FOOD & WATER ACTION EUROPE

WSG

HYDROGEN:

CLIMATE FIX

— OR —

FOSSIL FUELLED FICTION?

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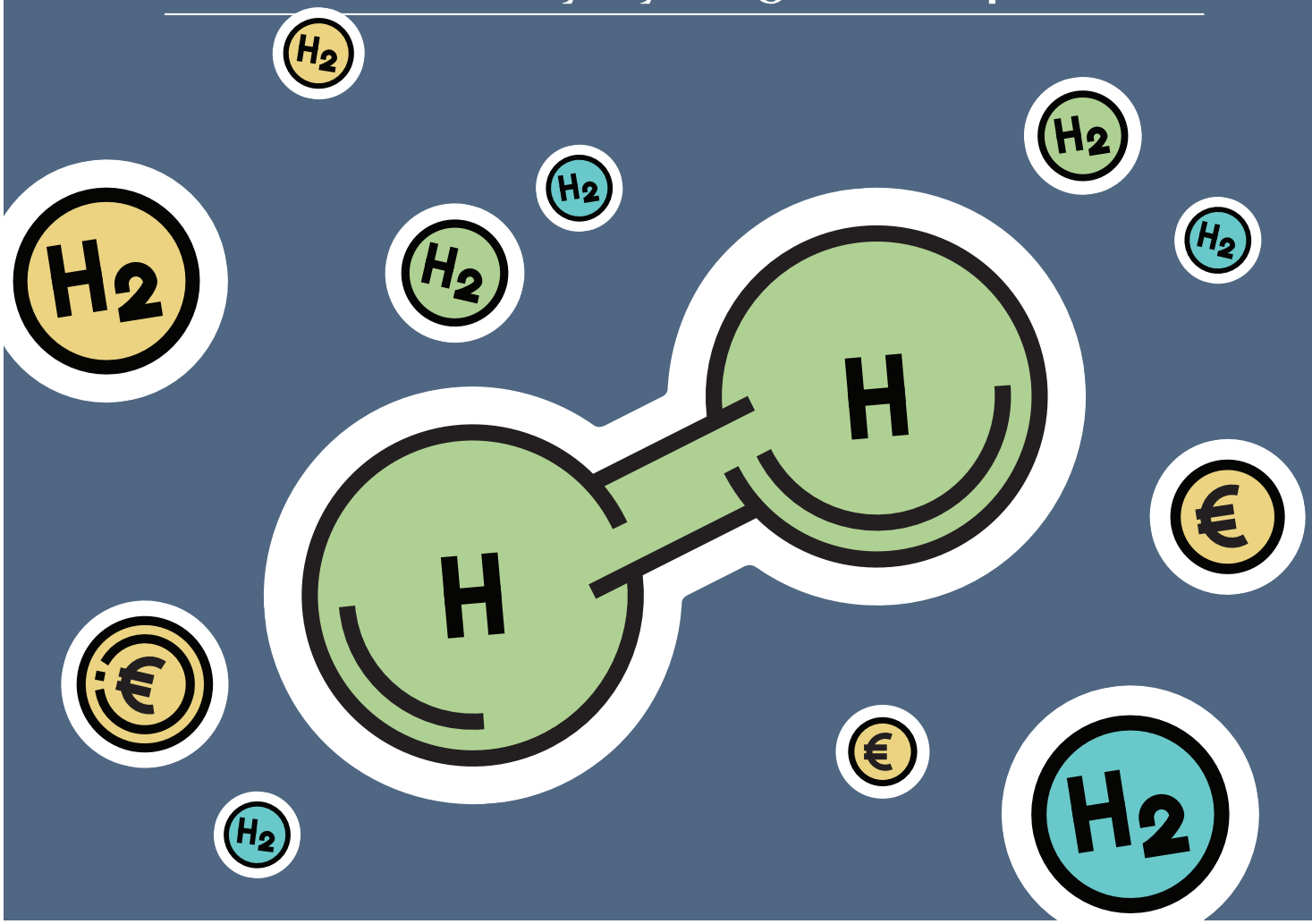
10 Reasons why hydrogen is a problem



INTRODUCING "HYDROGEN"

Hydrogen is everywhere. Literally everywhere. And not only because it is the most abundant element in the universe.

An ongoing, million-euro lobbying effort led by, among others, the fossil fuel industry[1] has seen hydrogen framed as *the* cornerstone to our energy transition, the silver-bullet solution to our energy and climate crises. To decision-makers and the general public alike, hydrogen is being hailed as a safe and necessary investment that will decarbonise the economy, whilst keeping lights switched on and industries alive.

But all that glitters is not gold. Behind this 'hydrogen-hype' lies an elaborate greenwashing effort that risks opening a new avenue to continue investments in fossil fuels, keeping oil and gas majors' planet-wrecking, socially unjust business models alive.

The aim of this report is to offer a clear and concise explanation of why hydrogen, regardless of how it is made, can create more problems than solutions for people and the planet. We have identified 10 key reasons that show why hydrogen poses serious climate, environmental and social justice risks.

A bit of science – Hydrogen occurs naturally on earth, but is only found in compound form with other elements. Because hydrogen normally does not exist as a singular element in nature and must be extracted from other compounds, it is an energy carrier, not an energy source. This is crucial. Hydrogen needs to be produced, before it can be used. Currently, most hydrogen is produced using fossil fuels (mainly fossil gas, using a technology called steam-methane reforming)[2] or from water (by splitting hydrogen and oxygen with electricity in a process called electrolysis)[3].

