



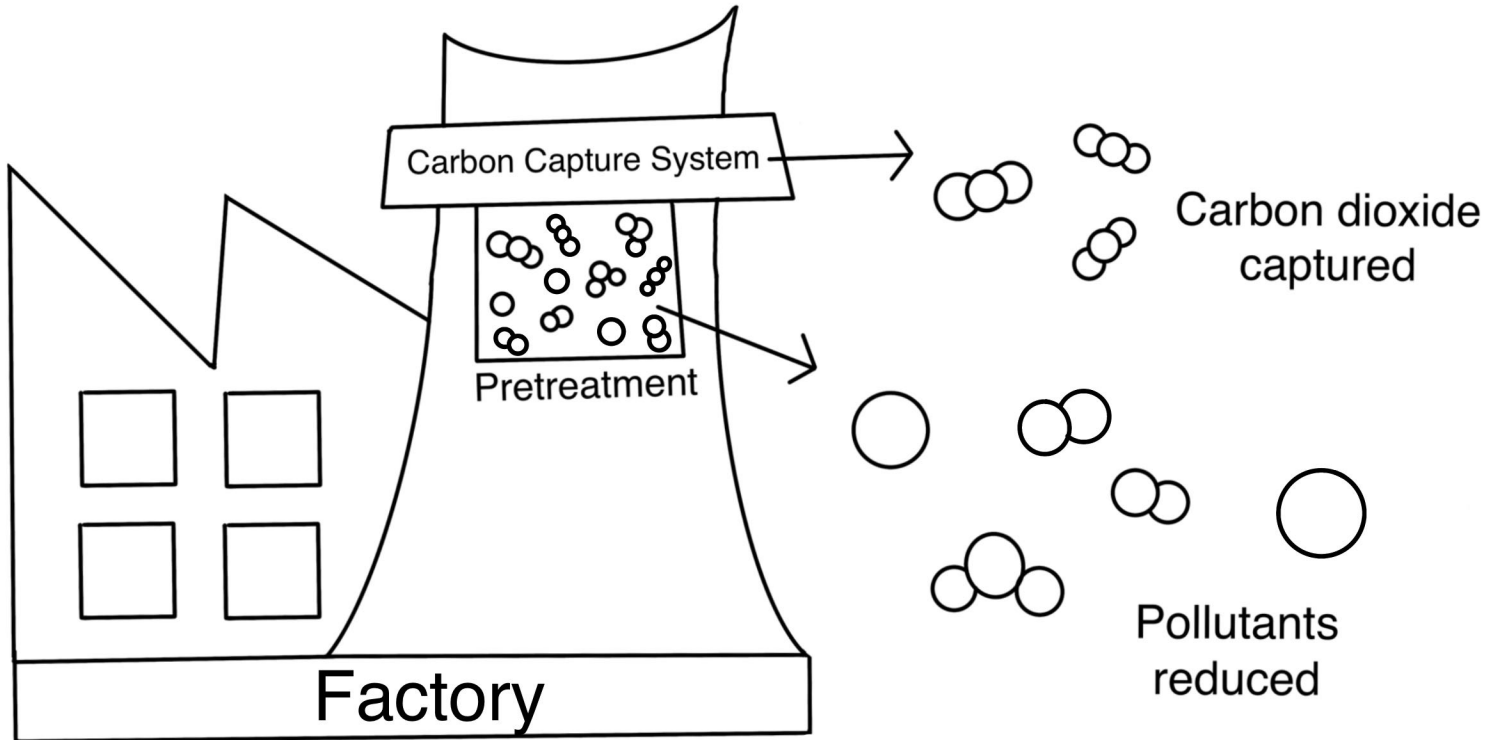
