the overall scenario

but

will play a lesser role in satisfying our future demands

Fossil fuels , especially coal, will continue to be the major source for decades

though

the value of coal is partially offset by environmental issues

Coal will continue to be ~

- major source of electricity generation
- major source of hydrogen for 'Hydrogen Economy'
- potential source of liquid fuels

Environmental issues to be faithfully addressed to ensure

Clean Coal Technology

Thus avoiding ~ 'Generation Conflict '

India's Primary Energy Mix

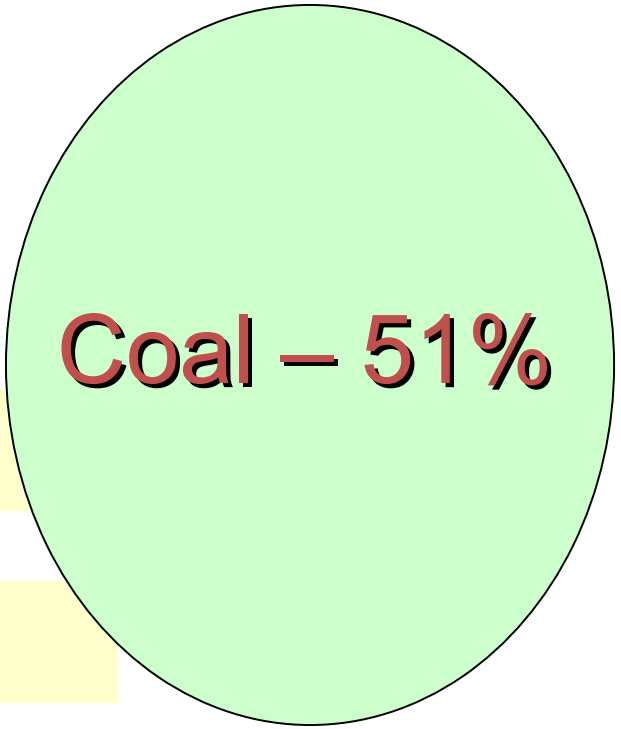
(consumption)

Oil – 36.4%

Natural Gas – 8.9%

Nuclear Energy – 1.5%

Hydro Electric – 2%



(TERI, 04/2007)

Coal will continue to be ~

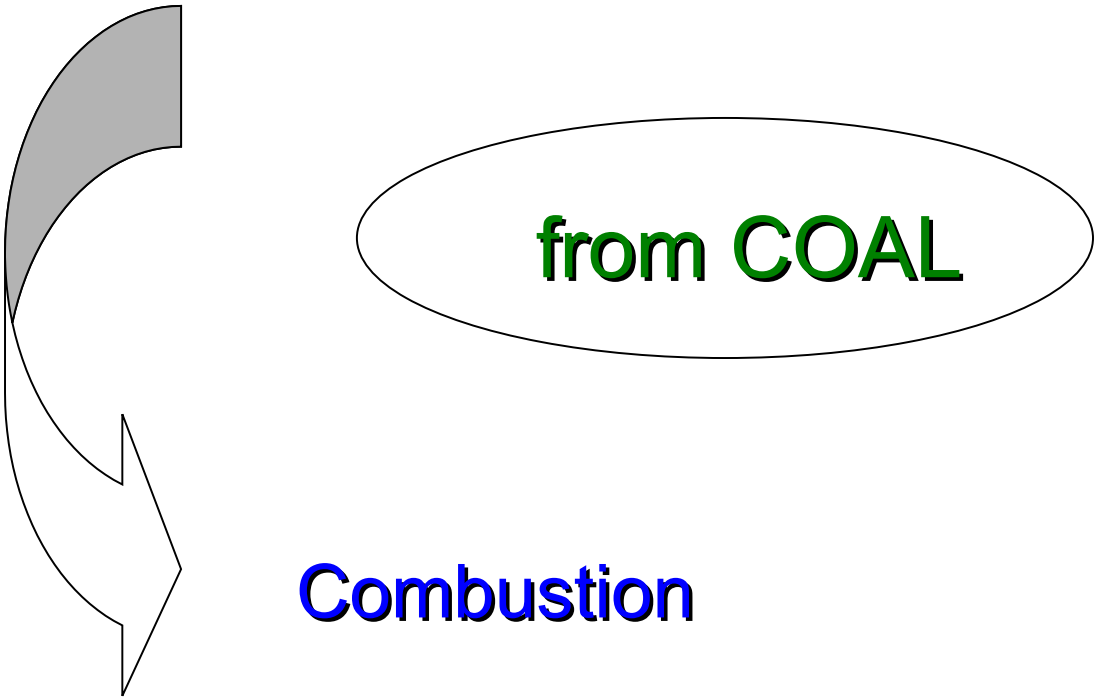
- major source of electricity generation, hydrogen for 'Hydrogen Economy', liquid fuels

Technologies used for generating ~ power

heat

coke

chemicals



Combustion

Gasification

Liquefaction

Carbonization

combustion

Harnessing steam power credited as most important technological advance

This technology is the single largest user of coal

Burning coal to generate heat

Primary use ~ burning in boilers to generate electricity

Resurgence of coal in power generation

~ using advance combustion &

~ ultra low emission technology

carbonization

Process by which coal is heated ~ volatile products driven off ~ leaving solid residue 'char'/ 'coke'

High temp. carb ~ production of metallurgical coke (>1650^{0}F) for blast furnaces / foundries

Coal of a definite range of rank/properties are essential

Low temp. carb ~ provide town gas / tar production / smokeless fuels for domestic & industrial heating / chemicals (<1350^{0}F)

Low rank coal preferred

liquefaction

'provides synthetic fuel'

Main problem ~ deficiency of H in coal ;

H/C ratio 0.7 to 1.2

Addition of H by

~ direct liquefaction by hydrogenation

~ indirect liquefaction by Fischer-Tropsch synthesis

~ Pyrolysis - removal of part of C

gasification

Process to upgrade solid feedstock

~ converting to gas

~ purified and used directly as fuel or

~ reacted to produce gaseous/liquid fuels/chemicals

Specially attractive to nations that have

~ coal reserves &

~ lack adequate oil & gas resource or depleting them

gasification (contd)

‘a well proven technology’