Today, hydrogen is mainly used in the refining and chemical sectors[4], largely as an energy feedstock. 99% of globally produced hydrogen is made from fossil fuels[5], with associated annual CO_2 emissions exceeding the equivalent to the emissions of the entire global aviation industry or some large countries such as Germany[6]. As of 2020, only 0.02% of global hydrogen production comes from renewable energy[7], so-called "green" or renewable hydrogen is expected to grow exponentially in the coming decade.

The REPowerEU plan[8] aims to produce 10 million tonnes (Mt) of hydrogen domestically and import an additional 10Mt from countries outside the EU annually by 2030[9]. To achieve the 10Mt of domestic production, total investments needs are estimated between €335 and €471 billion by 2030[10]. It is highly likely that much of this investment will come from public funding.

The push for a hydrogen economy is in full swing. But even if industry could produce renewable hydrogen at scale, it would still be less efficient and more expensive than direct electrification using 100% renewable energy. Both fossil hydrogen, and its renewable hydrogen counterpart carry multiple risks and concerns. Renewable hydrogen may make sense for a few niche uses, namely those sectors where direct electrification is not possible. However, this must not become a dangerous distraction from a genuine and just clean energy transition, in which hydrogen can only play a small role.

THE COLOURS OF HYDROGEN*

Colour	Process	Energy source used
Brown/Black	Gasification (adding steam and oxygen)	Coal
Grey	Steam Methane Reformation (SMR), Auto-Thermal Reformation of Methane (ATR) or Methane Gas-Heated Reforming	Fossil Gas
Blue	Complementing grey hydrogen with Carbon Capture and Storage (CCS)	Fossil gas
Turquoise	Thermal splitting of fossil gas (pyrolysis)	Fossil gas
Green	Electrolysis of water	Renewable electricity
Pink/Purple/Yellow	Electrolysis of water	Nuclear power
White/Golden	Geological hydrogen occuring in its (rare) natural form	

**Please note that this hydrogen rainbow is not complete and that there are more hydrogen colours and hydrogen generation processes.*

POINT #1

THE HYDROGEN HYPE HIDES A GREENWASHING SCAM

Amidst Europe's latest hydrogen hype, **several EU countries presented ambitious hydrogen strategies** to develop production and import plans[11]. The EU aims to have **20 Mt/year of available hydrogen by 2030**[12]. While it prioritises renewable hydrogen, fossil fuel based hydrogen remains within the scope of the plans.

Already ahead of this new target, several new **conglomerates formed to sustain the hype**. One of these is the European Clean Hydrogen Alliance[13] set up by the EU Commission. It consists mainly of companies, trade groups and a dwindling number of civil society groups. It functions to identify hydrogen projects and facilitate investments in the hydrogen economy. This alliance shares many members with lobby associations like Hydrogen Europe, who also **count major fossil fuel companies** (like Shell, BP, RWE, TotalEnergies, Gasunie and Eni, etc.) and **big fossil gas infrastructure operators** (Fluxys, Snam, Engie etc.) as key members[14]. The **lobby push** from these hydrogen proponents has been extensive. Between December 2019 and May 2022, the EU Commission had close to an average of one meeting every working day with lobbyists representing oil, gas, and coal companies. The most discussed topic was hydrogen[15]. Clearly, the attempt by the fossil fuel industry to use hydrogen to greenwash their dirty business is not falling on deaf ears with decision makers.

The UN defines greenwashing as follows: *"by misleading the public to believe that a company or other entity is doing more to protect the environment than it is, greenwashing promotes false solutions to the climate crisis that distract from and delay concrete and credible action."*[16]

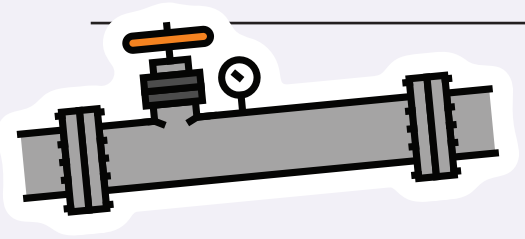
By portraying **hydrogen as a solution** to the climate and energy crises' EU decision makers are aligning themselves with the interests of fossil fuel companies[17]; **delaying urgently needed and proven climate solutions** *(see points 7 and 10)*. As framed by lobby watchdog Corporate Europe Observatory: "why reduce traffic, transition to agro-ecological farming, or decommission fossil gas pipelines when you can continue your dirty business with hydrogen?"[18]

Almost all globally produced hydrogen is currently based on fossil fuels (see introduction). Despite this, big hydrogen players have attempted to lobby EU decision makers to **water down the definition of 'renewable' hydrogen** to include hydrogen made from fossil fuels.[19] Under the guise of decarbonising our economy using hydrogen, billion-euro handouts are being promised to the same polluters responsible for mass ecocide, land grabs and human rights violations in indigenous and racialised communities in former colonised places: all for an **overhyped solution that will have little positive impact on the climate at all** *(see point 4)*.

