



# Between green extractivism and energy justice: competing strategies in South Africa's hydrogen transition in the context of climate crisis

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## ABSTRACT

The global race for green hydrogen is not just about decarbonisation, but also about power and profit. Examining the formation of a political project around an emerging hydrogen economy in South Africa, this article shows that a hydrogen transition is fundamentally contested. Employing (neo-)Gramscian hegemony theory and historical materialist policy analysis, it delineates four competing hydrogen initiatives in the policy debate: green extractivism, green developmentalism, fossilism and energy justice. The findings indicate the dominance of green extractivism, which prioritises the export of green hydrogen to Europe and reproduces patterns of neocolonialism and unequal ecological exchange. Contestations arise both from reactionary forces clinging to fossil fuels as well as from initiatives pursuing justice-centred transitions through green developmentalism and energy justice. This study contributes to the debate on justice in the global energy transition by highlighting alternative transition pathways in the global South that challenge green extractivism through sovereign industrial development and energy justice.

## KEYWORDS

Green hydrogen; energy transition; green extractivism; (neo-)Gramscianism; industrial policy; energy justice

## MOTS-CLÉS

Hydrogène vert ; transition énergétique ; extractivisme vert ; (néo-)Gramscianisme ; politique industrielle ; justice énergétique

## PALAVRAS-CHAVE

Hidrogênio verde; transição energética; extrativismo verde; (neo-)Gramscianismo; política industrial; justiça energética

## Entre extractivisme vert et justice énergétique : stratégies concurrentes pour la transition hydrogène de l'Afrique du Sud dans le contexte de la crise climatique

## RÉSUMÉ

La course mondiale à l'hydrogène vert n'est pas seulement une question de décarbonisation, mais aussi de pouvoir et de profit. En examinant la formation d'un projet politique autour de l'émergence d'une économie de l'hydrogène en Afrique du Sud, nous montrons que la transition vers l'hydrogène est fondamentalement contestée. En nous appuyant sur la théorie de l'hégémonie (néo-)gramscienne et sur l'analyse matérialiste historique des politiques, nous délimitons quatre initiatives concurrentes dans le débat politique relatif à l'hydrogène : l'extractivisme vert, le développementalisme vert, le fossilisme et la justice énergétique. Nos conclusions soulignent la prédominance de l'extractivisme vert, qui donne la priorité à l'exportation d'hydrogène vert à destination de l'Europe et

reproduit des schémas de néocolonialisme et d'échange écologique inégal. Les contestations proviennent à la fois des forces réactionnaires qui s'accrochent aux combustibles fossiles et des initiatives poursuivant des transitions axées sur la justice par le biais d'un développement vert et d'une justice énergétique. Cette étude contribue au débat relatif à la justice dans la transition énergétique mondiale en mettant en évidence des voies de transition alternatives dans les pays du Sud qui remettent en question l'extractivisme vert par le biais d'un développement industriel souverain et de la justice énergétique.

### **Entre o extrativismo verde e a justiça energética: estratégias concorrentes na transição para o hidrogénio na África do Sul no contexto da crise climática**

#### **RESUMO**

A corrida global ao hidrogénio verde não tem apenas a ver com a descarbonização, mas também com a energia e o lucro. Analisando a formação de um projeto político em torno de uma economia emergente de hidrogénio na África do Sul, este artigo mostra que as transições de hidrogénio são fundamentalmente processos contestados. Empregando a teoria da hegemonia (neo)gramsciana e a análise política materialista histórica, expõem-se quatro iniciativas concorrentes no debate político: extrativismo verde, desenvolvimentismo verde, fossilismo e justiça energética. Os resultados indicam o domínio do extrativismo verde, que prioriza a exportação de hidrogénio verde para a Europa e reproduz padrões de neocolonialismo e trocas ecológicas desiguais. As contestações surgem tanto de forças reacionárias agarradas aos combustíveis fósseis como de iniciativas que procuram transições centradas na justiça através do desenvolvimentismo verde e da justiça energética. Este estudo contribui para o debate sobre a justiça na transição energética global, destacando caminhos alternativos de transição no Sul global que desafiam o extrativismo verde através do desenvolvimento industrial soberano e da justiça energética.