Began with the production of town gas

~ progressed to production of fuels ~ 0il ~ synthetic gas

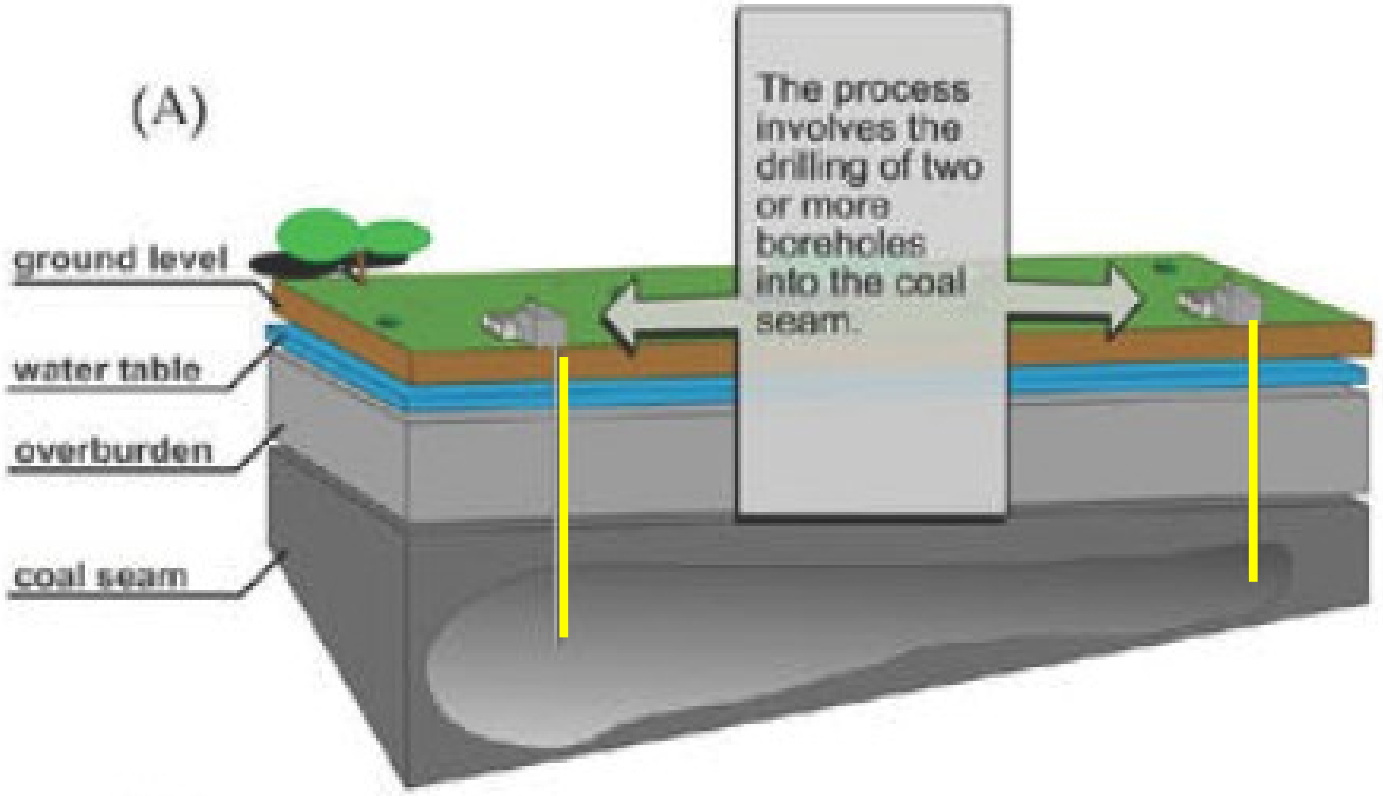
~ chemicals ~ and recently IGCC power generation

surface gasification ⟷ underground in situ gasification

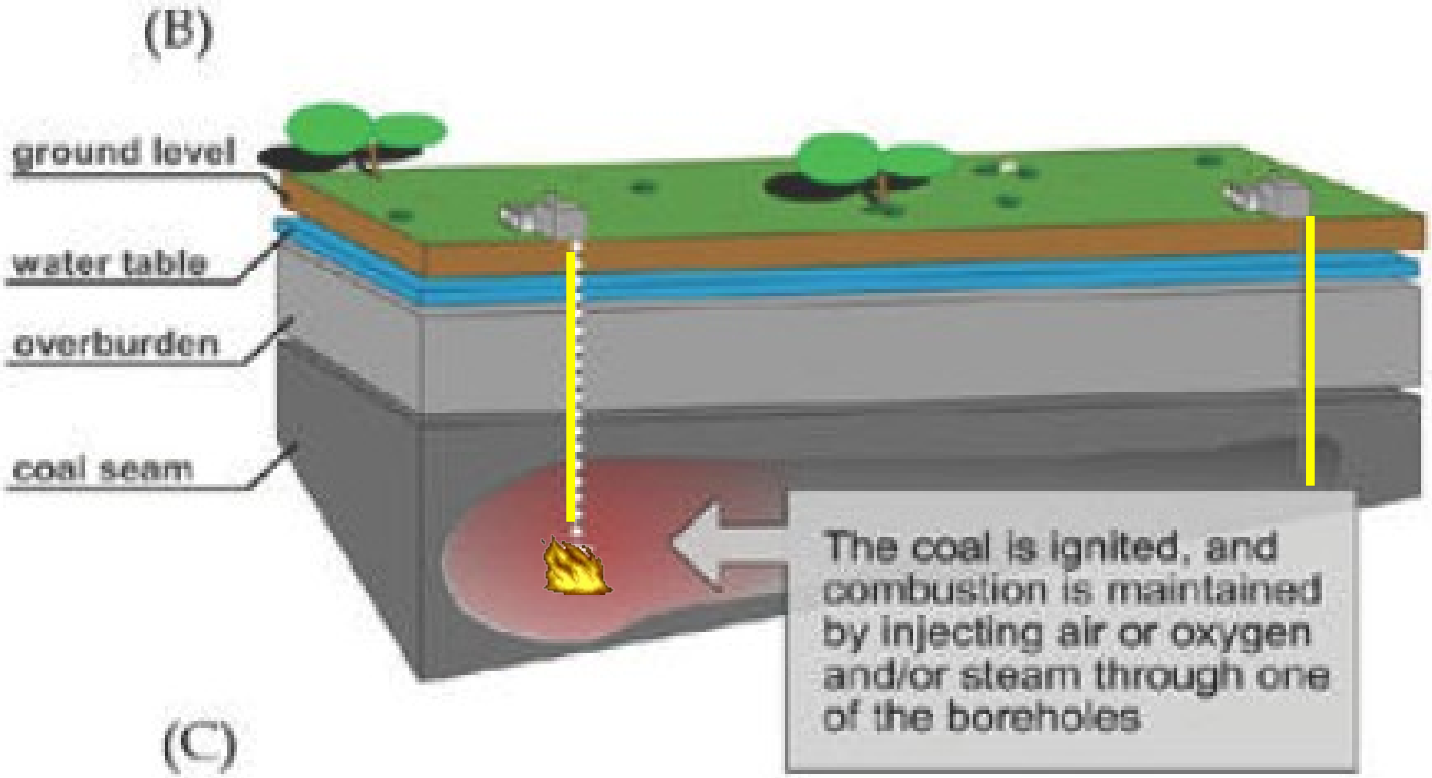
gasification process is ‘*comparatively insensitive*’ to coal properties

~ coal that are unsuitable for other processes can be utilized

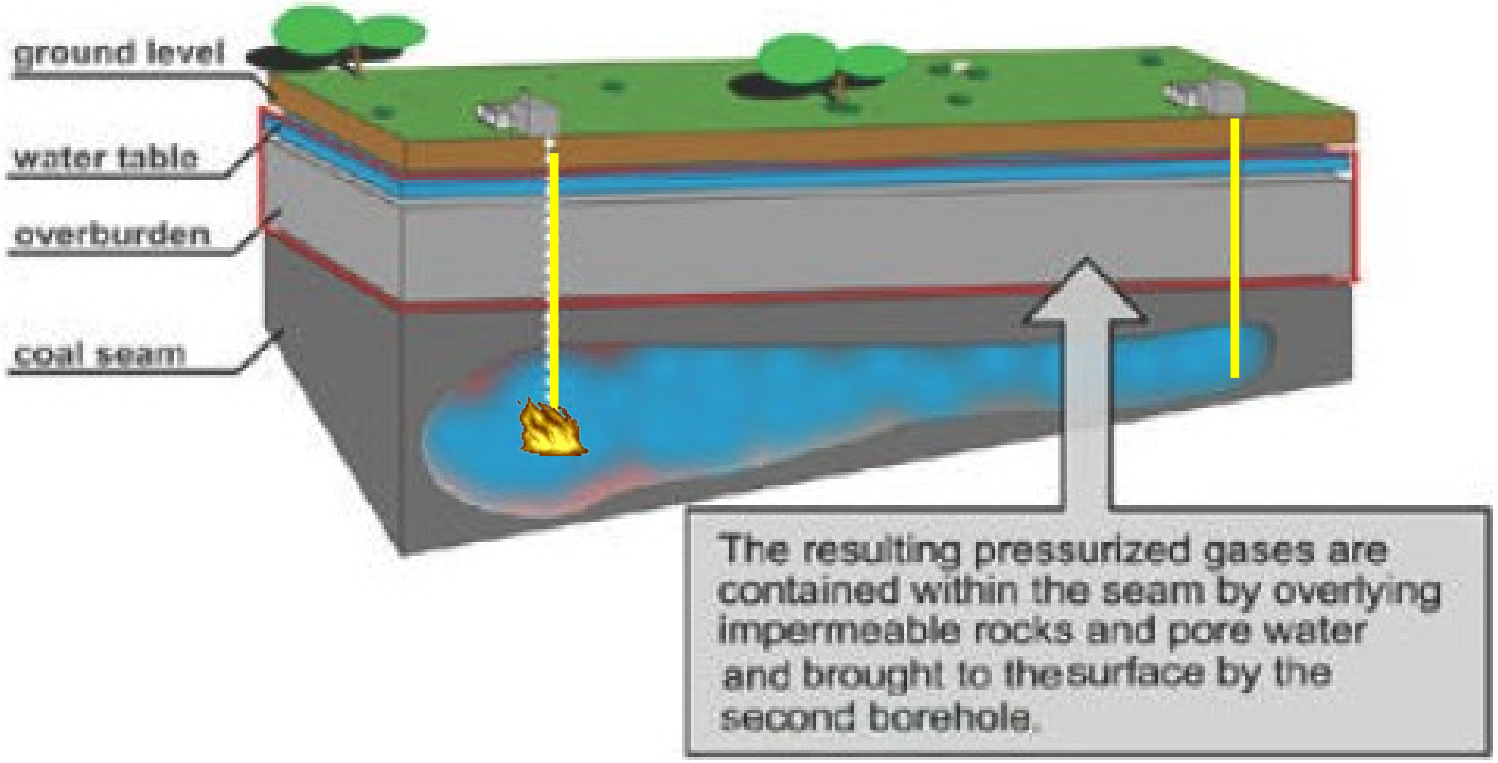
Two boreholes are drilled into the coal seam



