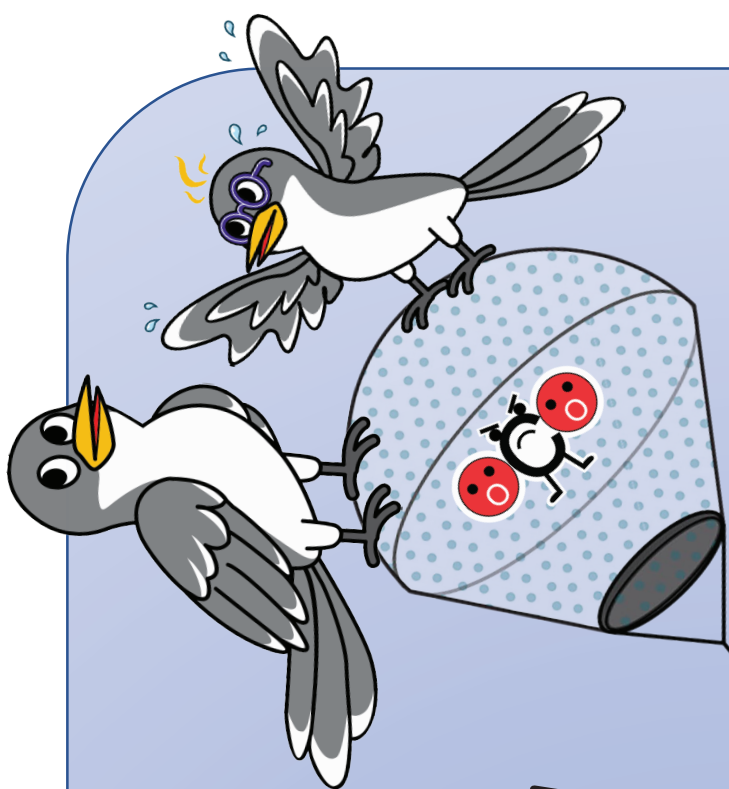




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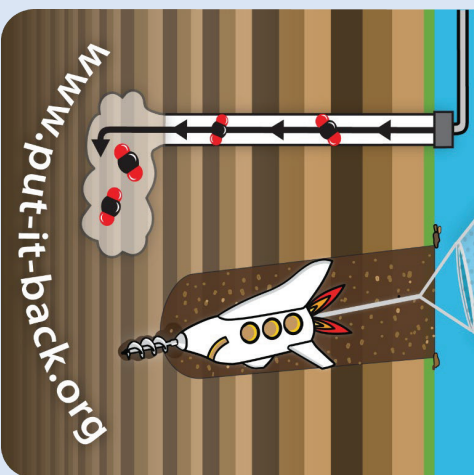
Let's save our planet with
Science & Technology!
*Come join our CCS
adventure on Earth!*



Carbon-nots to the Rescue!

Learn with Cosmo & Maya!

**Carbon-nots
to the Rescue!**



Join us as we commit to
decreasing greenhouse gases in our
atmosphere by decreasing our carbon
footprint, and by supporting carbon
capture and storage (CCS).
Support CCS today!

Gulf Coast Carbon Center
Bureau of Economic Geology
The University of Texas at Austin
To learn more, please visit us at:
www.put-it-back.org

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Photo Credit: Jay McGowan

Cosmo and Maya are the Texas State
Bird known as **Northern Mockingbirds**

Mockingbirds are known to mimic a variety of
sounds. Their song is a long series of phrases that
they often repeat 2 to 6 times before shifting to a
new sound.

They are found often in open grounds and with
shrubby vegetation (hedges, fruiting bushes &
thickets)

Mockingbirds eat mainly insects during the
summer, but switch to eating mostly fruit in fall and
winter

- **Population:** Stable, not endangered
- **Clutch size:** 2 to 6 eggs (pale blue or
greenish white speckled with red or brown)
- **Incubation period:** 12 to 13 days
- **Nesting period:** 12 to 13 days
- **Broods:** 2 to 3

To learn more: <https://www.allaboutbirds.org/guide/>

Would you like to become a Carbon-not?

What is carbon dioxide (CO₂)?

CO₂ is known as a **greenhouse gas**, since this gas *traps* heat in our atmosphere.

CO₂ has been recorded in the atmosphere in studies since 1958 at the Mauna Loa Observatory in Hawaii.

