TALKING ABOUT GREEN HYDROGEN

HEINRICH BÖLL STIFTUNG
CAPE TOWN
South Africa | Namibia | Zimbabwe
MACUA
WAMUA
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TALKING ABOUT GREEN HYDROGEN: *What is it all about?* is jointly published by Earthlife Africa, Economic Justice Network of FOCCISA, Heinrich Böll Foundation [Cape Town], MACUA [Mining Affected Communities United In Action], WAMUA [Women affected by Mining United in Action] and WoMin African Alliance.

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Third edition, March 2023

Printed by Silver Banana, Cape Town, South Africa

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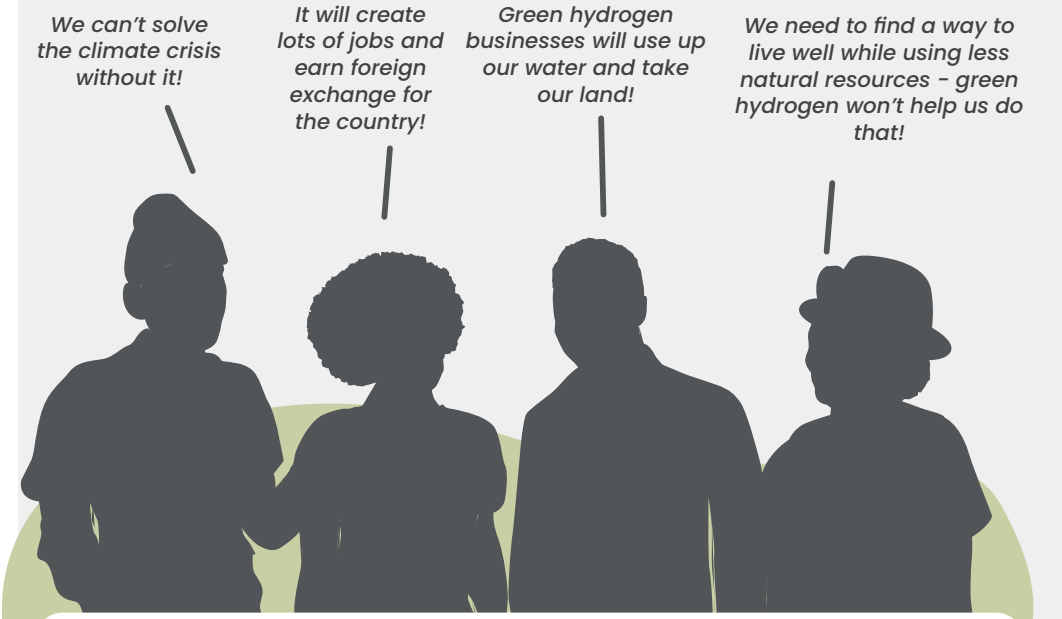
Across South Africa and around the world, a lot of people are excited about something called 'green hydrogen'

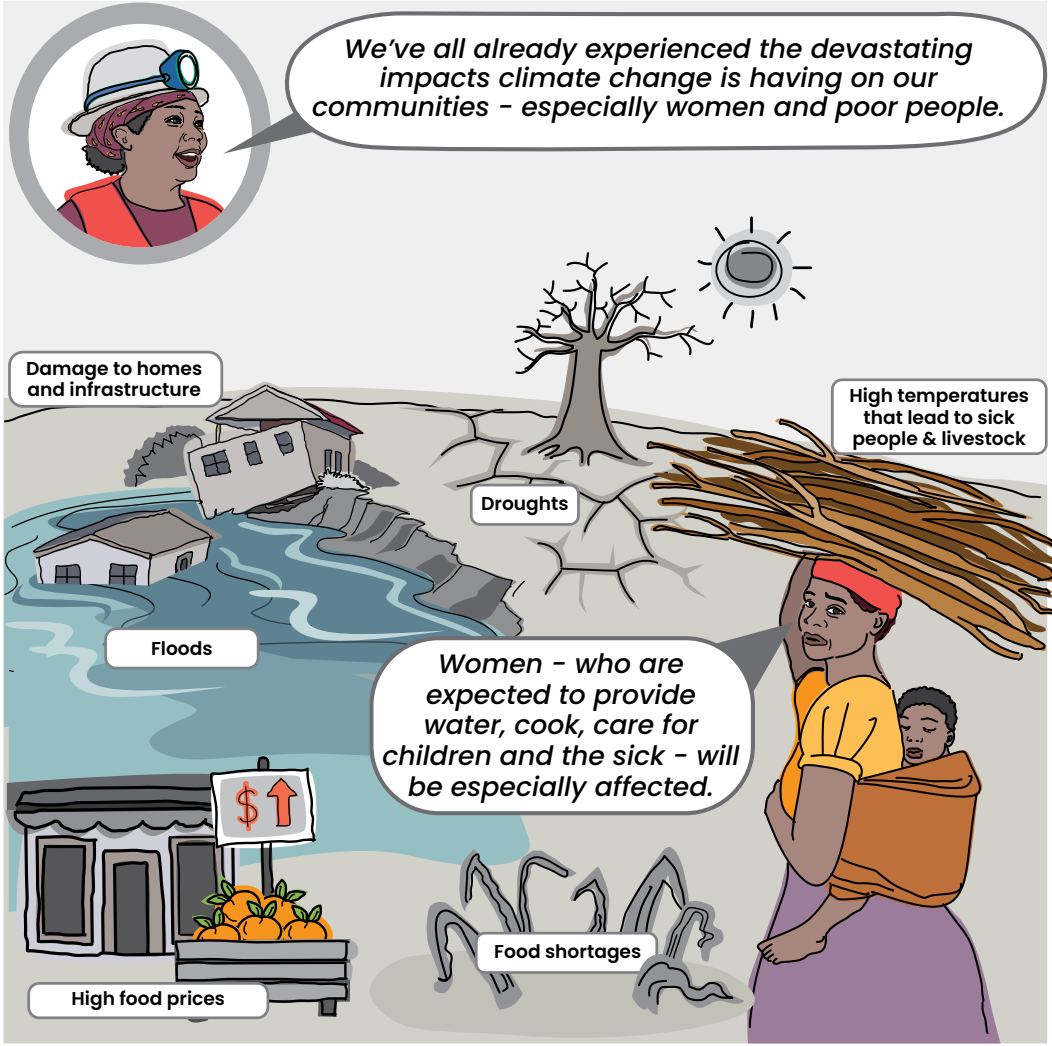


But what is green hydrogen? Will it be useful for South Africa? How will it impact your community? What does it mean for climate justice? This booklet will give you information so that you can make up your own mind.

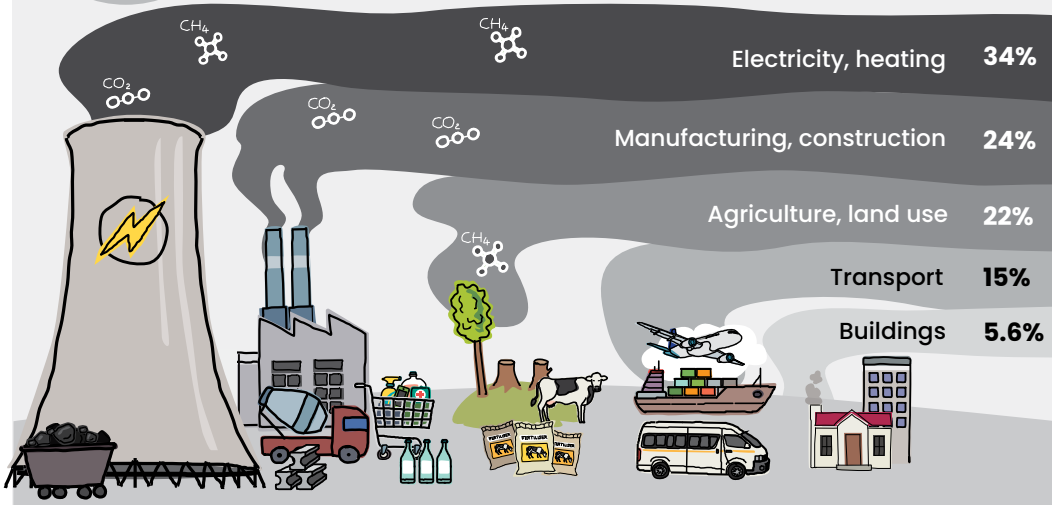
Underlined words are explained in the dictionary at the back.

PART 1 What's climate change, and what's it got to do with green H_2 ?

To understand the fuss about green hydrogen – also written as 'gH_2' - we need to first understand ***climate change*** *- one of the most serious and urgent crises humanity faces*


We've all already experienced the devastating impacts climate change is having on our communities - especially women and poor people.
Damage to homes and infrastructure
High temperatures that lead to sick people & livestock
Droughts
Floods
Women - who are expected to provide water, cook, care for children and the sick - will be especially affected.
$
Food shortages
High food prices

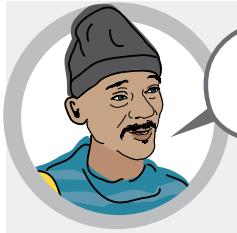
*Climate change is happening because we release **Greenhouse Gases (GHGs)** when we burn fossil fuels like coal, oil and gas. When GHGs like **Carbon dioxide (CO_2)** and **methane (CH_4)** are released into the air, they make the earth warmer.*



Sources of SA's Greenhouse Gas (GHG) emissions

*To stop climate change we have to stop releasing CO_2 and other GHGs into the air - and we have to do it fast - **at least 45% by 2030!** The problem is that almost every part of our economies depends on activities that release GHGs.*

So what can we do?

