


# CARBON SEQUESTRATION METHODS

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# OUTLINE

- Overview
    - What is carbon sequestration methods
  - Why we use this method
    - why is CO<sub>2</sub> a problem
  - How does it works
  - Examples
  - Problems
  - Conclusion
  - Questions
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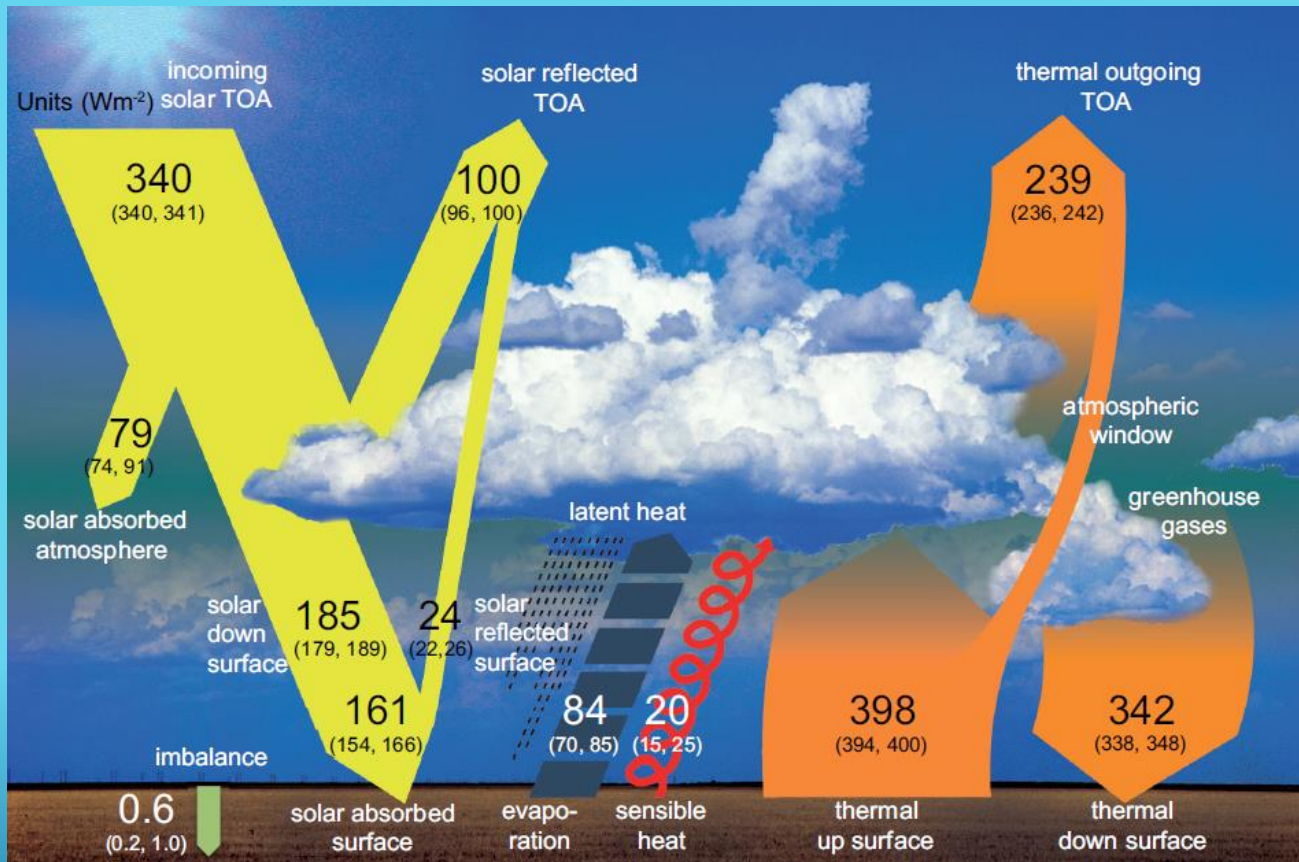
# WHAT IS CARBON SEQUESTRATION METHOD

Carbon sequestration is capturing the carbon dioxide produced by burning fossil fuels and storing it safely away from the atmosphere. It is a range of technologies that hold the promise of trapping up to 90% of the carbon dioxide emissions from power stations and industrial sites. It involves collecting, transporting and then burying the CO<sub>2</sub> so that it does not escape into the atmosphere and contribute to climate change.