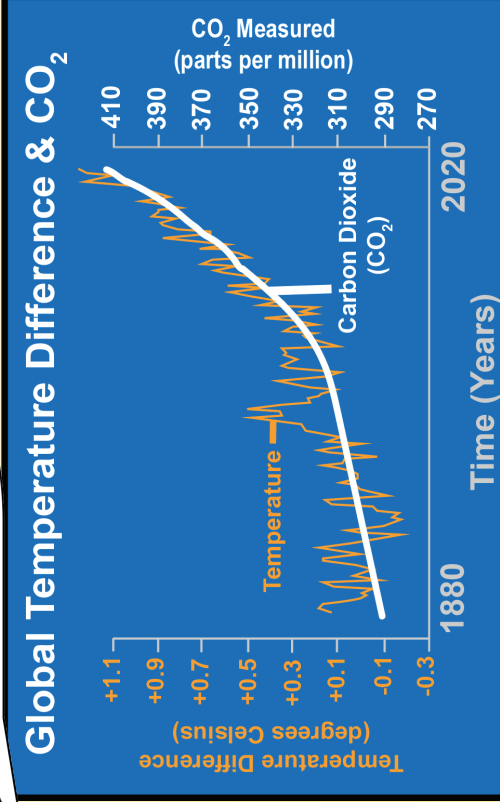
Higher concentrations of CO₂ are observed due to various human activities.

CO₂ can enter Earth's atmosphere when we burn fossil fuels like **coal**, **natural gas**, and **oil**, as well as **trees**, and **solid waste**.

It can also enter the atmosphere as a result of chemical reactions that occur when manufacturing things like **plastic**, **cement**, and **steel**.

Cosmo,
I am getting too hot
and too thirsty!
TOO HOT!
TOO THIRSTY!

Oh gee Maya!
There is a rise in average
temperature on Earth, because there
is *too much CO₂* in the atmosphere.
TOO MUCH CO₂!



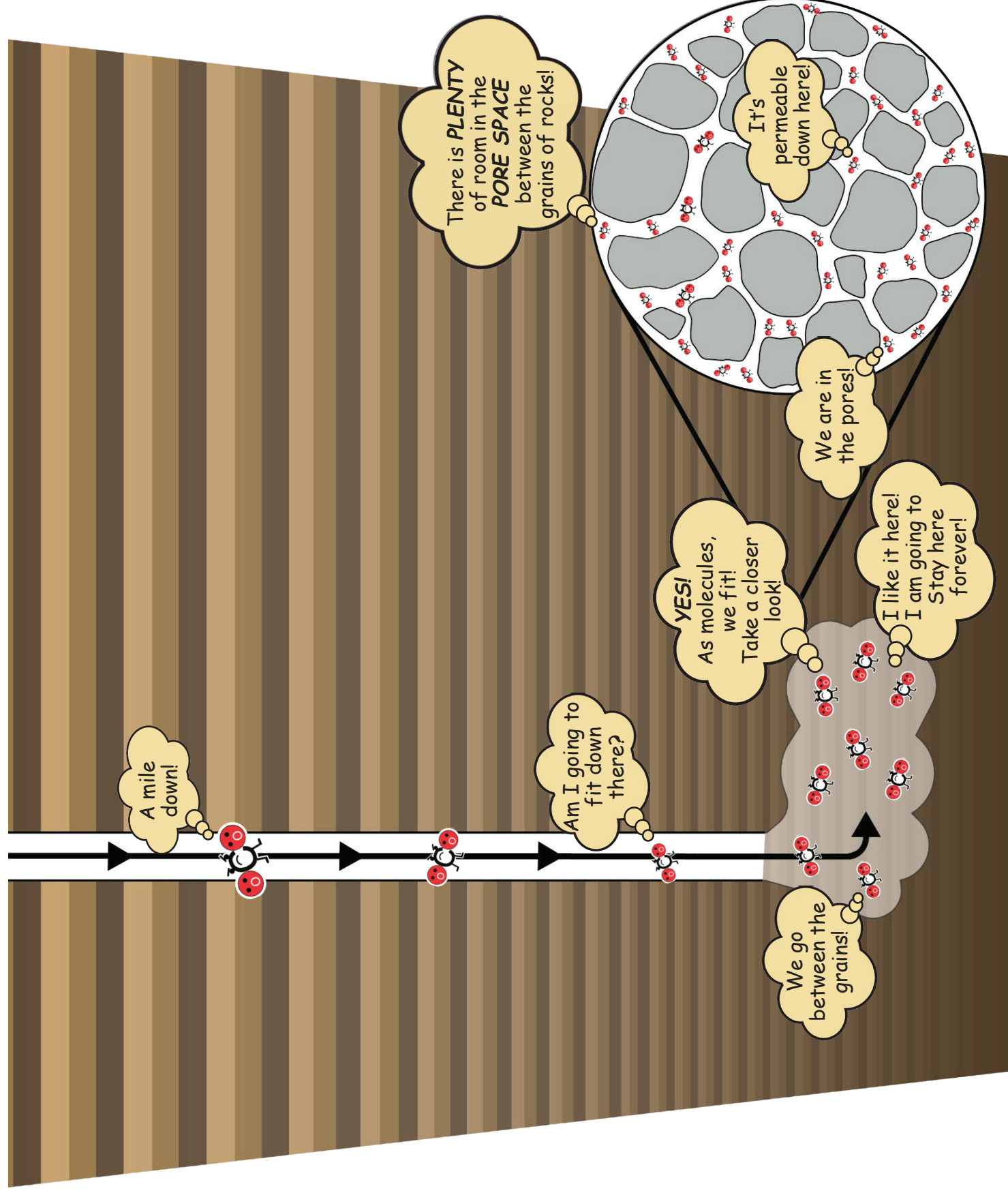
CO₂ comes from a variety of natural sources, but **human-related emissions** have been responsible for an increase in the atmosphere since the industrial revolution.