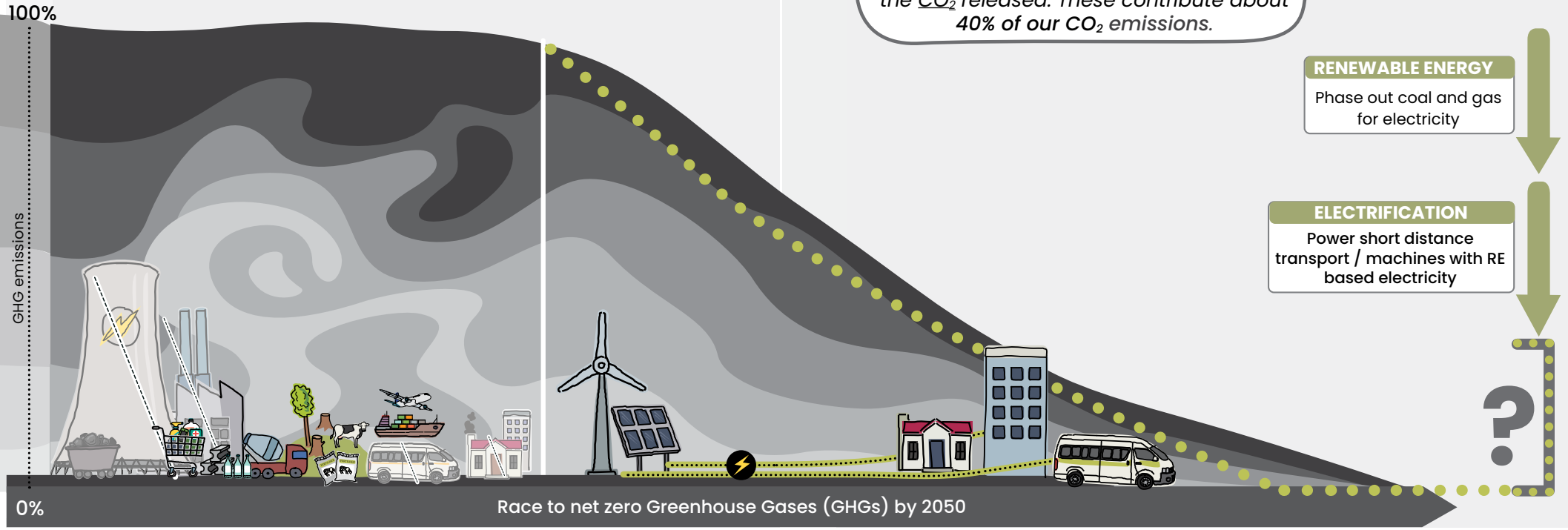


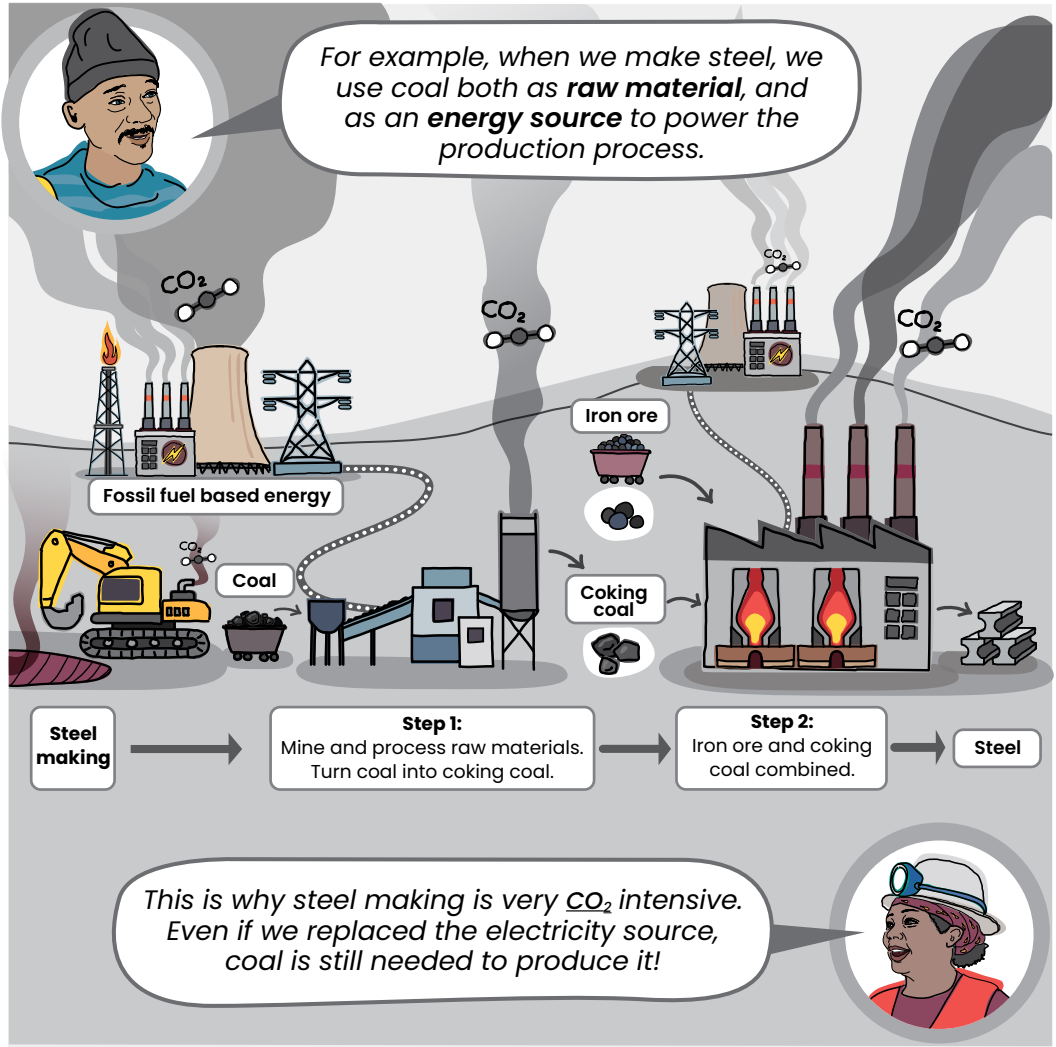
*Well, first, using **Renewable Energy (RE)** sources like solar and wind instead of coal to generate electricity will help reduce A LOT of the CO_2 we release.*

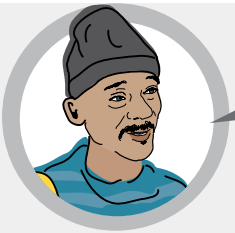
*This is because electricity from coal or gas is responsible for about **a third** of our CO_2 emissions.*

And, once our electricity comes from renewables (RE), we can also take machines that right now need oil, petrol or gas, and convert them to use RE electricity instead.

*However, there are industries in which REs and electrification will not help us reduce the CO_2 released. These contribute about **40% of our CO_2** emissions.*

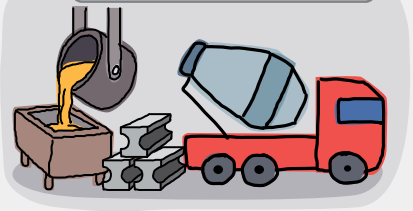



For example, when we make steel, we use coal both as raw material, and as an energy source to power the production process.
CO_2
CO_2
CO_2
CO_2
Fossil fuel based energy
Iron ore
Coal
Coking coal
Steel making
Step 1:
Mine and process raw materials. Turn coal into coking coal.
Step 2:
Iron ore and coking coal combined.
Steel
This is why steel making is very CO_2 intensive. Even if we replaced the electricity source, coal is still needed to produce it!

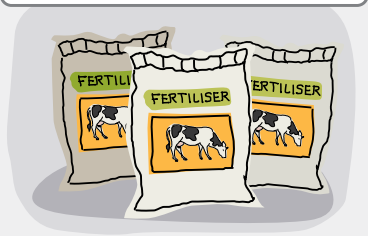


There are other sectors in which CO_2 emissions are equally difficult to reduce. They are called 'hard-to-abate' sectors.

Producing iron and cement for houses, bridges and roads.



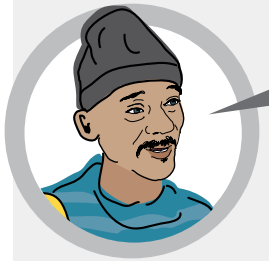
Producing fertilisers, on which our food supply *(currently)* depends.



Making fuel for heavy transport.

Making plastics, glass, cleaning products, electronics...

So what do we do about these?

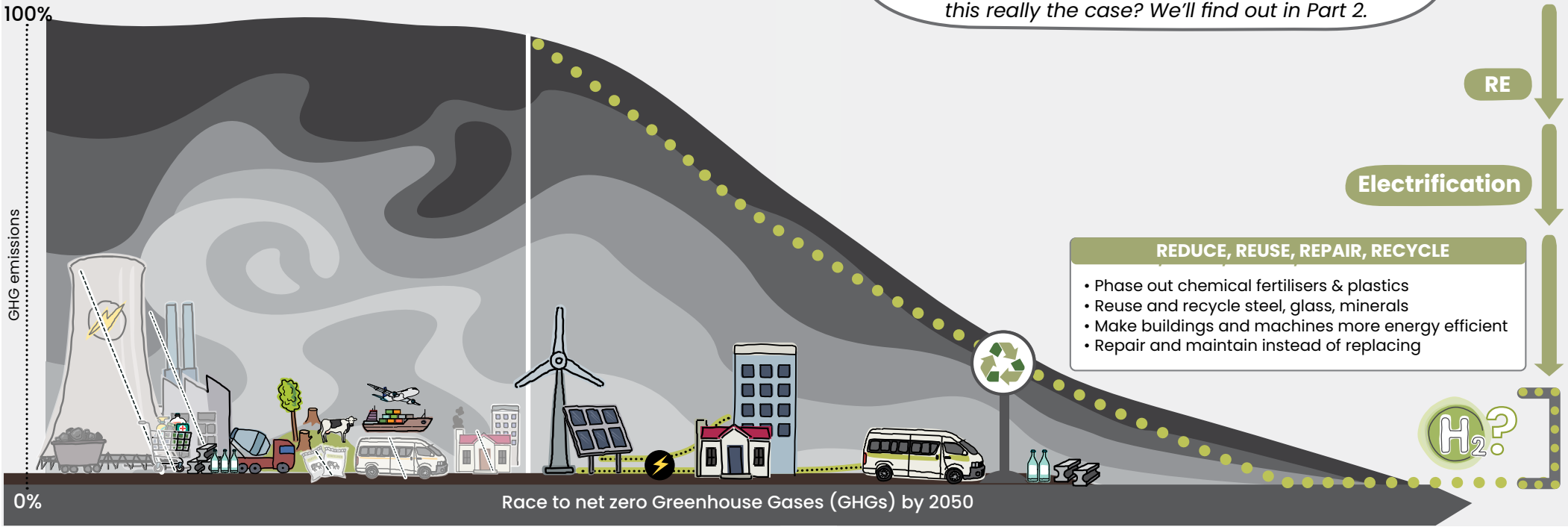


*Some, we need to phase out. Most plastics and **chemical fertilizers**, for example. These destroy our environments not just because they release CO_2. They also pollute our oceans, rivers and soils.*

Others, we we must learn to use less of and recycle more.

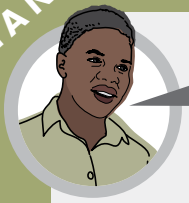
But even then, if we want more people to have access to bridges, trains, buildings, technology - even electricity - we'll still need new steel, electronics, glass and the other useful things produced in 'hard-to-abate' sectors.

***THIS** is where **green hydrogen COULD** come in. Some people say it could help us to lower CO_2 emissions in these 'hard-to-abate' sectors. But is this really the case? We'll find out in Part 2.*



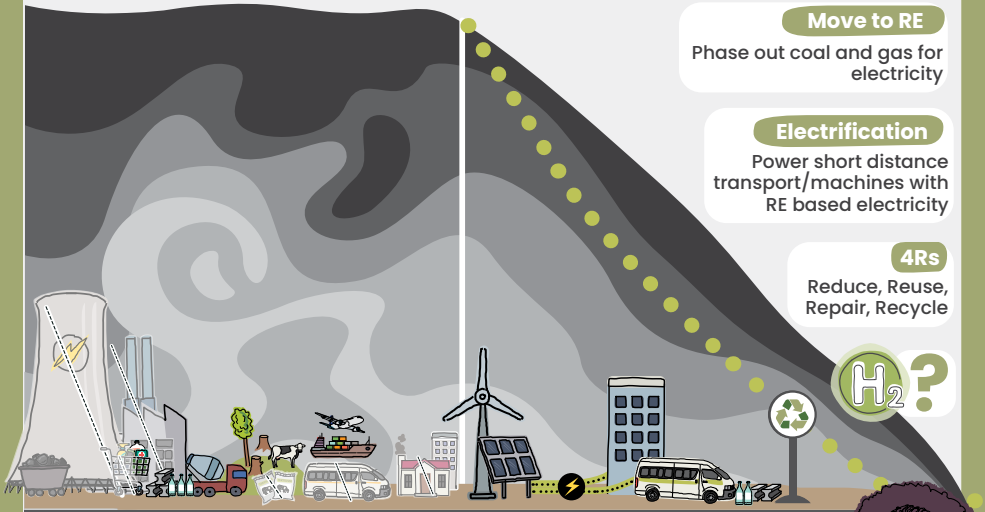
IN A NUTSHELL

What's climate change, and what's it got to do with green hydrogen?



