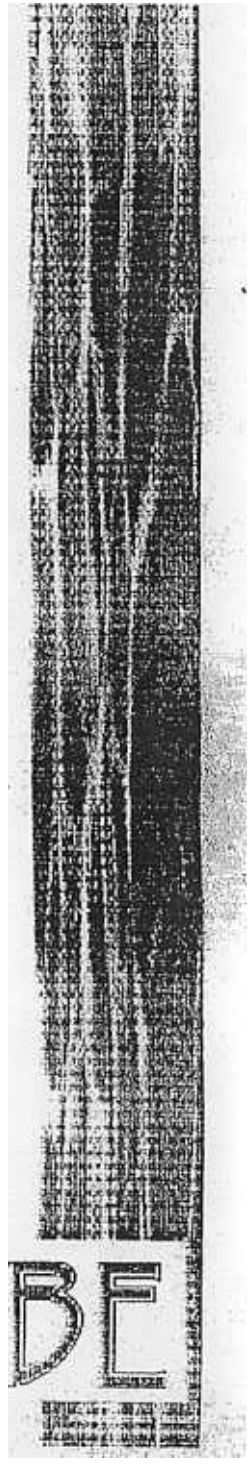
An overview of climate change and CO_2 abatement by capture and storage.

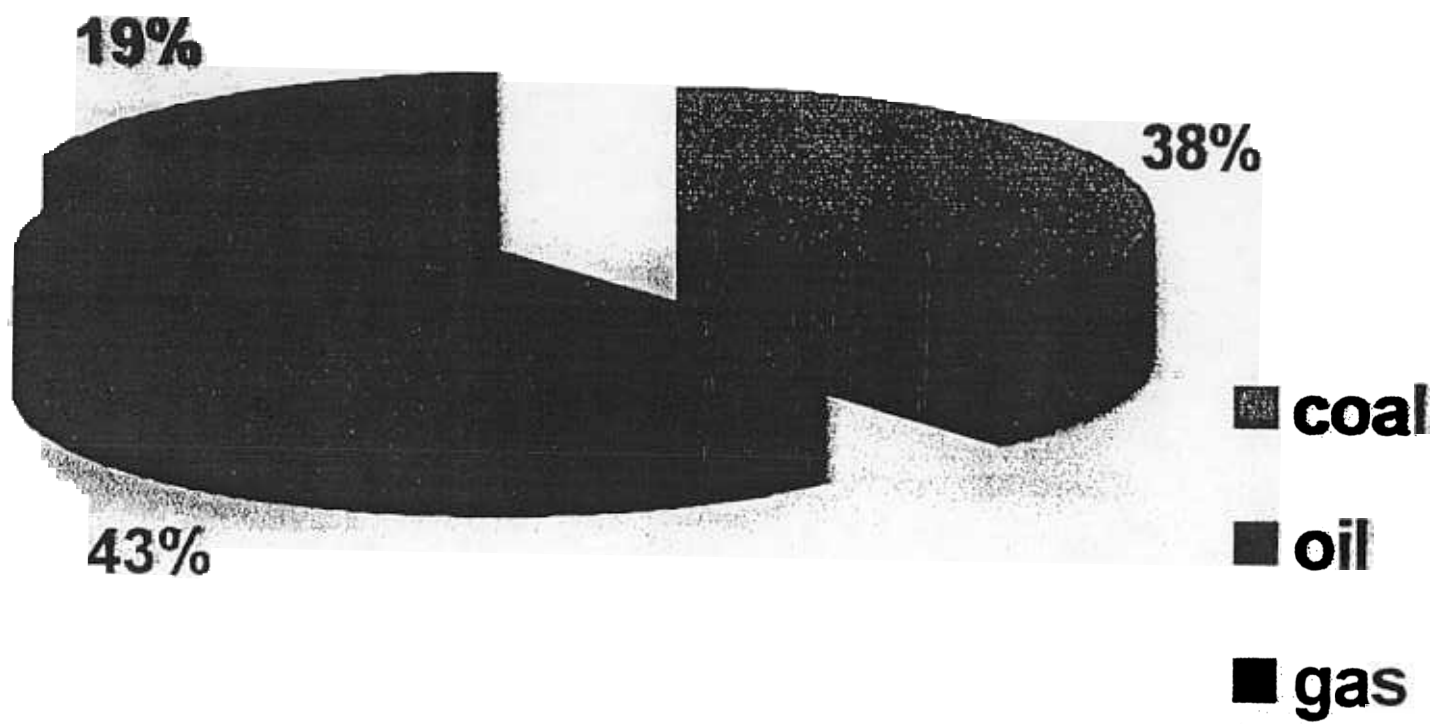
Harry Audus

AUBE energy&environment



CO_2 emissions by fuel type

Source: IEA 1997



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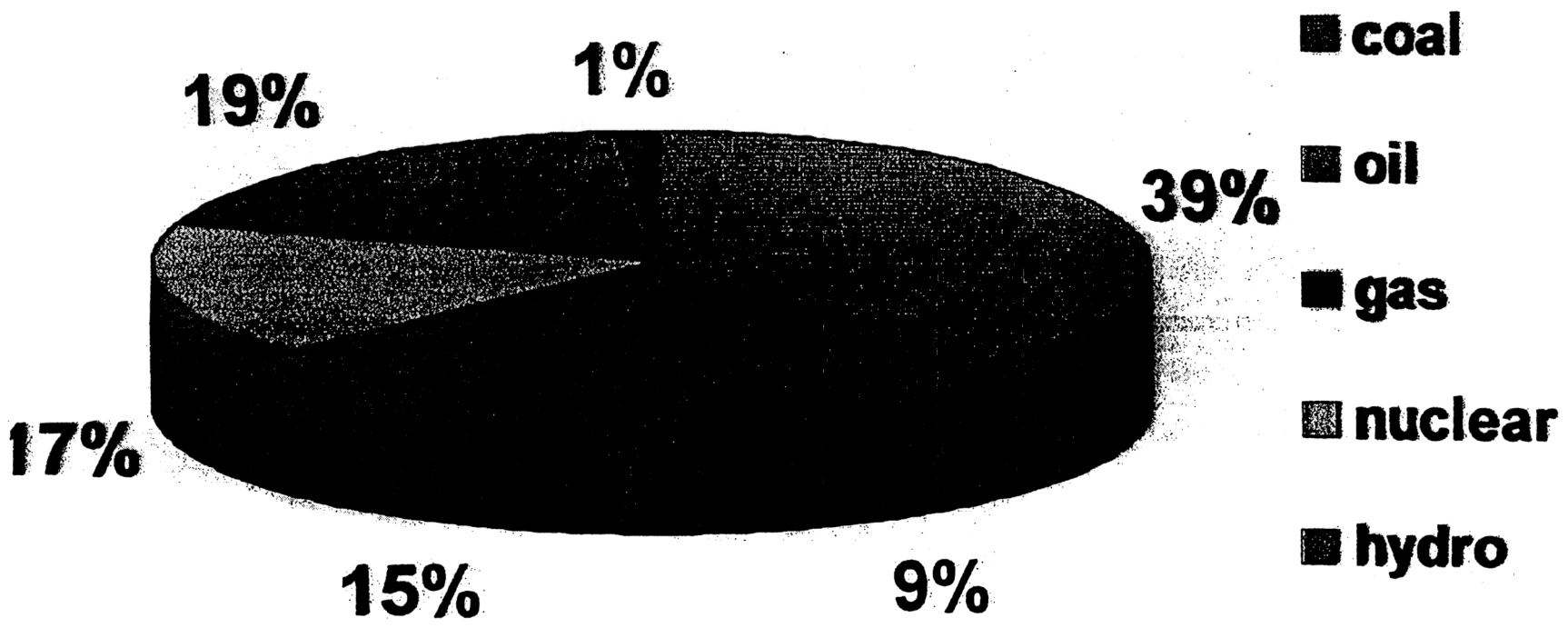