The hydrogen hype is largely a fossil-funded distraction. Looking beyond the hype means unmasking the **fossil fuel industry's attempt to stay in business during and beyond an energy transition. Instead of transforming our energy systems to renewables, hydrogen presents an opportunity to shift investments away from real climate solutions and keep power & influence in the hands of the fossil fuel industry**[20].

"We are strongly opposed to green hydrogen as we won't be fooled by the word green and the renewables that are being used. Our concerns include water use in places already plagued with water scarcity, the loss of agricultural land, infrastructure build-out, high costs, water desalination and worries about skewed development processes that exclude the rights and opinions of indigenous communities."

Neville van Rooy, Coordinator at The Green Connection, South Africa



POINT #2

HYDROGEN INFRASTRUCTURE COULD BECOME A CASH COW FOR THE FOSSIL FUEL INDUSTRY

For many reasons, transporting hydrogen is far from simple.
Most of the **hydrogen used today is not being moved at all**[21].

These transport challenges are rooted in the physics of hydrogen: it is prone to leaks *(see point 4)*, and contains very little energy in terms of volume[22]. Compared to fossil gas, the transportation of hydrogen through pipelines requires three times more compressor power[23]. This makes **transporting hydrogen less efficient and more expensive**. Transporting liquefied hydrogen by boat, for example, is an extremely expensive and energy intense process. Hydrogen liquefies only once cooled down to -253°C. This temperature is only 20°C above 'absolute zero'![24] Importing hydrogen in the form of ammonia is also challenging, due to low efficiency and safety risks *(see points 3 and 8)*. And this is without even looking at the additional issues of importing hydrogen: which result in devastating ecological and social impacts related to building new import facilities and thousands of kilometres of hydrogen pipelines.

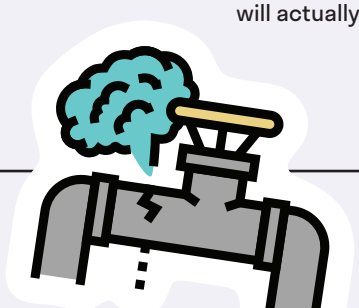
Why is there such a strong push to build an entire new hydrogen grid despite clear limitations? There are **500 large-scale hydrogen transport projects proposed** for Europe alone, almost entirely by the fossil gas transport industry[25].

The current **business model of fossil gas transport companies** like Fluxys, Énagas, GRTGaz, SNAM, Plinacro & Co - **building and operating gas infrastructure** - is threatened by a just, green transition because it necessitates a phase out of fossil gas, and it's associated transport. The build-out of something akin to the fossil gas grid for hydrogen would greatly benefit the fossil gas transport industry as it could **sustain a similar business model**.

> **"Fossil fuel companies, especially oil companies and gas system operators (TSOs), are looking to hydrogen as the magic solution, and proposing totally disproportionate plans. There are clear indications that the proposed projects (both production and transport, such as H2MED) do not respond to the needs to develop a just ecological transition, but rather to maintain their activity and profits, only greenwashed."**
>
> Marina Gros Breto
> Ecologistas en Acción

The fossil gas transport industry wants a voice in hydrogen infrastructure planning[26] despite the practical realities and requirements between hydrogen and fossil gas for transport being fundamentally different in many aspects. They **blur the lines between gas and hydrogen infrastructure** by claiming that large parts of the gas network can be **retrofitted or repurposed** to transport hydrogen in the coming years. A claim that is far from realistic[27]. The fossil gas transport industry has also advocated for hydrogen **'blending'** - mixing fossil gas with hydrogen - which is a wasteful and costly distraction[28]. Further, the transport infrastructure comes with high costs[29]; a leaked list of EU top priority infrastructure shows that building **and operating even a few dozen hydrogen projects would cost over €70 billion**[30]. Unsurprisingly, all those projects have been **proposed by the fossil gas transport industry**.

An inefficient, unchecked, hydrogen infrastructure push **reproduces the same dynamics that created the current climate and ecological crisis:** an energy economy to facilitate over-consumption of energy and resources in the wealthiest nations. It will result in a network of stranded assets, paid for in the billions by the European taxpayer - redirected from urgently needed, proven solutions that will actually get us off fossil fuels.



POINT #3

HYDROGEN IS DANGEROUS

Hydrogen poses significant risks to the health and safety of workers and communities alike.

Hydrogen is a colourless, odourless and tasteless gas. Leaks are almost impossible to detect with human senses, yet because hydrogen is highly flammable and volatile - even more so than gas - it poses a serious risk of fire[31].

The 1937 Hindenburg disaster should be a warning for hydrogen advocates[32]: a hydrogen-filled airship suddenly caught fire, killing 36 people. And explosions are not confined to the history books: hydrogen pipelines still pose major dangers, especially to communities living closeby[33]. When large amounts of hydrogen is released outdoors eg. through leaks, it mixes with atmospheric oxygen (air) creating a very explosive or flammable mixture[34]. **Once released into the atmosphere hydrogen can easily be ignited[35]. The resulting explosions could generate blast waves that can result in serious harm to people and buildings.** In 2019 alone, three hydrogen explosion incidents occurred within 20 days[36].

