

TALKING ABOUT GREEN HYDROGEN

What is it all about?

H_2



HEINRICH BÖLL STIFTUNG
CAPE TOWN
South Africa | Namibia | Zimbabwe



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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.


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 Hydrogen?



*To understand the fuss about green hydrogen – **also written as 'gH₂'** – 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

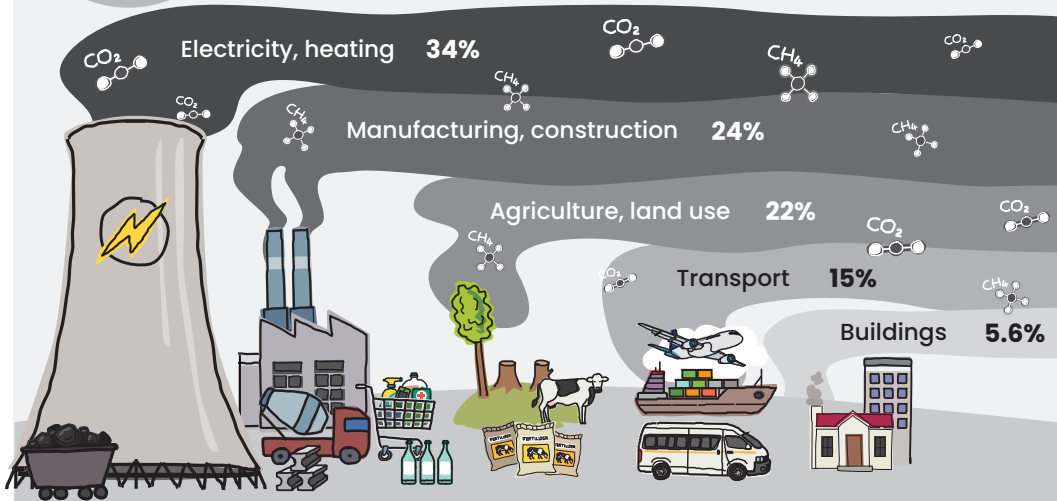
Women - who are expected to provide water, cook, care for children and the sick - will be especially affected.

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 (CO₂)** and **methane (CH₄)** 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 CO₂ 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 CO₂ we release.

This is because electricity from coal or gas is responsible for about a third of our CO₂ 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.



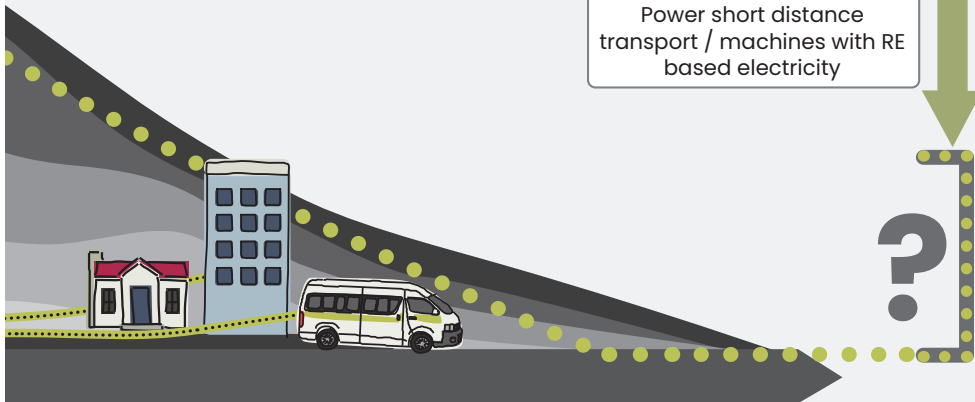
However, there are industries in which REs and electrification will not help us reduce the CO₂ released. These contribute about 40% of our CO₂ emissions.

RENEWABLE ENERGY

Phase out coal and gas for electricity

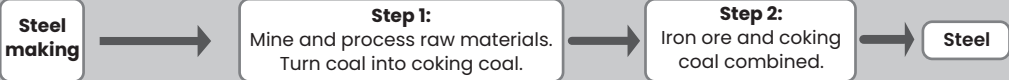
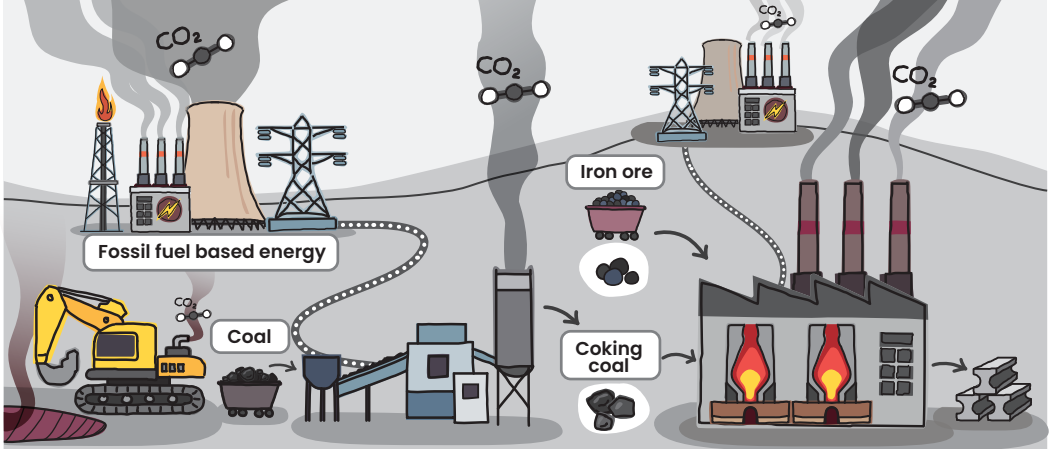
ELECTRIFICATION

Power short distance transport / machines with RE based electricity






For example, when we make steel, we use coal both as **raw material**, and as an **energy source** to power the production process.



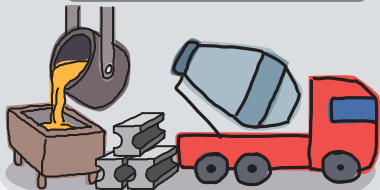
This is why steel making is very **CO₂** intensive. Even if we replaced the electricity source, coal is still needed to produce it!





There are other sectors in which CO₂ 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...