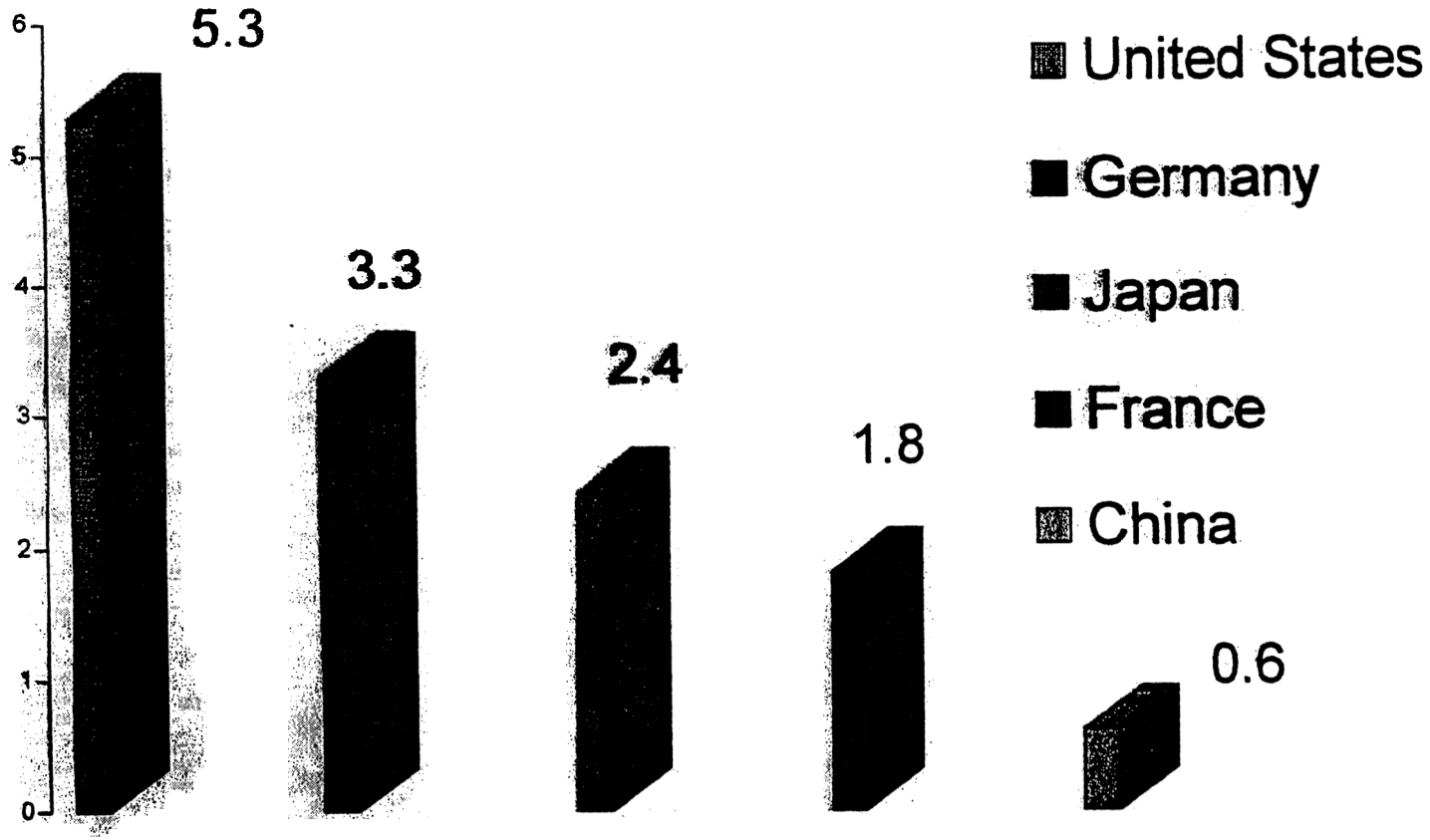
Fuel shares of electricity generation

source: IEA -1997



Carbon emissions

Source: WEA -1996



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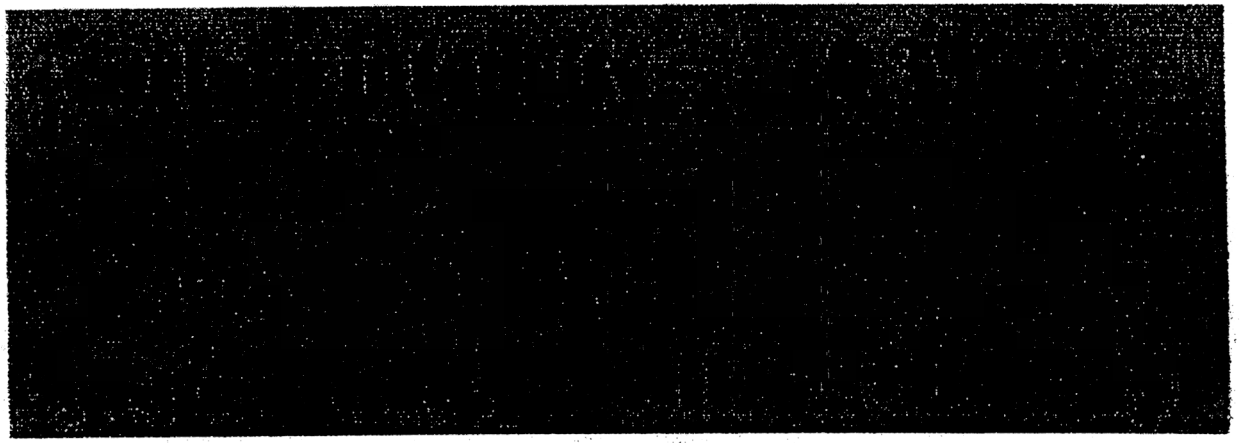
Kaya identity: emission projections

carbon = N x (GDP/N) x (E/GDP) x (C/E)