Hydrogen storage and transportation are particularly hazardous. Hydrogen can be stored either as a gas or as a liquid at extremely high pressure, making it prone to damage equipment and generate high-pressure leaks which increase the risk of fire or explosions[37]. Additionally, while hydrogen is non-toxic, in confined indoor environments, it can cause explosions, as well as asphyxiation[38]. Explosions and flames are also the biggest risks associated with its transportation. Projects to blend gaseous hydrogen into existing fossil gas pipelines pose higher dangers than conventional fossil gas transport[39], not to mention **plans to convert hydrogen to ammonia for easier transportation** *(see point 2)*. **Ammonia is a highly toxic, corrosive and explosive chemical:** anything but safe and low-impact. Transporting hydrogen-derived ammonia around the world by road, rail or boat poses serious safety concerns, including the possibility of fatal accidents and toxic clouds. These not only jeopardise human health but also damage the wider ecosystem: for example **any leak at sea would be highly toxic for marine life**[40].

Some energy companies also want to roll out the widespread use of hydrogen for heating homes. Yet, hydrogen boilers are not only wildly inefficient but also pose health and safety risks. Hydrogen is four times more explosive and four times more likely to result in a fatality or injury in homes than fossil gas[41].

Scaling up the production of renewable hydrogen would result in an increased demand for PFAS. **PFAS is short for per-and polyfluoroalkyl substances, and they are used in several ways for the production and transport of hydrogen**, especially in the electrolyser technologies. These substances are also known as 'forever chemicals' because they persist in the environment for a very long time, contaminating our food, water and land[42]. PFAS have been linked to severe human health risks, posing a risk for workers and local communities, especially vulnerable communities already overburdened by multiple sources of pollution. Still, the hydrogen lobby pushed to weaken the EU's proposal of a broad ban of PFAS[43], claiming that it would undermine Europe's energy security and industrial and climate goals[44].

POINT #4

HYDROGEN IS A CLIMATE HAZARD

Hydrogen at scale is far from the climate solution its champions claim.
The majority of hydrogen in the current global mix is made using fossil fuels[45].

'Grey' hydrogen, made from fossil gas using a process called 'steam methane reforming', is spewing CO_2 into our atmosphere[46], 'brown' or 'black' hydrogen is made with coal,[47] and 'blue' hydrogen, authorised as low-carbon in the latest EU sustainability regulation, is also fossil fuel-based hydrogen[48]. 'Green' hydrogen is considered to be the cleanest of the hydrogen rainbow as it is created using renewable energy, although it still has significant climate and ecological impacts.

The climate impact of current fossil hydrogen production is massive. Still, hydrogen advocates highlight various decarbonisation efforts, though none of these are totally green either. 'Blue' hydrogen is generated using fossil fuels with the addition of Carbon Capture and Storage (CCS) which aims to remove CO_2 emissions from the process (see box point 7).[49] This sounds promising but an honest look shows consistently underwhelming CO2 capture rates that are struggling to reach even 90% captured CO_2, CCS projects regularly failing and closing down[50], highly questionable permanent storage opportunities, and high energy intensity realities. All leading to high climate impacts for this supposedly 'clean' blue hydrogen; impacts that are notably higher than simply burning fossil gas.[51]

'Green' hydrogen is damaging for the climate too, not only because it depletes water and other vital resources *(see point 5)* **but also creates emissions due to the high leakage potential of hydrogen.**[52] When emitted into the atmosphere, **hydrogen contributes to global warming by increasing the amount of other greenhouse gases such as methane and ozone**[53]. Although hydrogen does not emit carbon dioxide (CO2) when burned or used in a fuel cell, **it has a global warming effect that is almost 12 times stronger than CO_2 if released into the atmosphere**[54]. Even a seemingly small 10% leakage rate during these processes has the power to erase the very advantages meant to be gained from this allegedly cleaner alternative to fossil fuels.

Finally, a lack of advanced monitoring technology leaves a **significant gap in our capacity to effectively detect and address hydrogen leaks**, intensifying our predicament. Hydrogen molecules, smaller and lighter than methane, prove exceptionally challenging to contain; making leaks nearly inevitable. So, whether grey, brown, pink, yellow, blue or green, hydrogen production is never an impact-free or completely 'clean' process.

"In recent years, the industry has promoted the idea of "blue hydrogen," which is made from natural gas but with some effort to capture carbon dioxide. Unfortunately, carbon dioxide is not easy to capture, and it is expensive to even try. A lot of energy is needed for the carbon dioxide capture, and this comes from consuming even more natural gas. Green hydrogen is also promoted by the oil & gas industry, which they group together with blue hydrogen under the name of "clean hydrogen" in the marketing and lobbying. Be careful not to get caught up in the hype of the oil & gas industry."

Robert W. Howarth, Cornell University; Co-author of the 2021 paper on "How Green is Blue Hydrogen?"

POINT #5

HYDROGEN HAS NEGATIVE IMPACTS ON NATURAL RESOURCES

The Global North's quest for hydrogen points to a new era of neocolonial extractivism based on the appropriation of natural resources across former colonised areas.

These issues are more widely known in the case of the fossil fuel industry, and therefore in fossil hydrogen production. However, the social and environmental injustices for renewable hydrogen follow very similar patterns. Its production relies heavily on natural resources, inflicting extensive environmental and social risks to those already living in climate vulnerable ecosystems facing unjust debt, political repression, and poverty.