We've all already experienced the devastating impacts of climate change. To stop it from getting worse, we need to urgently reduce greenhouse gases (GHGs).

Changing our electricity sources from coal to renewable energy (RE), and using less natural resources will take us a long way there – but not all of it.



Race to net zero Greenhouse Gases (GHGs) by 2050

Some people say that green hydrogen can help us reduce GHGs in that 'final mile'.

PART 2 What is green hydrogen – and how could it help lower carbon emissions?

To understand the answer, let's start by asking:

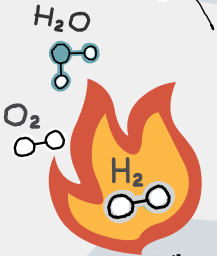
What is hydrogen?

Hydrogen – H_2 – is a gas molecule

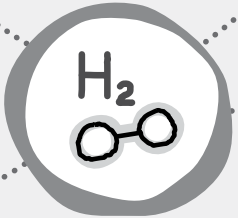
It is the lightest element in the universe.

It is *everywhere* – it is the most common molecule in the universe

In its natural form, it is **never alone**. It's always with other molecules.



H_2 '**burns clean**' – when heated, H_2 only **releases water and/or oxygen**.

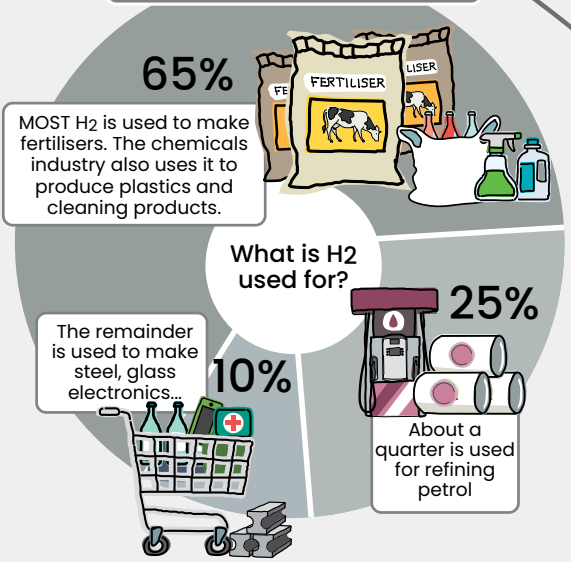


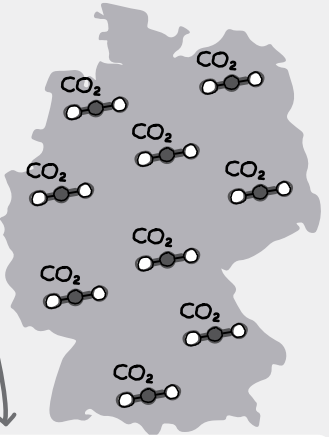
With **carbon dioxide (CO_2)**, it forms **methane – (CH_4)**

When it's joined to **Oxygen (O_2)** it forms water **(H_2O)**

H_2 is essential to many of those 'hard-to-abate industries in which it is difficult to lower the $\underline{CO_2}$ released.

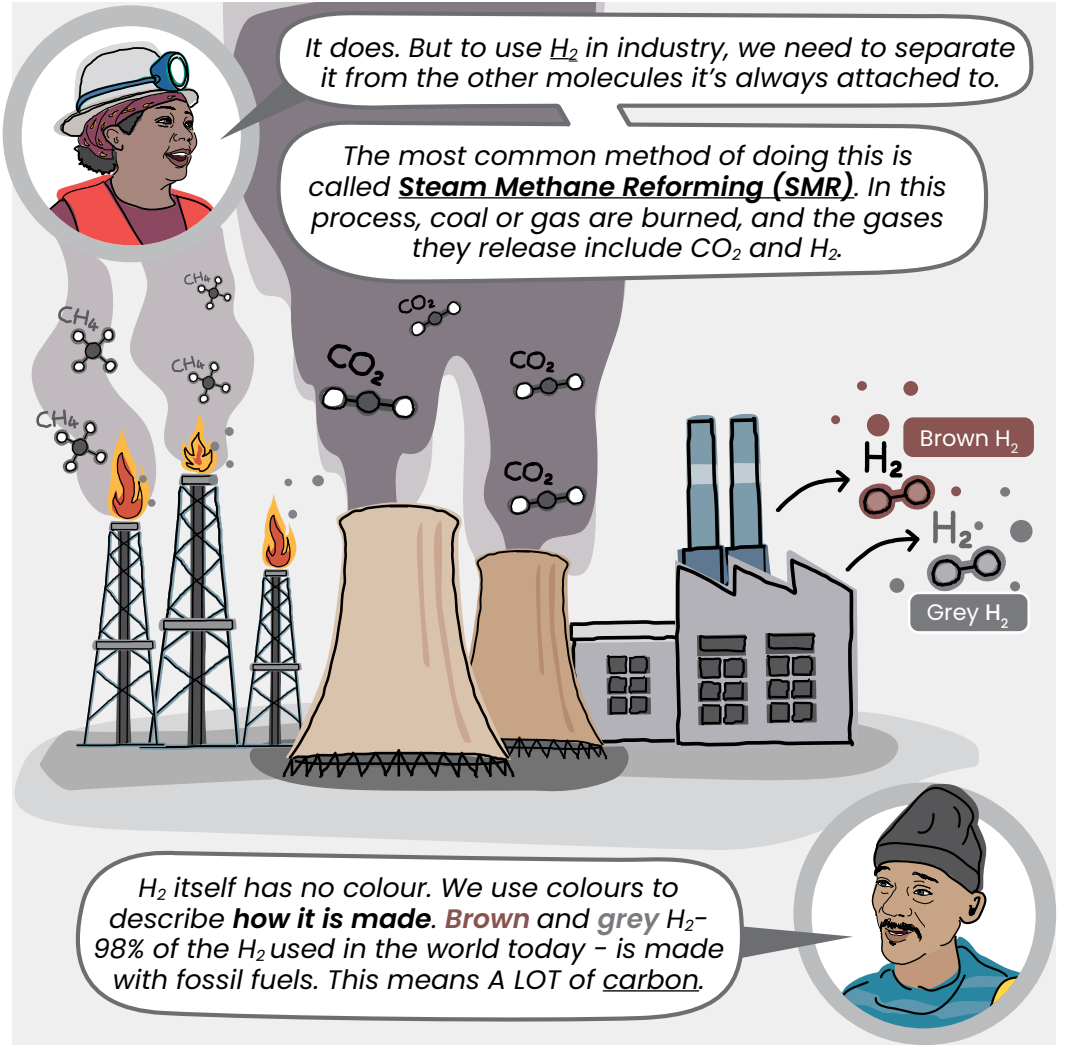
Worldwide, we use about **90 million tons** of H_2 every year for:





This results in around **830 million tons of CO_2** every year - more than the $\underline{GHG}$ emissions of the whole of Germany!

But I thought you said that H_2 'burns clean'?


It does. But to use H_2 in industry, we need to separate it from the other molecules it's always attached to.
The most common method of doing this is called **Steam Methane Reforming (SMR)**. In this process, coal or gas are burned, and the gases they release include CO_2 and H_2.
CH_4
CO_2
Brown H_2
Grey H_2
H_2 itself has no colour. We use colours to describe **how it is made**. **Brown** and **grey** H_2– 98% of the H_2 used in the world today – is made with fossil fuels. This means A LOT of carbon.

There are, however, ways to make H_2 without releasing CO_2

Some people say that to produce 'CO_2 -free' hydrogen, we could 'capture' the CO_2 released when we make grey or brown H_2, and store it underground. This is called **'Carbon Capture Utilisation and Storage' (CCUS)**.

H_2 H_2

H_2 made with CCUS is called **blue**

CO_2 CO_2 CO_2

CH_4 CH_4 CH_4

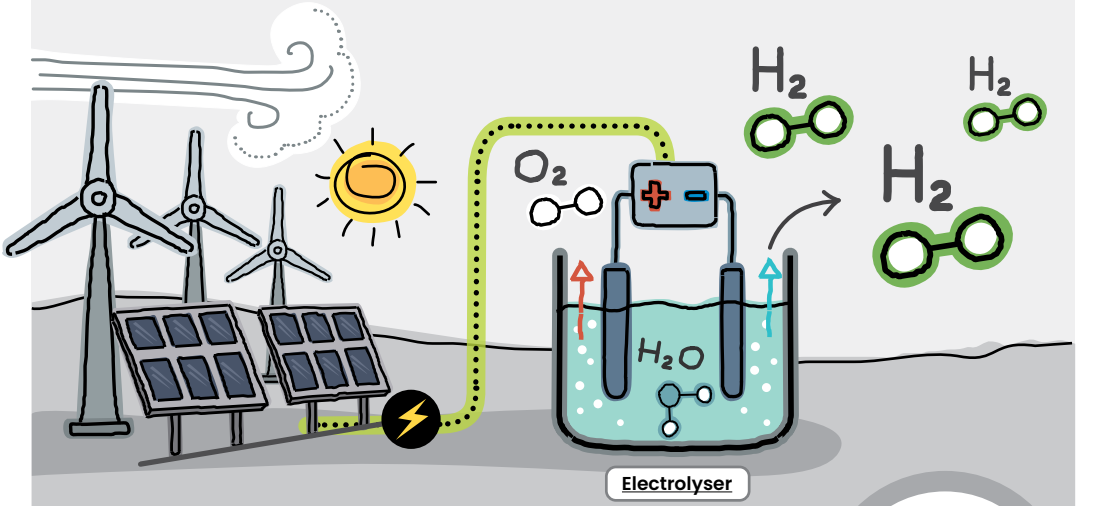
CH_4 is a dangerous GHG that leaks from gas wells and pipes.

This may sound good, but CCUS technologies aren't proven to work at large scale. So they don't exist yet. Additionally, Even if the CO_2 is captured, **producing gas releases methane (CH_4)**.

A lot of gas and oil companies are promoting **blue H_2**. They also call it **'clean' H_2**. If they convince people that blue H_2 is really 'clean', they'll have political and financial support to keep drilling for gas & oil.

So actually, **there is nothing clean or carbon free about blue H_2.**

The only H_2 that might help us reduce CO_2 emissions is H_2 that is produced when **renewable energy (RE)** is used to split water (H_20), into H_2 and Oxygen (O_2) through a process called **electrolysis**. **This is called green hydrogen - gH_2.**



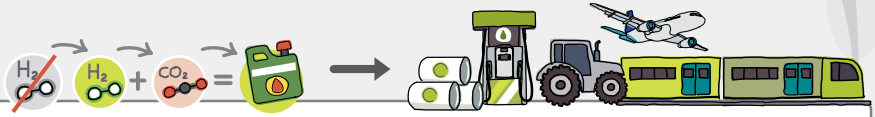
This technology is not new, but currently, making green H_2 is much more expensive than making brown or grey H_2 so it not used much. It therefore has not used at large scale.