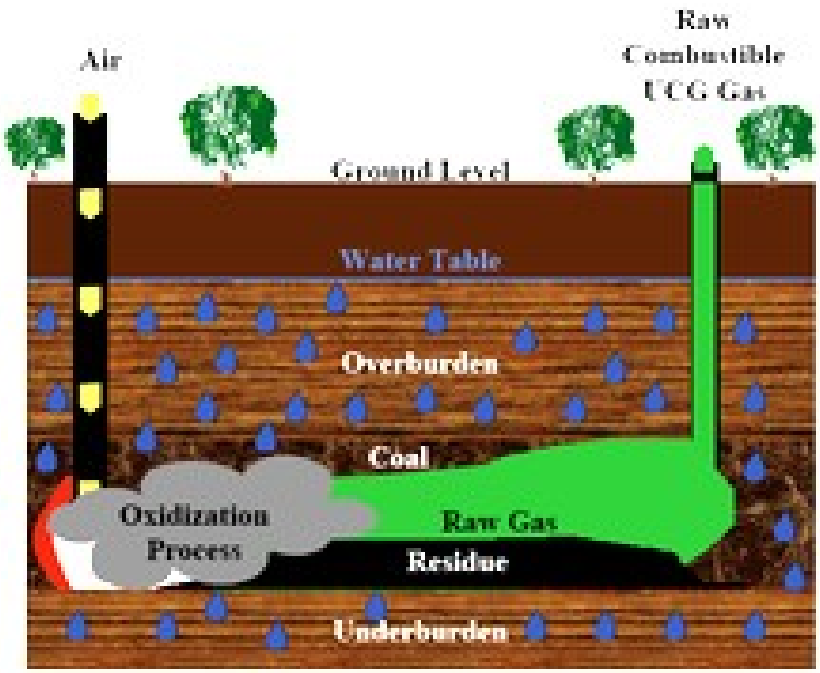
Coal is ignited, combustion is maintained by injecting air or oxygen and steam