Water. Large-scale plans for hydrogen expansion could create significant water stress in places already struggling with scarcity[55]. **To produce just 1 kg of hydrogen, 9 kg of water** is required, with inefficiencies potentially doubling this demand to **18-24 kg**[56]. Globally, over 70% of proposed hydrogen projects are planned in areas already grappling with water scarcity issues, like Spain and Chile[57]. Nearly **85% of hydrogen projects aiming for completion by 2040 may need to source their water from desalination**[58], which would require additional energy. This risks destroying wildlife[59], damaging drinking water sources and corrupting soil health.

Land. Renewable hydrogen projects require enormous areas of land for the **expansion of renewable energy capacity**. For example, the Aman project in Mauritania[60], one of the world's biggest renewable hydrogen projects, will cover an area of 8,500 km2, seven times the size of London.

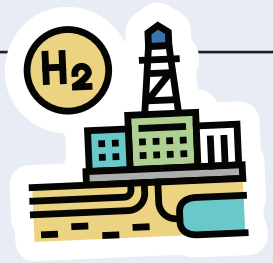
Because it is so land-intensive, renewable hydrogen developments in the Global South carry high risks of land grabs, displacements of communities, unfair debt agreements, biodiversity loss and land-use conflicts. This is possible in states like Mauritania because there is a general pattern of poorly enforced human rights regulations in former colonised countries, as well as in countries who were subjected to structural adjustment programmes which empowered reckless corporations to pursue industrial activities[61].

Critical raw materials. As hydrogen production scales up, so too will the need for raw and critical materials required to make renewable energy technologies[62]. However, these materials are unevenly concentrated in a small number of countries in the Global South, who have already faced significant problems due to existing extractive industries. The EU is already planning to drastically increase imports of renewable hydrogen from predominantly former colonised countries[63]. This is in total continuity with the (neo)colonial dynamics of our current fossil fuelled energy system, whereby resource-rich regions are forced to bear the costs of extractivism, including environmental degradation and human rights abuses, to meet the demands of Global North's resource-hungry nations.

Additionally, the health effects are outsourced to places and areas that cannot afford to refuse the activities of multinational companies, and the negative health effects of their activities[64]. Growing demand for raw materials threatens to deepen support for repressive regimes[65], intensifying unsustainable mining practices already experienced in many economically poor, resource-rich countries[66], all worsening the already existing environmental and social problems.

"We are concerned about plans that include taking hydrogen, especially 'white' hydrogen from geological formations. Indigenous Peoples and organisations in Colombia are concerned and are warning about the negative environmental and social impacts that will be generated, where these could be similar, or as serious, as those produced by hydrocarbon development, including fracking."

Oscar Sampayo - human rights defender on environmental issues, member of CRY-GEAM, advisor to the National Indigenous Organisation of Colombia (ONIC).



POINT #6

HYDROGEN WORSENS THE NEOCOLONIAL DYNAMICS OF OUR CURRENT ENERGY SYSTEM

The EU's hydrogen expansion plans risk creating damaging geopolitical outcomes that **cement the same violent and extractive neocolonial relations present in our current fossil fuel energy system.**

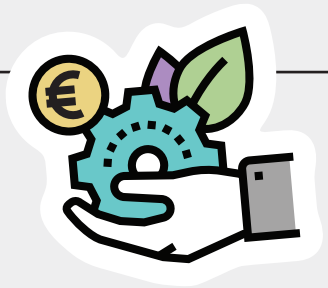
Projections[67] demonstrate international hydrogen pipelines will connect EU member states with Morocco, Algeria, Tunisia, Egypt (via Greece), Russia, Ukraine, Norway and the UK, alongside further foreign imports via ships[68]. In total, half of the EU's hydrogen demand is to be met by imports from outside the continent[69], a significant portion coming from former colonised nations grappling with their own energy, economic and ecological crises, produced by historical occupation and imperial practises committed by EU member states[70]. Germany, for example, are projecting import figures of 70% of their future hydrogen use, a trend likely to grow over time[71].

The top 25 hydrogen lobby groups collectively invest a staggering €75 million annually in lobbying the EU institutions[72]. This corporate firepower is **encouraging mass imports from countries with weak regulations on environmental impacts and human rights** in order to secure business opportunities and market influence during and after the energy transition. In Namibia, for example, over half[73] of the rural population does not currently have access to energy and it is a country particularly vulnerable to the consequences of climate change. Yet, Namibia aims to become one of Africa's first green hydrogen export hubs[74].

In cooperation with German investors[75] the Namibian government is investing €10bn[76] in a new hydrogen pipeline that will destroy a national park, remove employment opportunities within the local tourism sector; degrade agricultural land, drinking water and heritage sites, and create further debt for a country already facing hidden debt costs equivalent to 10%[77] of their whole national GDP. This project is a case in point. The energy produced[78] is intended for German consumption, leaving Nambian's with no solution to their own energy poverty crisis, but further debt, ecological damage and social insecurity. Similarly damaging plans are being made in the Democratic Republic of Congo[79] with a devastating dam project for hydrogen production, as well as in Chile[80]. Ultimately, the EU's hydrogen import targets[81] replicate the neocolonial dynamics of our current fossil fuelled system, **taking renewable energy potential from countries who need it for their own energy transitions, meanwhile exacerbating energy poverty and increasing the likelihood of fossil fuel lock-ins for indebted, energy-poor nations**. The same colonised places and areas harmed by the fossil fuel industry also lose out in Europe's not-so-green hydrogen race.

