

A Way of Reducing Carbon Dioxide Indoors

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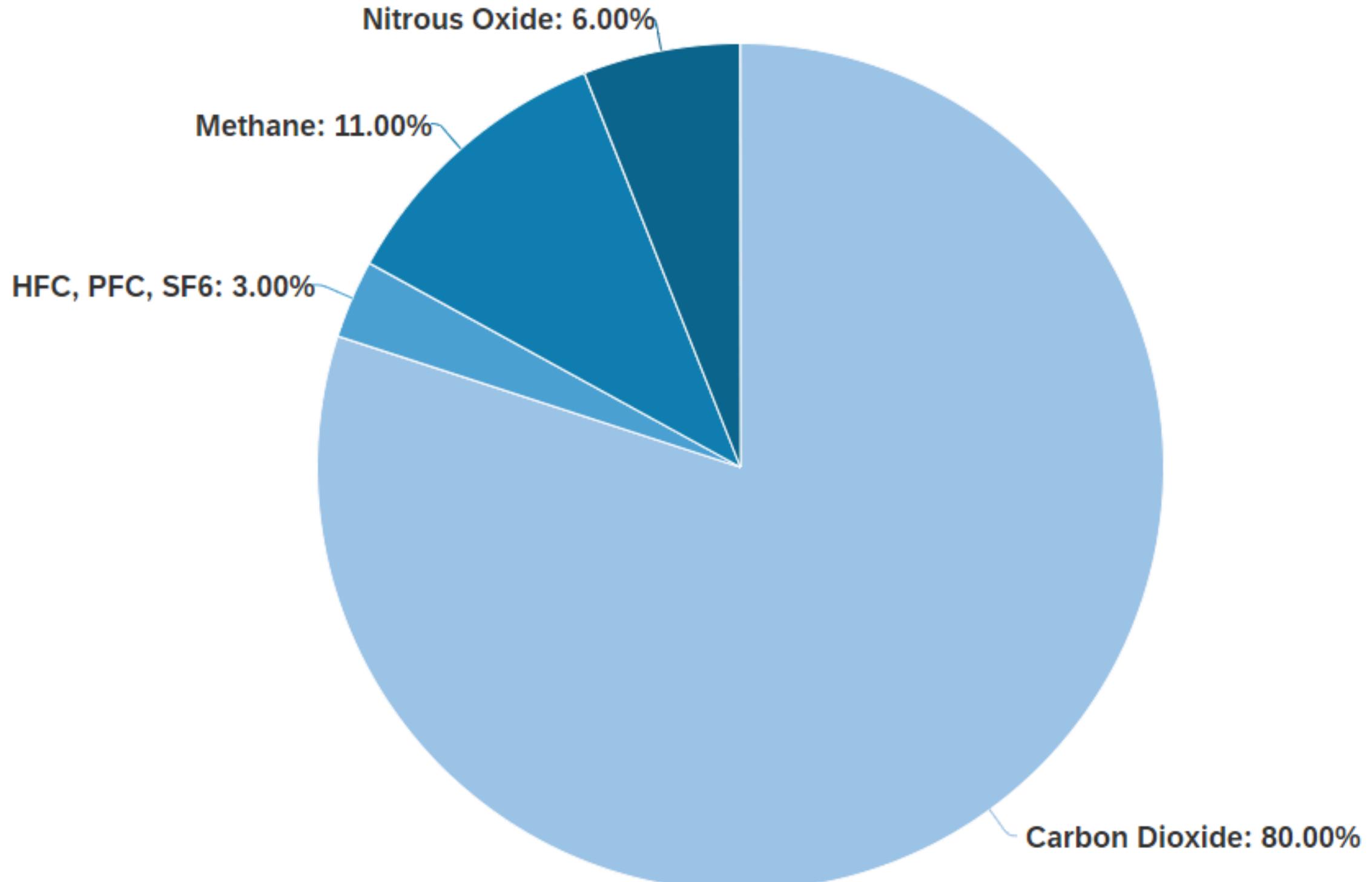
13 CLIMATE ACTION