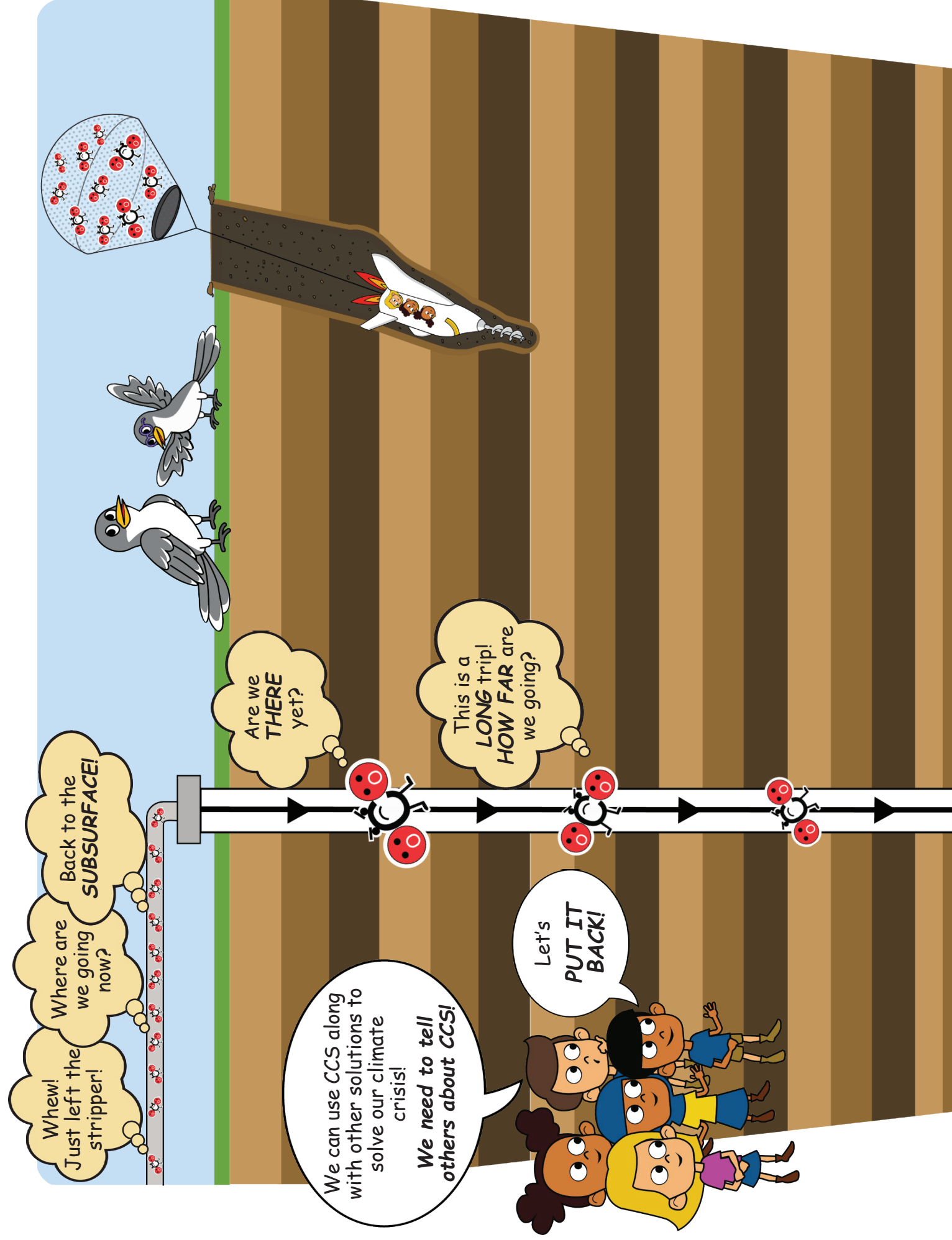
Oh, dear!
Rising heat causes
HOTTER HEAT WAVES,
MORE FREQUENT
DROUGHTS, FIRES,
HEAVIER RAINFALL,
and FLOODS!