Carbon = 0.997 x 0.99 x 1.016 x 1.013

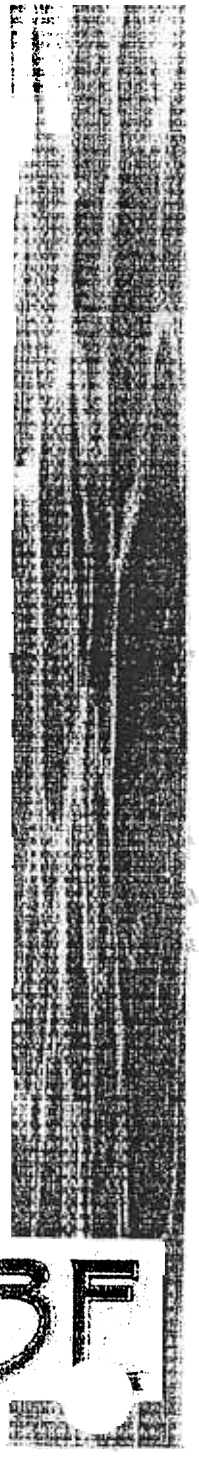
= 1.016 ie 1.6%/yr

Carbon emissions using Kaya identity

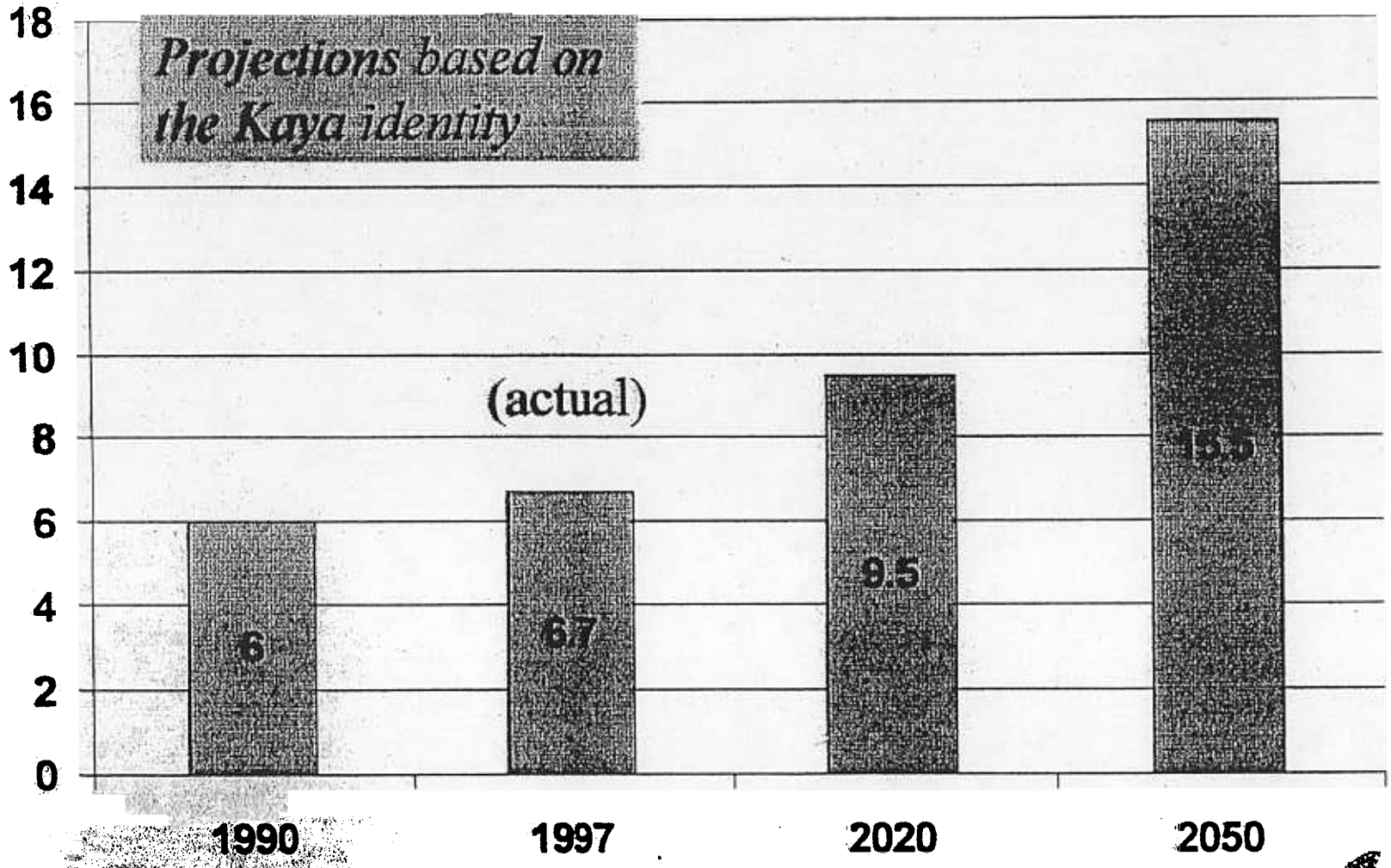
1990 figures:

- world population
  - 5.3 billion
- world average per capita GDP
  - 4 100 (1990) US$
- energy intensity
  - 0.49 watt-years / $
- carbon intensity
  - 0.56 Kg carbon / watt-year

Carbon emitted ≙ 6 Gt C/year (6 000 000 000 tonnes /year)



Global carbon emissions-GtC/yr



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CO_2 emission reduction options

- improved efficiency
  - end use
  - generation
- low/no carbon sources of energy
  - nuclear
  - renewables
  - natural gas
- enhancement of natural sinks
  - forests
  - ocean
- capture and sequestration of CO_2