Sources of Greenhouse Gas Emission

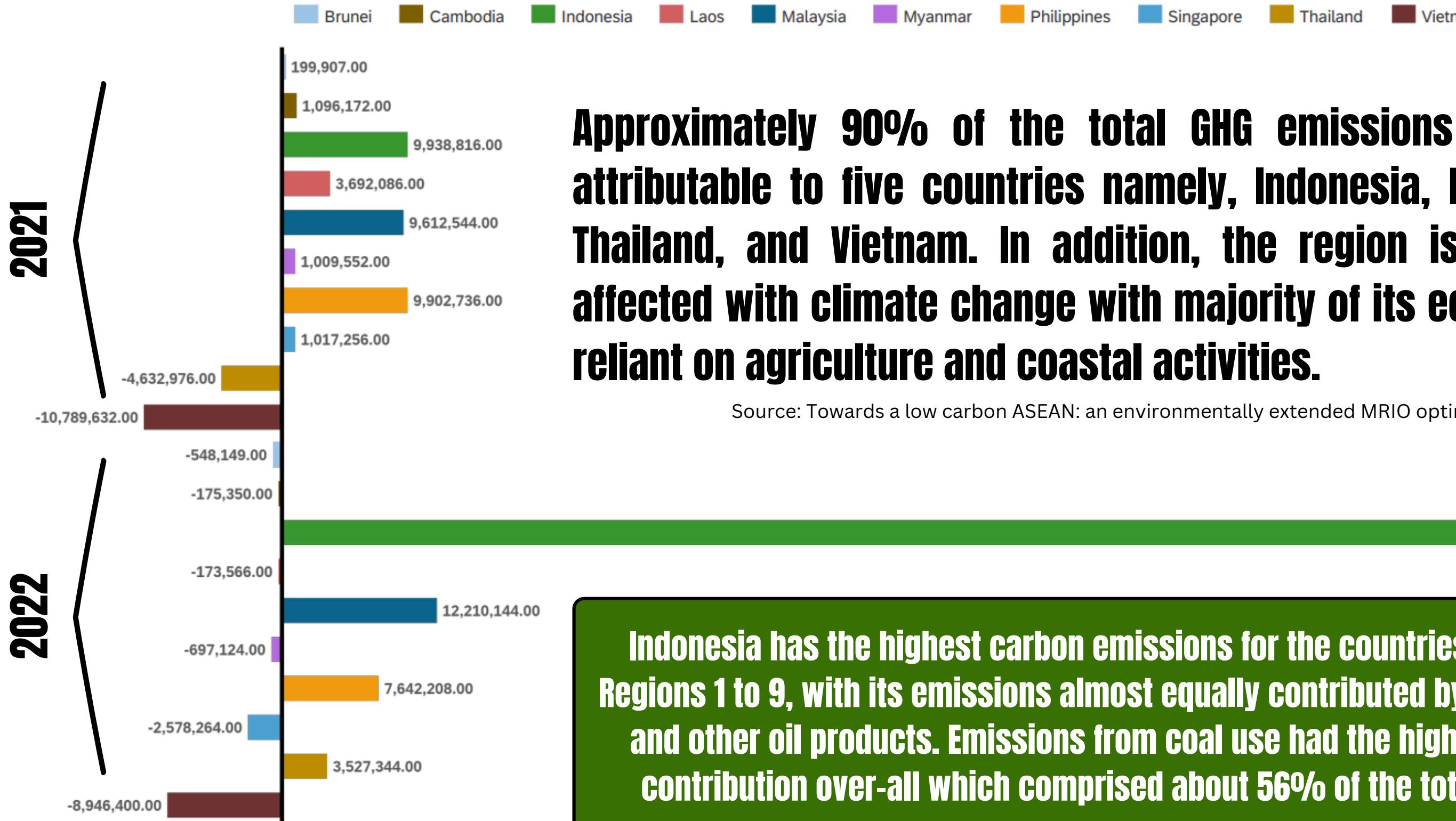


Overview of Greenhouse Gas Emissions (2022)



CO₂ is the most present gas in the Earth's atmosphere representing exactly 79.7% of greenhouse gas emissions. It is a colorless, odorless, and harmless gas but still has a big impact in our atmosphere.

2021-2022 carbon dioxide emissions in ASEAN countries.



