



Converting CO₂ to Methane

Why in News

Recently, Indian Scientists have designed a **photochemical method (Photocatalyst)** to convert Carbon Dioxide (CO₂) to Methane (CH₄).

- A photochemical method is a **chemical reaction** initiated by the absorption of **energy in the form of light**.

Key Points

▪ About:

- A polymer has been designed to **absorb visible light and catalyse the reaction** which reduces CO₂.
 - Most catalysts contain toxic and expensive metal counterparts. Therefore scientists designed a **metal-free porous organic polymer to overcome this drawback**.
- The photochemical method of reducing CO₂ uses solar light as a **renewable source of energy**.
 - There are several ways in which CO₂ can be reduced, including photochemical, **electrochemical**, photoelectrochemical, photothermal, and so on.

▪ Mechanism:

- The catalyst has a chemical called the **Conjugated Microporous Polymer (CMP)**.
- It can uptake CO₂ onto its surface due to its high CO₂ intake capability at room temperature, **converting it into methane as a value-added product**.
- There are some **key requirements** of a photo-catalyst to convert CO₂ into value-added products, which rely upon:
 - Light-harvesting property.
 - Charge carrier (electron-hole pair) separation proficiency.
 - Presence of proper electronically aligned conduction band.

▪ Significance:

- Methane can be one of the value-added products with significant uses as the cleanest burning **fossil fuel** and can directly be used in **fuel cells** as a hydrogen carrier.
- It is also the main component of **natural gas** and has the potential to replace coal for electricity generation and furnishing flexible supply to reinforce intermittent renewable generators.

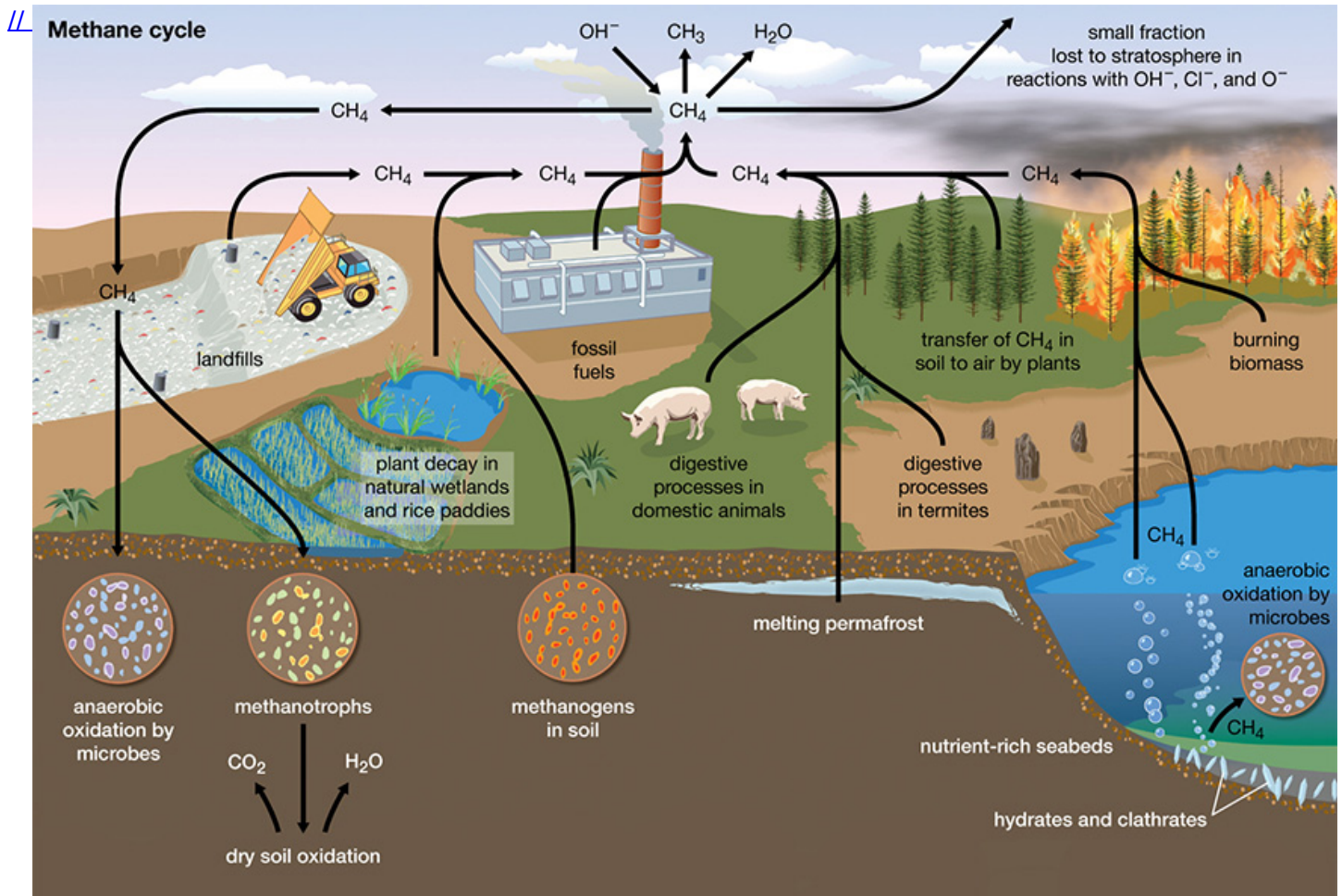
Methane

▪ About:

- Methane is gas that is **found in small quantities in Earth's atmosphere**.
- It is the **simplest hydrocarbon**, consisting of one carbon atom and four hydrogen atoms

(CH₄).

- Methane is a powerful **greenhouse gas**. It is **flammable**, and is used as a fuel worldwide.
 - Methane is produced by the **breakdown or decay of organic material** and can be introduced into the atmosphere by either **natural processes** – such as the decay of plant material in wetlands, the seepage of gas from underground deposits or the digestion of food by cattle – or **human activities** – such as oil and gas production, rice farming or waste management.
- Methane is called **marsh gas** because it is found at the surface of marshy places



▪ Major Uses:

- It is an **important source of hydrogen and some organic chemicals**.
- It reacts with steam at high temperatures to yield carbon monoxide and hydrogen; the latter is used in the **manufacture of ammonia for fertilizers and explosives**.
- Other valuable **chemicals derived from methane include methanol, chloroform, carbon tetrachloride, and nitromethane**.
- The **incomplete combustion of methane yields carbon black**, which is widely used as a reinforcing agent in rubber used for automobile tires.

▪ Environmental Impact of Methane:

- It is **84 times more potent than carbon** and doesn't last as long in the atmosphere before it breaks down. This makes it a **critical target for reducing global warming** more quickly while simultaneously working to reduce other greenhouse gases.
- It is responsible for creating ground-level **ozone**, a dangerous air pollutant.

[Source: PIB](#)

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