Maya,
it is
getting
HOTTER!!

Hmm...
WHERE IS ALL
THAT CO₂
COMING
FROM?

PEOPLE,
can you stop
letting CO₂ go?
THIS has to STOP!
HAS TO STOP!





I see it every day.
Carbon that was stored in the Earth as coal, oil, or gas is **burned** (combusted) to make energy. The **CO₂** that is released mixes with the atmosphere.

CO₂ is also emitted by **chemical reactions** not related to combustion. The production of cement, metals, like iron and steel, and certain chemicals can make

A LOT OF CO₂!
A LOT OF CO₂!

I'm a chemical element known as **carbon (C)**, and I am the backbone for life.



On Earth, I am mostly stored in rocks and sediments underground.

Fossil fuels contain mostly **C** and **Hydrogen (H)**. **When fossil fuels are burned or used in industrial processes** C bonds with **O₂** to form **CO₂**.

I'm an **oxygen molecule (O₂)**, and am essential for living organisms. When burning, I react with **C** to form **CO₂**.



I'm **CO₂**, a gas that forms when **C** and **O₂** bond.



When high volumes of **CO₂** accumulate in the atmosphere, heat becomes trapped there.

I'm a **nitrogen molecule (N₂)**, and I am inert, making me chemically inactive.

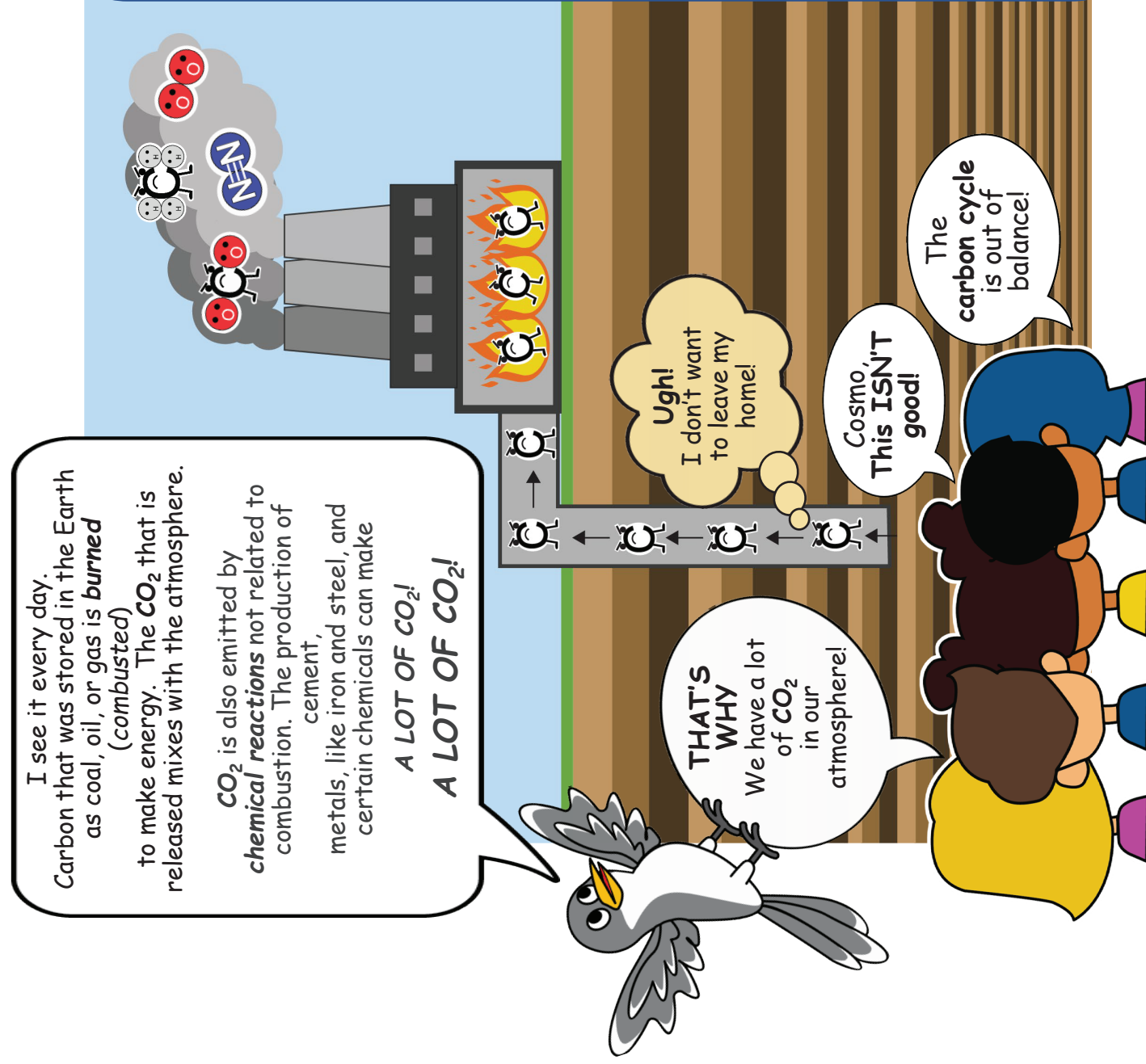


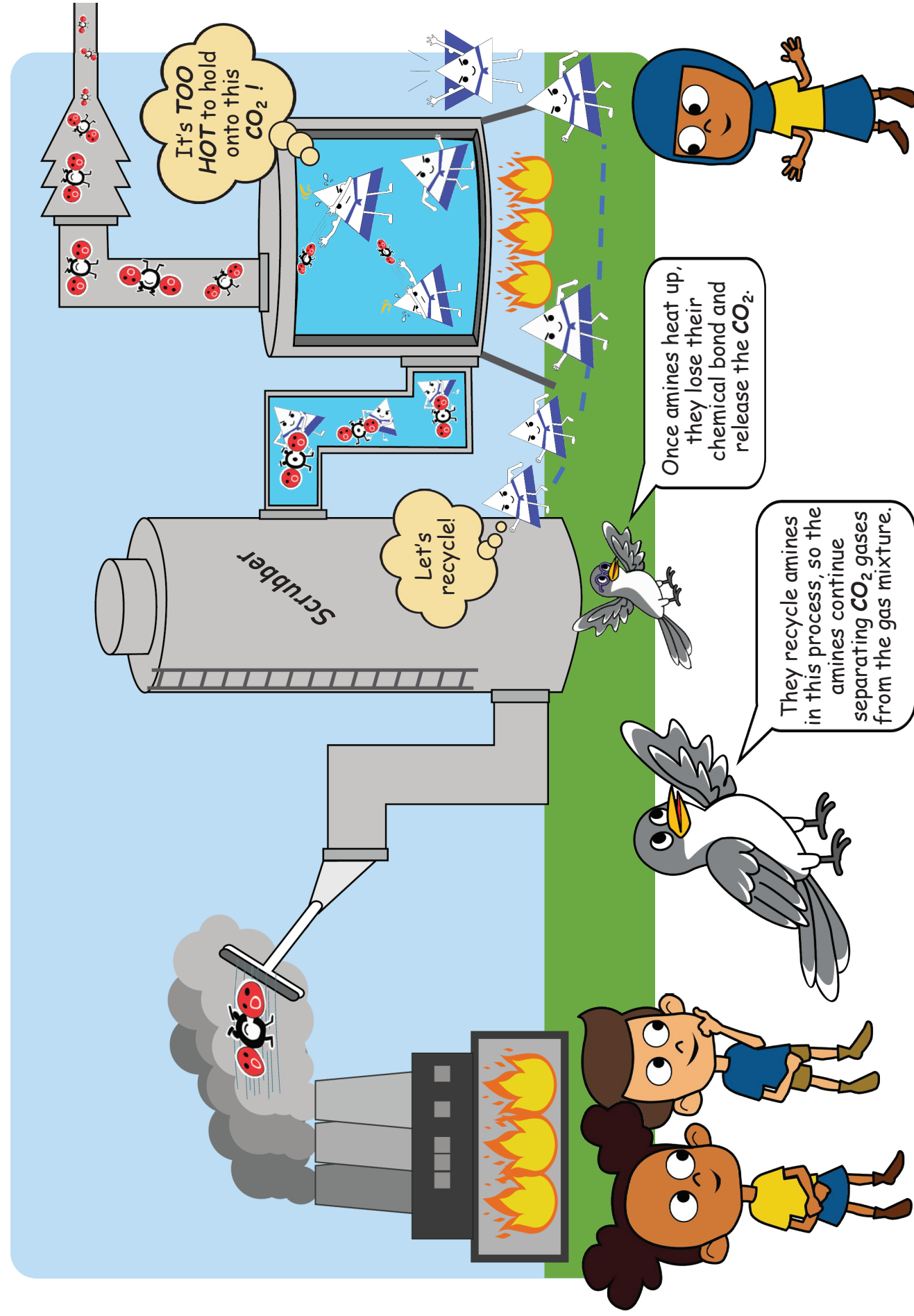
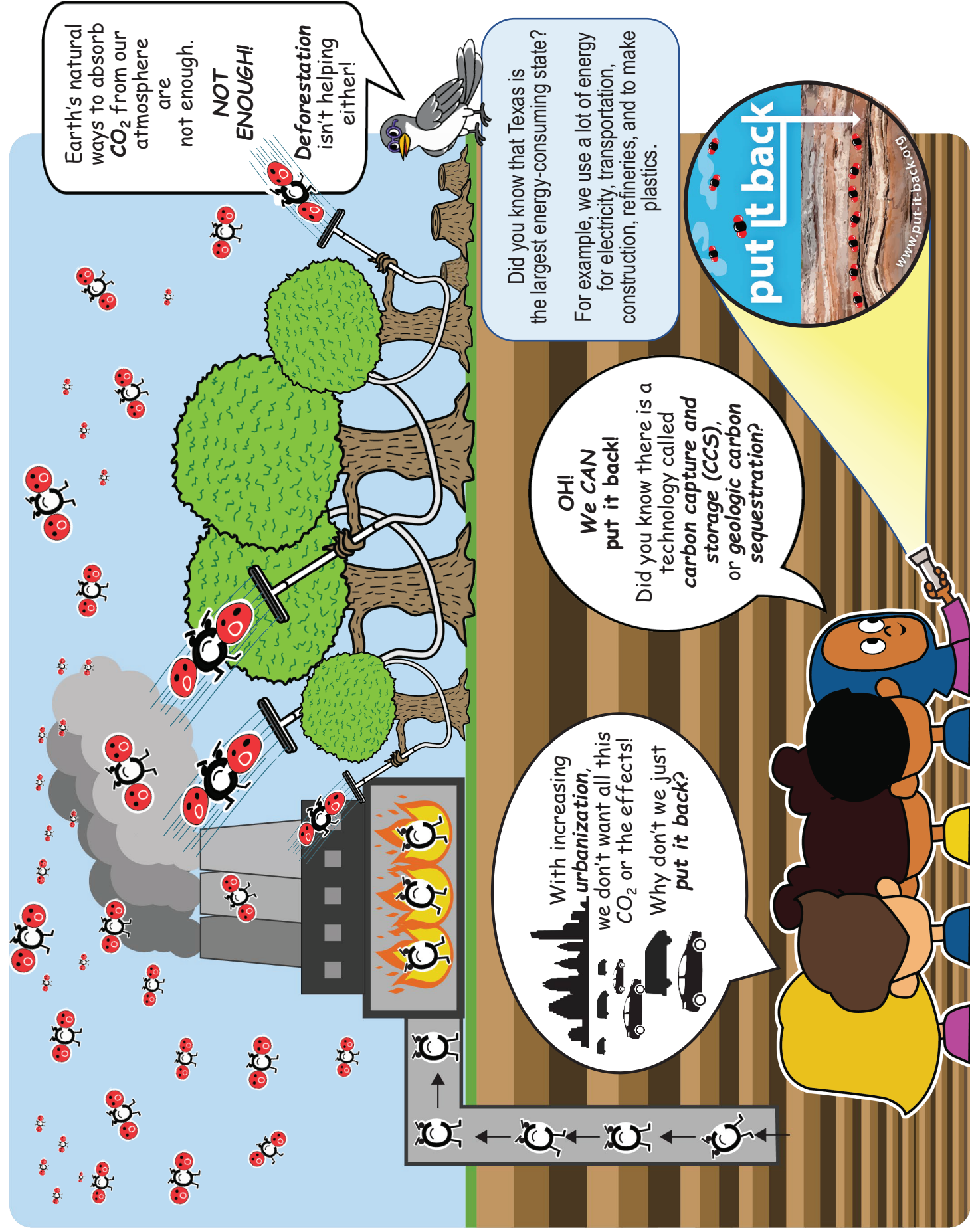
I'm a gas known as **methane**.