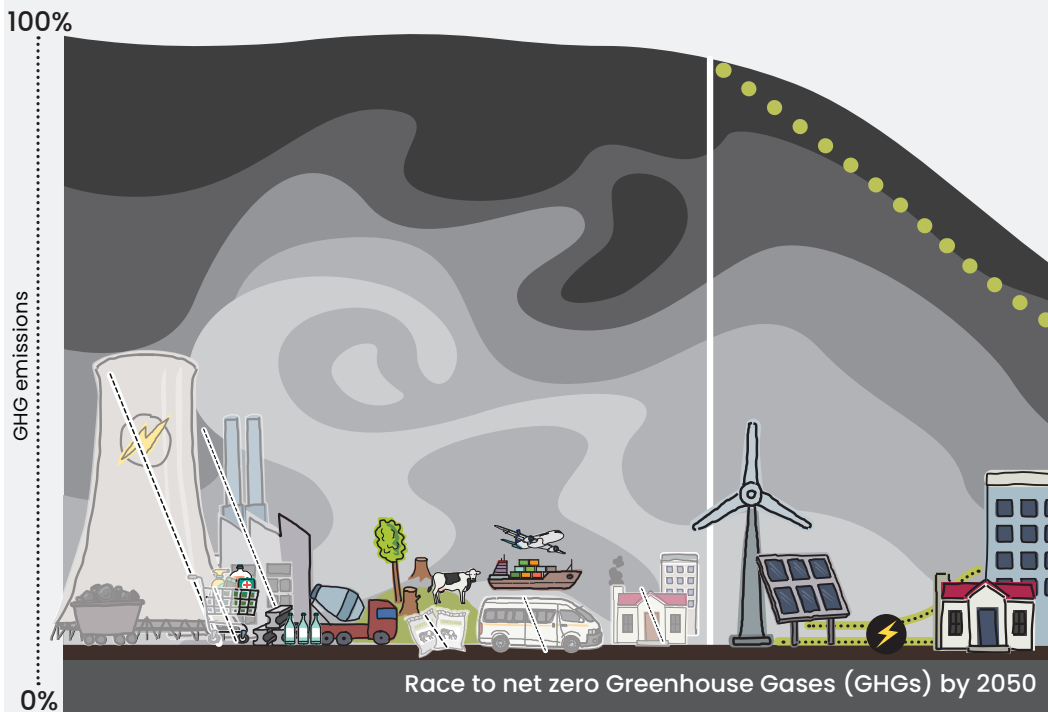
So what do we do about these?



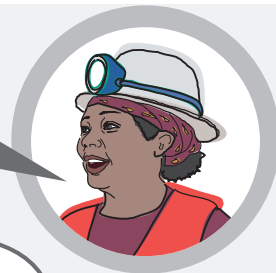


Some, we need to phase out. Most plastics and **chemical fertilizers**, for example. These destroy our environments not just because they release CO_2 . They also pollute our oceans, rivers and soils.

Others, we 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.



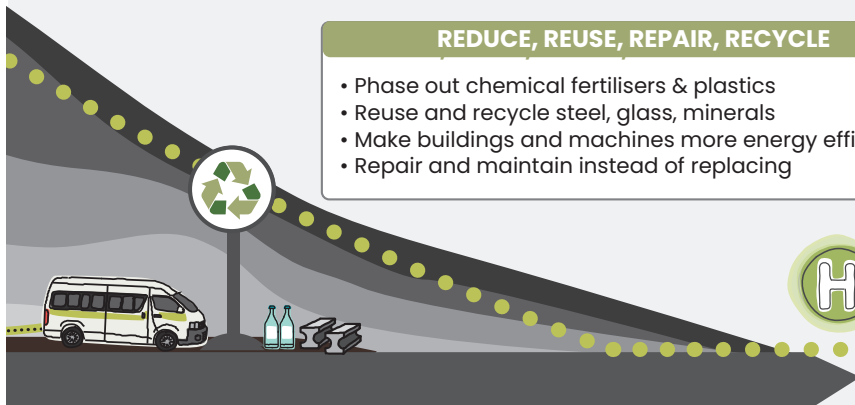
THIS is where **green hydrogen** **COULD** come in. Some people say it could help us to lower CO₂ emissions in these 'hard-to-abate' sectors. But is this really the case? We'll find out in Part 2.

RE

Electrification

REDUCE, REUSE, REPAIR, RECYCLE

- Phase out chemical fertilisers & plastics
- Reuse and recycle steel, glass, minerals
- Make buildings and machines more energy efficient
- Repair and maintain instead of replacing

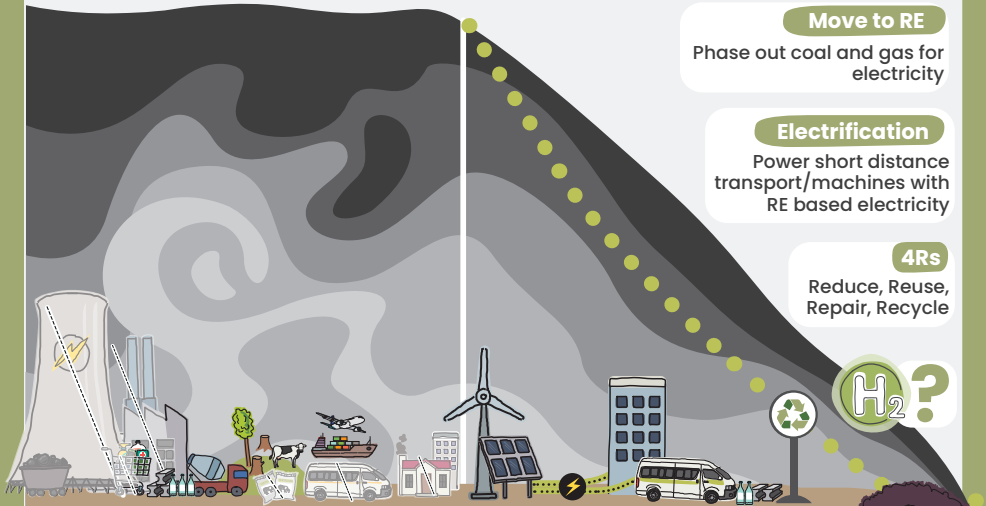


What's climate change, and what's it got to do with green hydrogen?



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.



Move to RE

Phase out coal and gas for electricity

Electrification

Power short distance transport/machines with RE based electricity

4Rs

Reduce, Reuse, Repair, Recycle



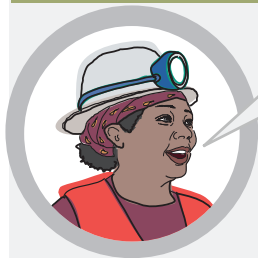
Race to net zero Greenhouse Gases (GHGs) by 2050

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.

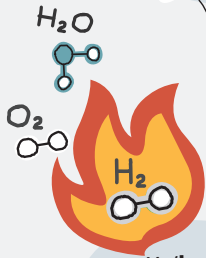
It is *everywhere* - it is the most common molecule in the universe



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



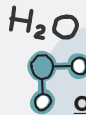
H_2 'burns clean' - when heated, H_2 only releases water and/or oxygen.



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



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





H₂ is essential to many of those 'hard-to-abate' industries in which it is difficult to lower the CO₂ released.

Worldwide, we use about **90 million tons** of H₂ every year for:

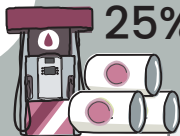
65%

MOST H₂ is used to make fertilisers. The chemicals industry also uses it to produce plastics and cleaning products.



What is H₂ used for?

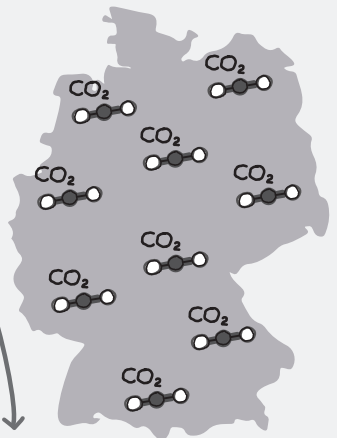
25%



About a quarter is used for refining petrol

10%


The remainder is used to make steel, glass electronics...



This results in around **830 million tons** of CO₂ every year - more than the GHG emissions of the whole of Germany!