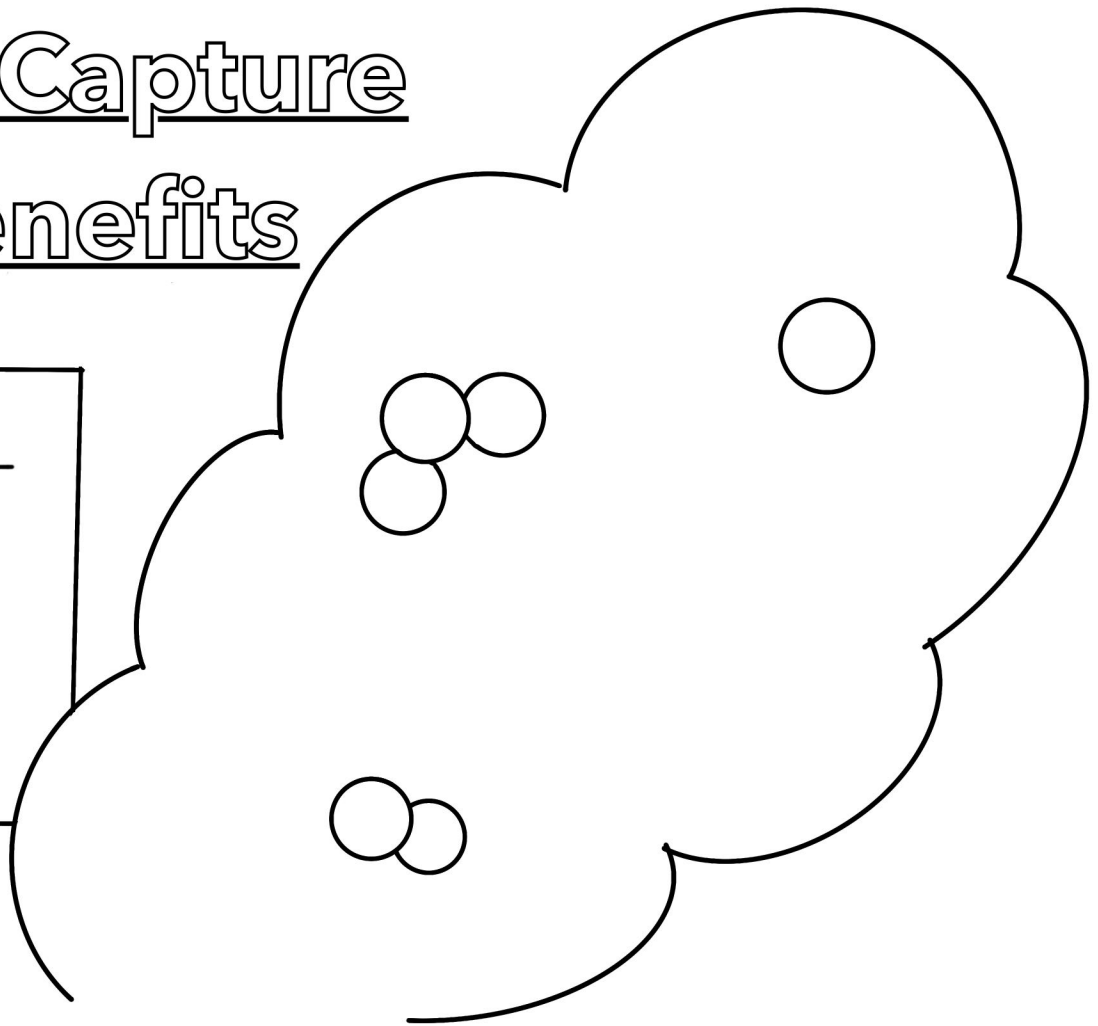