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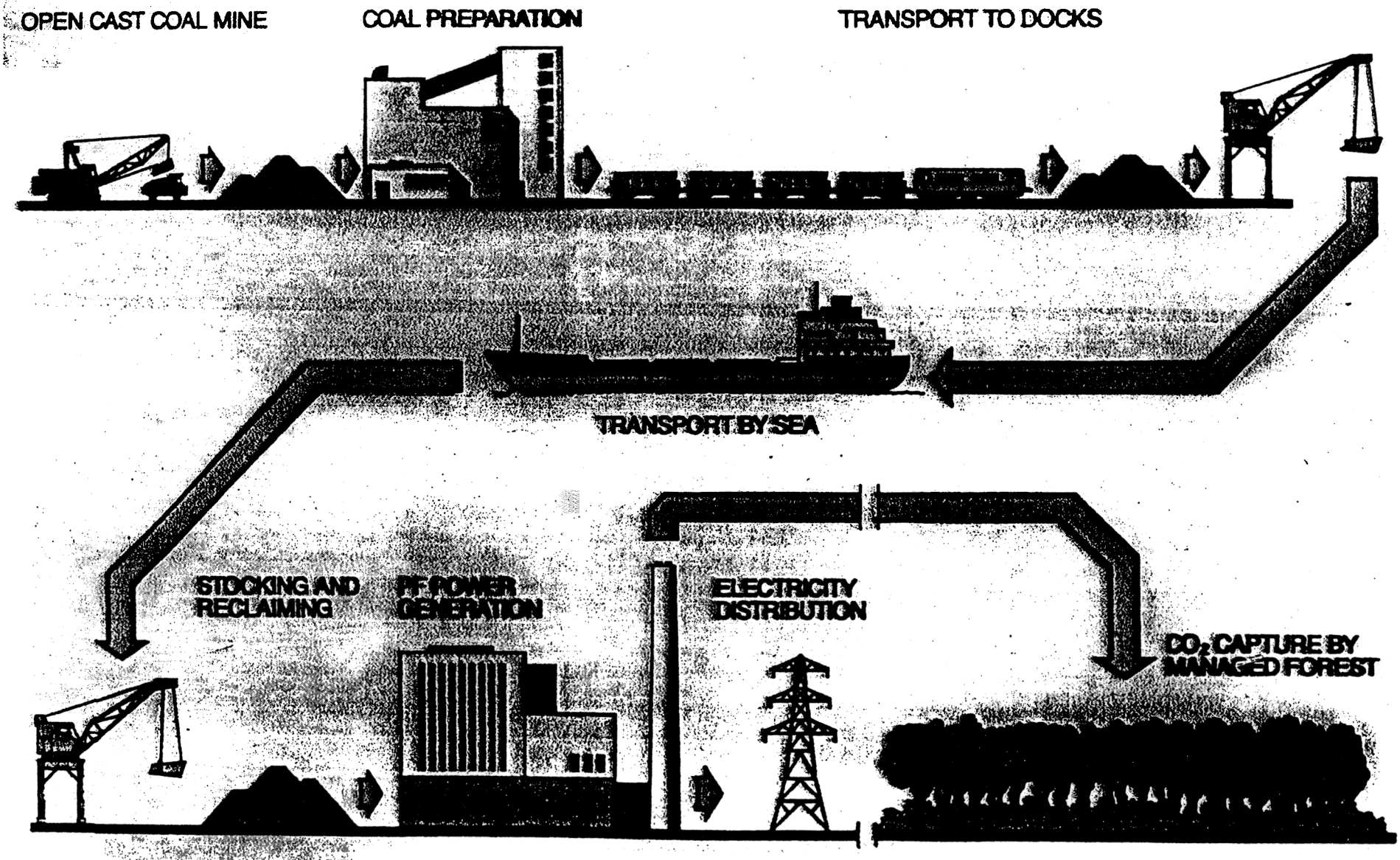
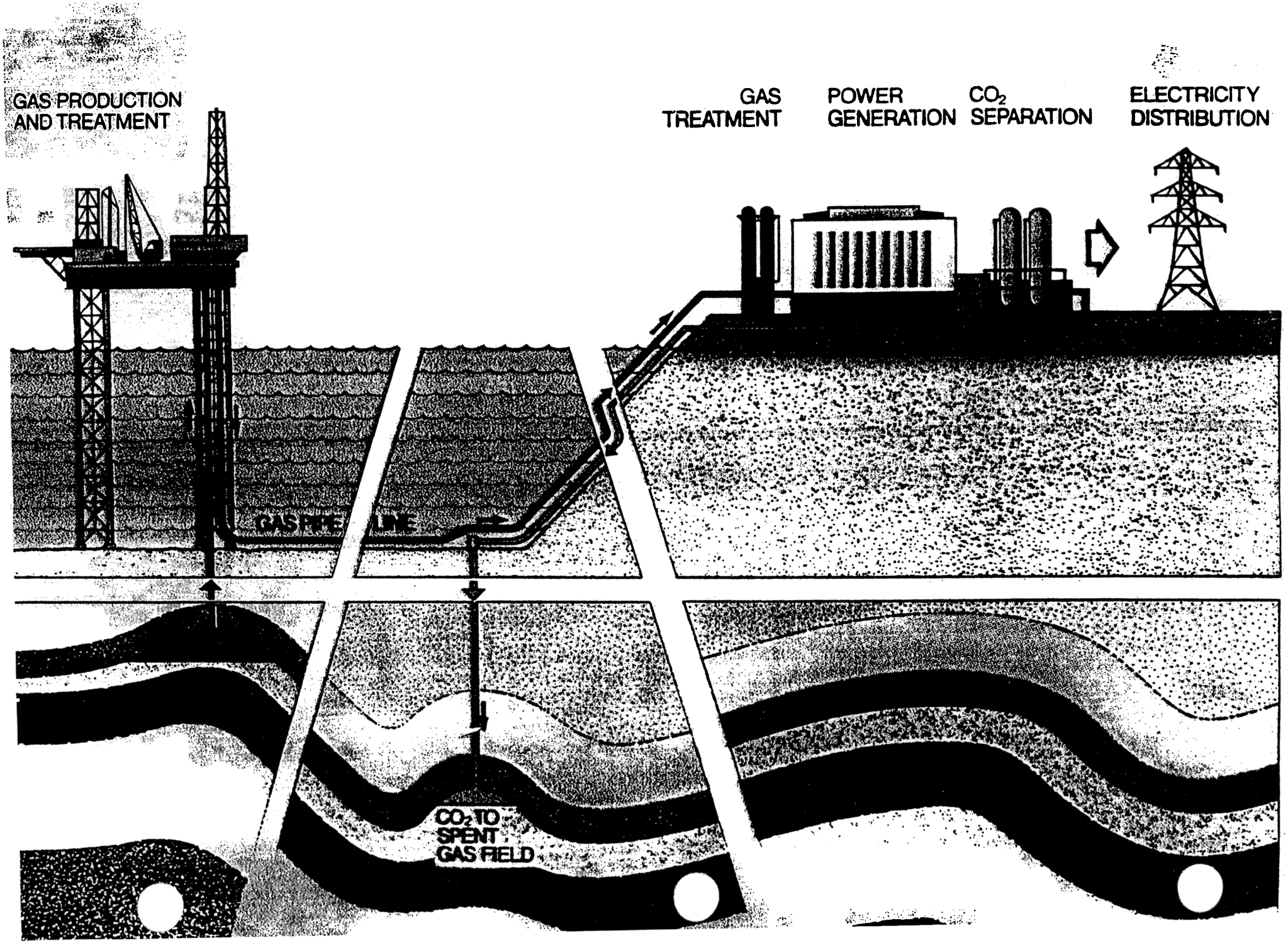
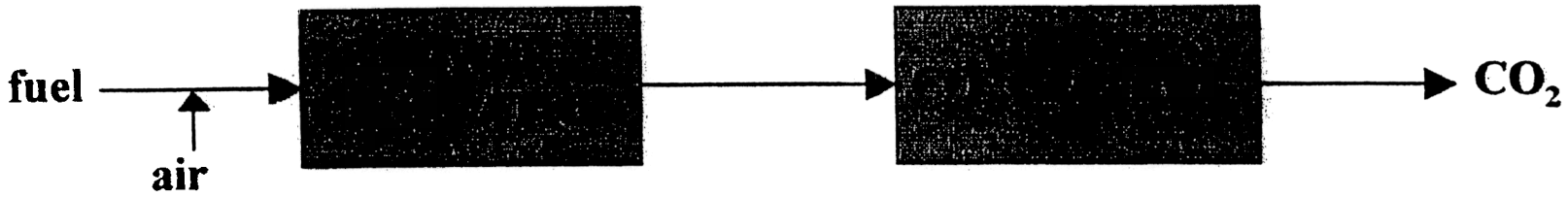

OPEN CAST COAL MINE
COAL PREPARATION
TRANSPORT TO DOCKS
TRANSPORT BY SEA
STOCKING AND RECLAIMING
PF POWER GENERATION
ELECTRICITY DISTRIBUTION
CO_2 CAPTURE BY MANAGED FOREST

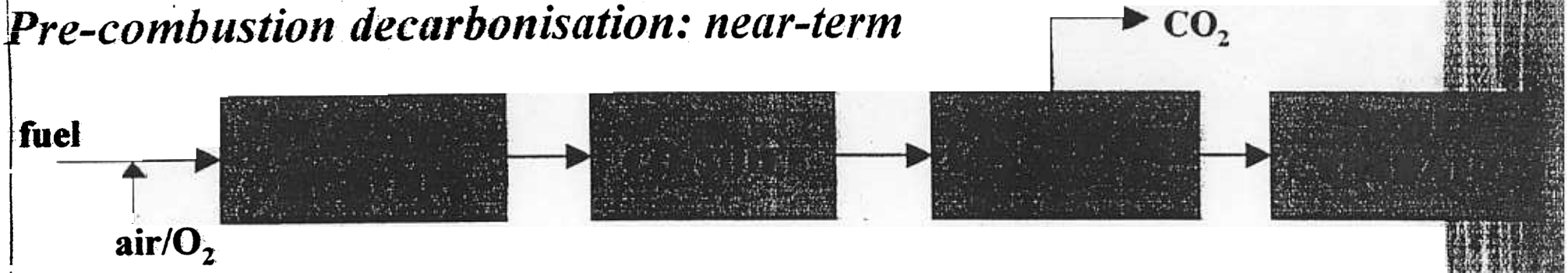

GAS PRODUCTION AND TREATMENT
GAS TREATMENT
POWER GENERATION
CO_2 SEPARATION
ELECTRICITY DISTRIBUTION
GAS PIPE LINE
CO_2 TO SPENT GAS FIELD