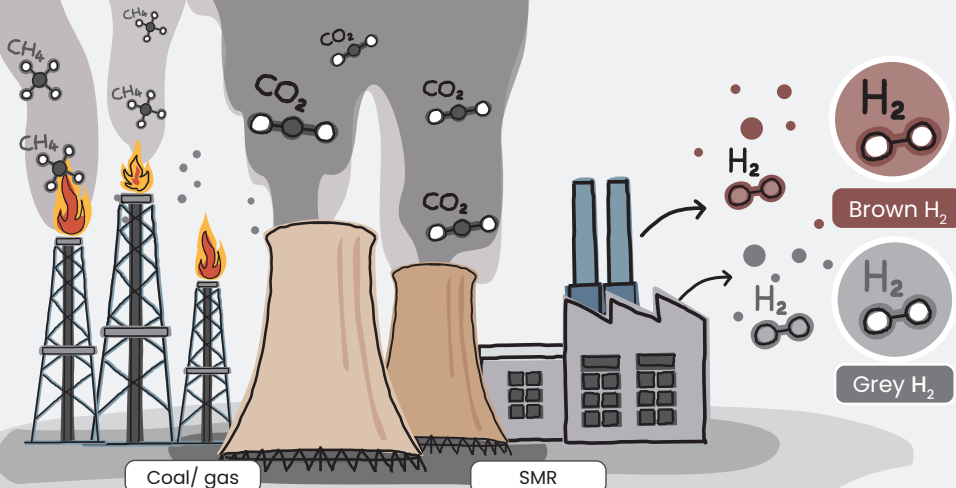
But I thought you said that H₂ 'burns clean'?





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 .



H_2 itself has no colour. Colours are used to describe how it is made. H_2 made using coal is called brown or black. H_2 made using gas is called grey.

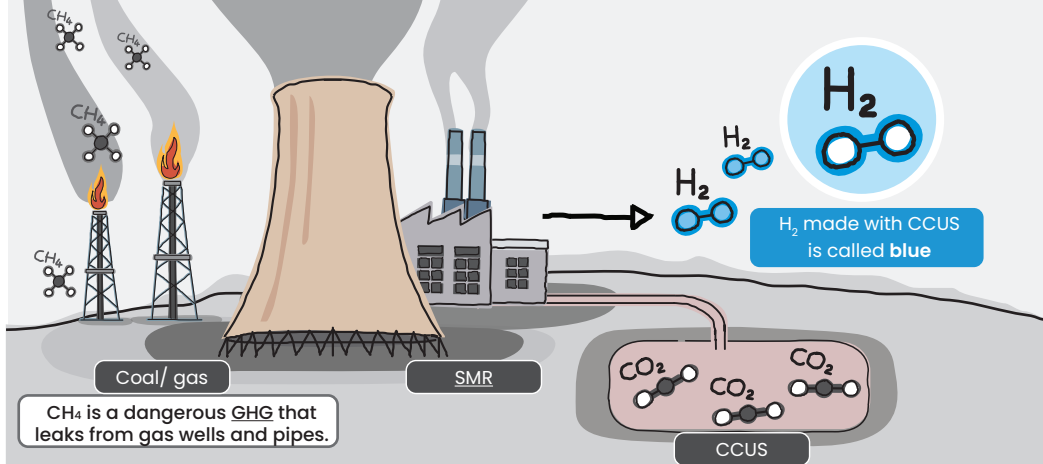
98% of the H_2 used in the world today is made with fossil fuels (gas, coal and oil). This means A LOT of carbon.





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

Some people say that to produce 'CO₂-free' H₂, we could 'capture' the CO₂ released when we make grey or brown H₂, and store it underground. This is called '**Carbon Capture Utilisation and Storage**' (CCUS).



CH₄ is a dangerous **GHG** that leaks from gas wells and pipes.

This may sound good, but CCUS technologies haven't been proven to work at large scale! Additionally, even if the CO₂ is captured, **producing gas releases methane (CH₄)**.

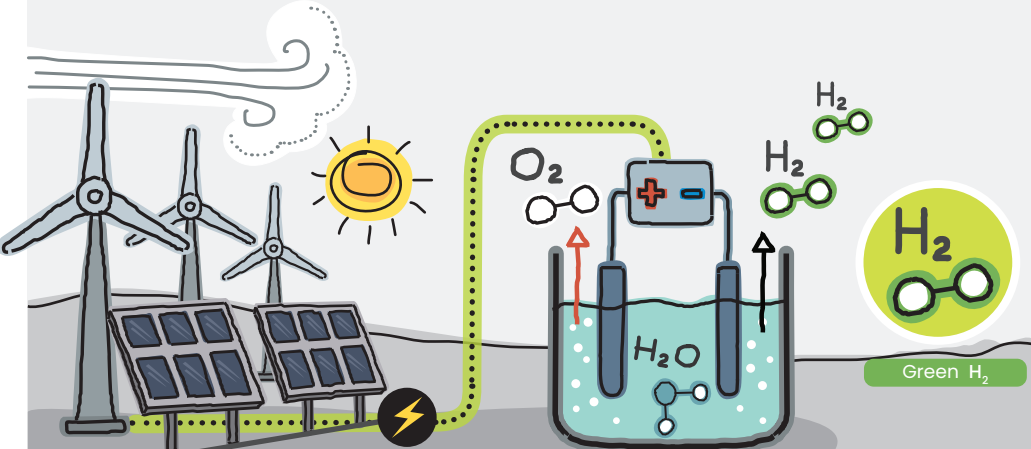
Gas and oil companies are promoting **blue H₂** which they also call '**clean**' H₂. Convincing people that blue H₂ is 'clean' will give them political and financial support to keep drilling for gas & oil.





So actually, **there is nothing clean or carbon free about blue H₂.**

The only H₂ that might help us reduce CO₂ emissions is H₂ that is produced when **renewable energy (RE)** is used to split water (H₂O), into H₂ and Oxygen (O₂) through a process called **electrolysis**. This H₂ is called **green - gH₂**.



RE based electricity

Electrolyser



Green H₂

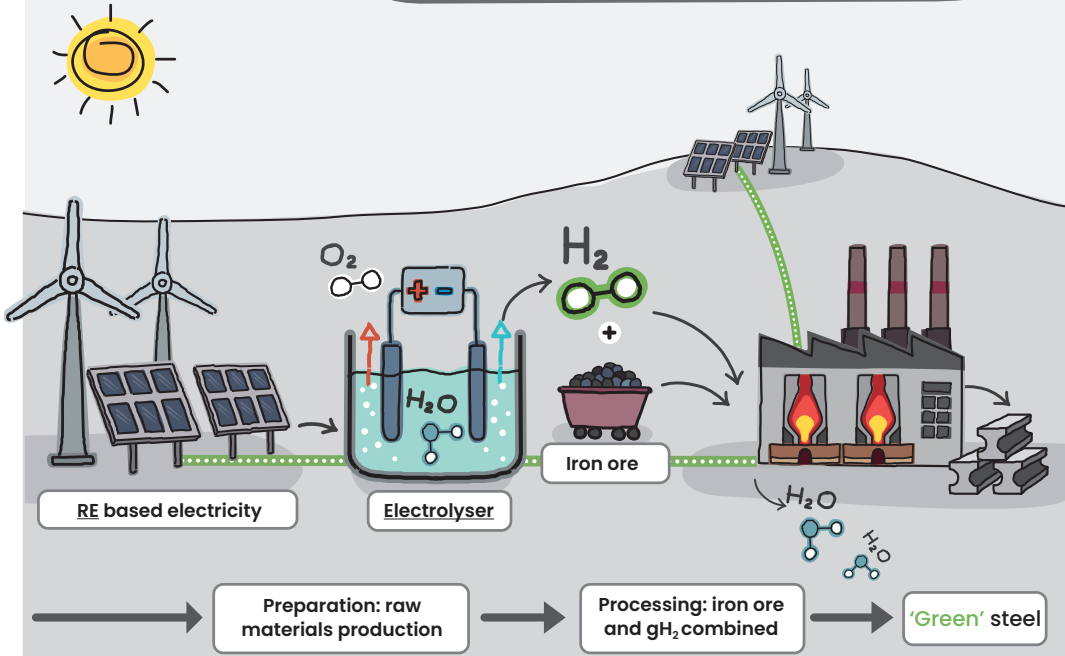
This technology is not new, but currently, making green H₂ is much more expensive than making brown or grey H₂ so it not used much. It therefore has not been produced at large scale.