Indonesia has the highest carbon emissions for the countries in Regions 1 to 9, with its emissions almost equally contributed by coal and other oil products. Emissions from coal use had the highest contribution over-all which comprised about 56% of the total.

Greenhouse Gas Emissions by Economic Sector in 2022

Agriculture Electric Power Industry Residential & Commercial Transportation

- **Transportation**

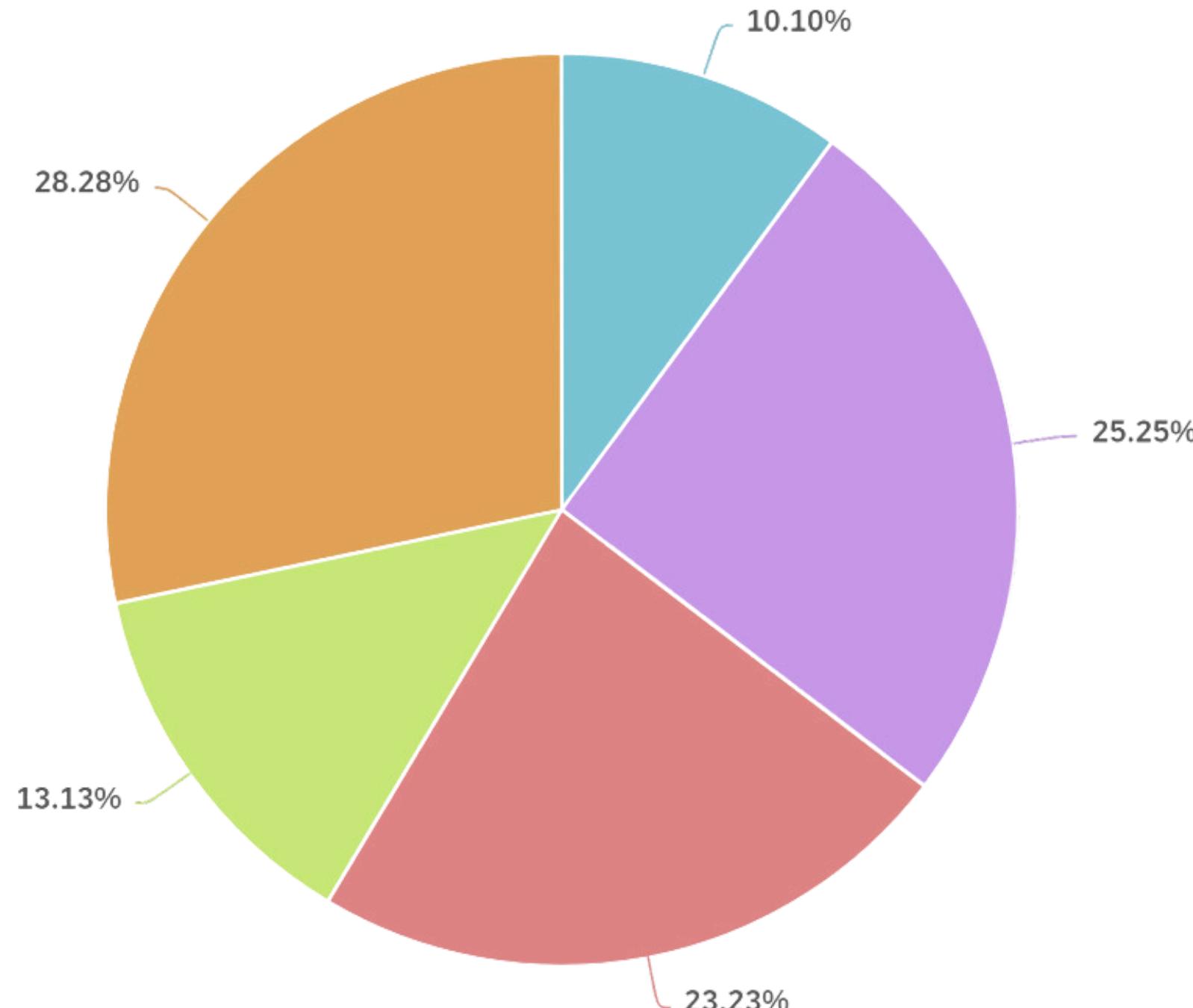
Greenhouse gas emissions from transportation primarily come from burning fossil fuel for cars, trucks, ships, trains, and planes.