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# WHY IS CO2 A PROBLEM?

## Green house effect



# WHY IS CO<sub>2</sub> A PROBLEM?

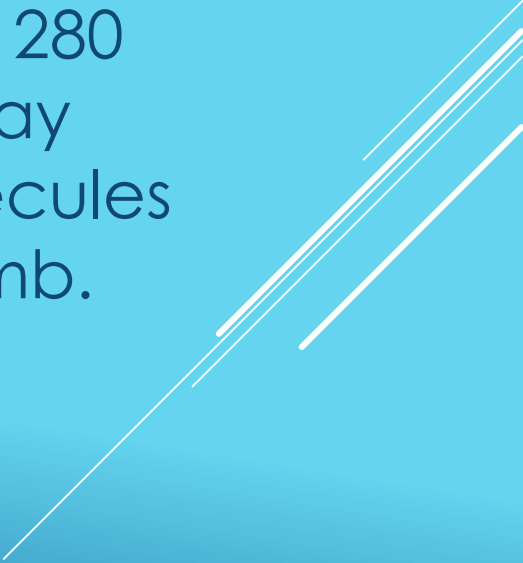
## Other side effects

Because plants absorb CO<sub>2</sub> as part of their growth cycle, an increase in the gas can cause growth changes in plants. A 2008 study by University of Illinois scientists found that soybeans grown in a high-CO<sub>2</sub> environment were more vulnerable to pests. A study by Southwestern University suggests that increased CO<sub>2</sub> reduces the protein content of many crops. In addition, high CO<sub>2</sub> levels in the oceans can affect the growth of some marine life, making some species more vulnerable to predators.

# WHY IS CO<sub>2</sub> A PROBLEM?

According to the U.S. Environmental Protection Agency (EPA), the amount of CO<sub>2</sub> in the atmosphere has gone up by 40 percent since 1750.

In pre-industrial times, every million molecules of air contained about 280 molecules of carbon dioxide. Today that proportion exceeds 380 molecules per million, and it continues to climb.

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Also, choking off the stream of carbon dioxide entering the atmosphere does not have a simple solution. Fossil fuels, which provide about 85 percent of the world's energy, are made of hydrocarbons, and burning them releases huge quantities of carbon dioxide. Even as renewable energy sources emerge, fossil-fuel burning will remain substantial in a long time.

Thus, carbon sequestration method is needed

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How it works?