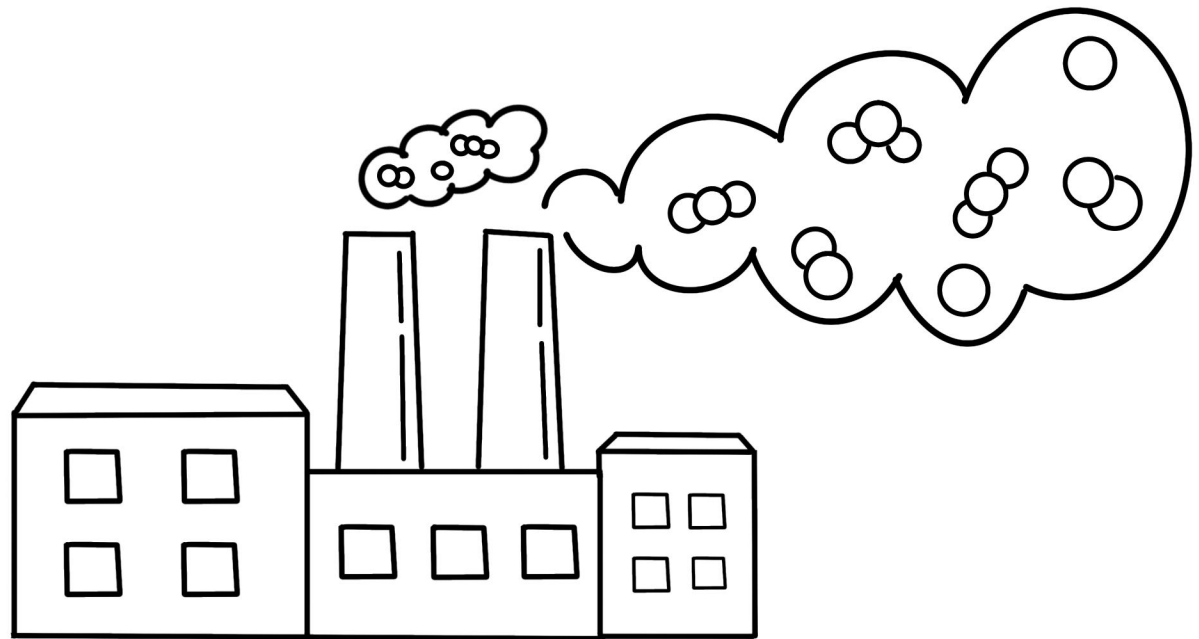
Carbon Capture

Co-Benefits

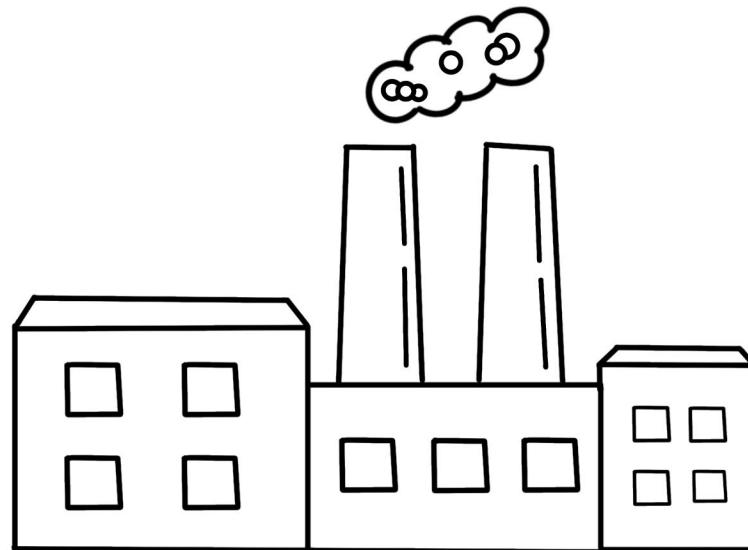
Color Key	
CO_2	
NO_x	
SO_2	
PM	



Electrification Co-Benefits



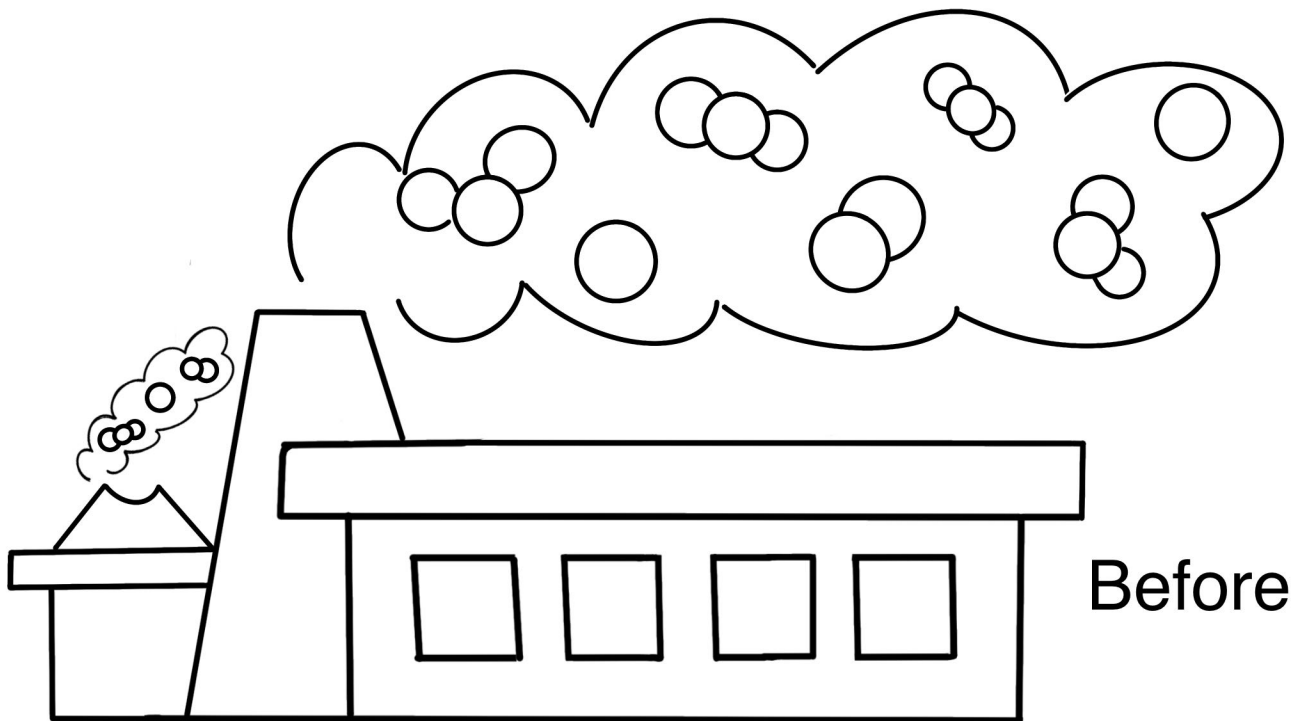
Factory Before



Factory After

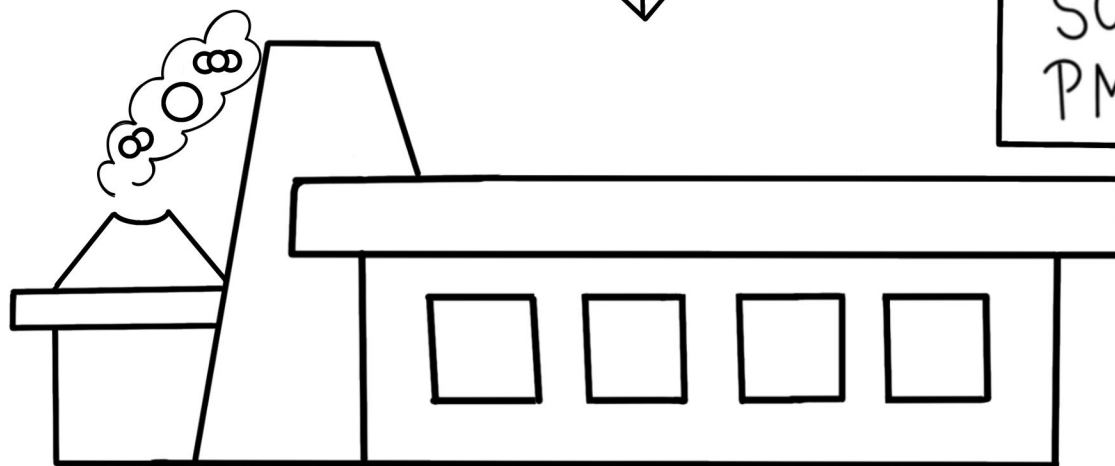
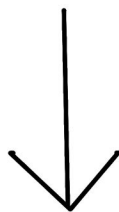
Color Key	
CO_2	=
NO_x	=
SO_2	=
PM	=

Fuel-Switching Co-Benefits



Before

Coal Powered Factory



After

Hydrogen Powered Factory

Color Key	
CO_2	=
NO_x	=
SO_2	=
PM	=

Coloring Book Instructions: Learning About Decarbonization

Welcome to your special coloring book! It's all about learning how we can make factories and power plants cleaner and better for the air we breathe. Follow these instructions to learn and have fun coloring.

Color Key Instructions

Before you start coloring, create a **color key** for the four pollutants you'll find in the pictures. Use the same colors for each molecule on all pages to stay consistent. You don't have to use the same color choices as below but try to stay consistent in the color of Oxygen (try to keep oxygen the same color in CO₂, NO_x, SO₂).