But, if it becomes cheap enough - which is possible if RE prices go down - green H₂ could allow us to reduce the CO₂ from those 'hard-to-abate' sectors.

For example, if we use gH₂ instead of coal to make steel, the only by-product is water.

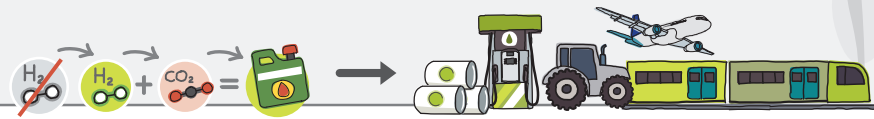




And it's not just steel. Green H₂ **could** be used in all the sectors in which reducing CO₂ is difficult - and others! For example:



We could make **green ammonia** for fertilisers, shipping fuel, chemicals and energy storage.
Currently **ammonia (NH₃)** is made when **grey H₂** is combined with **nitrogen (N₂)**. It could be made with green H₂ instead.



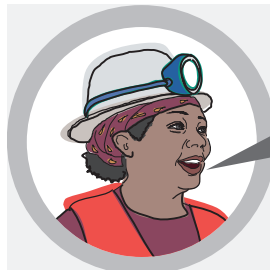
Instead of using grey H₂ to refine petrol or make **synthetic fuels (synfuels)** we could use green H₂.
Synfuels are made by combining H₂ with CO₂. When synfuels are made with gH₂ they are called '**green fuels**'. These are particularly important for industries like air travel. The CO₂ can be captured directly from the air or from waste processing.



Plastics, glass, electronics, and pharmaceuticals could be made with gH₂ instead of grey.



Green H₂ could replace gas heating for homes. It can also be used to generate high heat for industrial processes.

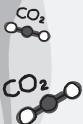


But just because we **could** use gH_2 for these purposes, doesn't mean we **should**. Some of these uses still release GHGs, and others are destroying our ecosystems in different ways:



Anything made with nitrogen (N_2) eventually releases Nitrogen Oxide (NO_2) - 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.




Using 'green fuels' to power transport and gH_2 to refine petrol could lower CO₂ emissions, but 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, redesigning our towns, 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 **wastful** - and costs up to 4 times as much! For similar reasons, vehicles travelling short distances should be electrified, not powered by gH_2 .



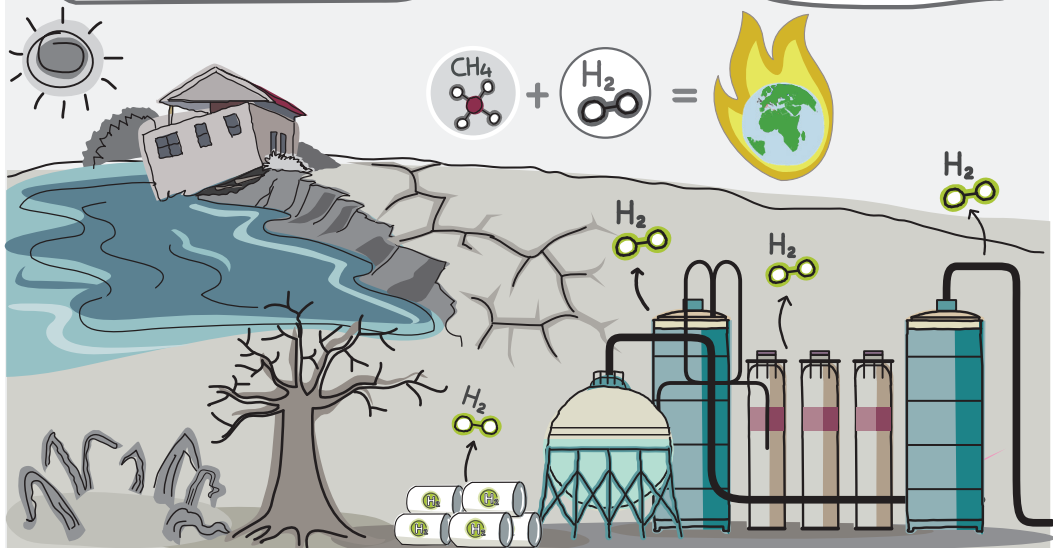
It is also a concern that H_2 itself - no matter how it is made - could act **LIKE a greenhouse gas**.

When H_2 is released into the air, it can combine with other **GHGs** - like **methane (CH_4)** - and extend their lifetime - making **climate change** worse.

Even if a lot of H_2 leaks though, using **gH₂** is still better than using gas. The reason is that in addition to leaking **CH₄** when it's taken from the ground, gas also releases **CO₂** when used.

More research is needed, but it's clear that **H₂ plants** will need **serious leak safeguards**

And, even if **gh₂** helps reduce **GHGs**, it doesn't mean that it's '**impact free**' for **gH₂ hosting communities**. Part 4 covers this.

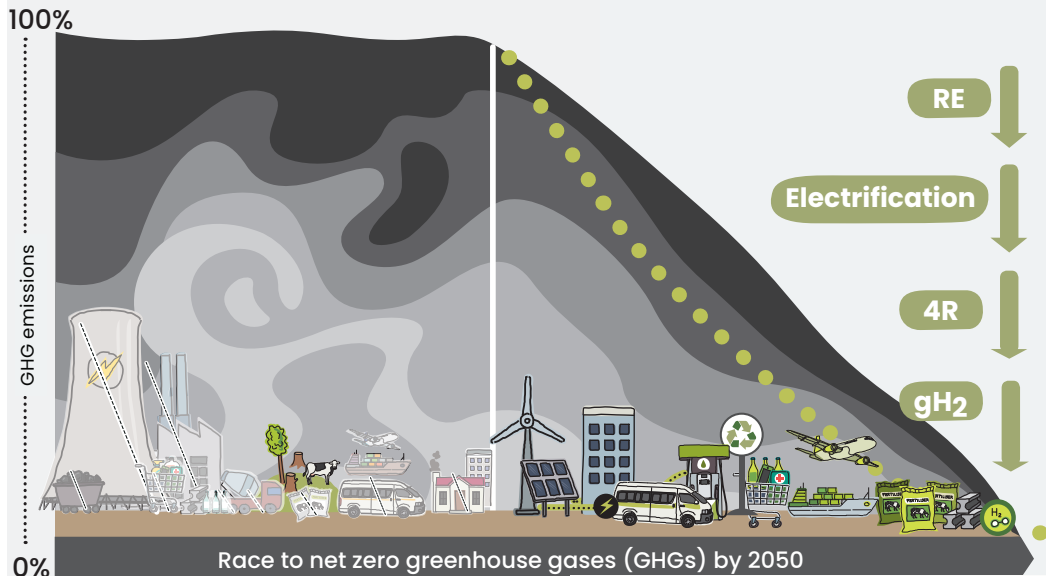


So, whether H_2 is completely 'CO₂ free' depends not only on how it's made, but also how it's used and transported.