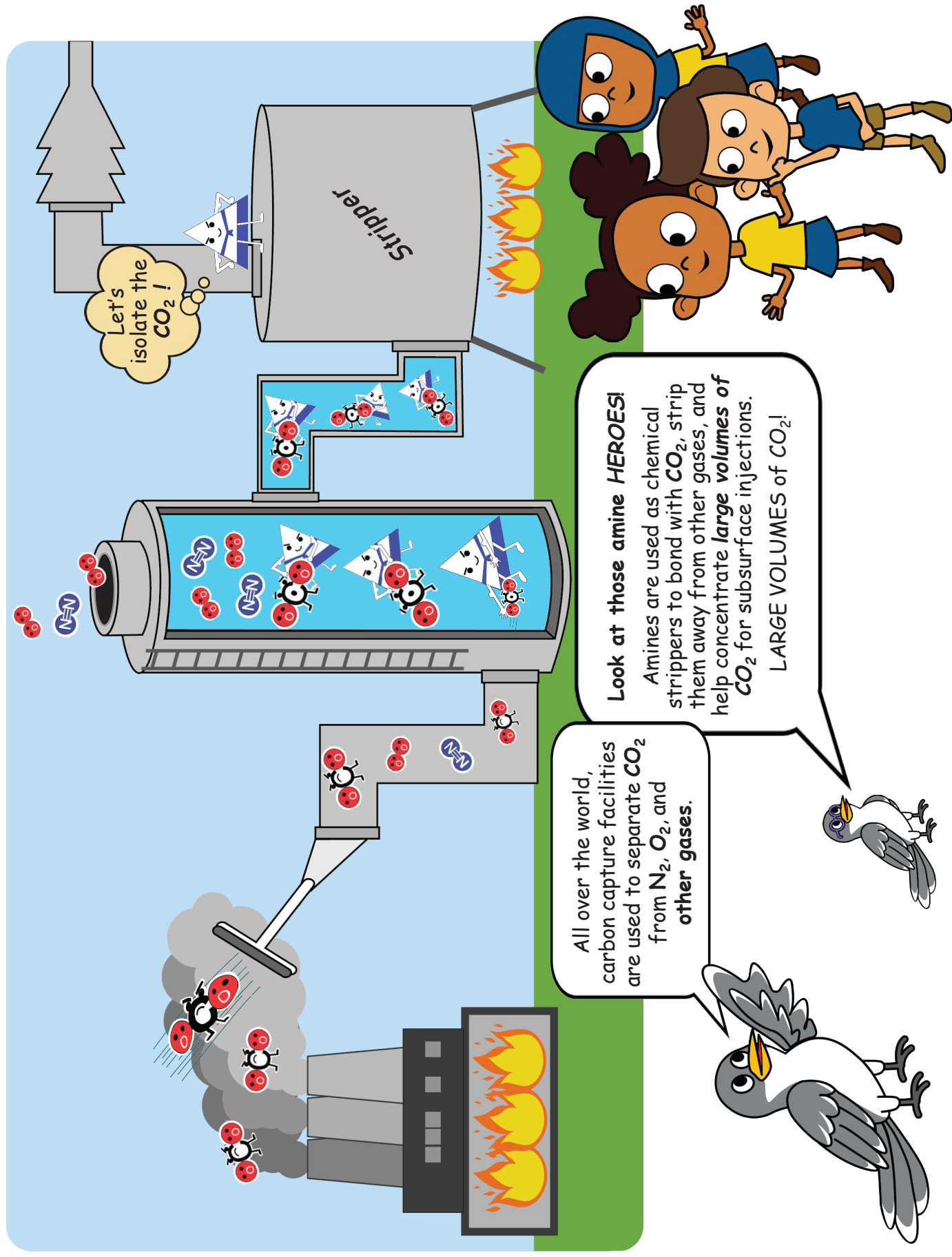


I am a molecule that contains 1 **C** and 4 **hydrogen** atoms.

I am the 2nd most abundant greenhouse gas after **CO₂** in industrial waste.







For CCS, the CO₂ is stored **deep** underground, far, far, **FAR DEEP!**

If we produce carbon from coal, gas, and oil underground, we can certainly take CO₂ generated today and **PUT IT BACK** in the ground to help our atmosphere!

In Texas, CO₂ is injected at least 0.5 to 2 miles down below the ground.