"Green hydrogen could have irreversible social and environmental impacts, ranging from biodiversity loss to massive displacement and impoverishment of populations and communities. It is important to avoid solutions that could compromise the socio-environmental balance in developing countries and thereby exacerbate poverty. The current massive rush to green hydrogen, in particular to meet the energy needs of the West, throws us back into an old vicious circle of extractivism with colonial connotations quite familiar to the populations of the South, of which the DRCongo is a distressing example. Extractivism in all its forms must be stopped, also in the energy sector."

Erick Kassongo, Executive Director of the Congolese Center for Sustainable Development Law (CODED)



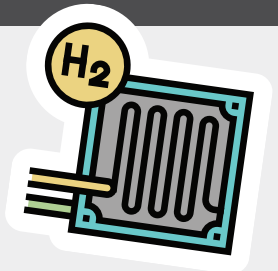
POINT #7

HYDROGEN IS AN UNCERTAIN BET THAT COULD ULTIMATELY BENEFIT POLLUTERS

The **absence of thorough and accurate impact assessments** on hydrogen consumption, supply and climate, to **limit hydrogen plans to a realistic size and form**, will inevitably cost precious time; jeopardising our ability to meet climate targets and roll out existing, proven and rapidly deployable solutions *(see point 10)*.

WHAT IS CARBON CAPTURE AND STORAGE?

Carbon capture and storage (CCS) is a technology that aims to remove and store carbon dioxide (CO_2) emissions before they are released into the the atmosphere, generally from large point sources like power generation or industrial facilities[82]. However, it is an unproven, expensive, and not economically viable technology, that repeatedly fails to meaningfully remove emissions from the atmosphere[83]. CCS provides oil and gas companies with an excuse to keep fossil fuels alive. And producing hydrogen from fossil gas with CCS (so-called 'blue hydrogen') actually releases more emissions than burning gas alone, due to the emissions intensity of creating blue hydrogen[84].



Betting on hydrogen to decarbonise our energy systems **risks leaving us dependent on gas as a fallback option.** This could happen a) if there is insufficient renewable hydrogen to feed an inefficient green hydrogen boom, b) if high costs or failing Carbon Capture and Storage technology (see box) hinder blue hydrogen from actually being 'low carbon', or c) if the oversized hydrogen grid plans fail - requiring continued fossil gas use. Massive investments in hydrogen infrastructure are a win-win situation for the fossil gas industry and a lose-lose for people and the planet.

There are several **crucial questions on hydrogen infrastructure that governments and companies with grand hydrogen plans usually cannot answer**. These include a) how would massive plans generating and importing hydrogen exactly materialise? b) where is a Europe-wide assessment for truly necessary hydrogen demand? c) why is there no analysis for priority-only uses of hydrogen? and d) how exactly would the hydrogen grid, based on such detailed analysis, look?

Still, European member states are going full steam ahead with massive hydrogen plans. An example being the list of proposed top EU level hydrogen infrastructure projects known as the 'Union List'[85], granting several advantages and top priority status to selected projects. Each and every project on the list has been submitted by fossil fuel industry players.

They provide very limited information about the hydrogen sources and consumers linked to their projects and the projects have been submitted with cost ranges of up to 50%. **This means that the already multi-billion Euro projects could easily become even more expensive.**

With the majority of hydrogen currently derived from fossil fuels, raising meaningful amounts of fully renewable hydrogen up from the current amount of well under 0.1%[86] anytime soon is an uncertain development. This puts a big **question mark on whether hydrogen will be able to fulfil its sustainability promises,** or if it is merely a lifeline for the fossil gas industry to continue production.

A network plan brought forward by the European fossil gas transport industry includes over 150 hydrogen projects with an average completion date in 2029[87]. These include **largely unneeded hydrogen transport projects which will likely be delayed and do not align with the urgent need for climate action.** Following summers of deathly forest fires and drought across the world, it is very clear that there is no time to experiment with energies that will fail at scale, especially when renewable energy solutions exist. A new hydrogen mega-industry functioning both as a cash cow and lifeline for the fossil fuel industry is the last thing we need in a climate emergency.

POINT #8

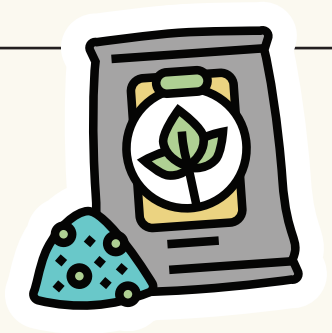
HYDROGEN IS EXPENSIVE

The EU's ambitious long-term hydrogen plans carry a heavy cost burden for the European public and could exacerbate the continent's energy crisis.

Green hydrogen is too expensive to be commercially viable at the moment. Currently, fossil fuel based hydrogen can cost up to $1.70 per kg whereas green hydrogen can cost as much as $8 per kg[88]. **Studies show that green hydrogen will still be more expensive globally, on average, than grey and blue hydrogen derived from fossil gas even in 2050**, while it will be only competitive in European markets after 2035[89]. Moreover, the technology itself (electrolysers) needed to produce green hydrogen are particularly expensive and account for up to 40% of the total cost of hydrogen production[90].