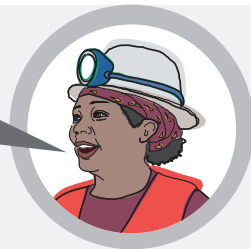


GH_2 **could** help us get to net zero CO_2 by 2050 - but how close depends on how and what we use it for!

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.



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 nuclear energy.

YELLOW



Water (H_2O) is converted into oxygen (O_2) and H_2 using electrolysis powered by electricity from the grid or solar power.

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.

Some in industry calls all of these 'clean' - but only green H_2 is made without fossils fuels or other dangerous materials!

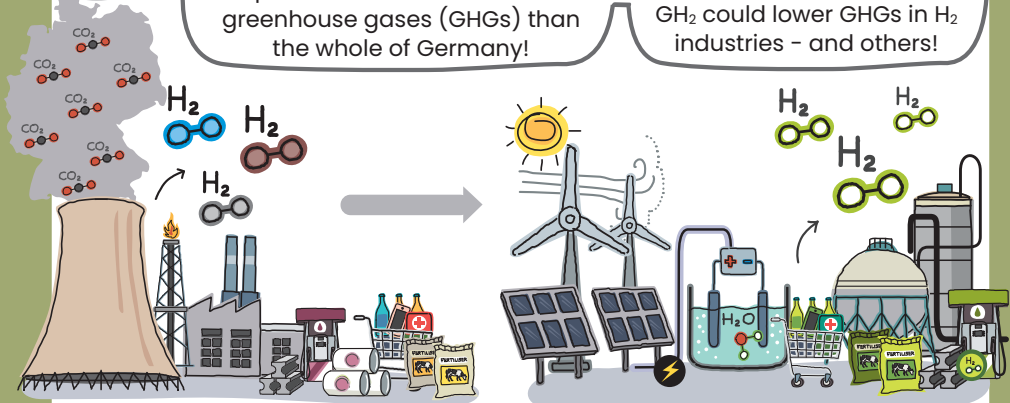
What is green hydrogen - and how could it help lower carbon emissions?



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 H₂ in South Africa?

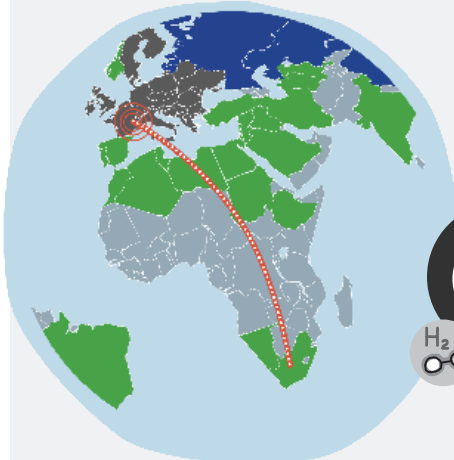


In South Africa, replacing grey H₂ with green H₂ could lower the carbon released from existing industries. This could help reduce climate change, and also improve air pollution.

But government also believes green H₂ could 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.



H_2 Grey steel / fertiliser



H_2 Green steel / fertiliser



- H_2 production potential and demand unknown
- 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 gH_2 can be made cheaply.

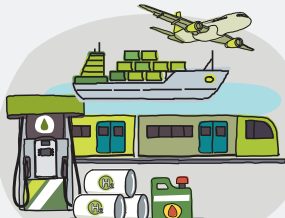




SA's H₂ strategy is outlined in a document called **Hydrogen Society Roadmap**. It indicates that the country will build an H₂ economy around the following goals:



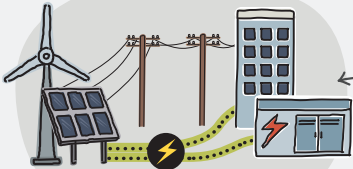
Manufacture hydrogen products and fuel cells.



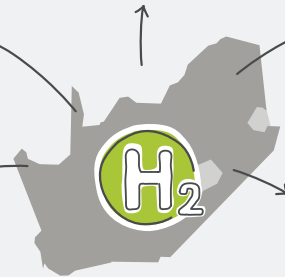
Decarbonise transport



Decarbonise energy intensive industries



Green the power sector



Produce H₂ / H₂ derivatives for export

The biggest problem with SA's programme is that it includes blue H₂. This provides fossil companies with a cover to keep polluting. Capture of carbon used in blue H₂ production relies on technology whose use is unproven.

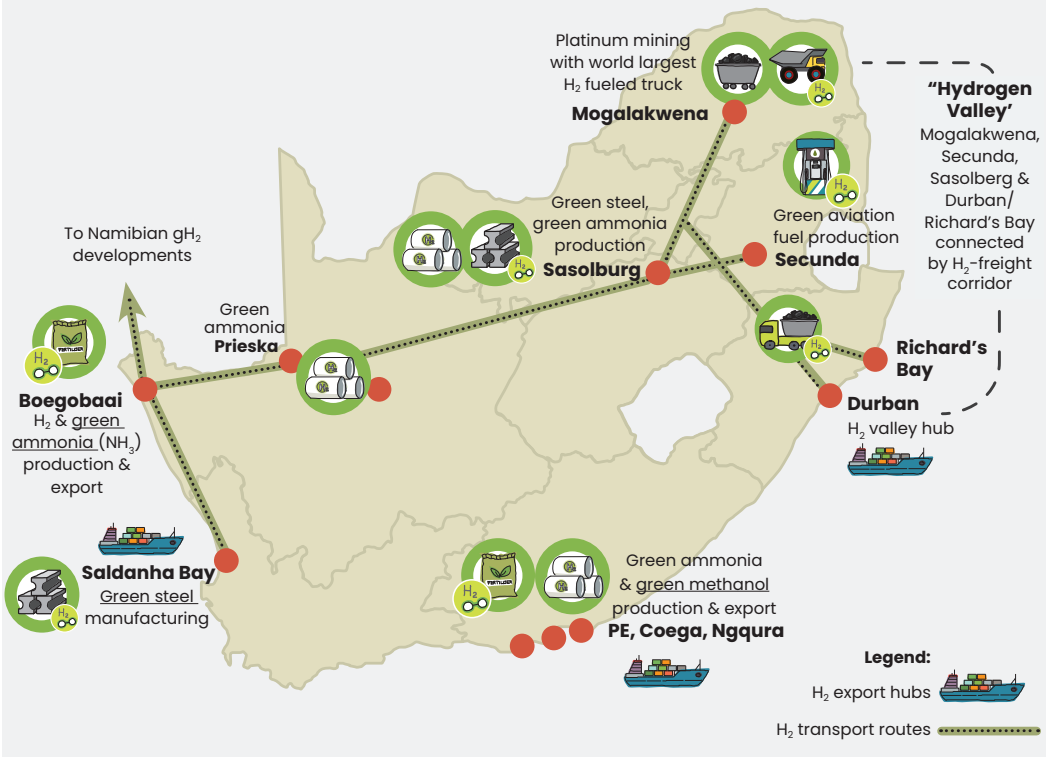
But there are also questions regarding the green H₂ plans put forward. We explore these next.





To 'kickstart' the country's green H₂ 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.