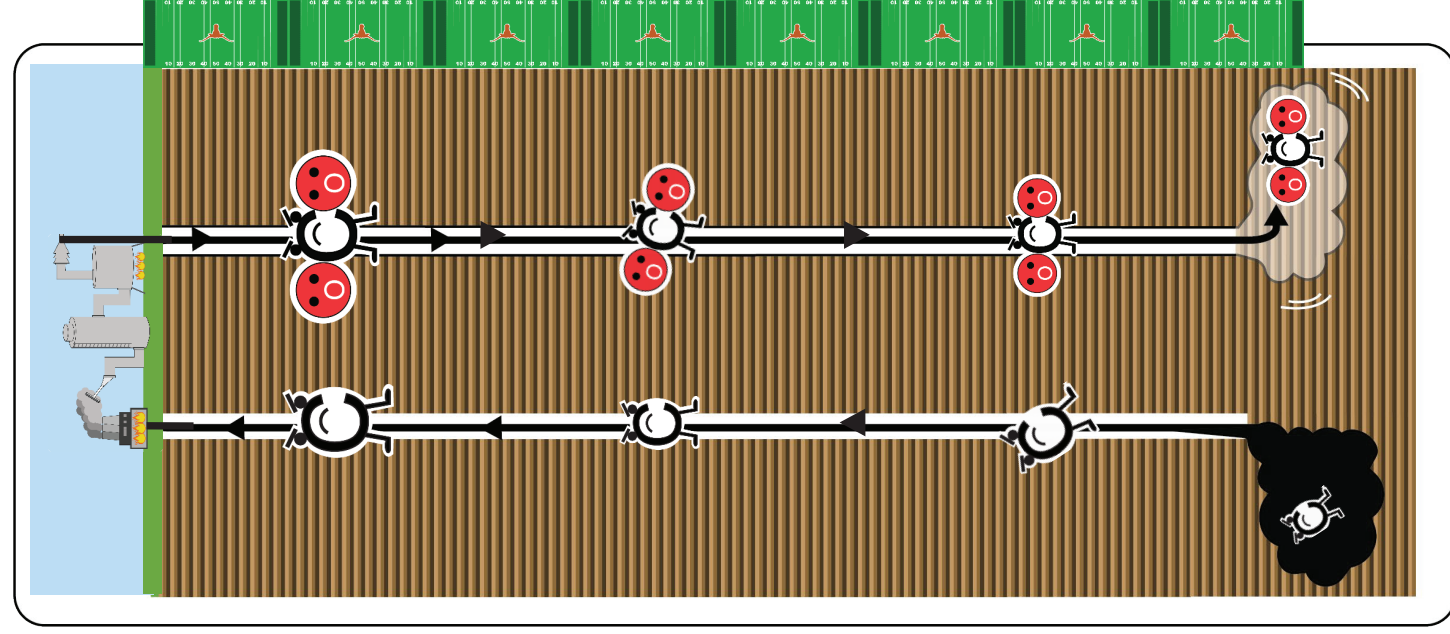
How many football field lengths put end-to-end does it take to show how deep we store CO₂ in the ground?

120 yards

Let's make some "back-of-the-envelope" calculations:

- 1 football field = 120 yards
- 0.5 miles = 880 yards
- 1 mile = 1,760 yards
- 2 miles = 3,520 yards...

- How many football fields stacked end-to-end would it take to get 0.5 miles down below the surface?
880 yards/120 yards = _____ football fields
- How many football fields stacked end-to-end would it take to get 2 miles down below the surface?
3,520 yards/120 yards = _____



Wow, that means for CCS projects, they don't inject CO_2 until they have drilled to at least 7.3 football fields down!

I can't throw a football **THAT** far!

Did you calculate the maximum number of fields stacked end-to-end that it would take?

Cool, this creates permanent and safe CO_2 storage!

Today's climate does not have to be this way. We do **NOT** have to be **SO hot!** **Hot!** **HOT!** Let's sequester, or store carbon underground to decrease greenhouse gas!

What helps decrease greenhouse gases?

- ☐ Save energy
- ☐ Walk, bike, or public transport
- ☐ Reuse, repair, and recycle
- ☐ Eat more vegetables
- ☐ Waste less food
- ☐ Clean up our environment
- ☐ Make your money count by supporting companies who use resources responsibly, cut emissions & waste
- ☐ Speak up & support activities like CCS

Learn more about actions for a healthy planet here: <https://www.un.org/en/actnow/ten-actions>

Oh, Cosmo, **HOW** do we separate CO_2 from all the different gases released from industrial processes?

We use **carbon separation plants**, and **amines** to separate CO_2 from other industrial gases produced. Calling all amines, **AMINES!**

Let's take a closer look at what happens in a carbon capture facility!

I'm a salt compound, known as an **amine molecule**. My job is to absorb CO_2 from industry emitted gases. I'm useful in the carbon battle! When I'm exposed to hot temperatures, CO_2 is stripped away from me.

One of the world's largest CCS projects is in Sugarland, near Houston, Texas.

This CCS project, known as the **Petra Nova plant**, was built to capture 1.4 million tons of CO_2 per year. After separating and capturing the CO_2 , the CO_2 is compressed, dried, and transported in a pipeline to inject underground for **safe and permanent storage**.

Get **THAT** CO_2 !

Put them in the liquid scrubber

Let's strip that CO_2 !