But, if it becomes cheap enough - green H_2 could allow us to take the CO_2 out of those 'hard-to-abate sectors, which is possible if RE prices go down.

For example, if we use gH_2 instead of coal to make steel, the only by-product is water.

*And it's not just steel. Green H_2 **could** be used in all the sectors in which reducing CO_2 is difficult - and others! For example:*

We could make **green ammonia** for fertilisers, shipping fuel, chemicals and energy storage.
Currently **ammonia (NH_3)** is made when grey H_2 is combined with nitrogen (N_2). It could be made with green H_2 instead.

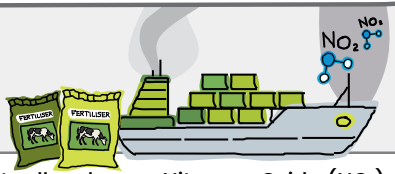


Instead of using grey H_2 to refine petrol or make **synthetic fuels (synfuels)** we could use green H_2.
Synfuels are made by combining H_2 with CO_2. When synfuels are made with gH_2 they are called '**green fuels**'. These are particularly important for industries like air travel. The CO_2 can be captured directly from the air or from waste processing.

Plastics, glass, semiconductors, and pharmaceuticals could be made with gH_2 instead of grey.

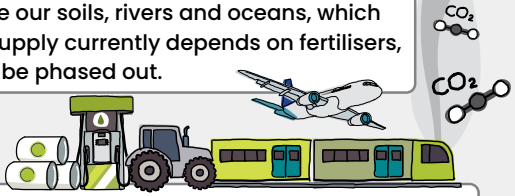
Green H_2 could replace gas heating for homes. It can also be used to generate high heat for industrial processes.

*But just because we **could** use gH$_2$ for these purposes, doesn't mean we **should**. Some of these uses still release GHGs, and others are destroying our ecosystems in different ways:*



Anything made with nitrogen (N_2) eventually releases Nitrogen Oxide (NO_x) – a powerful GHG – into the air. This means that these products **still threaten our climate.** We need to use less of them.

In addition, chemical fertilisers pollute our soils, rivers and oceans, which risks our future food supply. Our food supply currently depends on fertilisers, but they need to be phased out.



Although '**green fuels**' and using gH$_2$ for refining petrol could lower CO_2 emissions, it will not stop them completely. Anything made with carbon will eventually release CO_2.

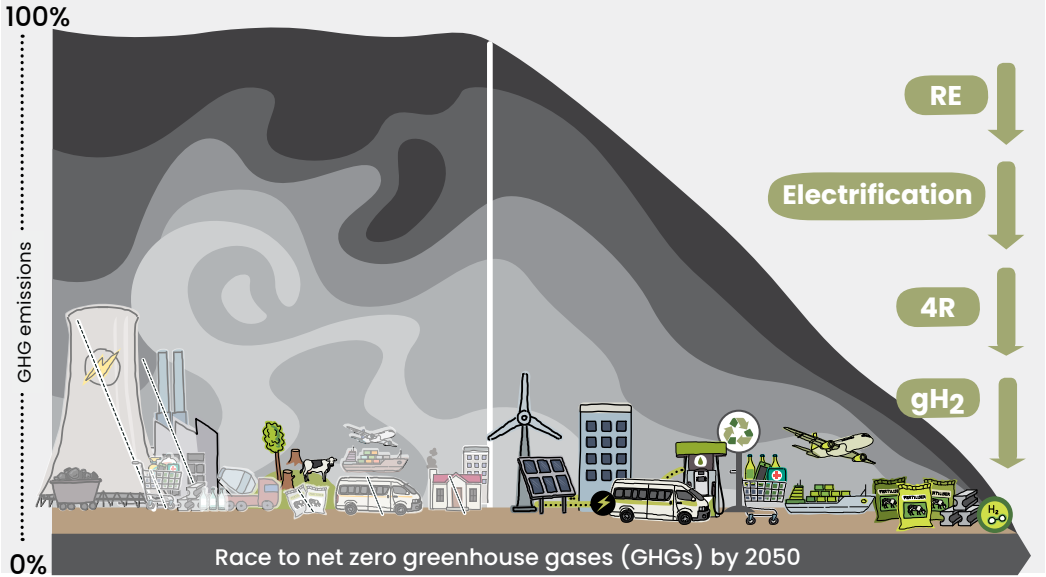
Instead of 'greening' petrol use, we must reduce it by introducing electrified public transport, switching to electric vehicles, and flying less.

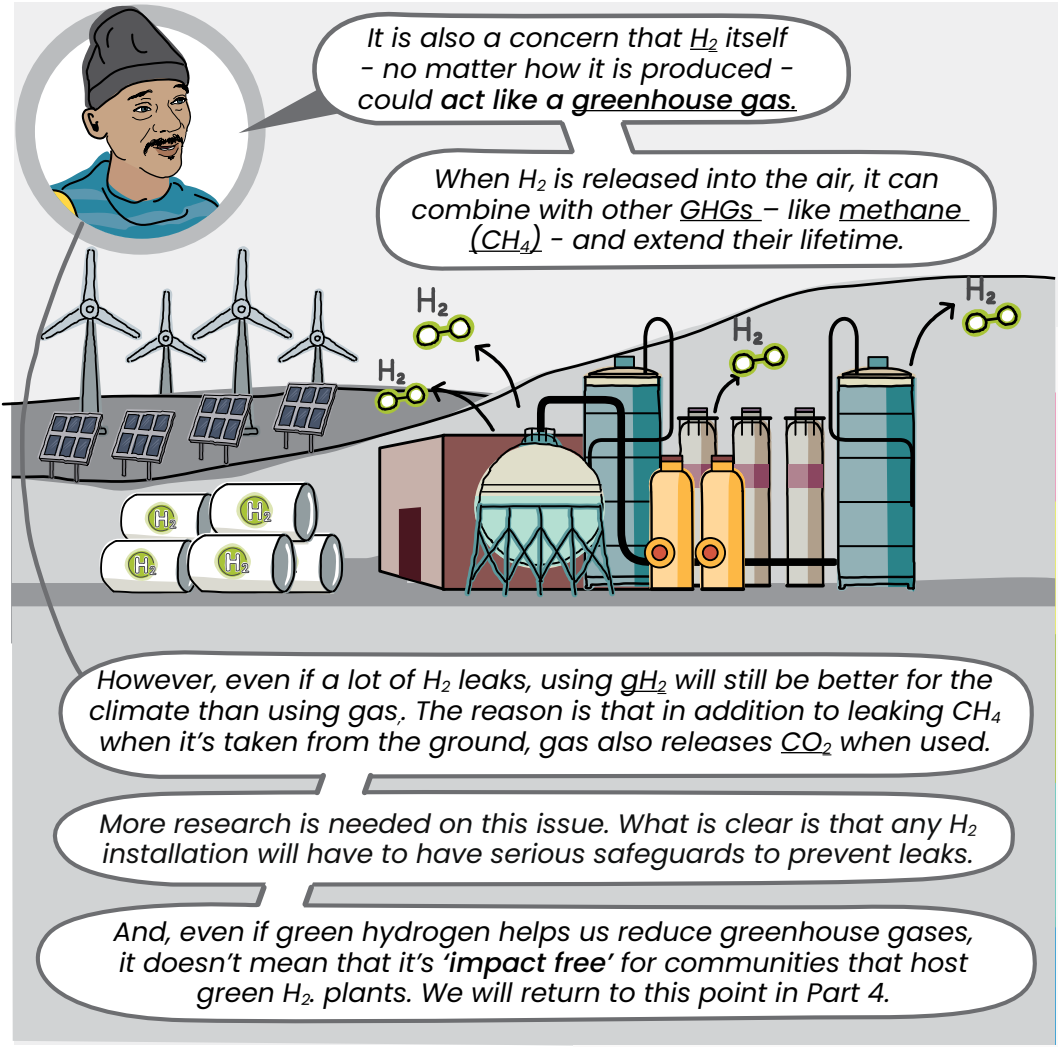
In many cases, although gH$_2$ ***could*** be used, there are cheaper and more efficient alternatives. For example, where homes can be heated directly with RE, **using gH$_2$ for the same purpose is wasteful – and costs up to 4 times as much!** For similar reasons, vehicles travelling short distances should be electrified, not powered by gH$_2$.

*So, whether H_2 is completely 'CO_2 free' depends not only on how it's made, but also how **it's used** and **transported**.*

*GH_2 **could** help us get to zero CO_2 by 2050 - but how close depends on how and what we use it for!*

It is really important that we do not use gH_2 to delay reducing our use of harmful products like fertilisers and plastics. We also shouldn't use gH_2 where direct electrification is possible.




It is also a concern that H_2 itself - no matter how it is produced - could act like a greenhouse gas.
When H_2 is released into the air, it can combine with other GHGs – like methane (CH_4) - and extend their lifetime.
H_2
H_2
H_2
H_2
H_2
H_2
H_2
However, even if a lot of H_2 leaks, using gH_2 will still be better for the climate than using gas. The reason is that in addition to leaking CH_4 when it's taken from the ground, gas also releases CO_2 when used.
More research is needed on this issue. What is clear is that any H_2 installation will have to have serious safeguards to prevent leaks.
And, even if green hydrogen helps us reduce greenhouse gases, it doesn't mean that it's 'impact free' for communities that host green H_2 plants. We will return to this point in Part 4.

In conversations about H_2 you may hear about other H_2 colours we haven't mentioned yet. The 'H_2 rainbow' is constantly changing - depending on new technology but also marketing initiatives... Below are the main ones.

H_2 colour	How it's made
PINK	Water (H_2O) is converted into oxygen (O_2) and H_2 using electrolysis powered by nucelar energy.
YELLOW	Water (H_2O) is converted into oxygen (O_2) and H_2 using electrolysis powered by electricity from the grid.
GREEN	Water (H_2O) is converted into oxygen (O_2) and H_2 using electrolysis powered by RE.
TURQUOISE	Gas (methane/CH_4) is converted into carbon black and H_2 using technology called pyrolysis.
BLUE	Gas (CH_4) is converted to CO_2 and H_2 using SMR technology. The CO_2 is 'captured' with CCUS.
GREY	Gas (CH_4) is converted to CO_2 and H_2 using SMR.
BROWN/ BLACK	**Brown/ black coal** is converted to CO_2 and H_2 using SMR.

Industry calls all of these 'clean' - but only green H_2 is made witout fossils fuels or other dangerous materials!

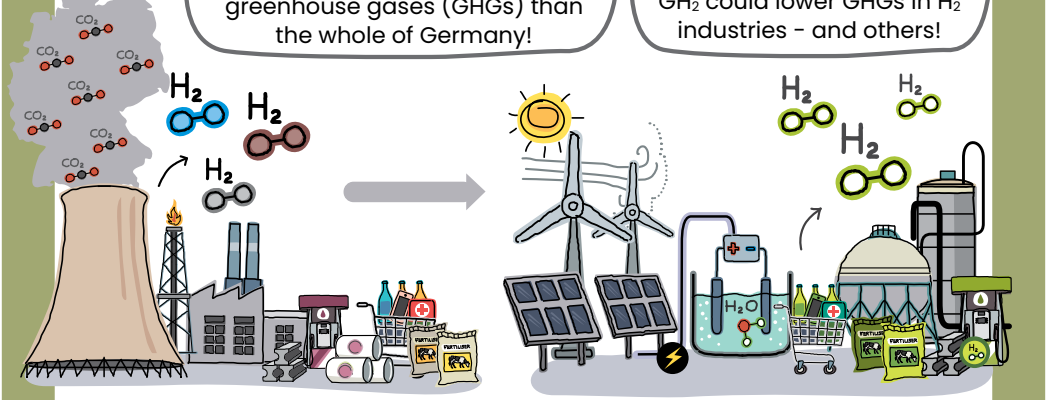
IN A NUTSHELL

What is green hydrogen - and how could it help lower carbon emissions?