- **Electricity production**

Electric power includes emissions from electricity production used by other end use sectors. In 2022, 60% of the electricity comes from burning fossil fuels, mostly coal and natural gas

- **Industry**

Greenhouse gas emissions from industry primarily come from burning fossil fuels for energy, as well as greenhouse gas emissions from certain chemical reactions necessary to produce goods from raw materials.



source: Sources of Greenhouse Gas Emissions by EPA

- **Agriculture**

Greenhouse gas emissions from agriculture come from livestock such as cows, agricultural soils, and rice production. Indirect emissions from electricity use in agricultural activities like powering buildings and equipment are about 5 percent of direct emissions.

- **Residential & Commercial**

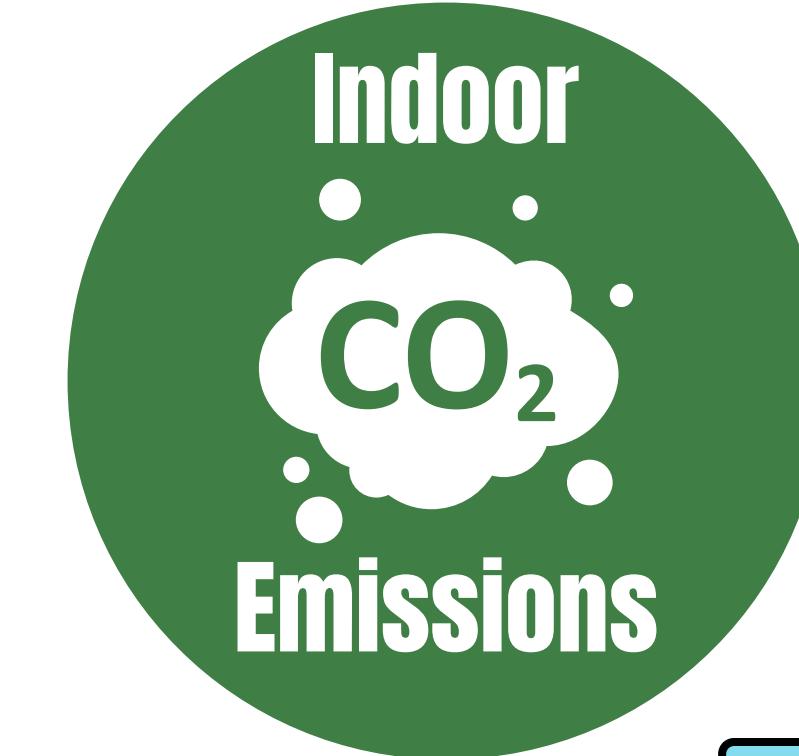
Greenhouse gas emissions from the commercial and residential sector come from fossil fuels burned for heat and the use of gases for refrigeration and cooling in buildings, and non-building specific emissions such as the handling of waste.



How do these sectors relate to indoor Carbon Emissions?



- Residential and Commercial : This is the most direct link to indoor emissions, representing the GHGs emitted from energy use within buildings.



- Electric Power : A significant portion of electric power consumption happens indoors. Thus, a major share of this sector's emissions can be attributed to indoor use.

- Industry : Some of these emissions come from the energy used in industrial buildings. Estimating the proportion that directly relates to indoor activities (e.g., factories, warehouses) can involve analyzing the energy consumption patterns of industrial operations.