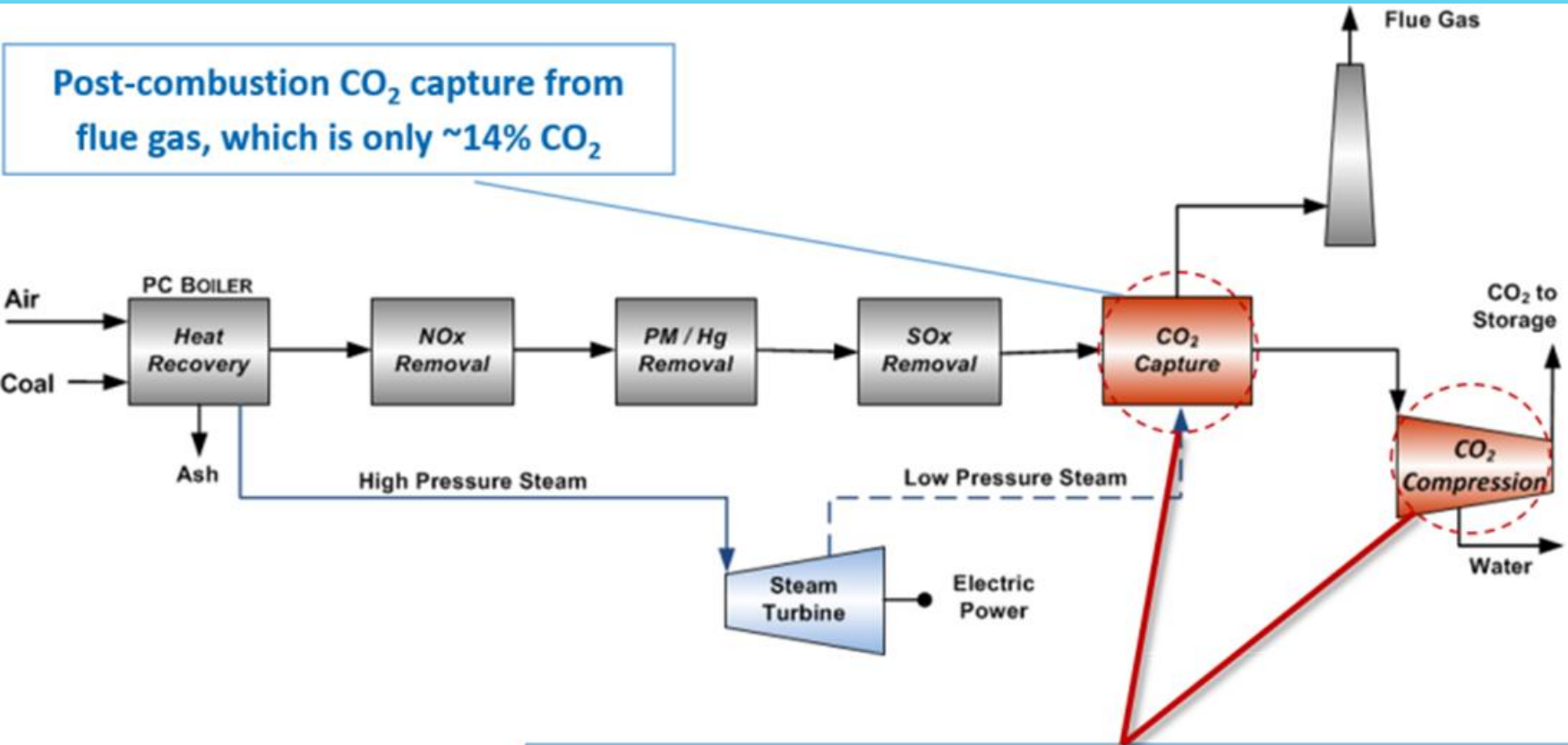


# There are three main techniques

- the post-combustion process involves scrubbing the power plant's exhaust gas using chemicals.
- Pre-combustion CCS takes place before the fuel is placed in the furnace by first converting coal into a clean-burning gas and stripping out the CO<sub>2</sub> released by the process.
- The third method, oxyfuel, burns the coal in an atmosphere with a higher concentration of pure oxygen, resulting in an exhaust gas that is almost pure CO<sub>2</sub>. (See below for further details).

# post-combustion carbon capture

Post-combustion CO<sub>2</sub> capture from flue gas, which is only ~14% CO<sub>2</sub>