CO_2 capture options

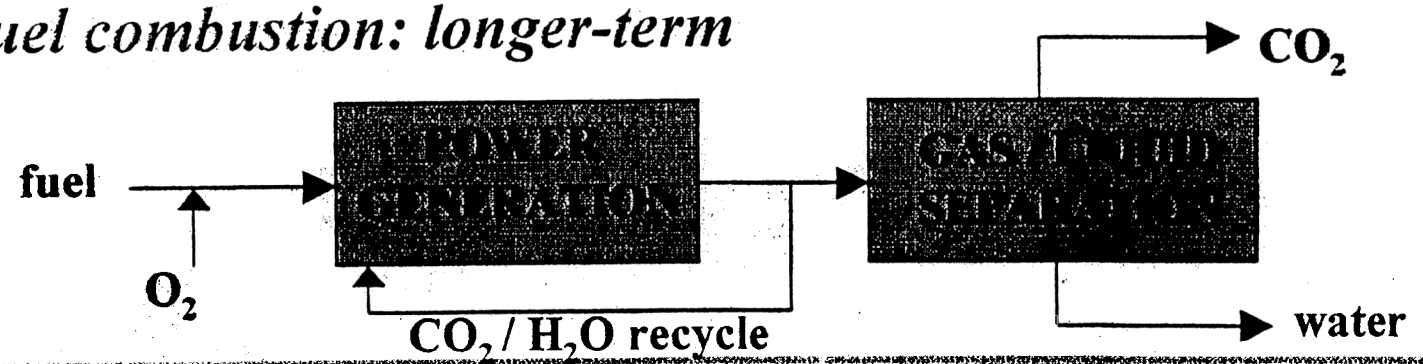
Post-combustion capture: available

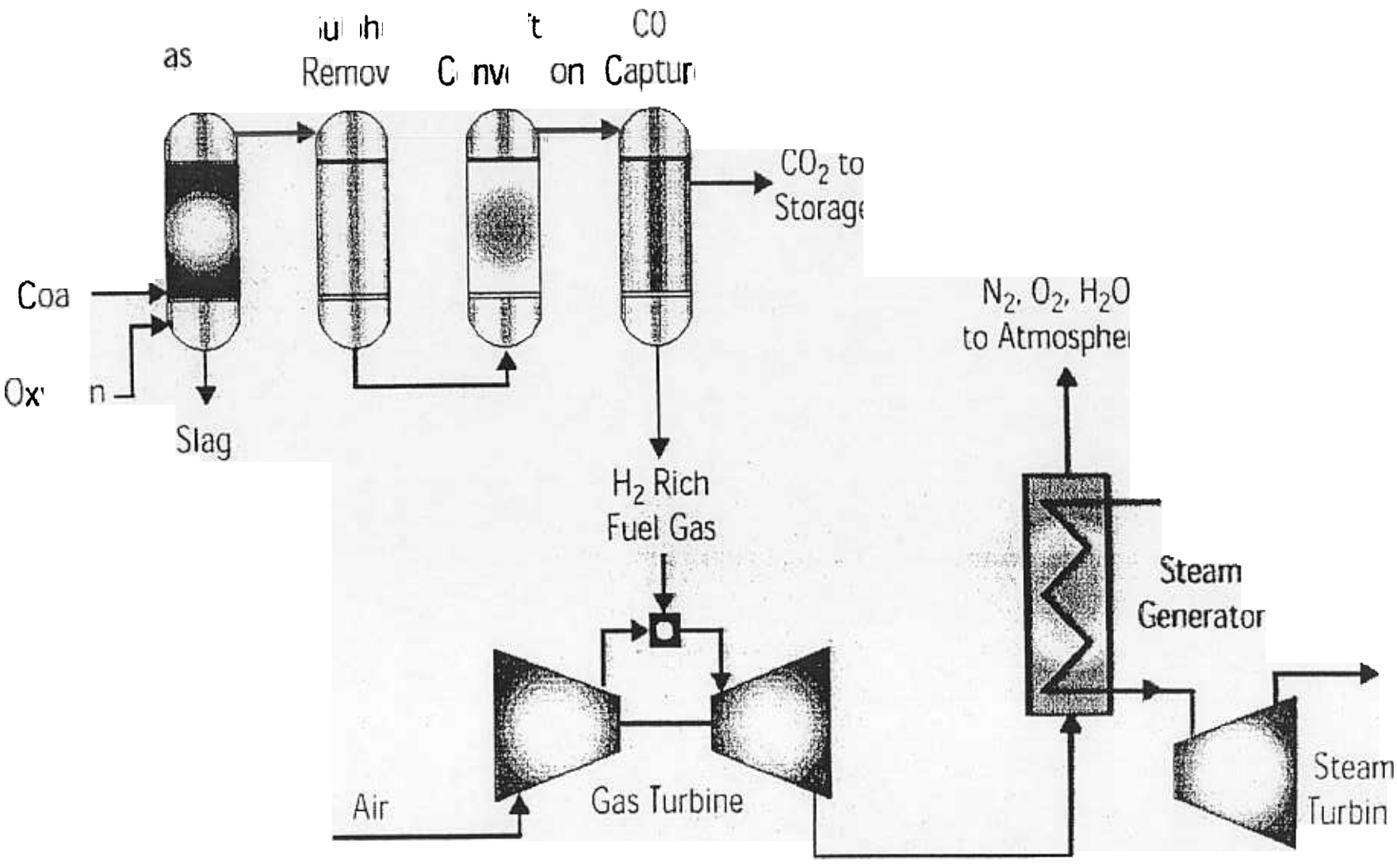


Pre-combustion decarbonisation: near-term