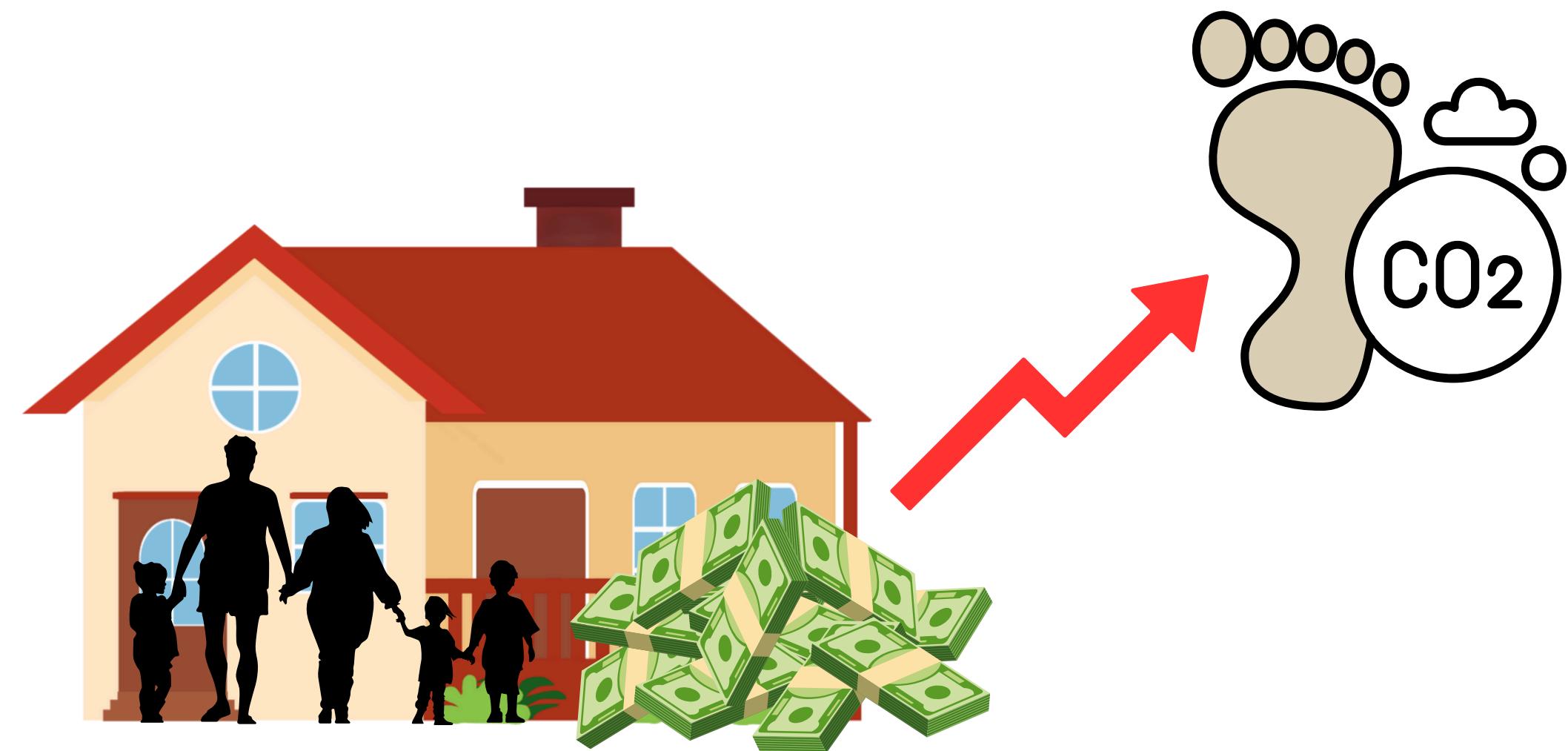
- Agriculture and Transportation : These sectors contribute less directly to indoor emissions. However, they impact overall carbon footprints, and activities associated with these sectors (ex. transport of goods, energy used in food processing) have indirect effects on indoor emissions.

How do Households contribute to Carbon Emissions ?

in a study of UK households, showed that high income households incur a higher proportion of their carbon due to ‘Recreation and Culture’ than lower income households.



Which means **the higher the income of households, the higher carbon emission they contribute**



Problem:

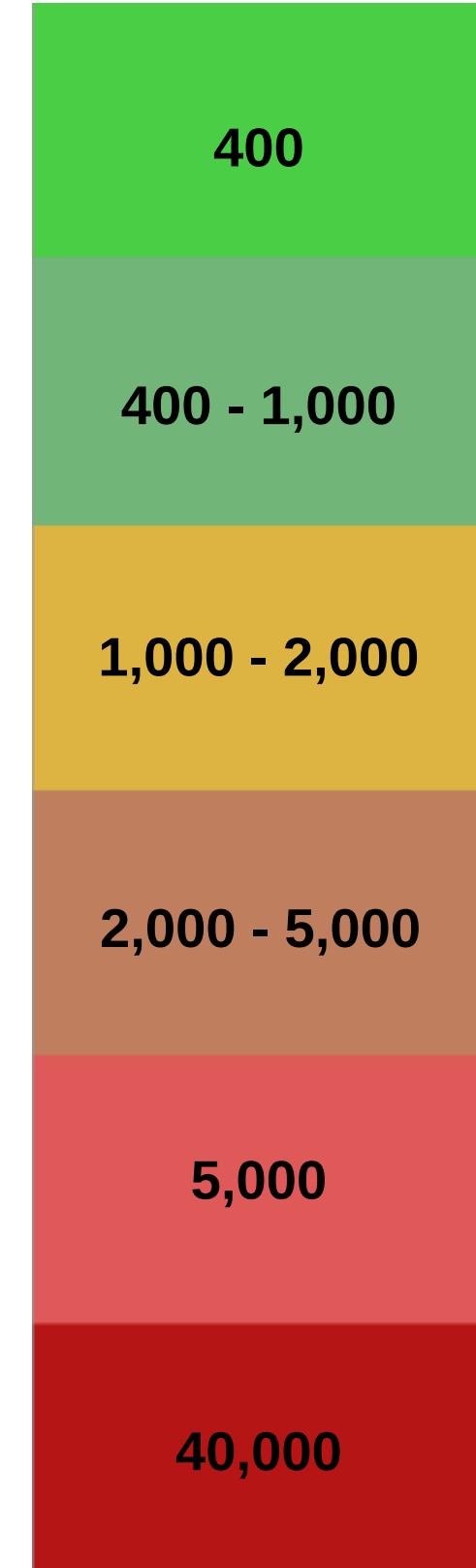
How Polluted is Indoor air?



Indoor air is on average **5 to 7 times more polluted than outdoor air**, even though we spend 80 to 90% of our time indoors, mainly in our workplace. This is due to many factors and pollutants that can have an impact on our health.



According to ANSES, the level of carbon dioxide in the indoor air of buildings is usually between **350** and **2500 ppm**.



400 ppm: Average outdoor air level.

400-1,000 ppm: Good air exchange in occupied spaces.

1,000-2,000 ppm: Drowsiness and poor air complaints.

2,000-5,000 ppm: Headaches, sleepiness, and poor concentration.

5,000 ppm: Unusual conditions, possible presence of other gases.

40,000 ppm: Harmful due to oxygen deprivation.

What are the possible causes of carbon dioxide indoors?



Carbon Dioxide Sources in the Home

- Humans and Pets
- Cigarettes
- The Ground Beneath Your Home
- Kitchen & Fireplace
- Poor Building Ventilation
- heating devices powered by gas or kerosene
- outdoor CO₂ seeping indoors, especially from nearby fossil fuel-burning sources like factories
- vehicle exhaust from garages or nearby roads and highways



Recommendation



Air purifier that uses algae

Why use algae as an Air Purifier?

In the vast oceans where algae naturally grow, it absorbs the carbon dioxide from the air and exports it to the depths of the ocean. Each individual cell of algae requires CO₂ for growth and releases oxygen in the air. Oceanic algae are responsible for **40%** of the total world's carbon fixation.

Algae are plant-like living things that use photosynthesis to absorb sunlight to produce and store starch as their food source.