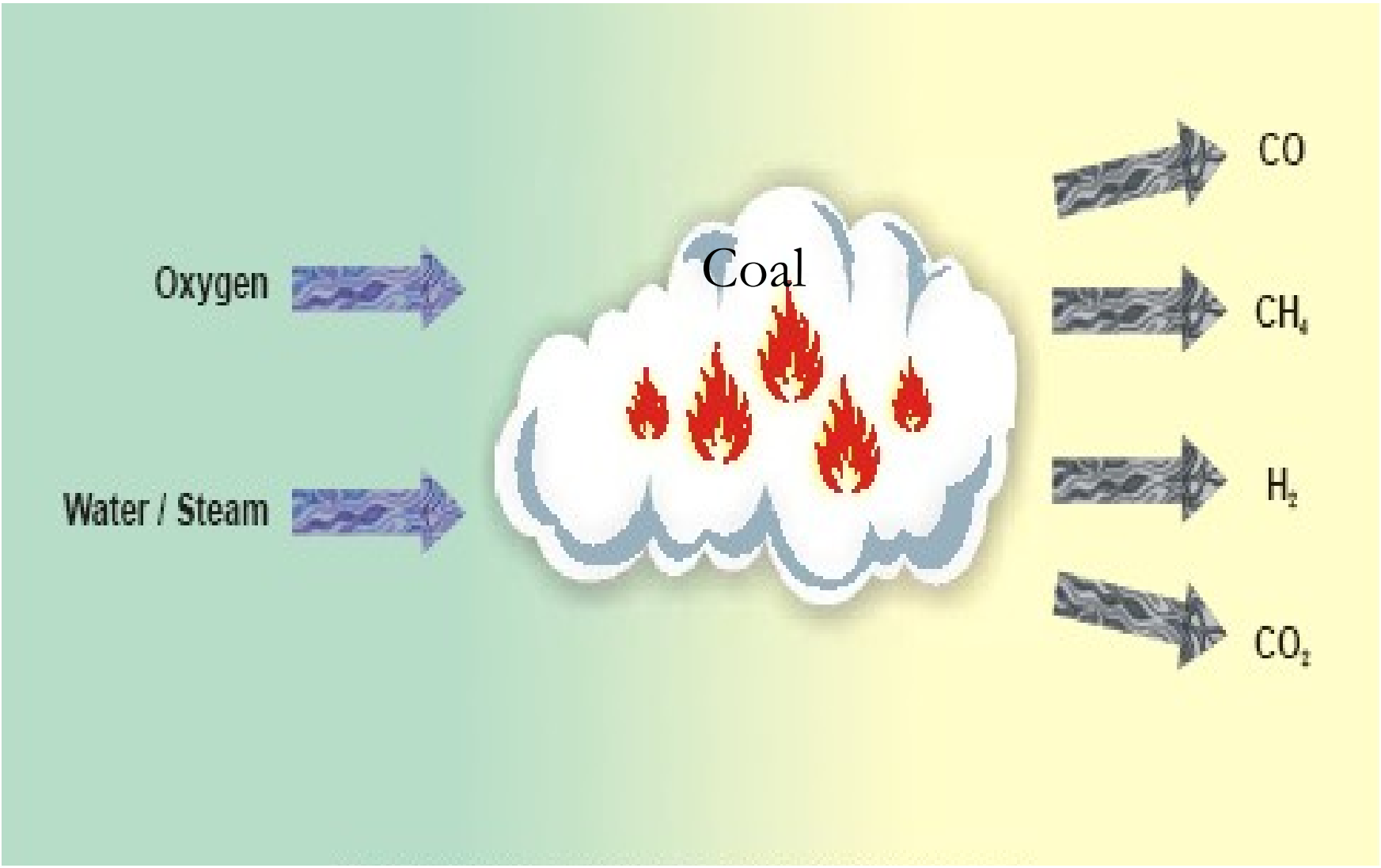


The resulting gases are brought to surface by the second bore hole

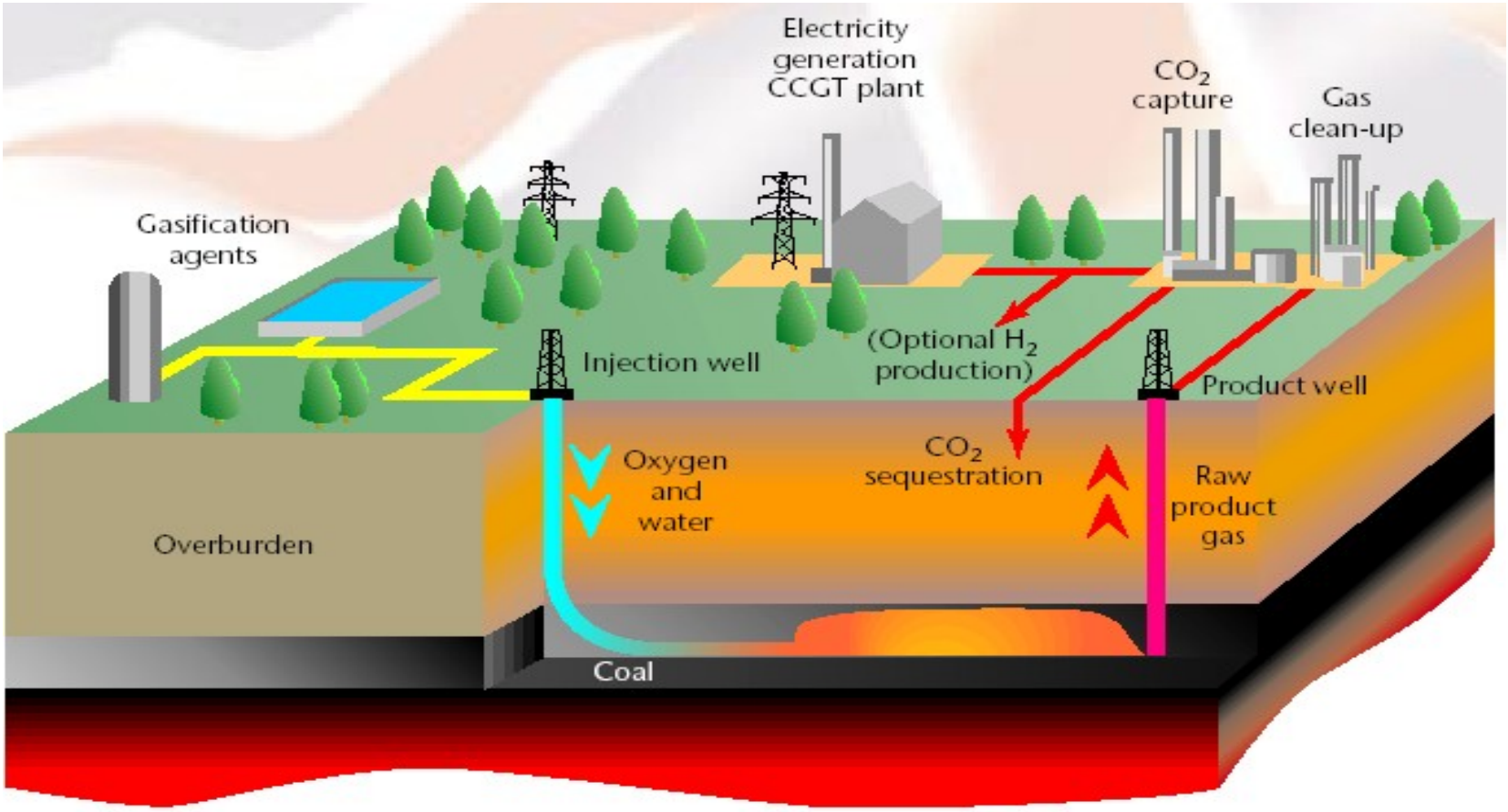


UCG PRODUCTION PROCESS




Oxygen
Water / Steam
Coal
CO
CH_4
H_2
CO_2

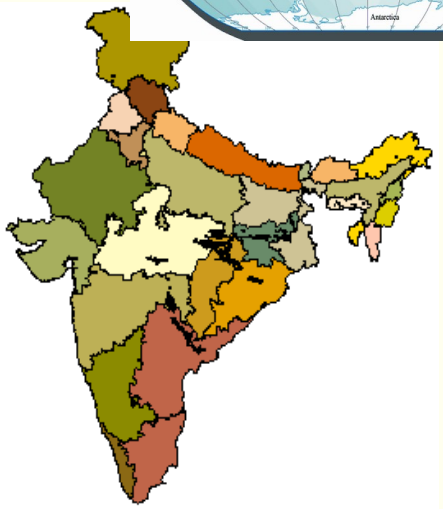
POWER GENERATION WITH UCG



CBM

Coal Bed Methane, thought earlier to be a hazardous gas in mines, has now emerged to be a viable source of eco-friendly thermal energy in recent years,

In USA, Australia & China, it has been proved to be a source of additional energy.



In India concept of exploration for CBM is very recent and in the present energy scenario it has attracted the active attention of scientists, technologists & planners of India.