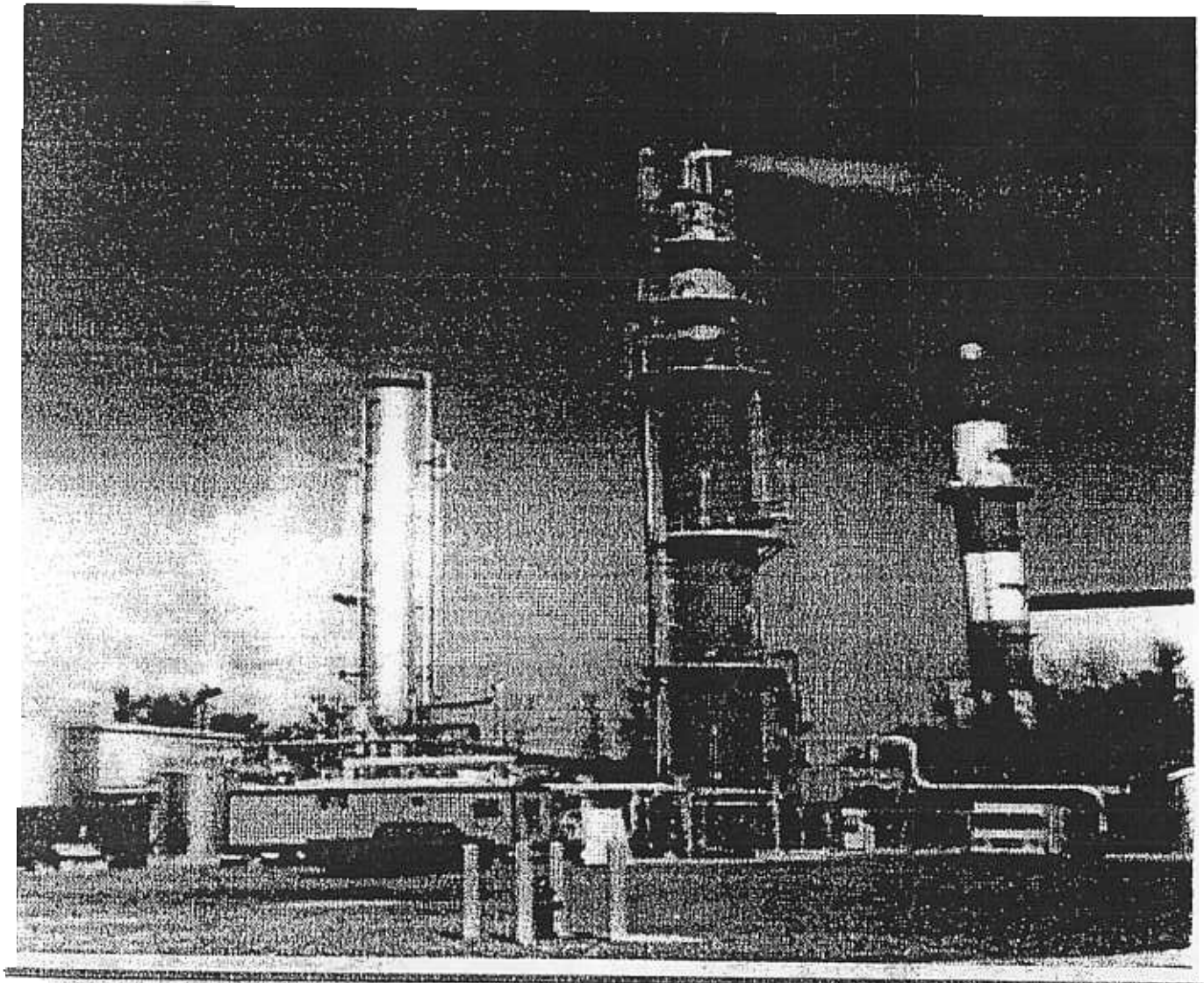
Oxy-fuel combustion: longer-term





IGCC with CO_2 captu

CO_2 Capture at AES Warrior Run power p ant



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