H_2 is a gas molecule that is formed when we burn fossil fuels.

H_2 is used in A LOT of industries – so many that globally, H_2 production releases more greenhouse gases (GHGs) than the whole of Germany!

But we could also make 'green H_2' (gH_2) using water and renewable energy. GH_2 could lower GHGs in H_2 industries - and others!



But whether gH_2 really reduces GHGs also depends on how it's used, stored and transported. Some uses of gH_2 still release GHGs. Others are wasteful and expensive.

Green H_2 **should not** be confused with blue H_2 or 'clean H_2'.

There's nothing clean about blue or 'clean' H_2 – it's made with coal and/or gas. It's argued that the CO_2 released can be 'captured', but this technology hasn't been tested at scale. And, even if all CO_2 was captured, dangerous GHGs like methane (CH_4) are released when gas is extracted and transported – where it cannot be captured.

PART 3 Why green H_2 in South Africa?

In South Africa, replacing grey H_2 with green H_2 could lower the carbon released from existing industries. This could help reduce climate change, and also improve air pollution.

But government also believes green H_2 could also help us tackle unemployment, create new industries, and earn much needed foreign exchange. Let's look at that in more detail.

Over the next 10 years, jobs in 'carbon intensive' industries – those that release a lot of CO_2 - will be lost because some high-income countries will stop importing carbon intensive products like steel. Replacing carbon in these products with green H_2 would lessen these impacts.

Grey steel / fertiliser

Green steel / fertiliser

H_2 production potential and demand unknonwn

Future green H_2 buyers

Potential blue H_2 sellers

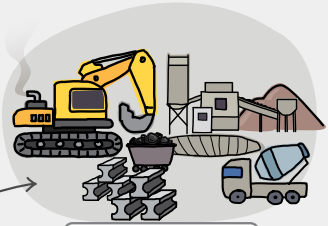
Potential green H_2 sellers

And, because green H_2 has so many potential uses, high income countries think they'll need much more of it than they can produce themselves. Many are starting to make deals with countries that have lots of sun and wind where lots of gH2 can be made.

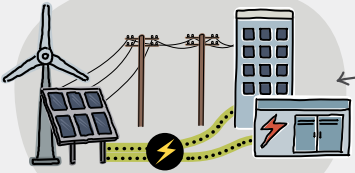
SA's H_2 strategy is outlined in a document called **Hydrogen Society Roadmap**. *It indicates that the country will build an H_2 economy around the following goals:*

Decarbonise transport

Manufacture hydrogen products and fuel cells.



Decarbonise energy intensive industries



Green the power sector

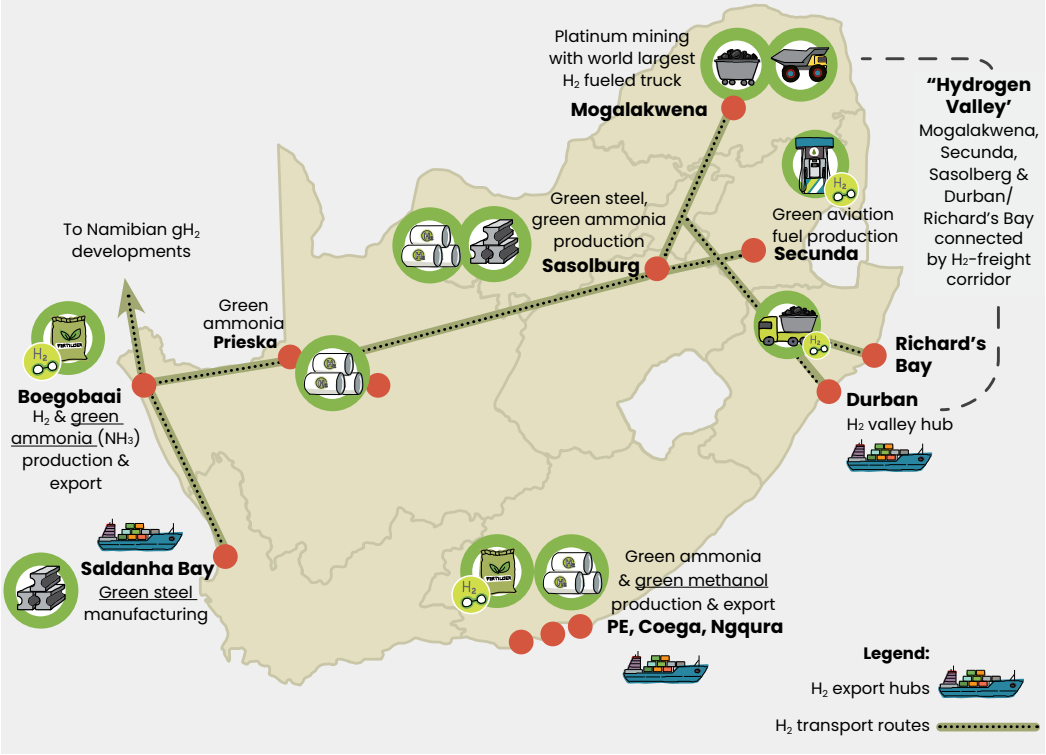
Produce H_2 / H_2 derivatives for export

The biggest problem with SA's programme is that it includes blue H_2. This provides fossil companies with a cover to keep polluting. ***Capture of carbon used in blue H_2 production relies on technology whose use is unproven.***

But there are also questions regarding the green H_2 plans put forward. We explore these next.

To 'kickstart' the country's green H_2 economy, SA's government is supporting some strategic projects. These include export focused projects and ones aiming to increase manufacturing in SA.

It is argued that these will create jobs and decarbonise the economy.



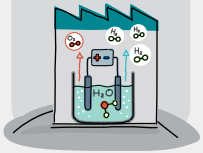
In theory, these, and the industries they are supposed to develop, could help create jobs in SA.

These could include NEW jobs created as the country develops new industries.

But it could also include protecting EXISTING jobs in companies that could go out of business because other countries no longer want to buy carbon intensive goods.

NEW:
gH_2 technology:

Electrolysers and H_2 fuel cells will be needed to make and use green H_2. Currently, no one makes these in large quantities. Because SA has Platinum - a material needed for these technologies – making electrolysers and fuel cells in SA could create new jobs.



EXISTING:
Platinum mining

Currently about 1/3rd of SA's platinum is used in the making of cars that use petrol. As the world moves to electric vehicles, demand for platinum will go down. Use of platinum in H_2 industries could save platinum mining jobs.

Over 36 000 people work in mining in SA.

NEW & EXISTING:
gH_2 based steel

SA's existing steel industry could grow by moving to 'green steel' production.

SA's steel industry employs about 30,000 workers.

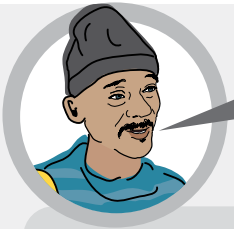
NEW & EXISTING:
gH_2 based fuels and chemical products

SA already has a synthetic fuel industry. Basing it on green H_2 instead of grey would clean it up and meet future demand for 'green fuels' for ships & planes.

Making green fertilisers could also create new jobs. It also means farmers could buy local fertilisers instead of imported ones.

EXISTING:
Transportation:

gH_2 related distribution could also protect jobs in transport that will be lost as global and local demand for coal goes down.



Of course, everyone will agree that we need more jobs in South Africa. But over the past 30 years, many industrial development plans didn't work out like they were supposed to.

WHITE ELEPHANTS AND FAT CATS?

In the past, SA invested in factories that failed for different reasons. Today they stand empty. These are called 'stranded assets'.

SA is far away from the developed countries that want gH_2 - won't they prefer to buy from closer producers? And what about the uses of gH_2 that aren't certain? There are also different types of electrolysers - will ones made with platinum succeed?

Will gH_2 demand actually be as big as we expect it to be?
If not, less jobs will be created. And if we took out national loans to support the gH_2 industry, we can end up with debts we can't pay.

Lastly, the companies leading the gH_2 industry - Sasol, for example - are already big. Should we use state money to subsidise them? Should we exempt them from paying taxes that could be used to finance other services?

WHAT KIND OF JOBS, AND FOR WHO?

Even if some industries are successful, who will jobs be created for, and what kind?

In the case of RE, most jobs created are in construction. These are temporary and poorly paid.

When (and if) permanent jobs are created, will they match the skills that South Africans have? Will they go to women and youth?and how safe will they be?

So we need to question whether supporting the gH_2 industry makes sense. Will it create jobs, and what kind? And what about other benefits that are being discussed, like helping SA with loadshedding?

JOBS - BUT AT WHAT COST?

Many marginalised households rely on nature based livelihoods like farming or fishing.

If gH_2 limits access to land or water, or kills ocean life, it could hurt such livelihoods. It would also destroy jobs in other industries that depend on these resources: agriculture; fishing, tourism and others.

Will we be creating new additional jobs through gH_2, or replacing some jobs with others? And will those who lost jobs be skilled for the new jobs?

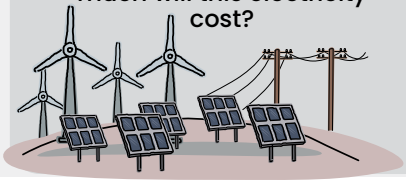
If not, will it be a <u>just transition</u>?

RENEWABLE ELECTRICITY FOR ALL?

To make profits, gH_2 companies will have to run their electrolysers 24/7 - rain or shine.

This means that gH_2 companies will need to install enough solar or wind so that they have a minimum supply - even when the sun doesn't shine or the wind doesn't blow. In that case, they may have additional electricity to sell when there is sun and wind.

But how much electricity will this be? Will it help with loadshedding? And how much will this electricity cost?

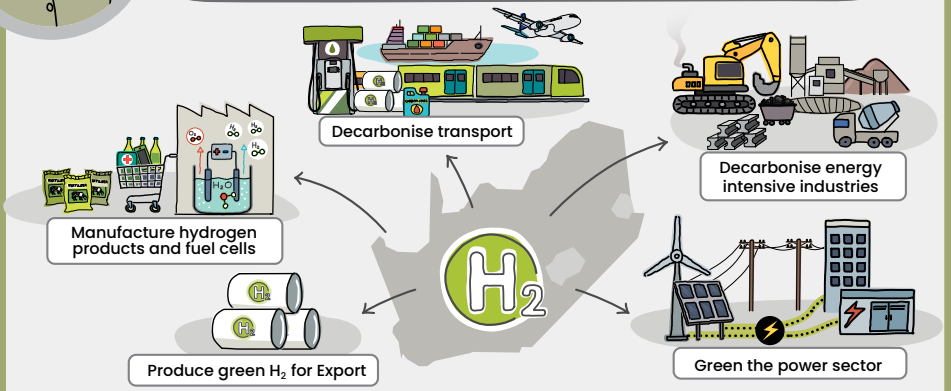


IN A NUTSHELL

Why green hydrogen in SA?