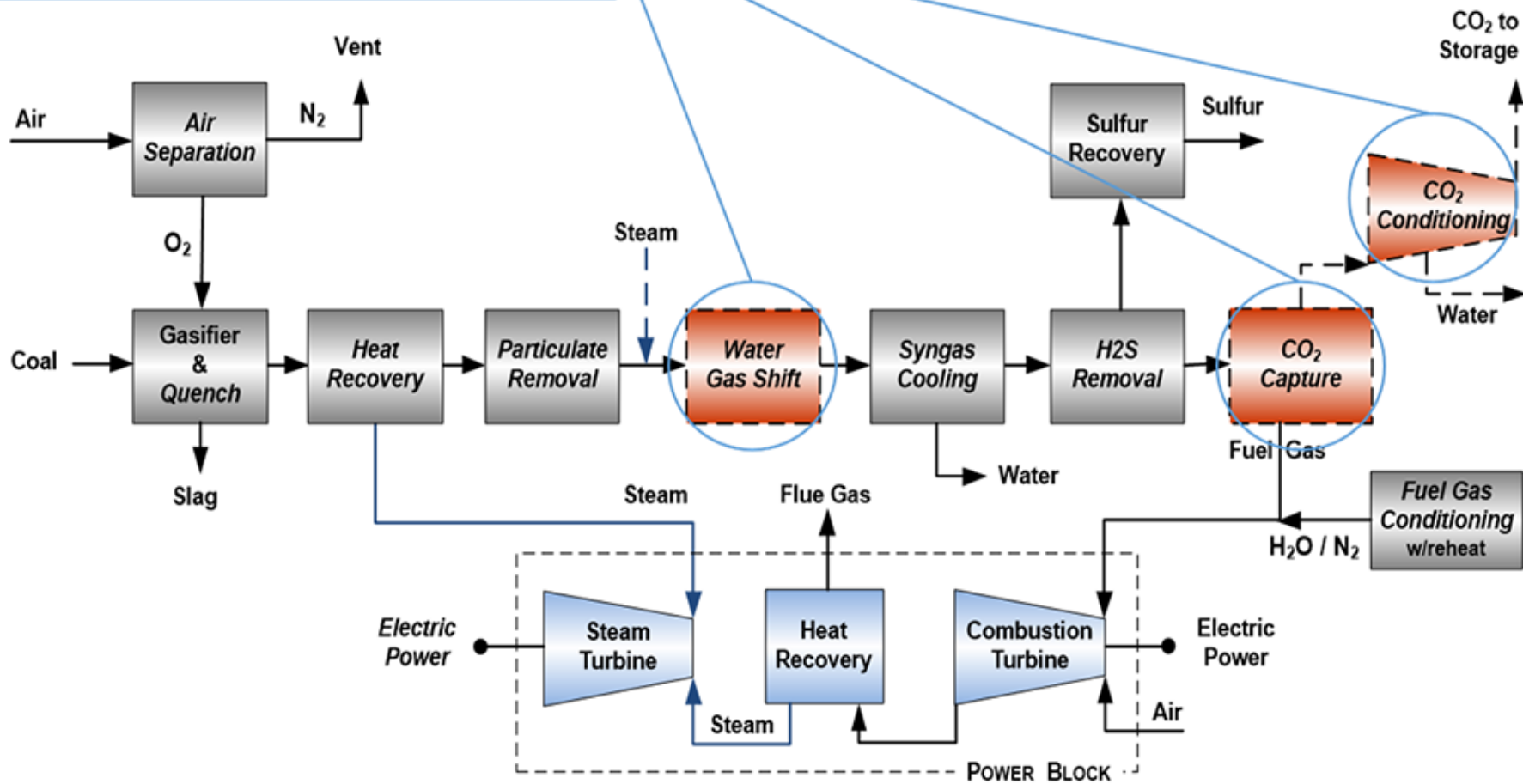
Two-step separation process requiring 5 energy inputs:

$$\text{Energy} = Q (\text{sensible}) + Q (\text{reaction}) + Q (\text{stripping}) + W (\text{process}) + W (\text{compression})$$