CBM VS NATURAL GAS

NATURAL GAS	CBM
METHANE – 85% + varying proportions of ethane, propane, butane, CO_2, N_2 , H_2S, He	METHANE – 95% + <3%CO_2 & N_2 & traces of ethane,propane
HEAT VALUE- 9000 KCal/Kg	HEAT VALUE- 8500 KCal/Kg

CBM

RELATIVELY CLEAN FUEL

GENERALLY OF PIPELINE QUALITY

AN IDEAL SUBSTITUTE FOR NATURAL GAS

CBM resource

Estimated CBM in coal-lignite deposits of India - 1.4 to 2.6 TCM

(49.4 – 91.8 TCF)

(source DGH)

26 blocks awarded for exploration & production

CBM resources in first 16 blocks estimated – 820 BCM

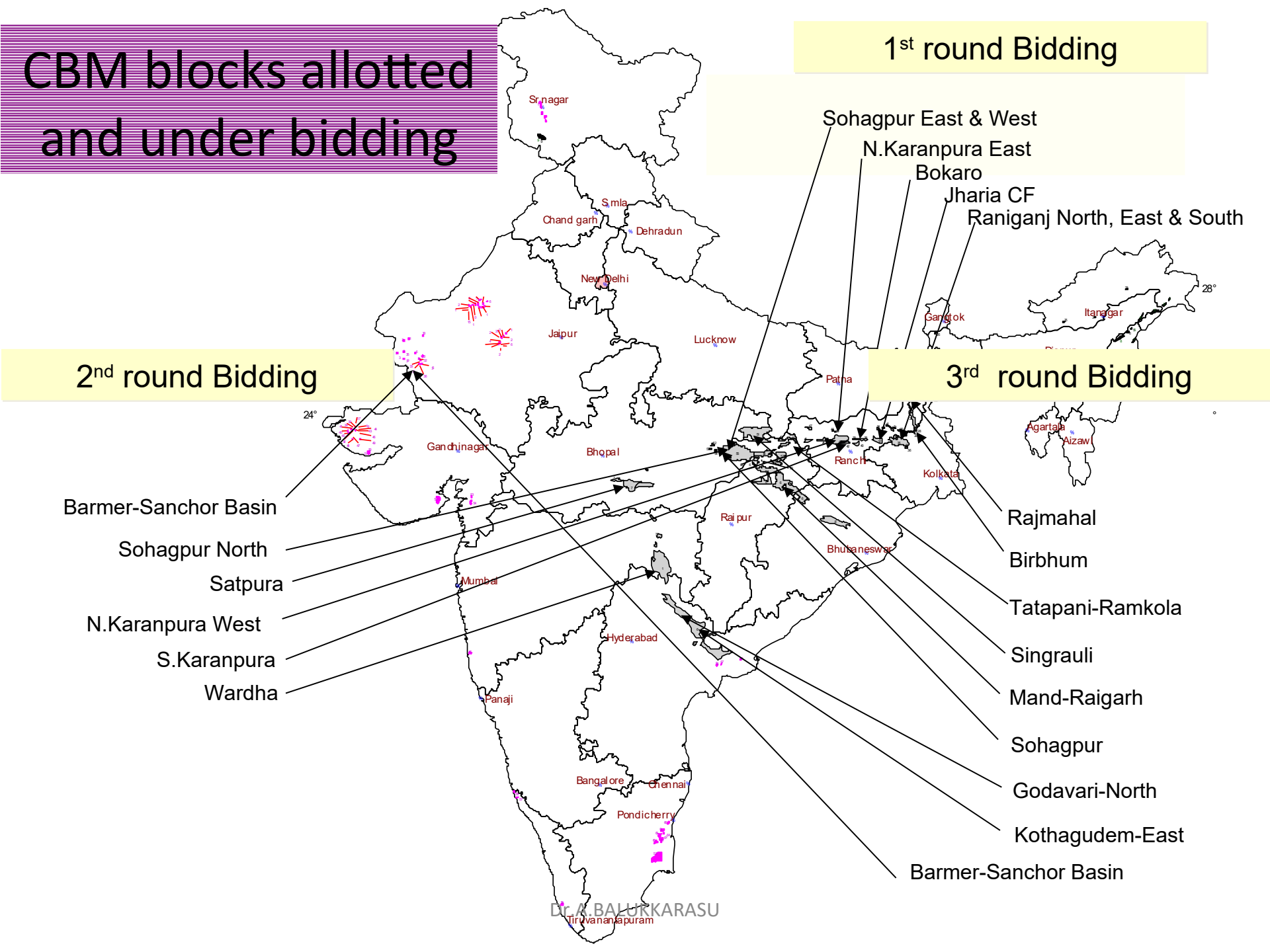
(28 TCF)