SA is planning to use green and blue H_2 to lower the CO_2 released from existing industries and heavy transport.

It's also planning to build new industries around green or blue H_2. Could these create new jobs and save existing ones?



There should be no place for blue H_2 in SA's strategy. It will only extend the life of fossil fuels.

Moreover, there is a lot of uncertainty regarding which uses of green H_2 will be economically successful, and which won't be. Many are too expensive .

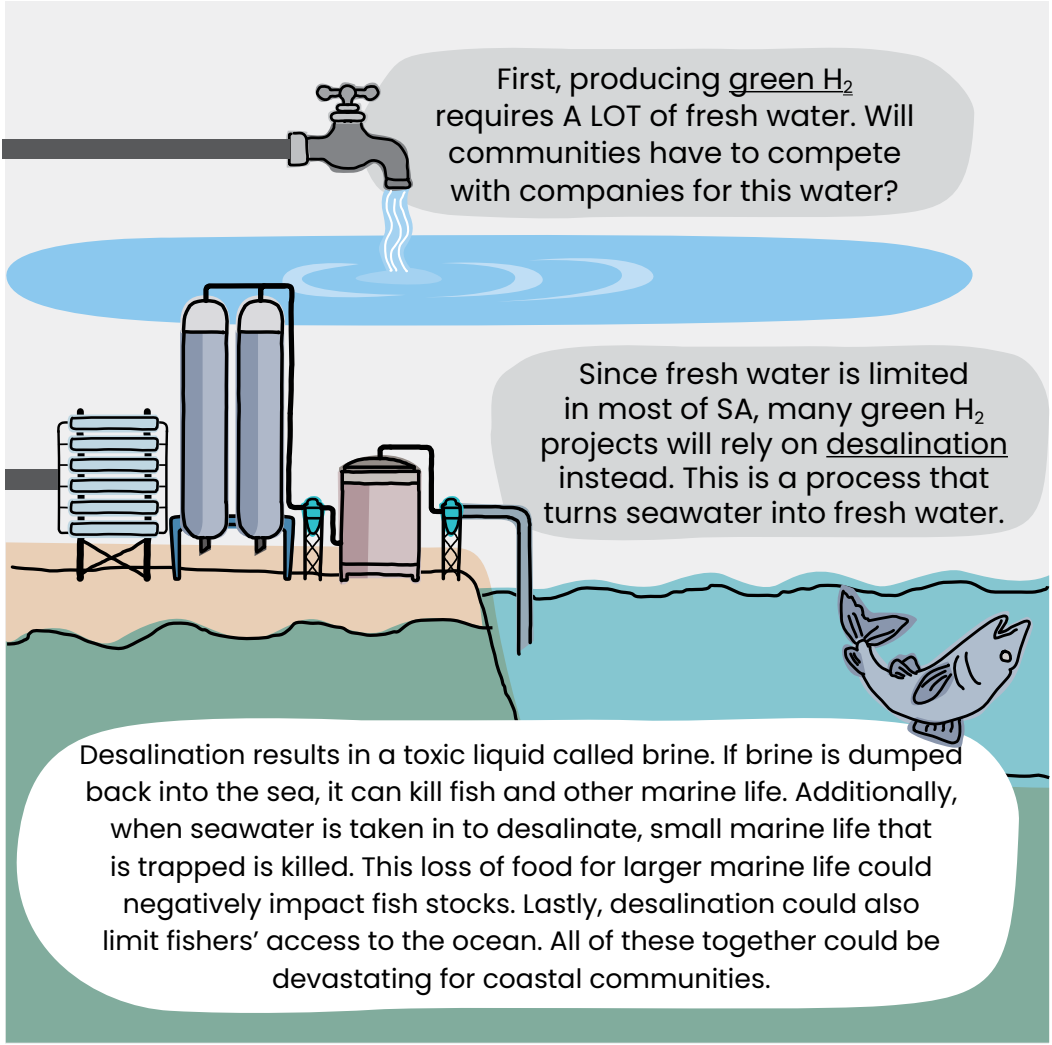
So will we be investing in industries that will succeed? What kinds of jobs will be created and for who? Or will we be spending tax money or even taking debt to help big companies make more profit?

So we need to ask: which parts of SA's H_2 strategy make sense? Which promises might not be kept?

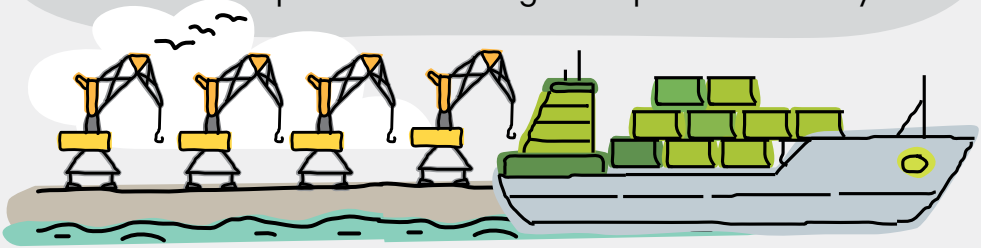
PART 4 What would green H_2 mean for host communities?

So, in theory, depending on how it is used, green H_2 could help reduce climate change and support job creation in South Africa. Sounds amazing. Is there a catch?

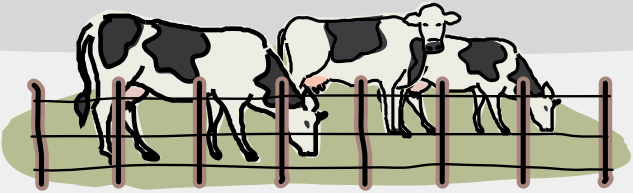
Well, just because green H_2 is carbon free, does not mean that it is impact free. We know that all 'mega projects' - including renewable energy ones - can have negative impacts on communities. In the case of green H_2, there are concerns.


First, producing green H_2 requires A LOT of fresh water. Will communities have to compete with companies for this water?
Since fresh water is limited in most of SA, many green H_2 projects will rely on desalination instead. This is a process that turns seawater into fresh water.
Desalination results in a toxic liquid called brine. If brine is dumped back into the sea, it can kill fish and other marine life. Additionally, when seawater is taken in to desalinate, small marine life that is trapped is killed. This loss of food for larger marine life could negatively impact fish stocks. Lastly, desalination could also limit fishers' access to the ocean. All of these together could be devastating for coastal communities.

Similarly, green H_2 projects that are focused on exports, will require new infrastructure like ports and rail. These could also negatively impact fish stocks and marine life, and limit community access to land and oceans. SA's plan in the Northern Cape includes a large new port and railway.

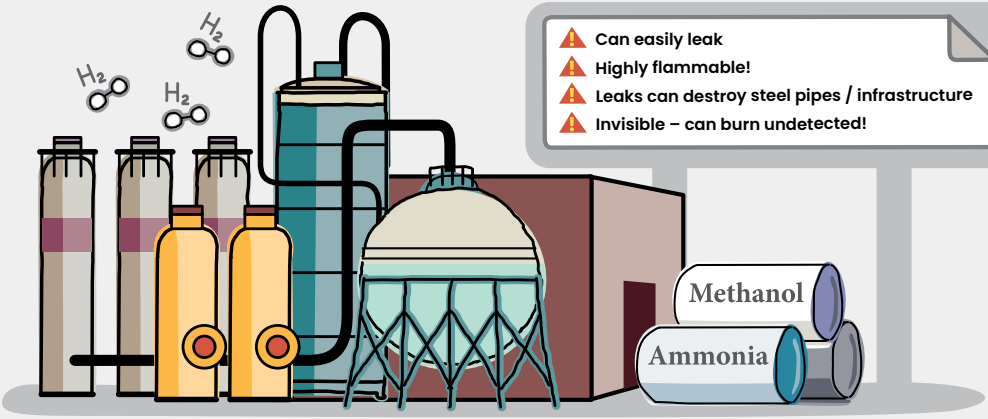


Green H_2 projects will also require A LOT of land. Fencing off common land that is currently accessible to all could disrupt grazing and small-scale farming or access to water bodies. Will this have impact on our food supply?



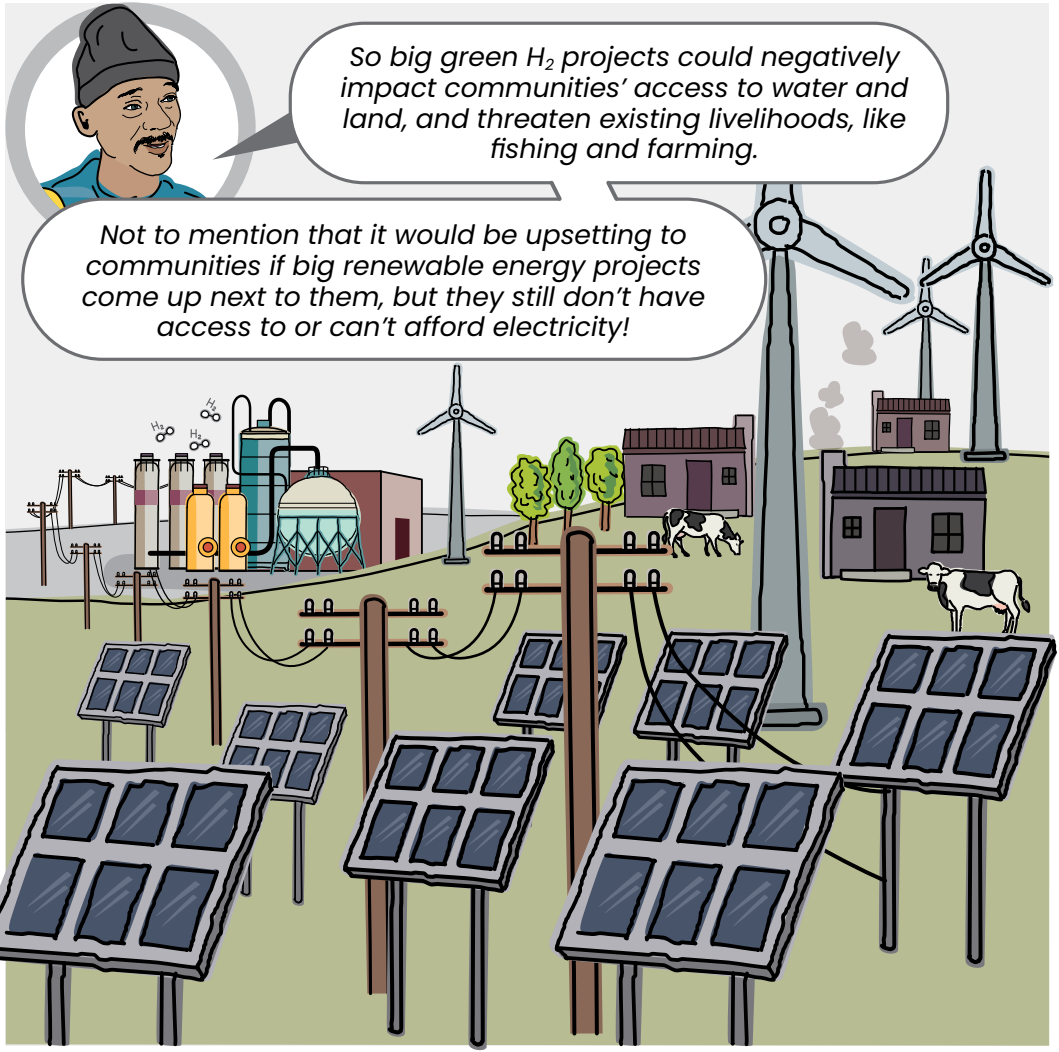
Moreover, as with any industry or energy source, there are health and safety concerns for both communities and workers

H_2 is a serious fire hazard, and because it is so light, it easily leaks. Although H_2 is not toxic, H_2 derivatives like ammonia (NH_3) and methanol (CH_3OH) are.