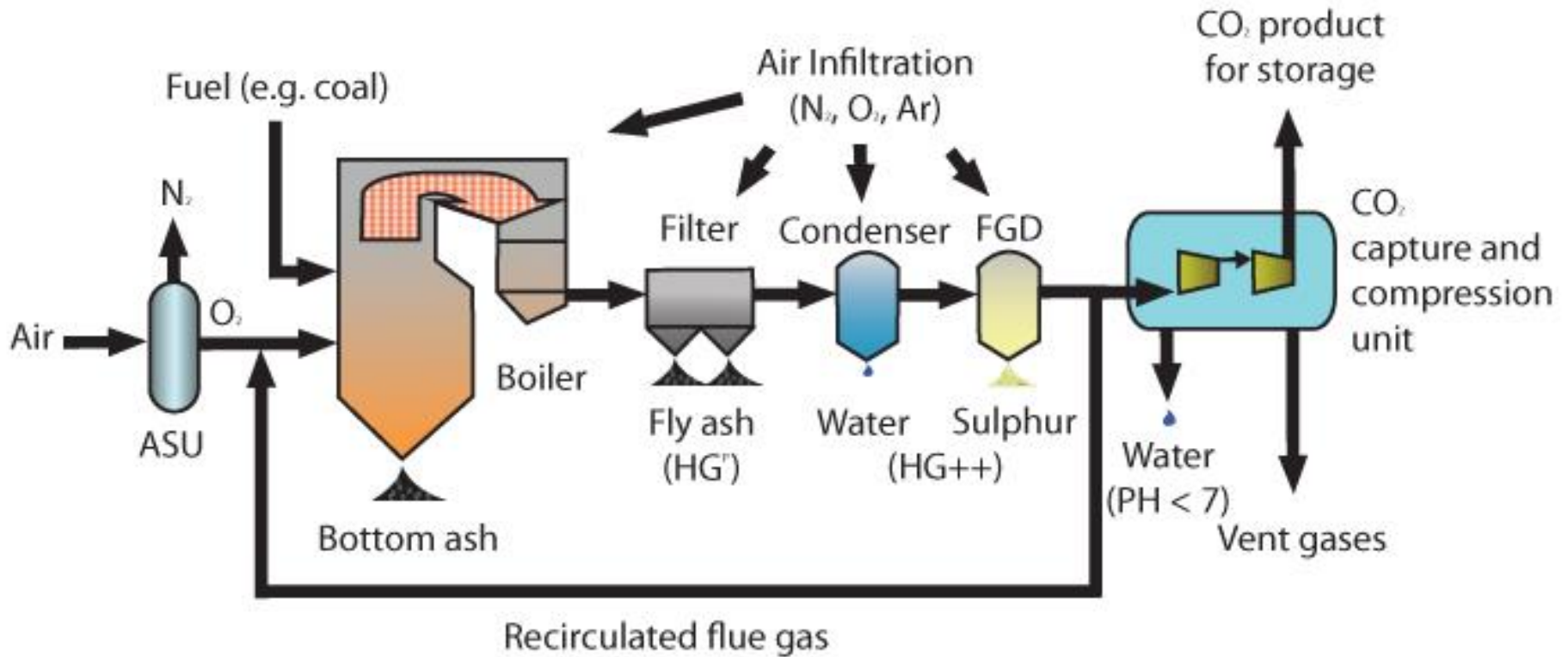
ALL must be reduced in order to significantly reduce Capture COE impact!

# pre-combustion carbon capture

Pre-combustion CO<sub>2</sub> capture from shifted syngas which is ~40% CO<sub>2</sub>