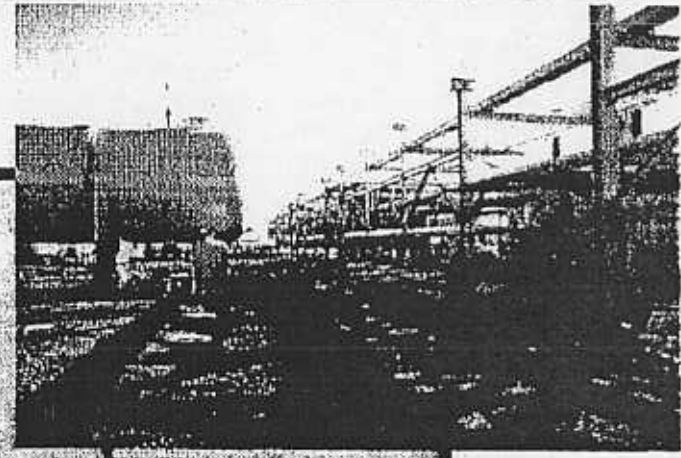
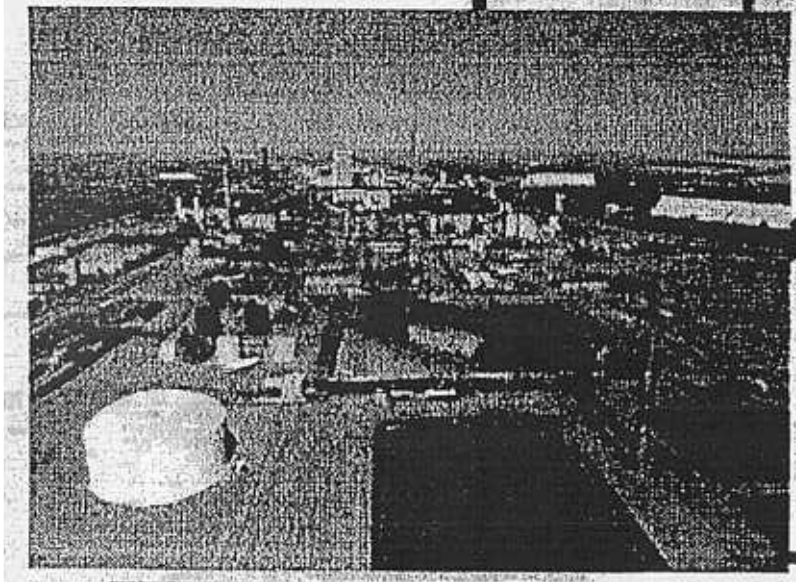
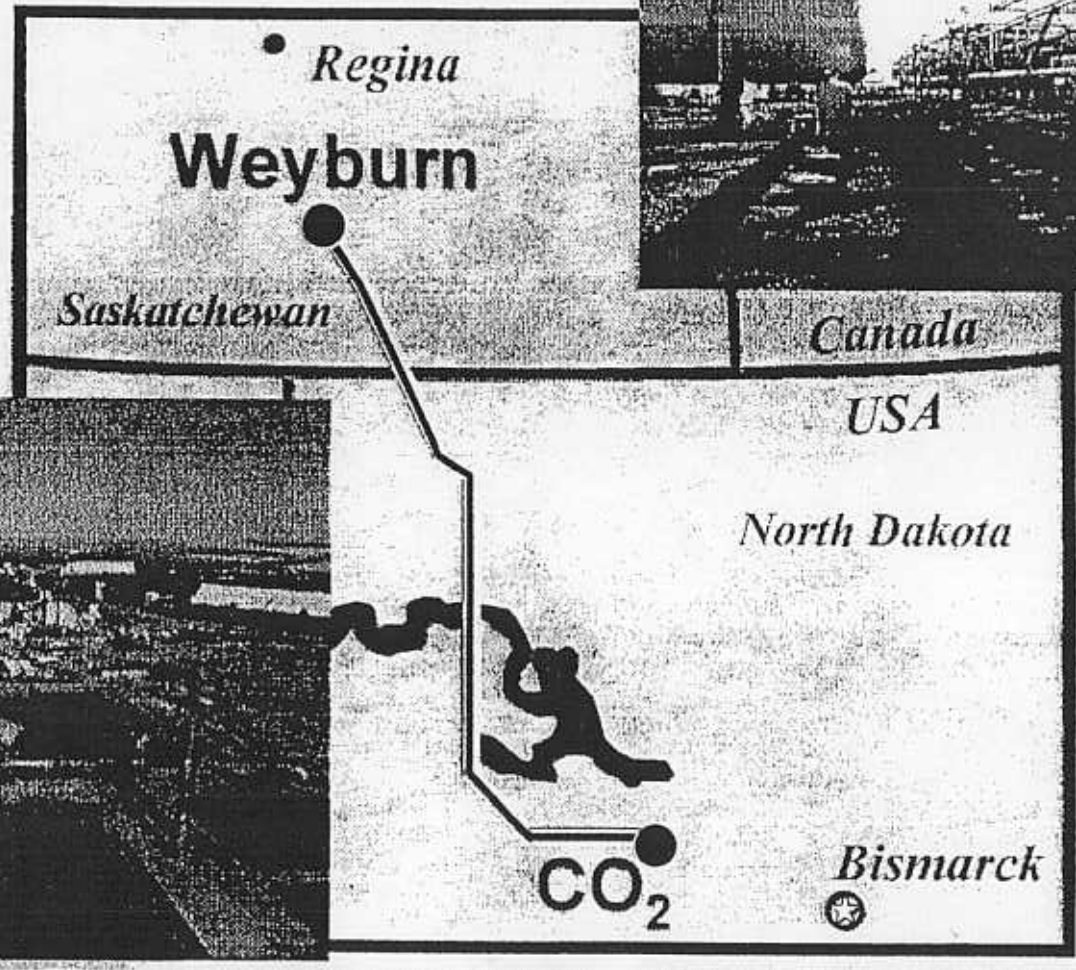
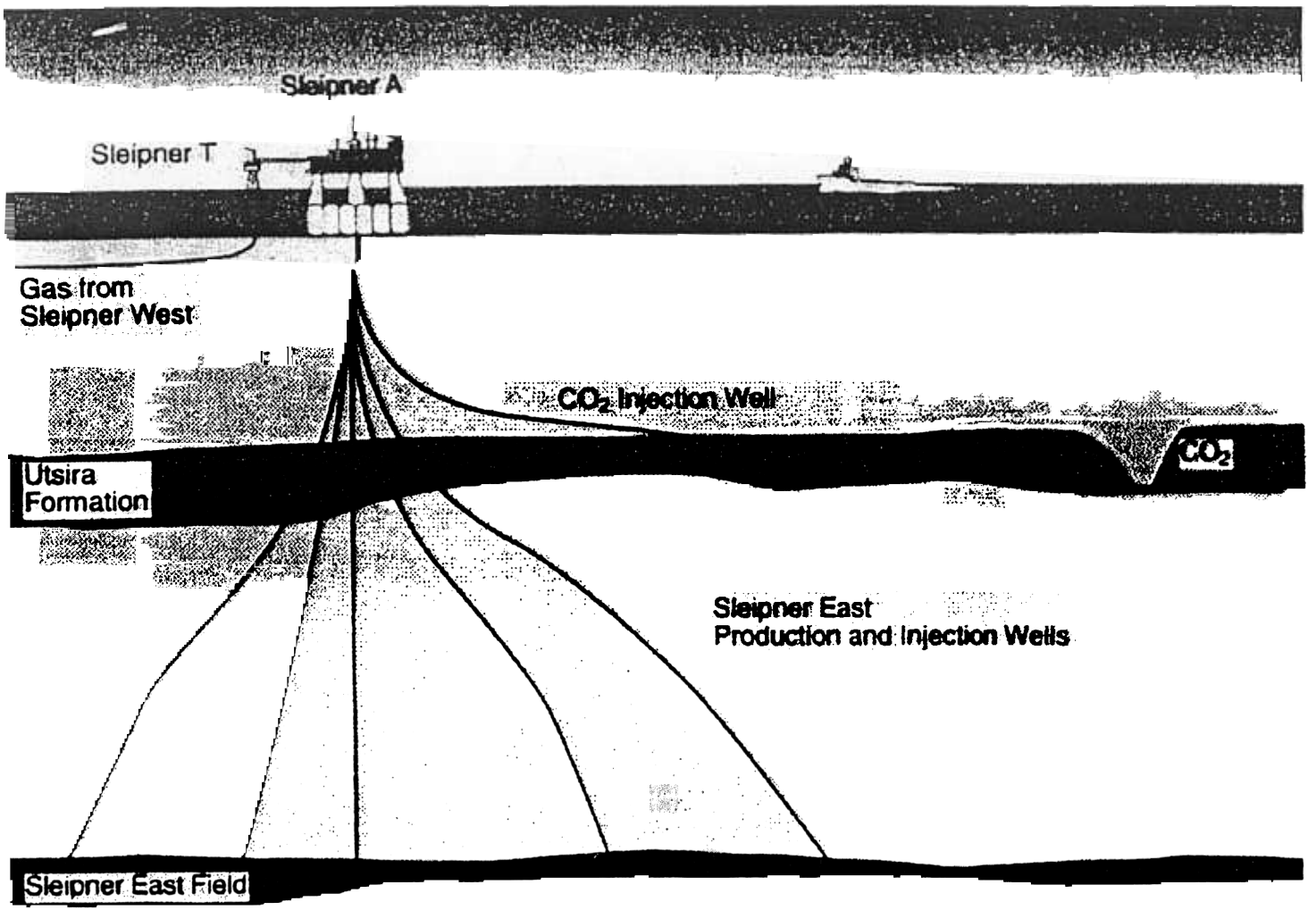
5 000 t/day CO_2 for Enhanced Oil Recovery