Estimated production from the 26 blocks - 38 MCM / day

(1341 MCF)

Commercial production commenced in July,07 from Raniganj cf

CBM blocks allotted and under bidding



Coal to OIL

Coal Beneficia-tion

liquefaction

'provides synthetic fuel'

Main problem ~ deficiency of H in coal ;

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Addition of H by

~ direct liquefaction by hydrogenation

~ indirect liquefaction by Fischer-Tropsch synthesis

~ Pyrolysis - removal of part of C

Direct Liquefaction ~ hydrogenation

~ H/C ratio increased by adding hydrogen donor

~ not widely accepted commercially

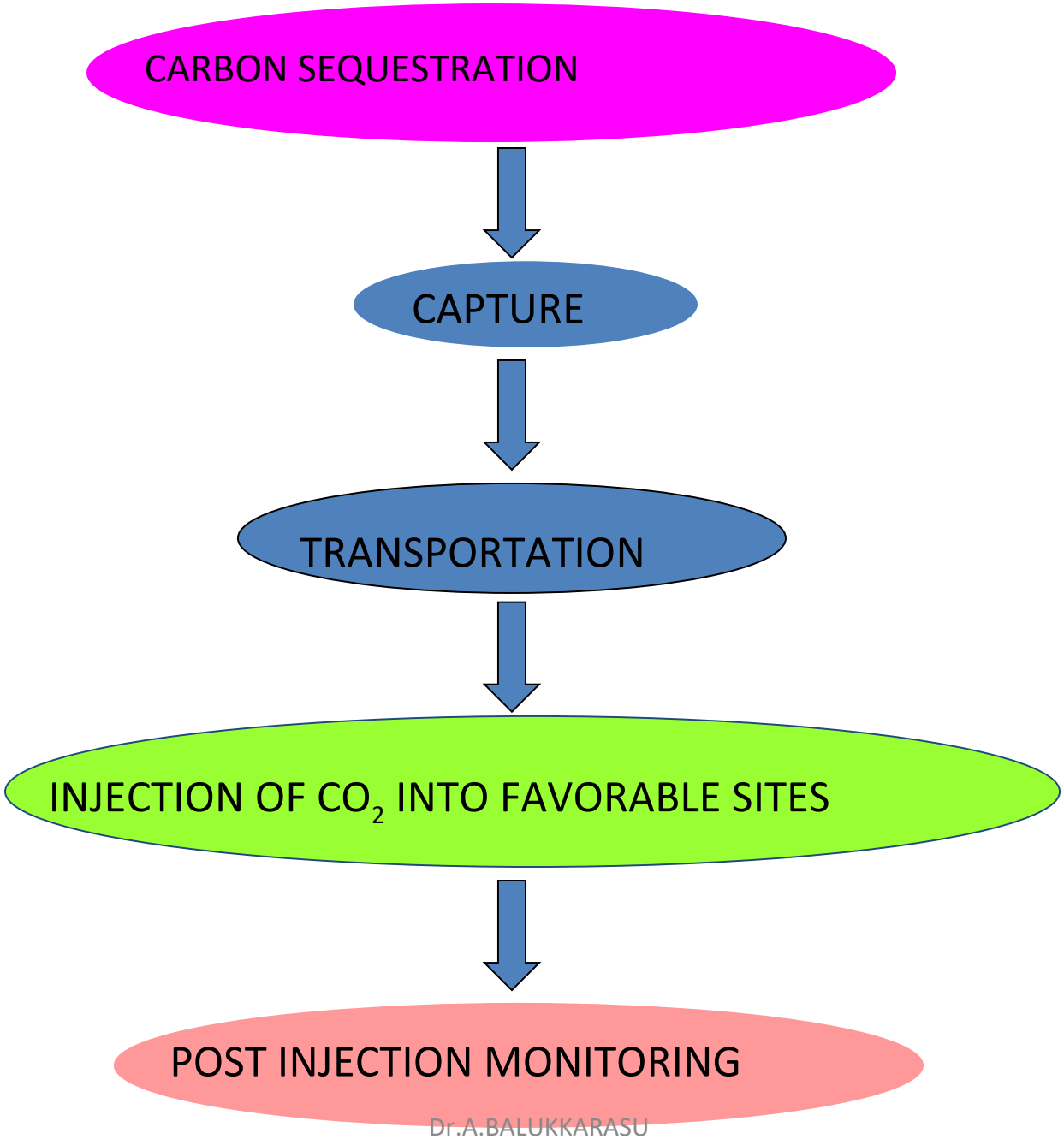
Pyrolysis ~ heating of coal

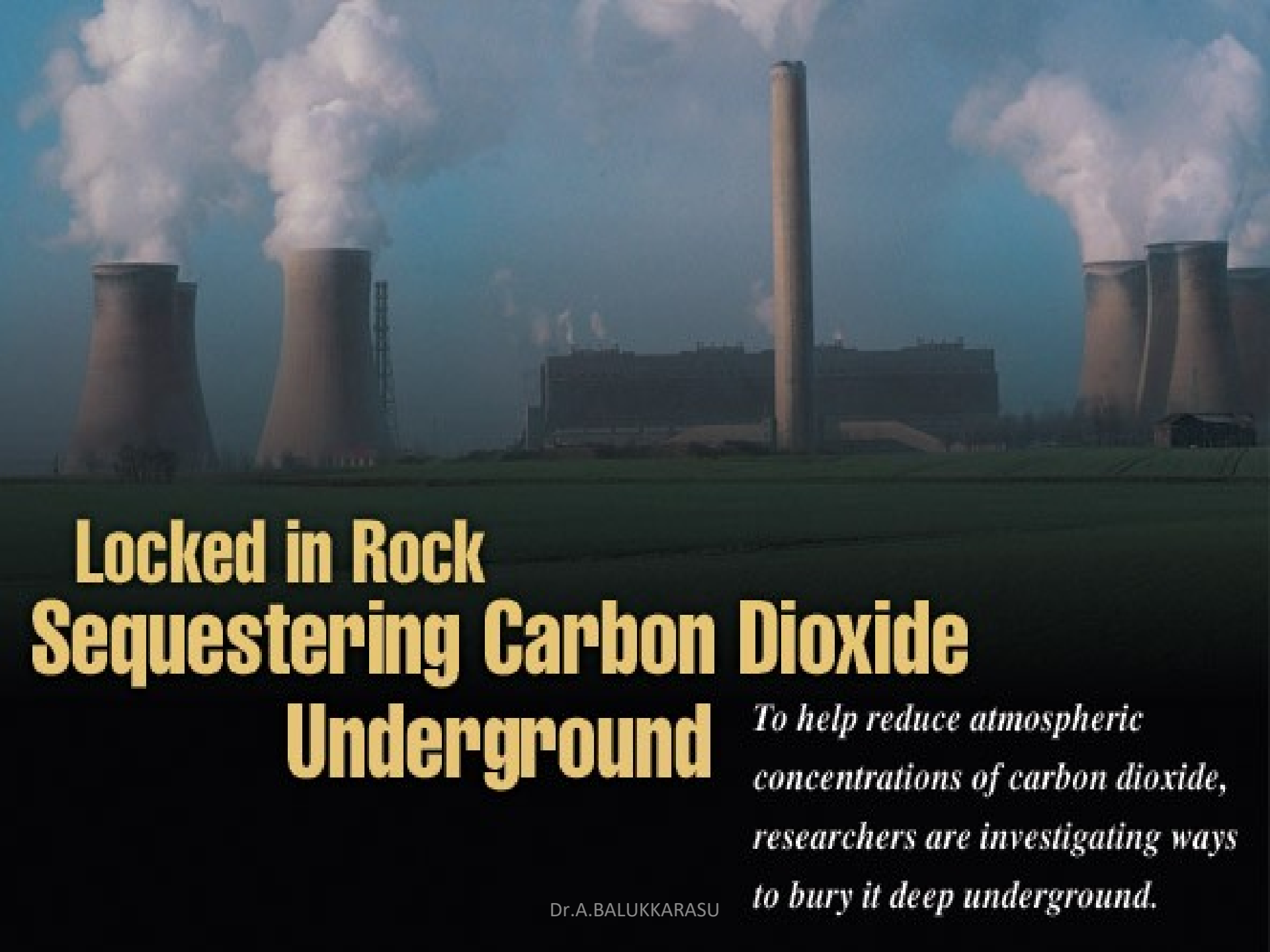
~ decompose to gas, char and tars

~ tars hydrogenated to produce heavy or light oils

Indirect liquefaction

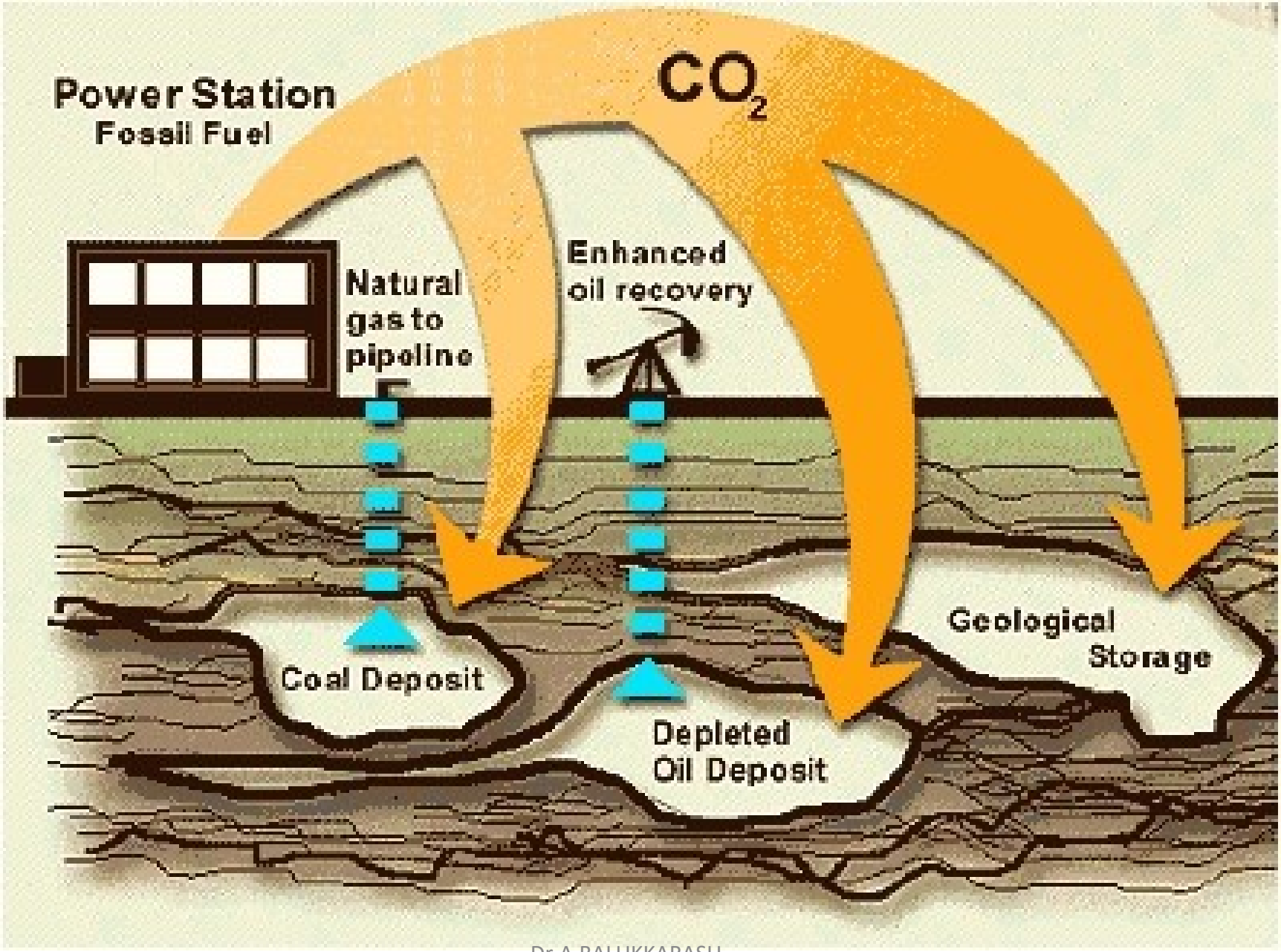
~ coal gasified to syngas ($CO + H_2$) ~ syngas processed into liquid by Fischer-Tropsch synthesis