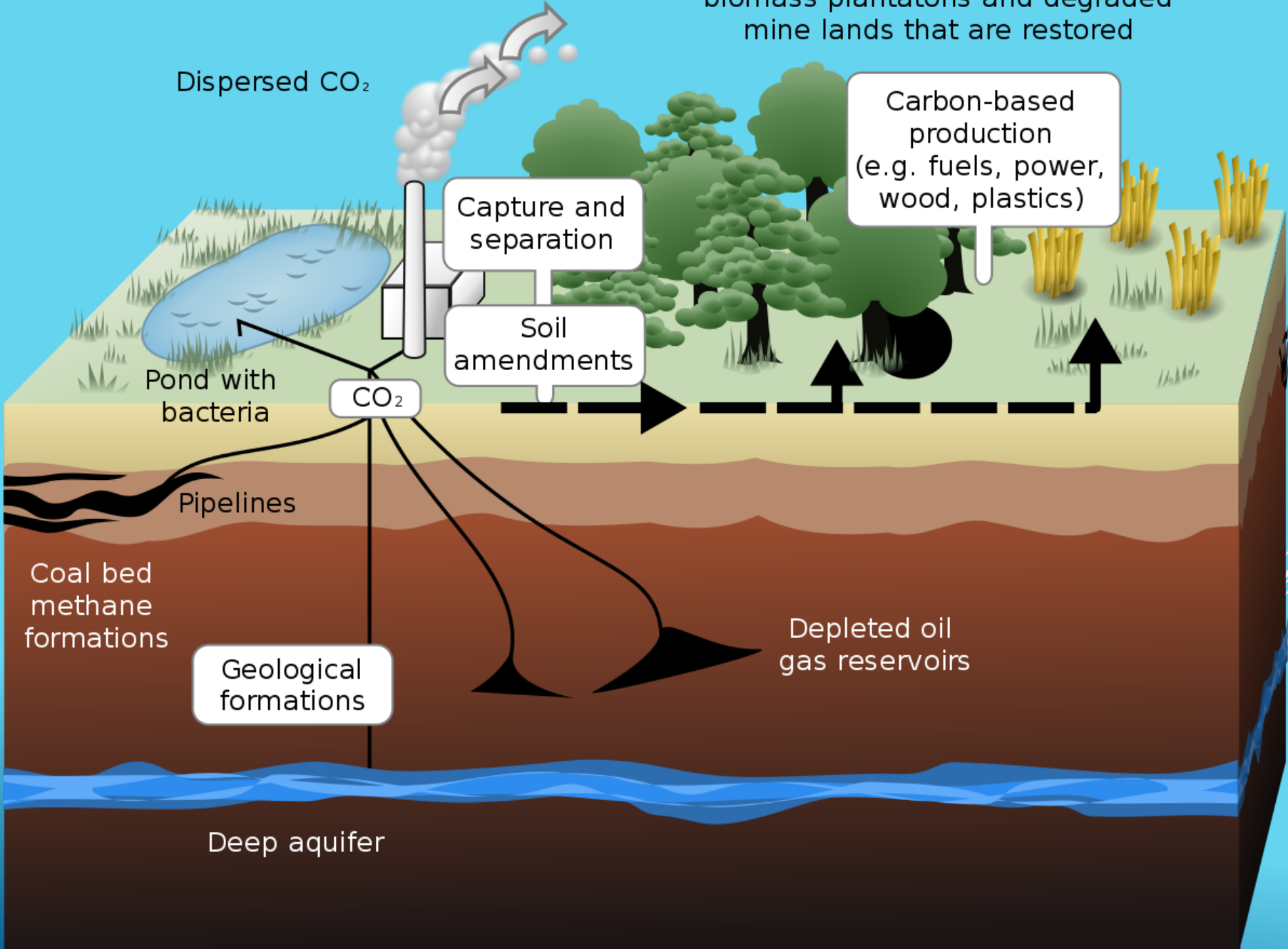
# oxyfuel



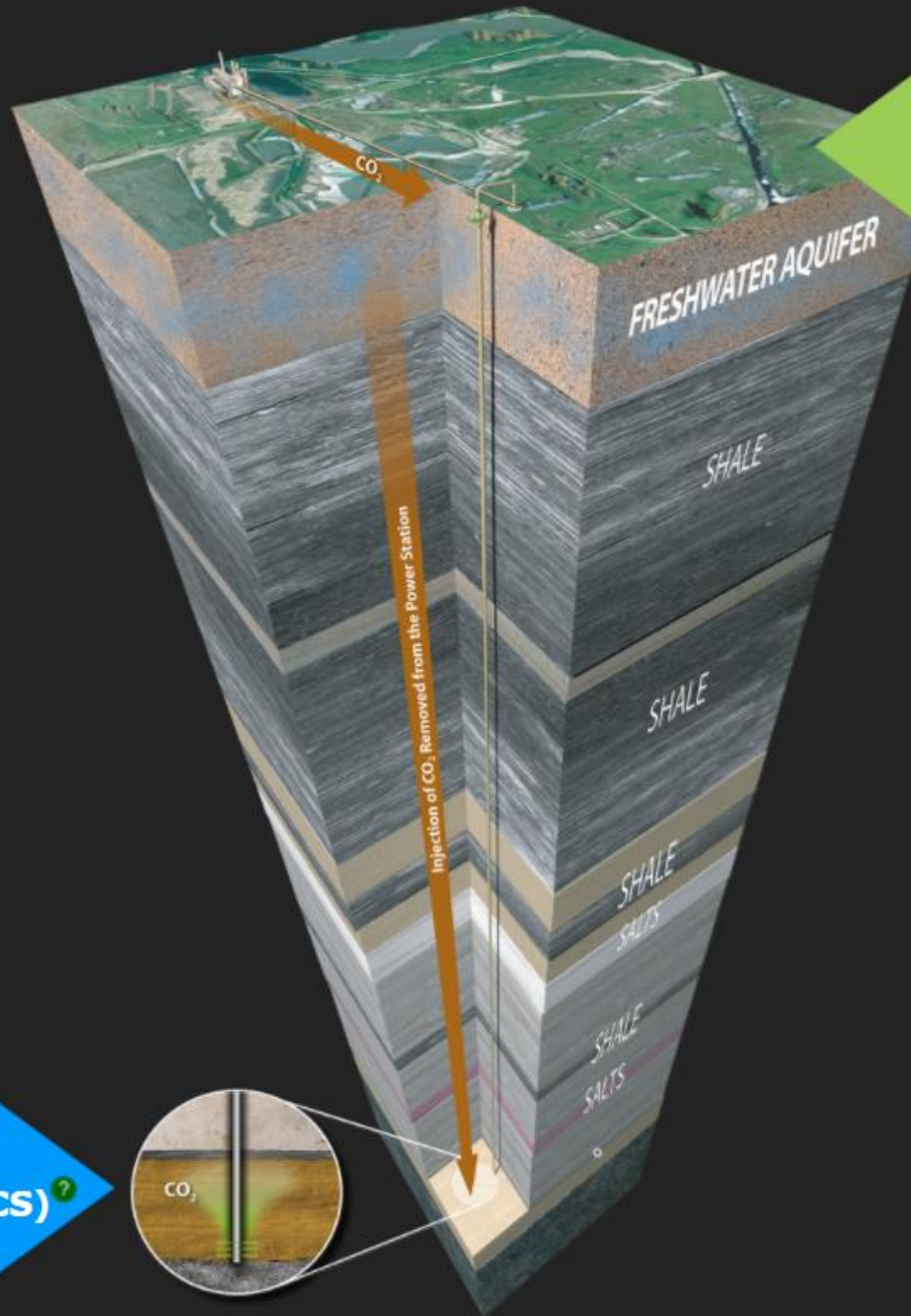
- Capturing
- Processing
- Storage
- reuse



Carbon dioxide uptake by forests, biomass plantations and degraded mine lands that are restored



**Terrestrial Sequestration** ?



**Geologic Sequestration (CCS)** ?

# REFERENCES

- <http://www.engineeringchallenges.org/challenges/sequestration.aspx>
- <https://www.theguardian.com/environment/2008/sep/05/carboncapturestorage.carbonemissions1>
- <https://sciencing.com/co2-bad-planet-4876.html>



Questions?