This means that as the industry expands, it is extremely important that no safety shortcuts are taken! H_2 industries must invest in leak detection technology and safety training.

It also means that gH_2 may be safer to use and produce in large centralised hubs, rather than in small installations like individual households or cars.


So big green H_2 projects could negatively impact communities' access to water and land, and threaten existing livelihoods, like fishing and farming.
Not to mention that it would be upsetting to communities if big renewable energy projects come up next to them, but they still don't have access to or can't afford electricity!

There could be ways of structuring gH_2 projects so that they contribute to a better life of the communities that host them.

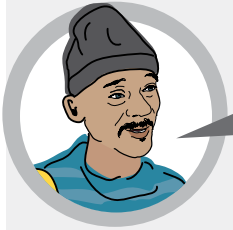
First off, gH_2 projects must only be implemented on the basis of Free, Prior and Informed Consent (FPIC) - a right recognised by the UN.

FREE, PRIOR AND INFORMED CONSENT (FPIC)

- The community was given enough time and information to consider the project and its impacts
- No violence was used to try influence the decision
- Money was not used to divide the community or influence the decision
- The decision was reached by the community on the basis of its existing decision-making customs

This means that the host community has been able to consider all the facts, and negotiate the development in a way which supports its own development vision.

*It also means that a community has the **right to say no!** to proposed projects. It can also take away a permission given earlier if promises aren't kept.*

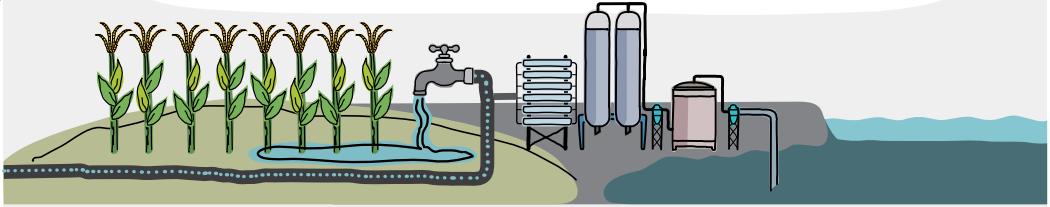


As with RE projects, most jobs in H_2 plants will be during construction. The number of permanent jobs thereafter, and what kind they will be, depends on what kind of project it is. In addition to jobs, there are other ways communities could benefit from RE or green H_2 projects. The Kipeto Wind Farm in Kenya is one example.

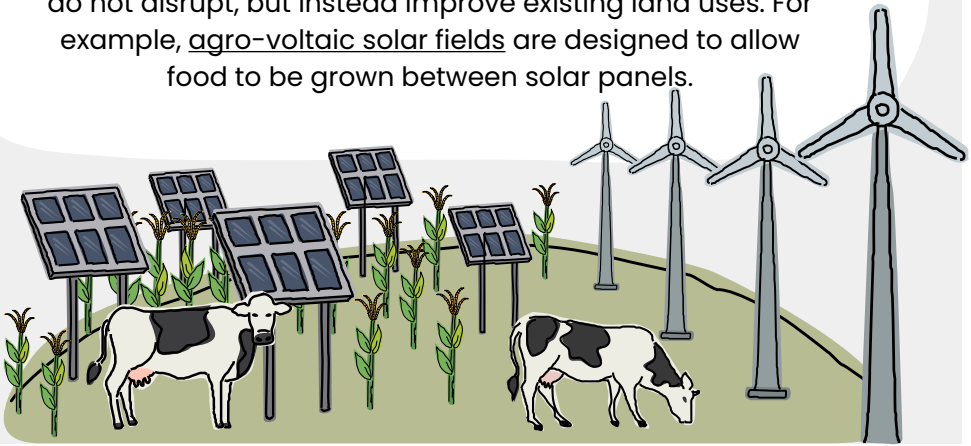
- 200 Masai landowners receive annual lease payments, and a percent of the income.
- A further 5% is channeled to a Community Trust Fund.
- New homes were built for families that had to be relocated, and the company also directs social responsibility spending to improving public facilities like clinics.
- The community benefited from both temporary and permanent jobs in the plant

OTHER EXAMPLES

Desalination plants that are part of green H_2 projects could supply water for community agricultural needs. In Gqeberha, the desalination plant will produce salt from the brine instead of dumping it.



As the climate gets warmer, both crops and livestock could benefit from shade provided or water collected by solar panels. RE projects should be designed so that they do not disrupt, but instead improve existing land uses. For example, agro-voltaic solar fields are designed to allow food to be grown between solar panels.



These sound great. But we know from SA's renewable energy and mining projects that despite laws that require projects only start after communities give permission, and regulations that say that these projects must benefit communities, this is often not the case.

THE RIGHT TO SAY NO

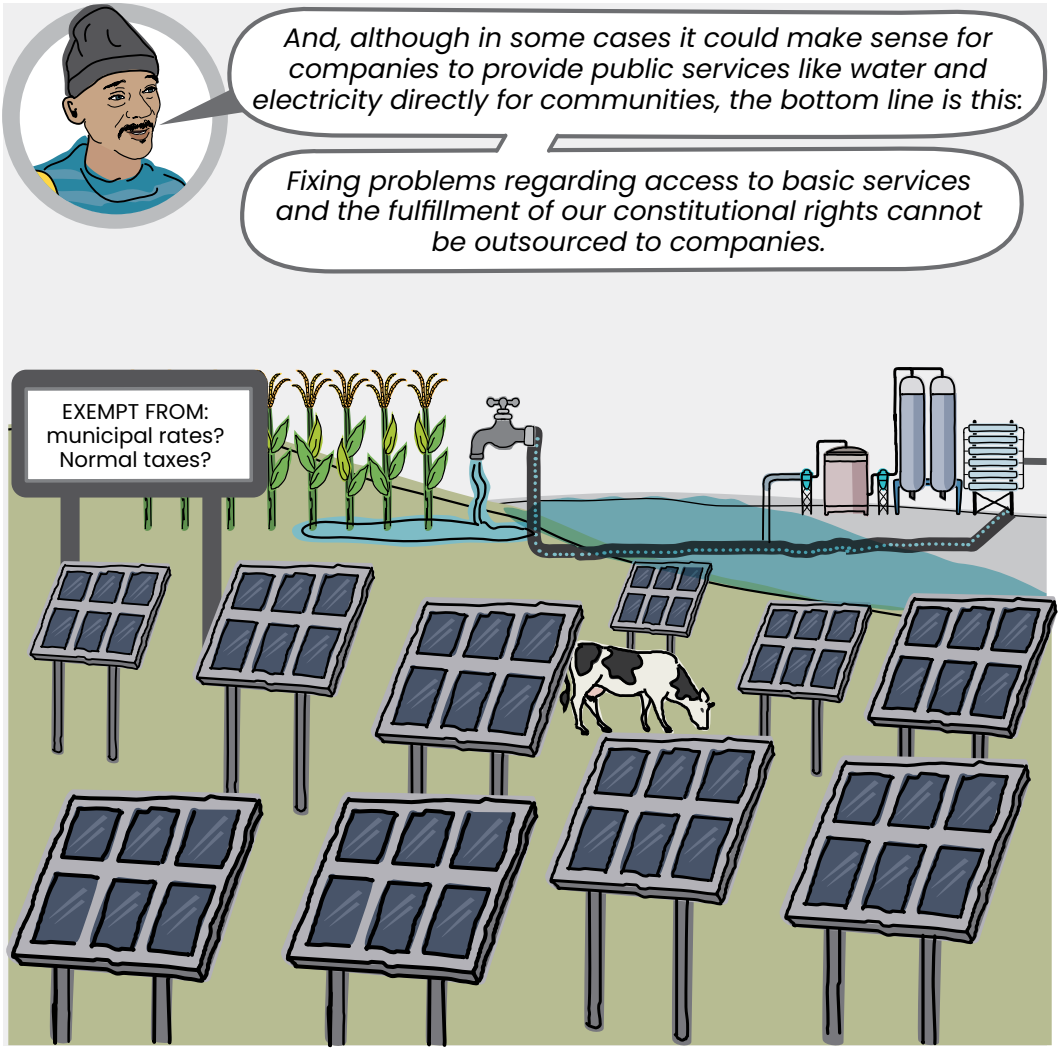
Despite the SA Constitutional Court affirming the principles of 'Free, Prior and Informed Consent', efforts to get communities to agree to mining projects have often included misinformation, threats or violence. Bribery is used to divide communities, and participatory processes are designed to exclude. Residents who refuse to give permission, like Fikile Ntshangase and Bazooka Rhadebe, have been murdered.

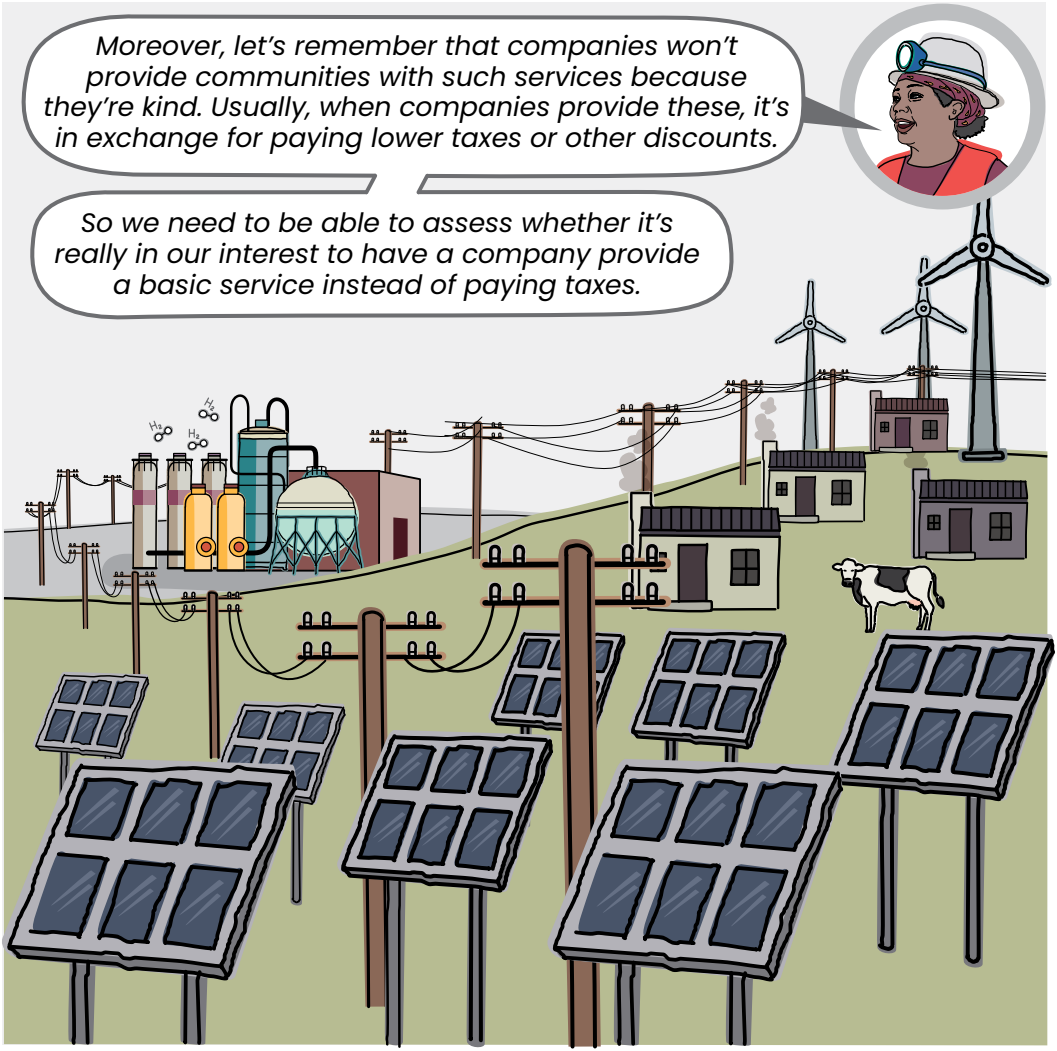
LOCAL DEVELOPMENT?