The process of liquefying hydrogen for transport consumes over 33% of its energy content, compared to the 10% needed for liquefying fossil gas[91]. While transporting hydrogen in the form of ammonia - particularly for transport via ship - is gaining support, it is still more expensive than transporting LNG[92] because turning it back into hydrogen after transportation using a process such as 'cracking' adds even more to the costs[93]. If hydrogen was to replace fossil gas in the global economy today, 3-4 times more storage infrastructure would need to be built, at the cost of $637 billion by 2050[94].

Particularly concerning from a cost-based perspective is the use of **hydrogen for household heating. Transitioning to hydrogen could increase household bills by 70% in the EU by 2025, totaling €240 billion in consumer costs**[95]. All this to say that hydrogen at scale will blow a hole in the public purse. When 1.1 billion people globally, including 50 million Europeans, already live in energy poverty, investing in leaky hydrogen for sectors like heating, where affordable, more socially-just, climate-friendly options exist, is a fraudulent use of public money and a pathway to poverty for millions more.



POINT #9

HYDROGEN IS LINKED TO DIRTY FOSSIL FERTILISERS

A link that is less obvious, but nevertheless problematic both environmentally and socially, is the **connection between hydrogen and fertilisers.**

"The bet on blue ammonia shows how the fertiliser and fossil fuel industries are increasingly collaborating to launder fossil fuels — particularly gas — as an ever-expanding source of both "clean" energy and "clean" agrochemicals. It is neither."

Lisa Tostado, Center for International Environmental Law (CIEL)

While there are alternative fertiliser production methods, the predominant choice is ammonia-based fertilisers. These rely on hydrogen: **the European fertiliser industry produces and uses 40% of the hydrogen in Europe today**[96]. Given that almost the entirety of this hydrogen is made from fossil fuels *(see introduction)*, we call these ammonia-based fertilisers 'fossil fertilisers'.

Fossil fertilisers come with a range of problems including **soil degradation, nitrogen leaching** (i.e. nitrogen moves out of the soil and - in the worst case - contaminates drinking water), **significant greenhouse gas emissions, the creation of dependency on more and more fertilisers**, and thus difficult financial dependencies for farmers[97]. On top of that, fossil fertilisers are derived from fossil fuels.

Ammonia is the basis of fossil fertilisers and through a chemical process (the so-called 'Haber-Bosch' process) hydrogen and nitrogen are combined together to produce ammonia.[98] The fact that the **Norwegian fossil fertiliser corporation Yara is the single largest private consumer of fossil gas in Europe** is an example for how important the fossil-gas-hydrogen-synthetic-fertiliser link is[99]. What's more: next to oil refining, fertiliser production is the second biggest use for hydrogen today[100].

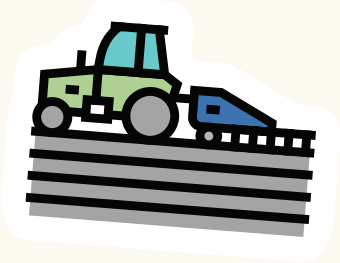
Just as with the hydrogen boom across other sectors, when it comes to synthetic fertilisers, there are big decarbonisation promises made. **Fossil fertiliser companies are important players in the hype around hydrogen, playing a key role in EU lobbying for hydrogen expansion**[101] and they benefit from subsidies for their unproven, costly and ineffective plans to produce blue hydrogen and blue ammonia.

Let's zoom in on the emissions problem of hydrogen-based fertilisers: Not only is the 'Haber-Bosch' process itself highly energy intensive - and powered by fossil gas - the emissions of the fossil fuels used to generate the hydrogen are dangerously high. **Even if 100% renewable hydrogen** is used to make ammonia-based fertilisers, **a large amount of emissions will still be produced due to the use of these fertilisers in fields**. Nitrous oxide, linked to the use of fertilisers has an important warming effect and its release into the atmosphere is the biggest human-made threat to the ozone layer[102].

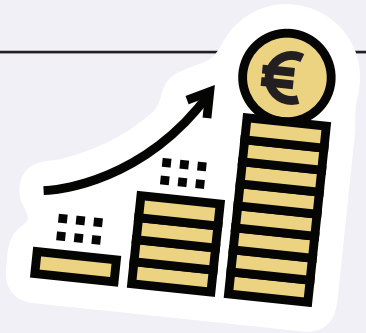
On top of that, the application of these fertilisers also reduces the soil's important ability to store CO_2[103]. This makes it crucial to ask important questions about where fossil fertilisers are really needed and how we can swiftly reduce their use where alternatives exist. There are simple ways to **reduce irresponsible use of fertilisers - and hydrogen - immediately, while in the mid and long term it will be crucial to move towards truly sustainable agriculture as soon as possible.**

"Through greenwashing and clever PR, 'green' fertilisers are presented as the perfect solution to consumers and industry, while fertiliser companies reinforce dependencies by maintaining the use of synthetic fertilisers and perpetuate the power structures in place in the agriculture and energy sectors in the context of socio-environmental crises and injustices."

Paulina Solis, ASEED



POINT #10



HYDROGEN DISTRACTS FROM REAL SOLUTIONS

As mentioned above *(see point 1)*, the fossil fuel industry sees hydrogen as a lifeline for continuing business as usual.