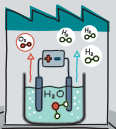
In theory, these, and the industries they are supposed to develop, could help create jobs in SA.

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:
gH₂ technology:

Electrolysers and H₂ fuel cells will be needed to make and use green H₂. 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 H₂ industries could save platinum mining jobs.

Over 36 000 people work in mining in SA.



NEW & EXISTING:
gH₂ 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:
gH₂ based fuels and chemical products

SA already has a synthetic fuel industry. Basing it on green H₂ 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:

gH₂ 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 rich 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.

Also, 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 H_2 , 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 just transition?



RENEWABLE ELECTRICITY FOR ALL?

To make profits, gH_2 companies will have to run their electrolyzers 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?

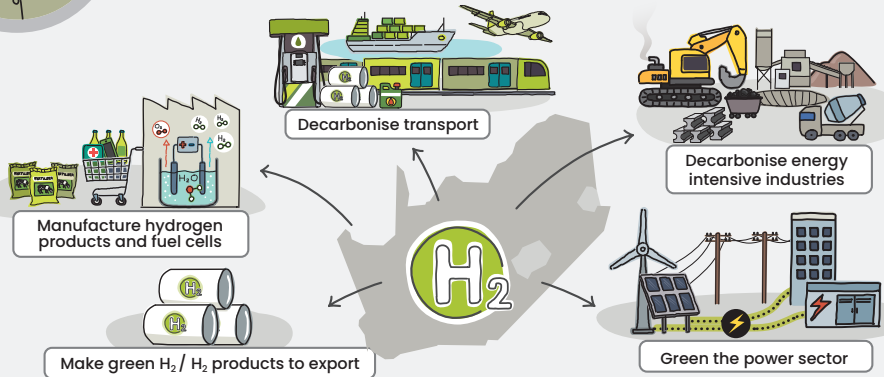


Why green hydrogen in SA?



SA is planning to use green and blue H₂ to lower the CO₂ released from existing industries and heavy transport.

It's also planning to build new industries around green or blue H₂. Could these create new jobs and save existing ones?



There should be no place for blue H₂ 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 H₂ 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 H₂ strategy make sense? Which promises might not be kept?



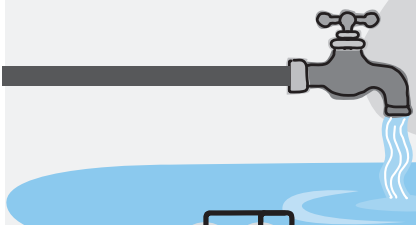
PART 4 What would green H₂ mean for host communities?



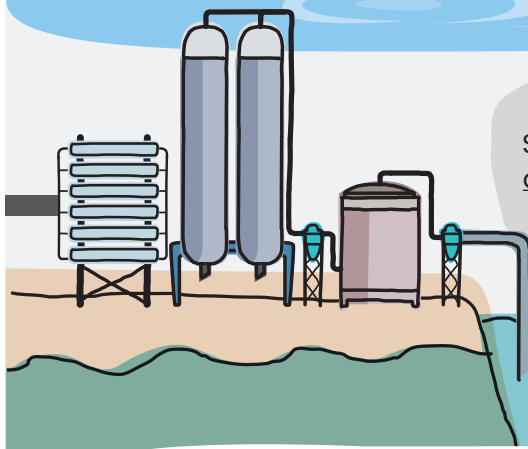
So, in theory, depending on how it is used, green H₂ could help reduce climate change and support job creation in South Africa. Sounds amazing. Is there a catch?

Well, just because green H₂ 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 H₂, there are concerns.

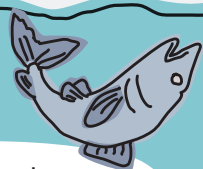




First, producing green H₂ requires A LOT of fresh water. Will communities have to compete with companies for this water?

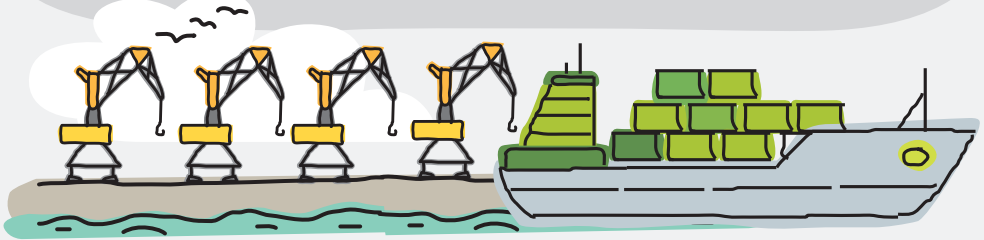


Since fresh water is limited in most of SA, many green H₂ projects will rely on desalination instead. This is a process that turns seawater into fresh water.

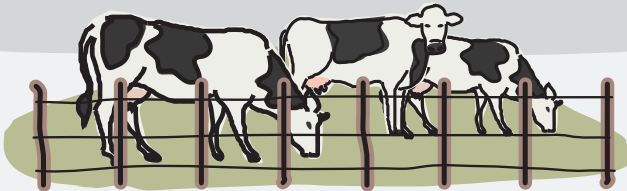


Desalination results in a toxic liquid called brine. If brine is dumped back into the sea, it can kill fish and other marine life. Additionally, when seawater is taken in to desalinate, small marine life that is trapped is killed. This loss of food for larger marine life could negatively impact fish stocks. And, desalination infrastructure could also limit fishers' access to the ocean. All of these together could be devastating for coastal communities.

Similarly, green H₂ 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.



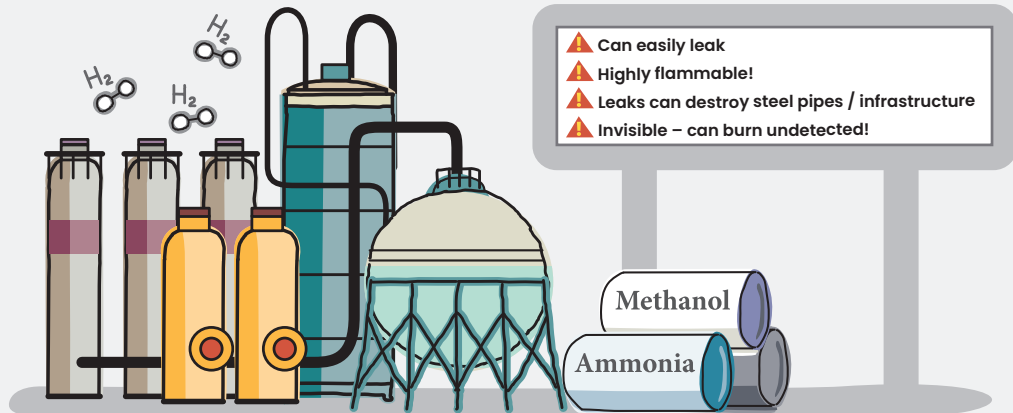
Green H₂ projects will also require A LOT of land. Fencing off common land that is currently accessible to all could disrupt grazing and small-scale farming or access to water bodies. Will this have impact on our food supply?





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.