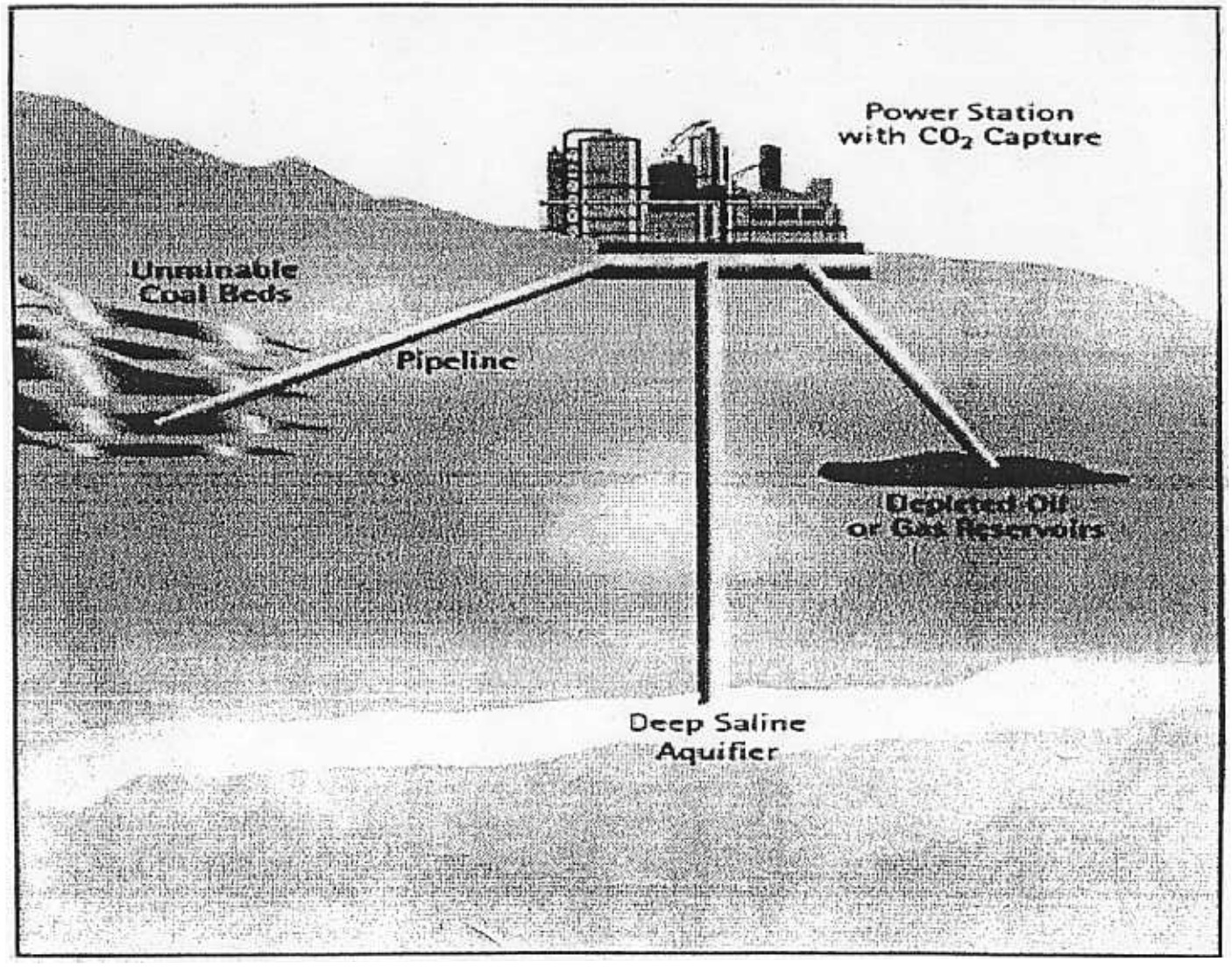




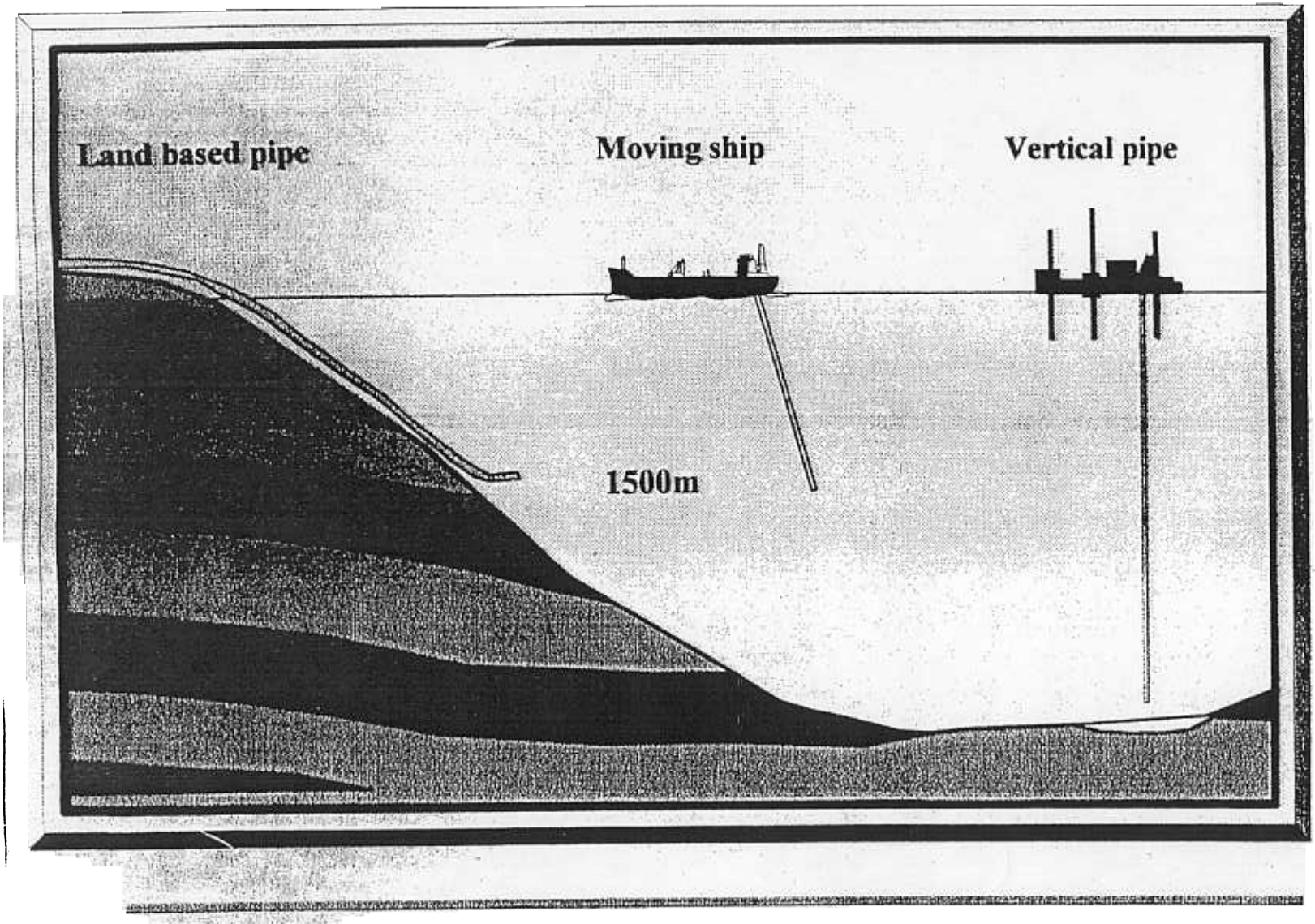
Storage of 1 million t/year of CO_2 under the North Sea



Underground options for storage of CO_2



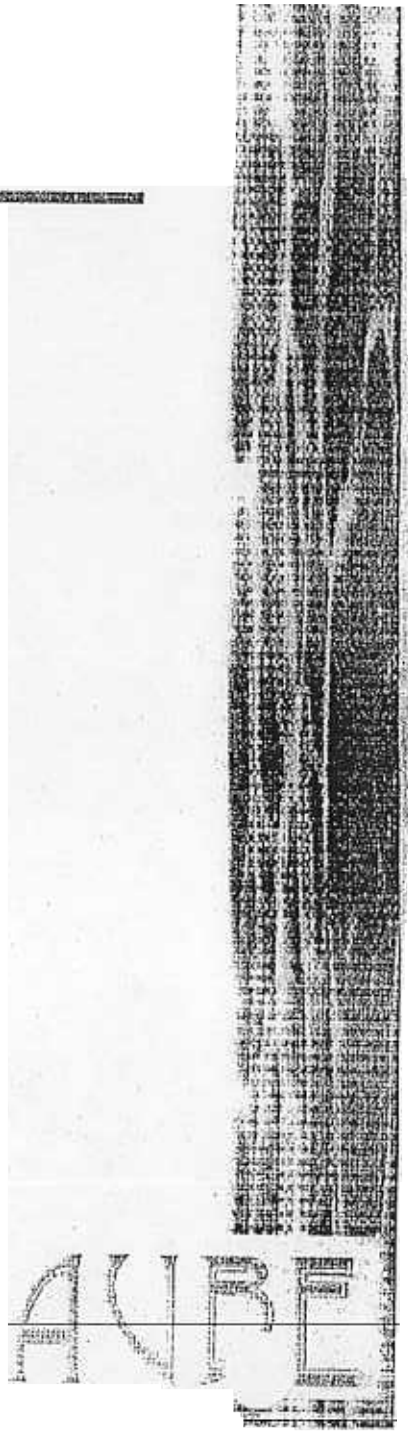
Ocean storage concepts for CO_2



CO_2 capture and storage

Underground capacity

- deep saline reservoirs
  - 400 - 10 000 Gt CO_2
  - 20-500% of emissions to 2050
- depleted oil&gas fields:
  - 920 Gt CO_2
  - 45% of emissions to 2050
- unminable coal measures:
  - > 15 Gt CO_2
  - > 1% of emissions to 2050



CO_2 capture and storage

Conclusion

- Capture: can be done but is seen as too expensive
  - R,D,&D need: reduce costs

- Storage: storage options of adequate size exist at a relatively low cost
  - R,D&D need: credibility and validation