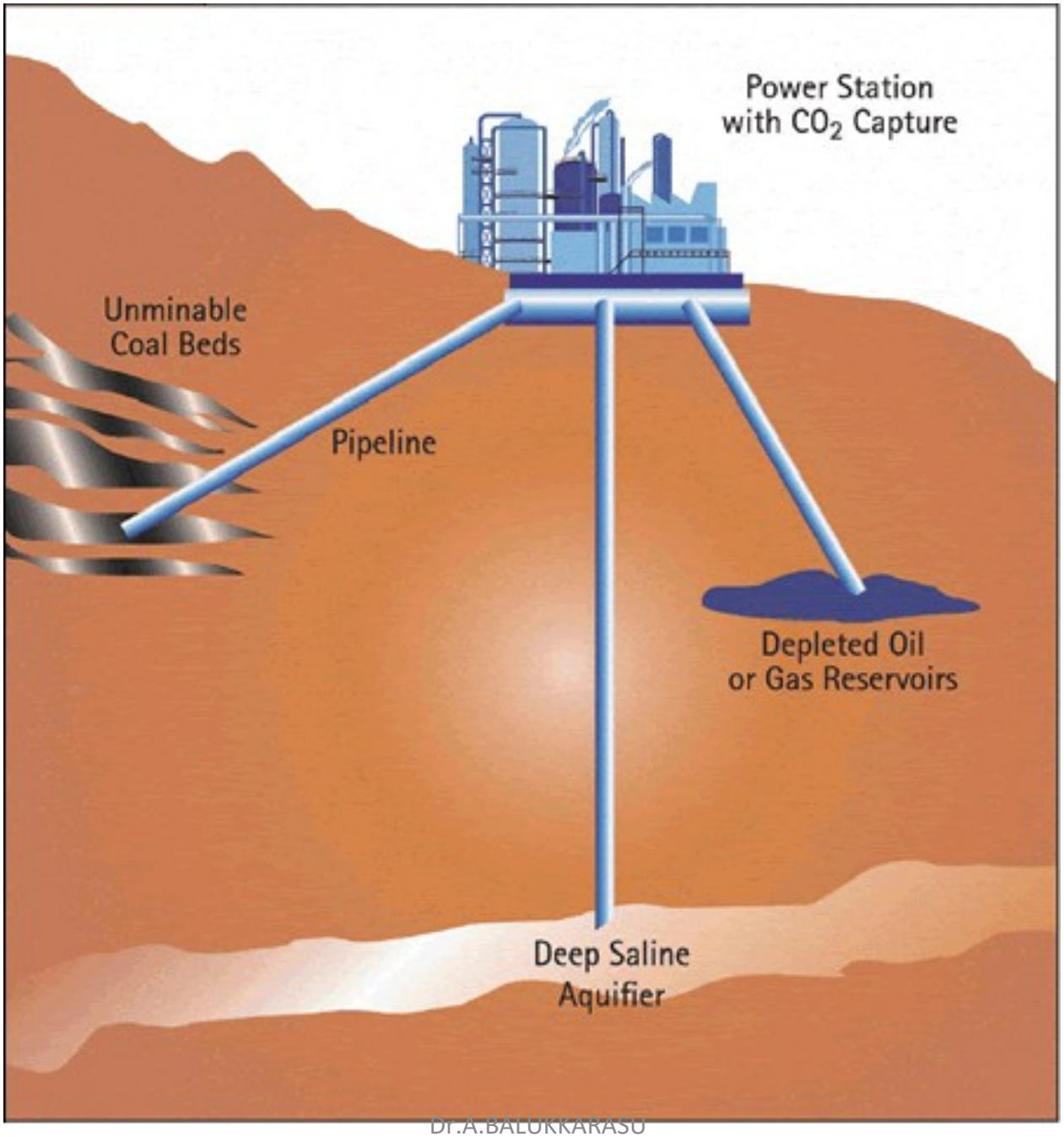

CARBON SEQUESTRATION
CAPTURE
TRANSPORTATION
INJECTION OF CO_2 INTO FAVORABLE SITES
POST INJECTION MONITORING



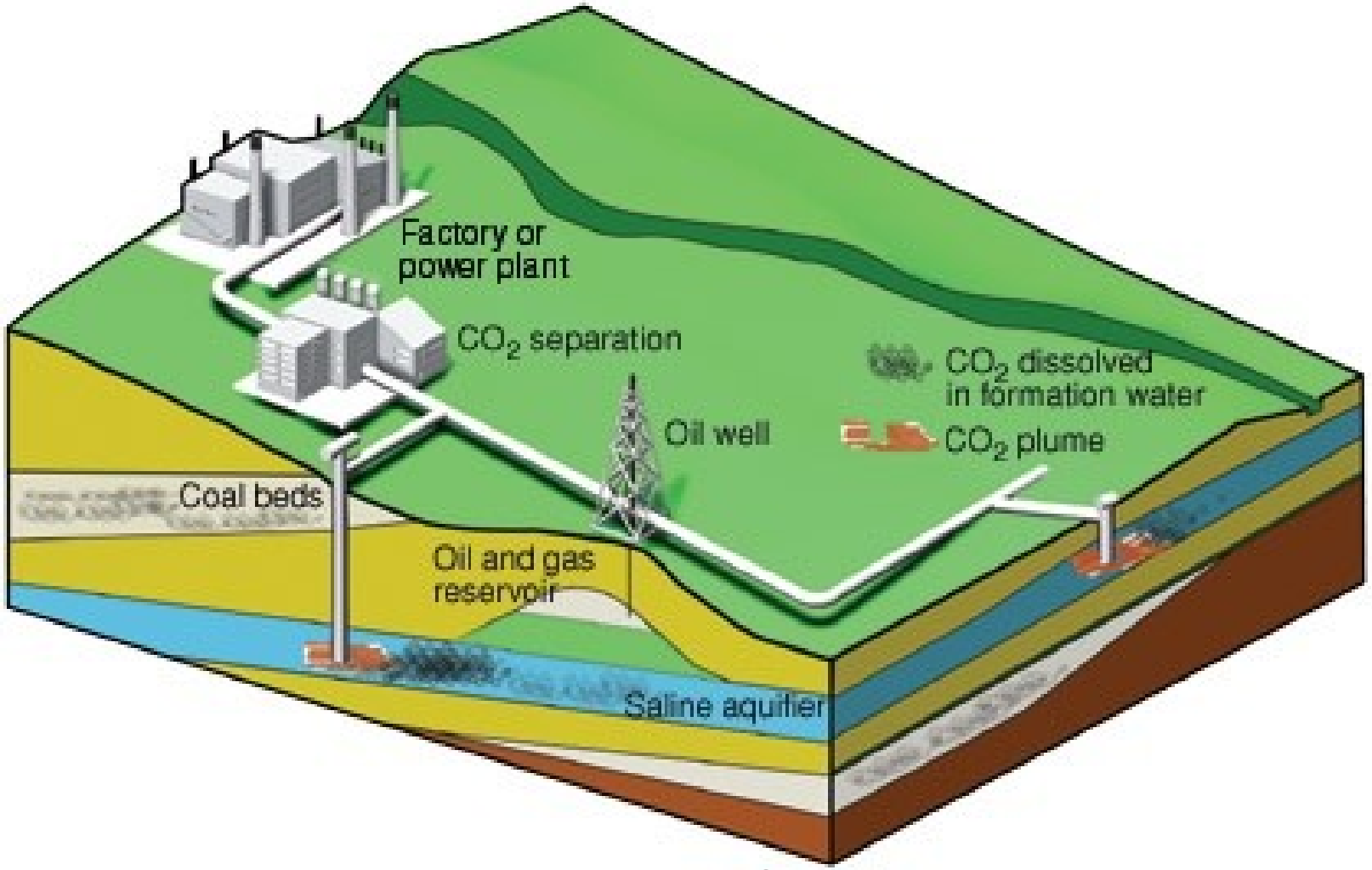
Locked in Rock
Sequestering Carbon Dioxide Underground

To help reduce atmospheric concentrations of carbon dioxide, researchers are investigating ways to bury it deep underground.