Both mining and RE developers are required to invest in projects that benefit their host communities. Too often, these promises are not kept. When they are, their quality is poor, or other problems emerge: building clinics where there isn't budget for nurses, or schools which the state can't maintain. To date, government hasn't done enough to ensure that companies work with communities to meet local needs, or acted where promises weren't kept. **We should ask: how should we structure projects to ensure communities benefit from gH_2?**

SHOW US THE MONEY

Both mines and RE companies have come into communities with promises of jobs, burseries and in the case of RE, a share of profits. Often, the jobs and benefits that actually resulted left communities disappointed. In some cases, it wasn't clear to communities that it would be years before they would get shares of the profits. **What lessons should we learn from these experiences?**


And, although in some cases it could make sense for companies to provide public services like water and electricity directly for communities, the bottom line is this:
Fixing problems regarding access to basic services and the fulfillment of our constitutional rights cannot be outsourced to companies.
EXEMPT FROM:
municipal rates?
Normal taxes?


Moreover, let's remember that companies won't provide communities with such services because they're kind. Usually, when companies provide these, it's in exchange for paying lower taxes or other discounts.
So we need to be able to assess whether it's really in our interest to have a company provide a basic service instead of paying taxes.

When developers approach us for permission for gH_2 projects, here are some questions we should ask:

CHECKLIST

Is the participation process following FPIC principles?

- ☐ Were project related participation adverts provided to all impacted communities in places they would see, and in languages they would understand?
- ☐ Were we given all relevant documents in a language we can understand?
- ☐ Were we given enough time and information to consider the project properly and in accordance with our established community decision making practices?
- ☐ If things go wrong, how will we hold the company accountable for promises made? Has the company set up mediation processes in case there are disagreements or complaints?
- ☐ Is money being used to divide the community? Are there cases of violence or intimidation?
- ☐ Have the developers acknowledged the community's right to refuse the project, or withdraw permission for it at a later point?

Add other →

☐ _____

*GH_2 developers will also need A LOT of permissions before they do **anything** on the land. It's important that legal procedures are followed.*

CHECKLIST

Is it legal? Is it fair?

- [ ] Did the developers get all the required licenses prior to beginning any work? Depending on the type of the project, these could include:
  - Environmental authorisation
  - Water Use Licence
  - Waste use licence
  - Atmospheric emissions
  - Land use permission
  - Grid connection license

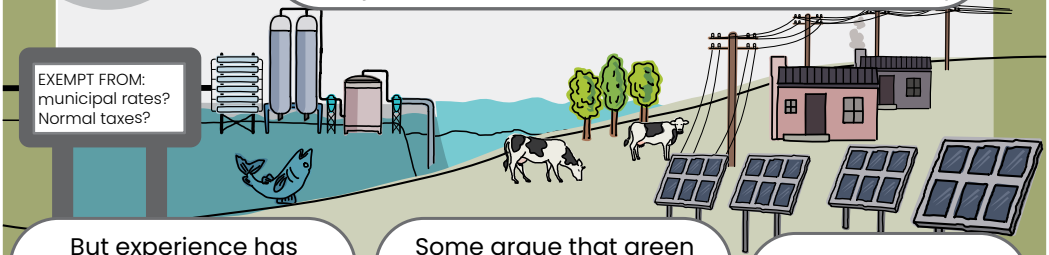
  Each of these must allow for participation opportunities - although these may occur at the same time!
- [ ] Do we need independent experts to help us judge whether promises being made are realistic, and assessments of impact accurate?
- [ ] Can we give our permission before speaking to independent experts? Who will pay for us to access independent advice if we need it?
- [ ] Are we being offered fair lease prices for our land? If shares of profits are being offered, when will we get them? Are we being offered fair compensation for loss of livelihoods or houses?
- [ ] _____

IN A NUTSHELL

What would green H_2 mean for host communities?

Like all mega projects, green H_2 developments pose threats to communities. These include loss of access to land and water, and, for projects on the coast, the destruction of marine life.

There could be ways of structuring projects so that they benefit local communities through income for leased land, jobs, and access to affordable water or electricity.



But experience has shown us that generally, communities only benefit when they have access to expertise to help negotiate fair deals, and when government is willing to help them hold companies accountable for broken promises.

Some argue that green H_2 projects could provide communities with access to electricity. Although this is possible, it will not be free. GH_2 companies will only be profitable if such services are provided in exchange for lower taxes or other 'deals'.

So we need to decide what is really better for communities and the country. Maybe gH_2 companies should just pay decent taxes at local and national levels.

And if green H_2 companies do provide services and core infrastructure, we'll need be sure we can hold them accountable if things go wrong.

DICTIONARY

Agrivoltaic agriculture: Approach to agriculture that sees the same land used for solar electricity generation and food production.

Ammonia (NH_3): Ammonia is a poisonous gas that is made by mixing different chemicals. It is used to make fertilisers, plastics, explosives and other chemical products.

Blue hydrogen: Hydrogen that is made with fossil fuels, but where the CO_2 is captured and stored instead of released into the air. (See CCUS).

Brine: Highly concentrated salty liquid.

Brown hydrogen: Hydrogen that is made from coal.

Carbon: A chemical element. Many things we find on earth e.g. wood, rocks, are made of carbon and other elements.

Carbon black: A solid form of carbon used in the tyre and other industries.

Carbon Capture, Utilisation and Storage (CCUS): Technologies that some say can capture and store CO_2 instead of releasing it into the air.

Carbon dioxide (CO_2): A gas made up of carbon and oxygen. It forms when we burn fossil fuels like coal, gas and oil. It is a greenhouse gas.

Carbon intensive: Products or industries that pollute the air with a lot of CO_2.

Carbon tax: A fine that states can charge industries that release a lot of CO_2.

Clean hydrogen (H_2): A term used primarily by industry to describe H_2 that some argue is less polluting than grey, brown or black H_2. It includes green H_2, but also H_2 types that are not tested or release other waste (e.g. blue H_2 and pink H_2 which is made with nuclear energy).

Chemical fertilisers: Industrially produced chemicals that provide nutrients to plants.

Climate Change: Long term changes to the weather that are caused by burning fossil fuels. When fossil fuels are burned, they release greenhouse gases that trap heat on the earth.

Decarbonisation: The reduction of the CO_2 released from different activities.

Desalination: A process which removes salt from liquids. When applied to seawater, the result is fresh water for drinking or farming.

Electric vehicles: Cars that are powered by an electric battery, not fuel.

Electrification: Changing machines so they can be powered by electricity instead of fossil fuels.

Electrolyser: The machine that is used for electrolysis.

Electrolysis: A process in which electricity splits water (H_2O) into hydrogen (H_2) and oxygen (O_2).

Energy efficiency: Using less energy to get the same results that previously required more energy.

Export: To export means to sell products to another country. Exported products, or 'exports' are made in one country and sold to buyers in another.

Foreign exchange: To import products (buy products from another country), buyers need to use money that is accepted by the countries who are selling. The most widely used foreign money types include the US dollar and the European Euro.

Fossil Fuel: Materials that naturally formed on earth over millions of years. They contain carbon, and can be burned for fuel. They include coal, oil and natural gas.

Free, Prior and Informed Consent (FPIC): A legal right that is recognised by the United Nations. It means that communities must give their permission - not simply be consulted - before projects on their land can begin.

Green Ammonia: Ammonia that is made with green H_2.

Green Fuels: Lower carbon alternatives to fossil fuels. They can be made by combining green H_2 with CO_2.

Green hydrogen (gH_2): hydrogen that is made when water (H_2O) is split into hydrogen (H_2) and oxygen (O_2) with renewable energy.

Green steel: Steel that is made without fossil fuels.

Greenhouse Gas (GHG): Gases that trap heat in the earth's atmosphere. They include carbon dioxide (CO_2) and methane (CH_4).

Grey hydrogen: hydrogen that is made by burning methane gas (CH_4).

Hard-to-abate sectors: Economic sectors in which reducing GHG emissions is either very expensive or impossible with current technologies.

High income countries: Rich countries.

Hydrogen (H_2): A gas molecule.

H_2 derivatives: Substances that are made from H_2. E.g. Green ammonia.

H_2 fuel cell: A machine that converts H_2 into electricity without using fossil fuels.

H_20: Water.

Import: To import means to buy products from another country. 'Imports' are products that were made in a different country to the ones in which they are sold.

Industrial development plans: State programmes that aim to increase local manufacturing and create jobs in factories.

Just Transition: The principle that when society moves from fossil fuels to low carbon energy sources, workers and the most vulnerable must benefit.

Low income countries Poor countries.

Mega projects: Big infrastructure projects that cost a lot of money, take many years to build, and require a lot of resources like land, water or other materials.

Methane (CH_4): A greenhouse gas made up of carbon and hydrogen.

Methanol (CH_3OH): A liquid chemical used to make plastics, paints, cosmetics and other products. It is also used as a fuel in boats, cars, and the electricity sector.

Nitrogen gas (N_2): A colourless gas that makes up 78% of the earth's atmosphere. Different forms of nitrogen are present in soils and are important to living beings.

Nitrogen Oxides (NOx): When N_2 combines with Oxygen (O_2) it forms a variety of toxic gasses known as Nitrogen Oxides. NO_x hurt human health and is a GHG.

Renewable Energy, Renewables (RE): Energy that is made from natural sources that are constantly replaced. E.g. solar energy (made with sunlight), wind energy.

Semi- conductors: The units that make mobile phones and other technology work.

Steam Methane Reform (SMR): The chemical process used to separate hydrogen from methane gas.

Stranded Assets: Infrastructure that cannot be used despite its high costs.

Synthetic fuels / Synfuels: Fuel that is made by combining different chemicals, instead of being taken from the ground.

Across South Africa and around the world, a lot of people are excited about something called 'green hydrogen'

We can't solve the climate crisis without it!

It will create lots of jobs and earn foreign exchange for the country!

Green hydrogen businesses will use up our water and take our land!

We need to find a way to live well while using less natural resources - green Hydrogen won't help us do that!

But what is green hydrogen? Will it be useful for South Africa? How will it impact your community? What does it mean for climate justice? This booklet will give you information so that you can make up your own mind.

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MACUA
WAMUA
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