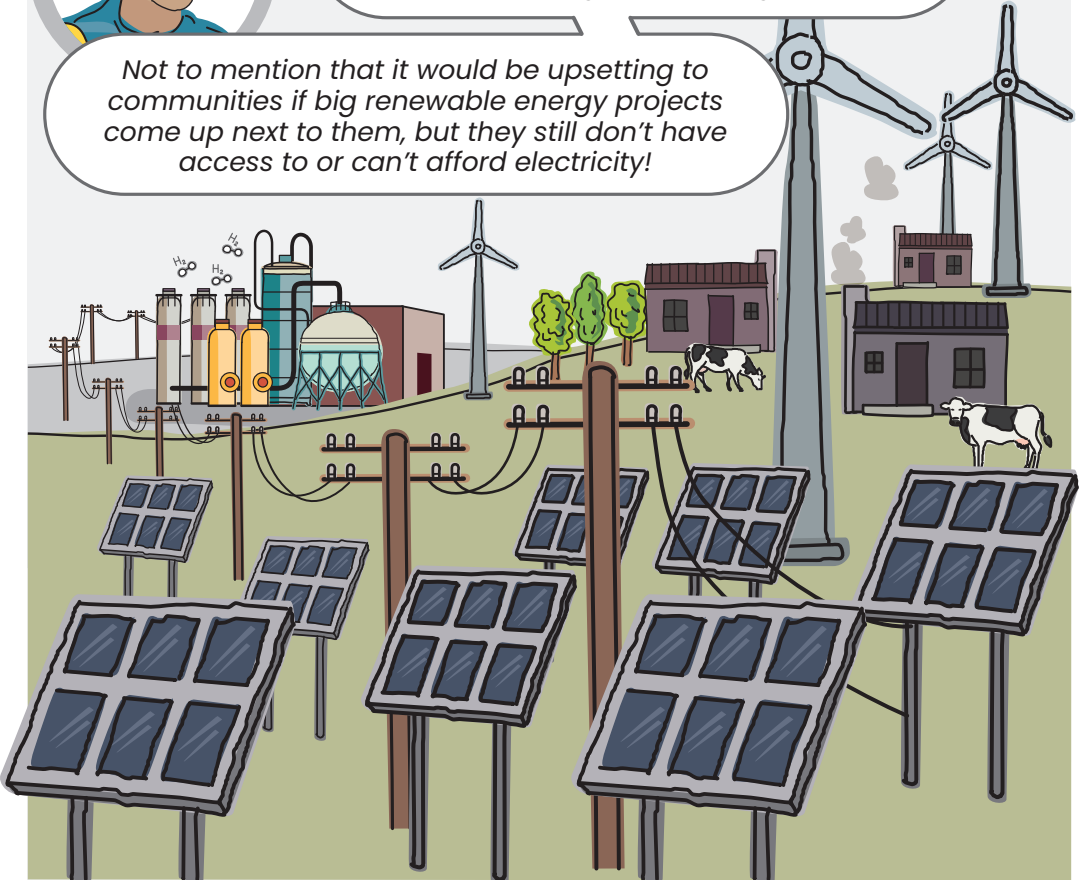
It also means that gH_2 may be safer to use and produce in large centralised hubs, rather than in small installations like individual households or cars.





So big green H₂ 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 gH₂ projects so that they contribute to a better life of the communities that host them.

First off, gH₂ 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 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 practices

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.*





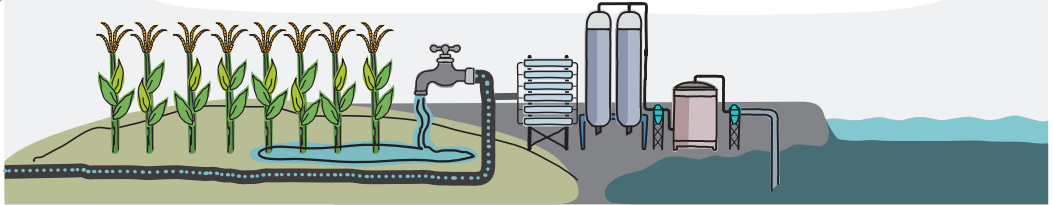
As with RE projects, most jobs in H₂ plants will be during construction. The number of permanent jobs thereafter, and what kind they will be, depends on what kind of project it is. In addition to jobs, there are other ways communities could benefit from RE or green H₂ projects. The Kipeto Wind Farm in 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.

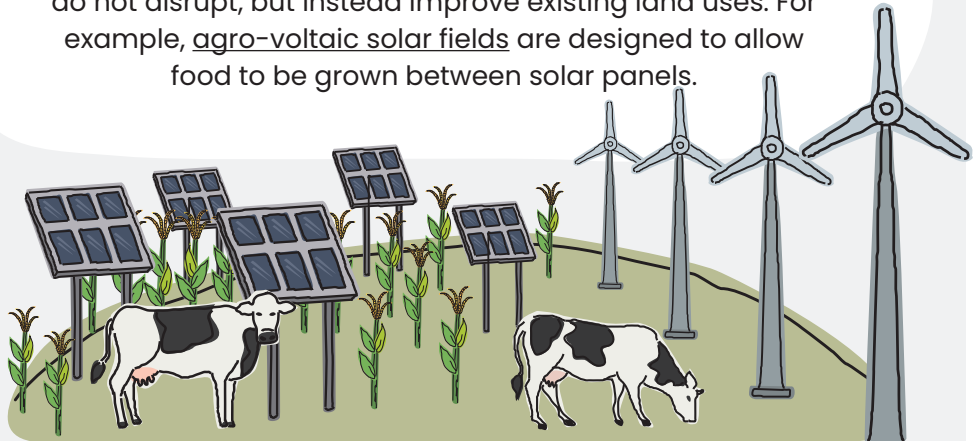


KIPETO WIND FARM

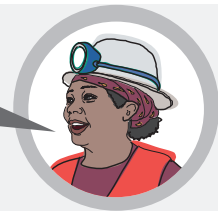
Desalination plants that are part of green H₂ projects could supply water for community agricultural needs. In Gqeberha, the desalination plant will produce salt from the brine instead of dumping it.



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 to 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?

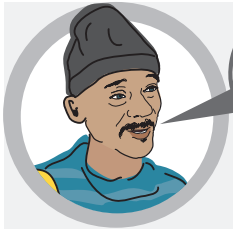
Both mining and RE developers are required to invest in projects that benefit their host communities. Too often, these promises are not kept. When they are, their quality is poor, or other problems emerge: building clinics where there isn't budget for nurses, or schools which the state can't maintain. 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