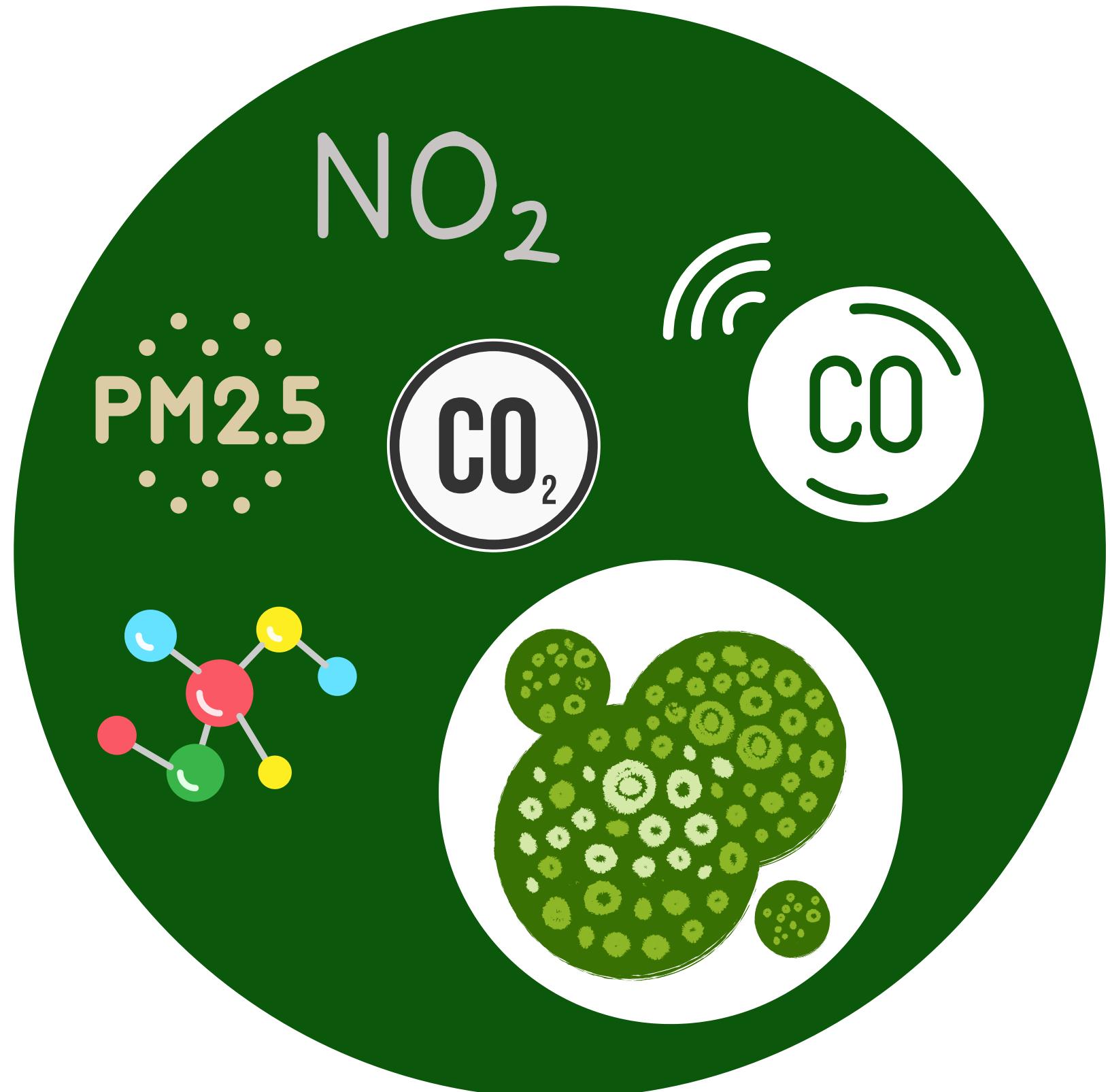
Image Source: AlgenAir Republic

Recommendation



Air purifier that uses algae

Algae naturally feed on pollutant particles and gases like CO₂, CO, NO₂, VOC's, PM 10 and 2.5 and transform them into oxygen, turning a problem into a solution. Their ability to absorb and remove the carbon dioxide in the air is 10 times higher than large trees as their whole bodies are photosynthetic.



Implementation



- Identify algae species that are highly efficient at photosynthesis and can thrive in indoor environments. Species like Chlorella and Spirulina are commonly used for their high CO₂ absorption rates.
- Design the air purifier to draw in indoor air, pass it through the algae bioreactor where CO₂ is absorbed, and then release purified air back into the room
- Launch pilot projects in various ASEAN countries to test the effectiveness of algae-based air purifiers. Select diverse environments such as homes, offices, schools, and commercial buildings.
- Install sensors to monitor CO₂ levels, humidity, and air quality before and after using the purifiers. Collect data to evaluate performance and make necessary adjustments.
- Set up production facilities in ASEAN countries to manufacture the air purifiers locally, which can reduce costs and support local economies.
- Launch campaigns to educate the public about the benefits of algae-based air purifiers for improving indoor air quality and reducing CO₂ emissions.



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