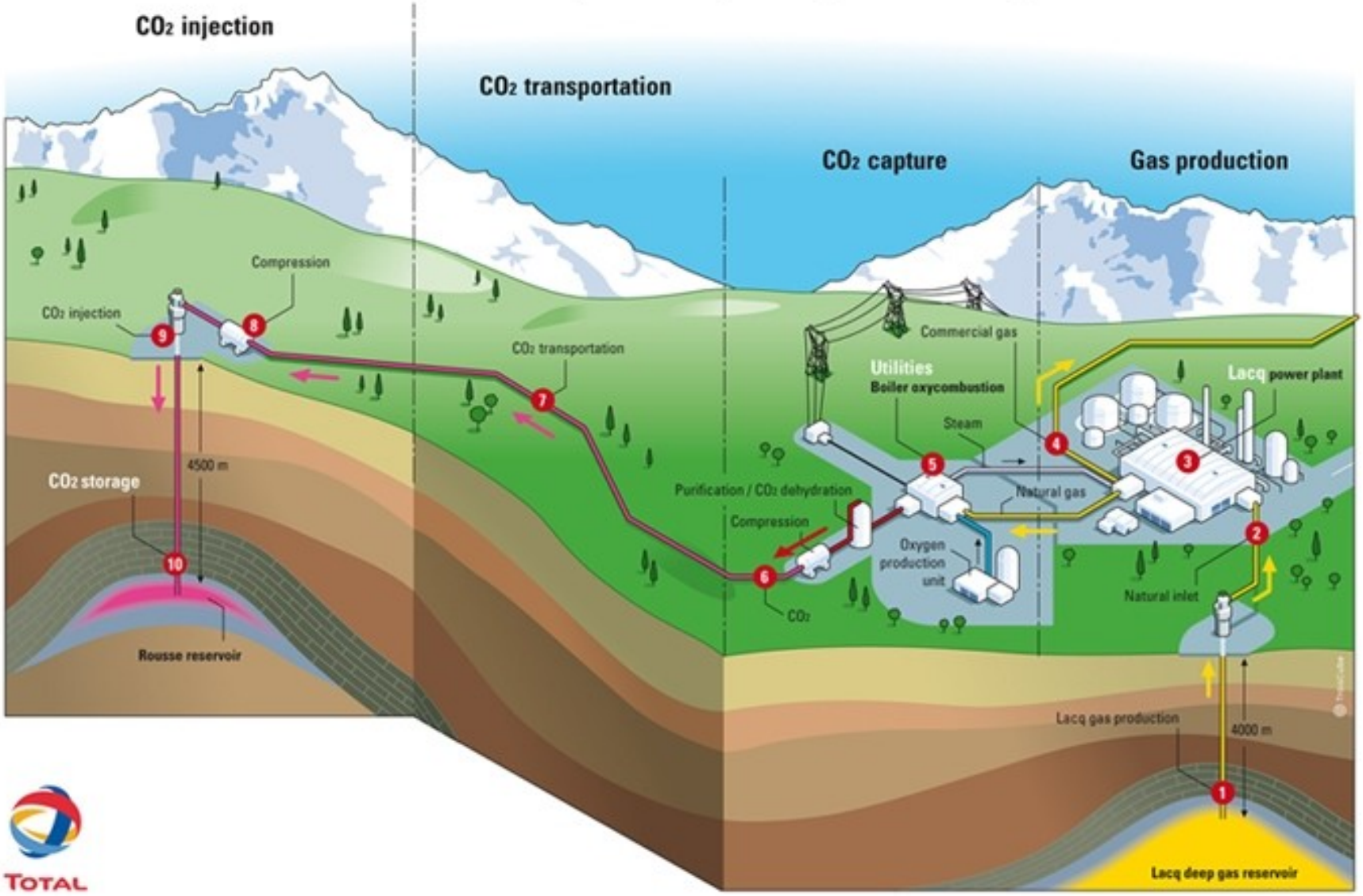

Power Station
Fossil Fuel
CO_2
Natural gas to pipeline
Enhanced oil recovery
Coal Deposit
Depleted Oil Deposit
Geological Storage


Power Station
with CO_2 Capture
Unminable
Coal Beds
Pipeline
Depleted Oil
or Gas Reservoirs
Deep Saline
Aquifier

Schematic diagram of the Carbon Sequestration process

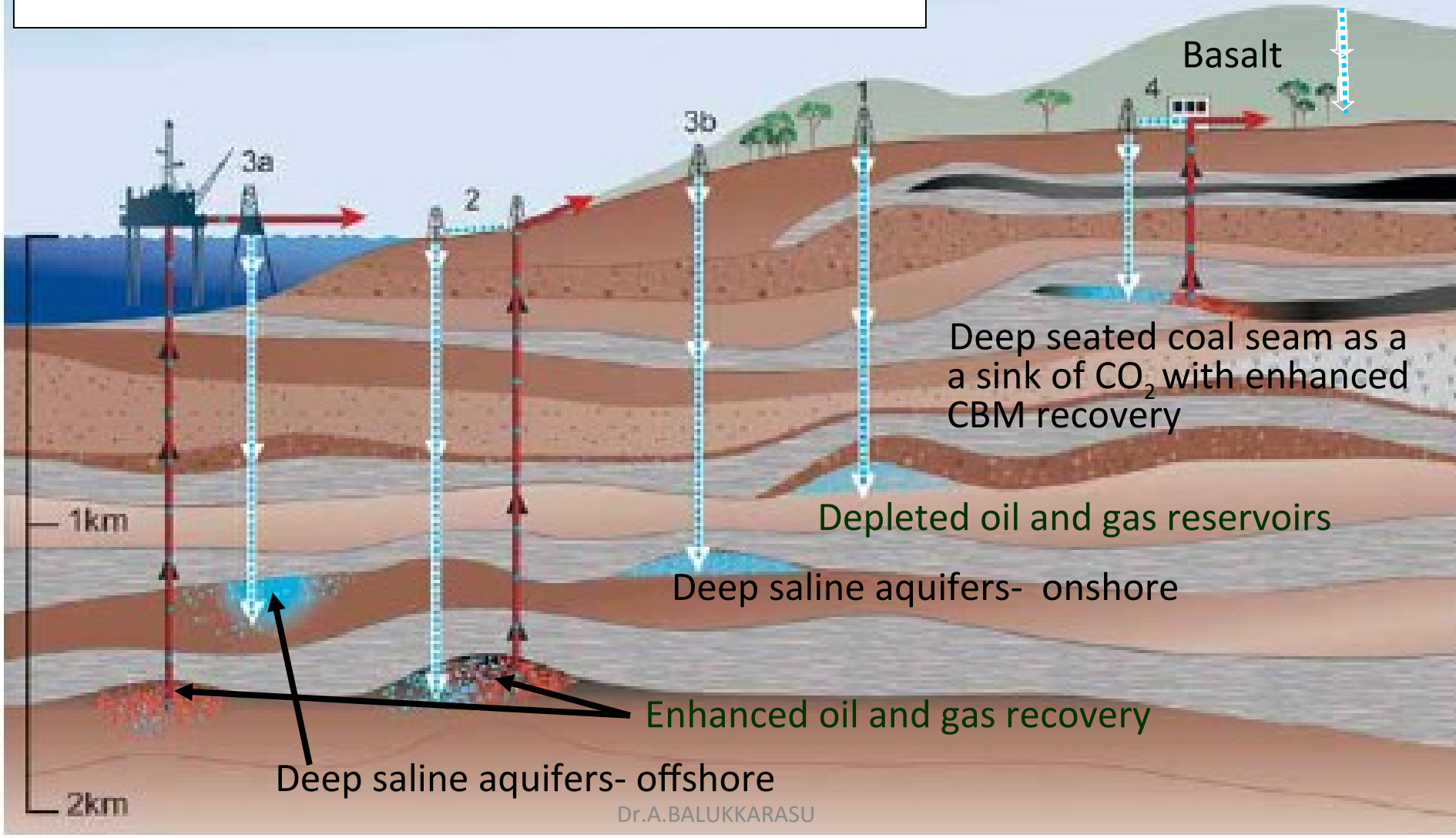


Carbon capture & geological storage



CO_2 SEQUESTRATION

~ geological options



PART-A (15X2=30 Marks)

Time 2hrs Maximum 50Marks

1. What is vitrinite reflectance and how is it measured?
2. What is coal made from?
3. What are coal macerals?
4. What is inertinite?
5. What is vitrinite in coking coal?
6. What is coal fluidity?
7. What is semi coking coal?
8. Explain the carbonization.
9. Explain the coal-bed methane.
10. Why is Coke used instead of coal?
11. Which is the mixture of coal gas?
12. What chemicals are in coal?
13. What is the main constituent of coal?
14. Why do we burn coal?
15. How long does it take to form coal?

PART-B (4X5=30 Marks)

16. Briefly state the Tertiary Coalfields in Assam, Arunachal Pradesh, Meghalaya, Gujarat, Rajasthan and Tamil Nadu **(Compulsory).**

17. Define the significance of various Parameters in Proximate Analysis.

(OR)

Explain the Gondwana Coalfields in Jharkhand.

18. Discuss the Gondwana Coalfields in Odisha.

(OR)

Describe the Gondwana Coalfields in Madhya Pradesh.

19. Explain the Gondwana Coalfields in Andhra Pradesh.

(OR)

Write about the Gondwana Coalfields in West Bengal.