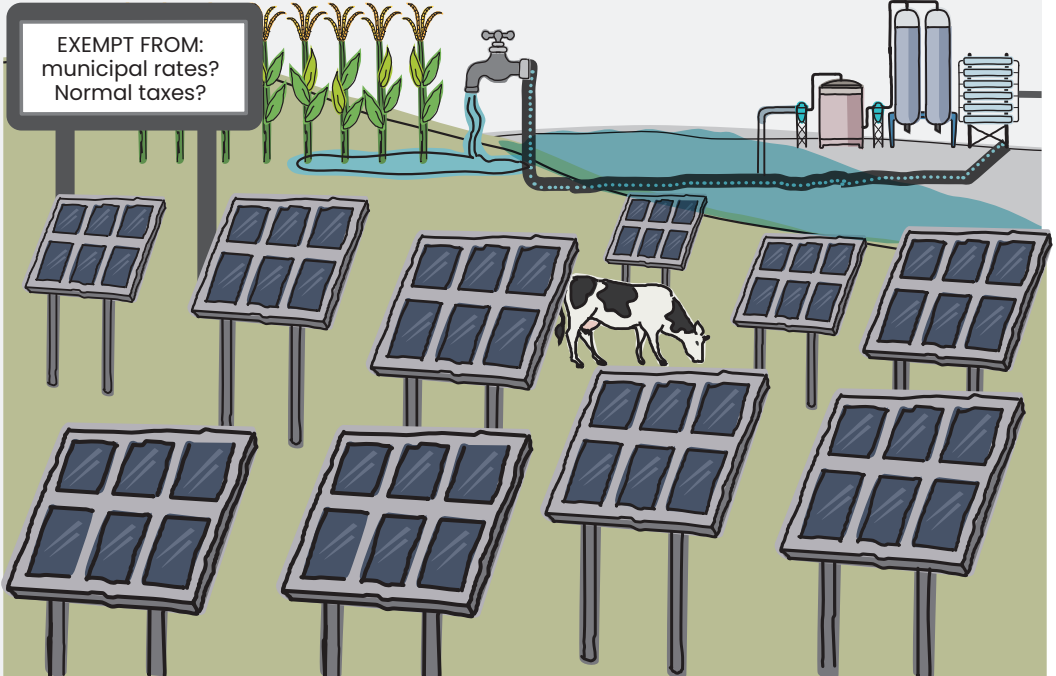
Both mines and RE companies have come into communities with promises of jobs, burseries and in the case of RE, a share of profits. Often, the jobs and benefits that actually resulted left communities disappointed. In some cases, it wasn't clear to communities that it would be years before they would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





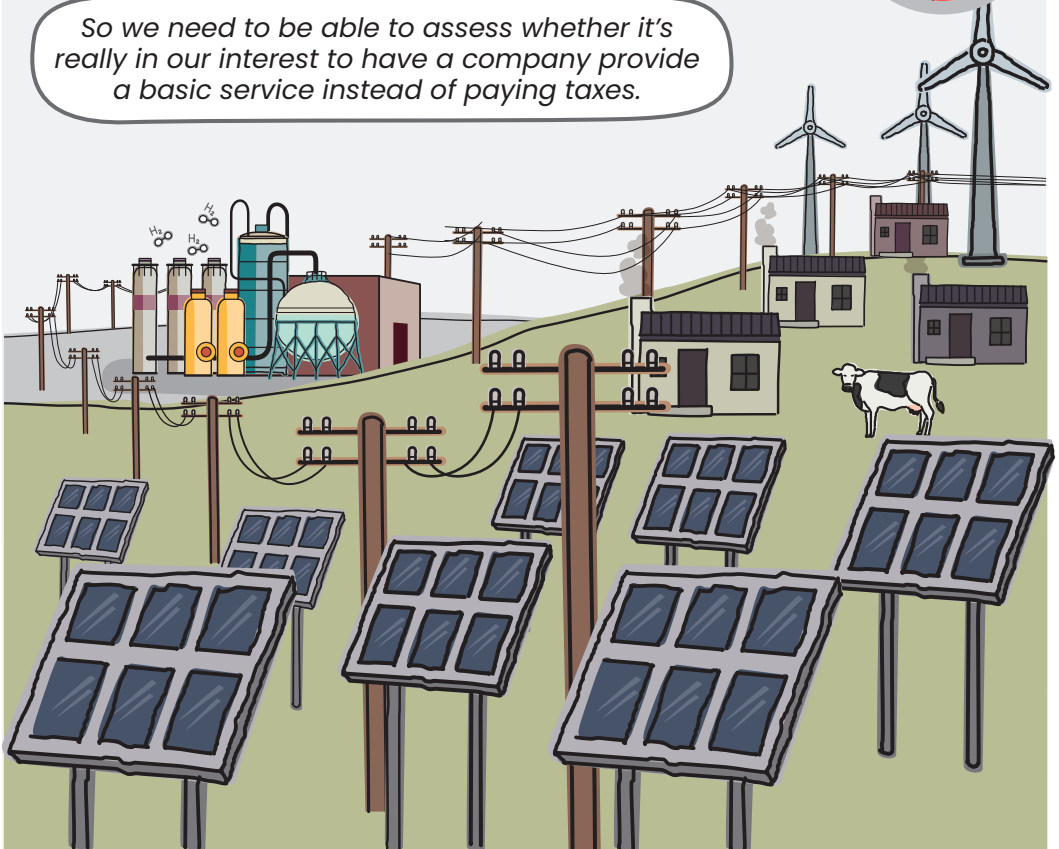
And, although in some cases it could make sense for companies to provide public services like water and electricity directly for communities, the bottom line is this:

Fixing problems regarding access to basic services and the fulfillment of our constitutional rights cannot be outsourced to companies.



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 gH₂ projects, here are some questions we should ask:

CHECKLIST



Is the participation process following EPIC 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

*GH₂ 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?

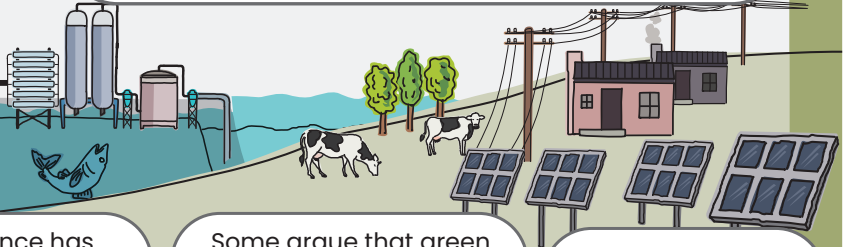
What would green H₂ mean for host communities?



Like all mega projects, green H₂ 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.

EXEMPT FROM:
municipal rates?
Normal taxes?



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 H₂ projects could provide communities with access to electricity. Although this is possible, it will not be free. GH₂ 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 GH₂ companies should just pay decent taxes at local and national levels.

And if green H₂ companies do provide services and core infrastructure, we'll need be sure we can hold them accountable if things go wrong.



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

Ammonia (NH₃): 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: See pages 18, 25 and CCUS below.

Brine: Highly concentrated salty liquid.

Brown hydrogen: Hydrogen that is made from coal. See pages 17, 25.

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 CO₂ instead of releasing it into the air.

Carbon dioxide (CO₂): 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 CO₂.

Carbon tax: A fine that states can charge industries that release a lot of CO₂.

Clean hydrogen (H₂): A term used primarily by industry to describe H₂ that some argue is less polluting than grey, brown or black H₂. It includes green H₂, but also H₂ types that are fossil based or release other waste. See page 18, 25.

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 CO₂ 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).

Emissions: Gas released into the air.

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 Fertiliser: Fertiliser made with green ammonia.

Green Fuels: Lower carbon alternatives to fossil fuels. Made by combining gH_2 with CO_2 . See synthetic fuels below and pages 21, 22.

Green hydrogen (gH_2): H_2 made from water and renewable energy. See pgs. 19, 25.

Green steel: Steel that is made without fossil fuels. See page 20.

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 made by burning methane gas (CH_4). See pgs. 17, 25.

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 (H₂): A gas molecule.

H₂ derivatives: Substances that are made from H₂. E.g. Green ammonia.

H₂ fuel cell: A machine that converts H₂ into electricity without using fossil fuels.

H₂O: 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 (CH₄): A greenhouse gas made up of carbon and hydrogen.

Methanol (CH₃OH): 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 (N₂): 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 (NO_x): When N₂ combines with Oxygen (O₂) it forms a variety of toxic gasses known as Nitrogen Oxides. NO_x hurt human health and is a GHG.

Pyrolysis: A process where fossil fuels are converted to H₂ using heat.

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

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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