"Addressing the multi-crisis requires degrowth: unhooking our economies from the never-ending growth trap and breaking with colonial material dependencies. This requires a radical reduction in energy throughput but, today, hydrogen is the poster-child of 'green' capitalism - providing a false solution behind which mega-corporations can hide their ever-expanding growth plans, which remain largely centred on fossil fuels. Hydrogen can only work within a framework of sufficiency and decolonial degrowth."

Degrowth in Action Collective

Even unrealistic targets for so-called 'green' hydrogen offer a perfect cover for fossil companies to keep selling us oil and gas while we wait for hydrogen to be available; including in sectors where direct electrification is a greener and cheaper option.

Although limited amounts of hydrogen produced from 100% renewable resources can help to decarbonise some industrial processes or sectors where no other alternatives exist, there is no such thing as impact-free hydrogen. **The creation of an entire, new hydrogen economy as currently promoted is beyond all reason**, especially in sectors where **we already have superior and cheaper clean energy alternatives, but also safer ones.** For instance, hydrogen has no role to play in uses including, but by far not limited to, home heating, cars or trains[104], and even many high temperature industrial heat uses[105] where electrification is much more efficient[106], less expensive and less dangerous. *(see point 3)*. **Switching to a hydrogen economy would require massive global investments in the range of $15 trillion until 2050**[107], a monstrous financial commitment that would fall largely on taxpayers and would make it even **harder to decarbonise the large amount of fossil fuel based hydrogen we already use today**.

Producing large volumes of hydrogen of any colour would drive resources and renewable electricity away from proven solutions that would help us phase out fossil fuels more quickly.

What we need is a systemic change that starts now. This must entail investing in real climate solutions, like direct electrification with 100% renewables and energy efficiency, circularity and measures to structurally reduce demand. All this is part of a mosaic of solutions to limit our hydrogen needs as much as possible in order to prioritise the implementation of real climate and social justice solutions. A truly transformative and just transition is one that invests in community-ownership models of renewable energy, that reduces consumption, and protects communities' rights globally from North to South.

OUR DEMANDS

- → We ask the **EU and member states** to stop all direct and indirect subsidies for fossil fuel based hydrogen. Replacing current fossil fuel based hydrogen with truly renewable hydrogen, where no alternatives to hydrogen exist, must be a priority.
- → We ask **decision makers** to cease policy and financial support for 'green' hydrogen imports which include green hydrogen mega-projects destined for European markets and which are linked to injustices and violations of human rights.
- → We ask **EU governments** for a thorough and honest assessment of the current hydrogen hype based on science, the laws of physics, and with utmost priority to the respect of human rights and necessary climate action.
- → We ask for a drastic shrinking of the currently outsized hydrogen plans with a clear limitation to hydrogen for no-regret uses. We demand structural measures to equitably reduce energy consumption to stay within planetary boundaries. This will avoid the creation of stranded assets and the channelling of resources into false solutions that ultimately harm the people and the planet.
- → In order to protect important energy and climate legislation and avoid false solutions we demand that EU institutions and national level decision-makers restrict the access of the fossil fuel lobby. This includes hydrogen lobby bodies and alliances which represent fossil fuel companies or other companies linked to fossil fuels.
- → We demand the EU to align its energy and climate policies with the needs of people and the planet in all corners of the earth, instead of the concerns of profiteering, and polluting, neocolonial corporations.

ACKNOWLEDGEMENTS

Authors
Frida Kieninger, Holly Hudson, Paola Matova, Enrico Donda & Josef Boraei

Thanks to
Blush Design Agency

Published November 2023

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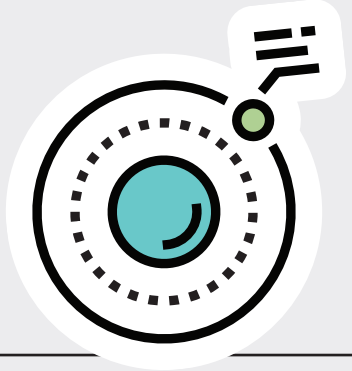

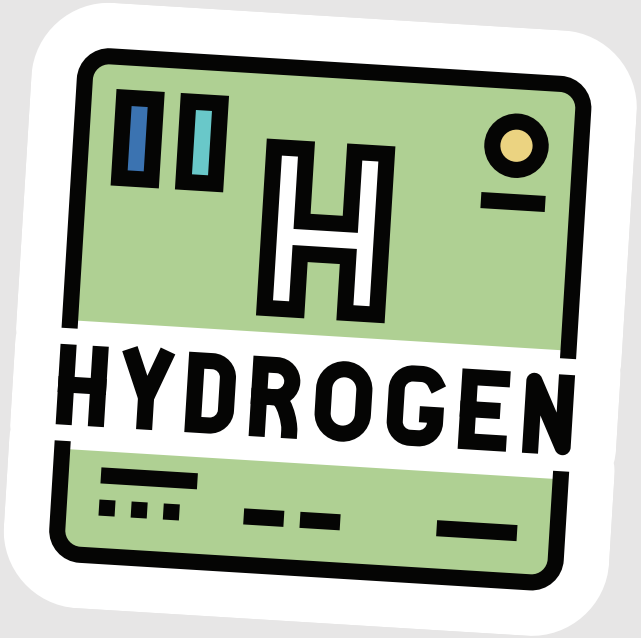

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