- 1. Carbon dioxide (CO₂):** An odorless gas that makes the **atmosphere** trap heat
 - **Structure:** One **carbon atom** in the middle, two **oxygen atoms** on each side.
 - **Color:** Use **blue** for carbon and **red** for oxygen.
 - **Science terms:** CO₂ has a **linear molecular angle** based on the bonding angle of carbon and oxygen.
- 2. Nitrous oxide (NO_x):** The X in NO_x is like a mystery number for any number of oxygen (like NO₂ or NO₃). Some have harsh smells and cause damage to your lungs, making it harder to breathe. NO₂ has a strong smell like bleach.
 - **Structure:** One **nitrogen atom** with one or more **oxygen atoms**.
 - **Color:** Use **green** for nitrogen and **red** for oxygen.
 - **Science terms:** NO_x can have different molecular shapes depending on the number of oxygen atoms.
- 3. Sulfur dioxide (SO₂):** Smells like rotten eggs! This molecule can also make the air unhealthy to breathe, especially if they have asthma.
 - **Structure:** One **sulfur atom** in the middle with two **oxygen atoms**.
 - **Color:** Use **yellow** for sulfur and **red** for oxygen.
 - **Science terms:** SO₂ has a **bent molecular angle** due to the sulfur atom's bonds.
- 4. Particulate Matter (PM):** Doesn't have a smell because it's made of tiny pieces of dust, dirt, and smoke. It can hurt your lungs and make it harder to stay healthy.
 - **Structure:** Tiny particles smaller than dust.
 - **Color:** Use **brown dots** to represent these tiny pollutants.
 - **Science terms:** PM includes small, harmful particles that can float in the air.

After making your color key, use it to color the **molecules** in the pictures. Make sure to show how the emissions change in the **before** and **after** pictures!

Page Instructions: Before and After Coloring

Page 1: Factory with Carbon Capture Technology

- This factory is special! It has **carbon capture technology**, which cleans the air by stopping most pollutants before they go into the **atmosphere**.
- **Upper arrow:** Color the **CO₂ molecules** being removed using your key.
- **Lower arrow:** Color other pollutants (NO_x, SO₂, PM) being reduced.
- **Optional:** Color the factory itself 😊.

Pages 2 & 3: Before and After Factories and Power Plants

- **Before:** These factories and power plants don't have any technology to stop **emissions**. Use your color key to fill in the smokestack **emissions** with CO₂, NO_x, SO₂, and PM **molecules**.
 - **After:** The cleaner factories and power plants have much smaller **emissions**—or none at all! Use the same color key to show how the numbers of **molecules** change.
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Key Science Words to Remember

1. **Carbon dioxide (CO₂):** One carbon atom with two oxygen atoms. Has no smell.
 2. **Nitrous oxide (NO_x):** One nitrogen atom and one or more oxygen atoms. Can smell like bleach.
 3. **Sulfur dioxide (SO₂):** One sulfur atom with two oxygen atoms. Smells like rotten eggs.
 4. **Particulate matter (PM):** Tiny pollutants smaller than dust.
 5. **Emitted:** Means “released into the air.” (Emissions are molecules released into the air by human activities)
 6. **Molecular angle:** The angle between atoms in a molecule.
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Fun Questions for You!

1. On Page 1, what is the name of the molecule being removed in the **upper arrow** by the carbon capture technology in the factory?
2. On Page 1, the **lower arrow** shows other pollutants being removed and reduced in the atmosphere. What are they?

3. On Pages 2 or 3, what do you notice about the **number** of the emitted particles from the factory or power plant **before** and **after**? How do they change?
 4. On Pages 2 or 3, what is missing from the emissions in the factory **after picture** compared to the **before picture**?
 5. Which pollutant has a sulfur atom in it?
 6. What does PM stand for, and why is it important to reduce it?
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Now grab your crayons and start coloring while learning about how we can help the Earth!

Answer Key

1. Carbon dioxide (CO₂)
2. NO_x, SO₂, and PM molecules
3. There are fewer emitted particles after carbon capture technology is added.
4. There is no sulfur dioxide (SO₂)
5. Sulfur dioxide (SO₂)
6. PM stands for particulate matter. Any answer indicating that **PM is or includes tiny pieces of dust, dirt, smoke, or other things in the air**. Or any answer explaining that **it's important to reduce PM because breathing it in can hurt your lungs or make it harder to breathe**.