### **Introduction**

Green and blue hydrogen are now being discussed as key solutions to the climate crisis via decarbonisation, energy security and socio-economic development. Countries in the global South rich in wind, solar and fossil gas resources are positioning themselves as future producers and exporters in the global hydrogen market. This development has sparked hopes for an African hydrogen revolution, aligning with the visionary foresight of Pan-African leader Cheikh Anta Diop, who in 1985 envisaged the continent's potential to spearhead a green hydrogen revolution (Gabor and Sylla 2023, 5). However, in the context of uneven development and unequal ecological exchange (Hickel et al. 2022), African countries will not inevitably benefit from the global hydrogen rush. The outcome is instead contingent on power struggles in the political economy of the global hydrogen transition.

Existing literature on hydrogen primarily focuses on technical feasibility, storage and transport solutions, industrial applications, economic cost analyses, life cycle assessments and environmental impact analyses (e.g. Dawood, Anda, and Shafiullah 2020; Howarth and Jacobson 2021). Only recently has social science research begun to explore the topic, focusing on policy initiatives, regulatory frameworks, public perceptions, social acceptance and geopolitical implications (Vallejos-Romero et al. 2023). Only a few works have adopted critical perspectives (Kalt and Tunn 2022), examining hydrogen-related injustices (Müller, Tunn, and Kalt 2022), green colonialism in the EU's hydrogen strategy (Claar 2022), neo-colonial patterns in North Africa's emerging hydrogen sectors (Hamouchene 2022), and financial subordination in Namibia's hydrogen partnerships (Gabor and Sylla 2023). Drawing on a (neo-)Gramscian perspective and historical materialist policy analysis (HMPA), in this article we analyse power struggles over South Africa's hydrogen future against the backdrop of extractivist, neocolonial and developmentalist patterns in the global energy transition (Alkhalili, Muna, and Yahia 2023; Dunlap 2018; Haag 2022). This analysis contributes to critical research on the global energy transition by shedding light on the power dynamics that lead to green extractivism, defined as 'a variation of extractivism, in which resource appropriation and extraction is materialized through climate change policy guidelines and legitimized by green discourses' (Bruna 2021, 163).

With South Africa in the spotlight of the global hydrogen rush due to its abundant solar and wind resources, the country presents an interesting case study for examining hydrogen developments in the global South. The trajectory of South Africa's hydrogen transition is emergent, uncertain and contested. While prioritising the direct export of green hydrogen may result in an extractivist hydrogen sector and exacerbate unequal ecological exchange, South Africa's strong industrial base and existing technologies offer the potential to avoid the resource trap by building sovereign green industrial capacity throughout the hydrogen value chain. Which transition pathway will be chosen depends on the outcomes of power struggles and has far-reaching political-economic and socio-economic consequences. We examine the actors, interests and strategies behind different transition pathways, analyse how struggles over the nation's hydrogen future are beginning to play out, and identify the potential and barriers for more equitable and democratic energy transitions.

We first develop the concept of political initiatives, understood as competing alliances between actors and their interests, narratives and strategies aimed at implementing a specific political-economic model of a hydrogen economy. After introducing the context of South Africa's emerging hydrogen economy, the study identifies four competing political initiatives: the *green extractivist initiative* seeks to transfer energy resources to the global North, prioritising export-oriented infrastructure and projects; the *green developmentalist initiative* aims to capture a larger share of economic value creation for the capitalist economy in South Africa through creating industrial linkages and establishing new green hydrogen value chains; the *fossilist initiative* aims to prolong South Africa's fossil fuel-based accumulation model; while the *socio-ecological initiative* addresses socio-environmental safeguards and demands energy justice.

## Hegemony theory and historical materialist policy analysis

Hegemony theory shows how policies presented as 'solutions' to climate or energy crises are related to power relations and conflicts between social forces, their interests, and ideas which

are embedded in societal structures. Social forces compete to generalise their worldviews and problem perceptions and push through their preferred political responses to societal crises. The power relations involved significantly shape the fundamental orientation and concrete implementation of political decisions, especially when the more dominant social forces can organise acceptance or approval by others by granting material concessions, establishing alliances or partially integrating the interests of competing social forces. If such a generalisation of interests succeeds, this is hegemony (Gramsci 2012, 101–118, 771–783, 1567, 1584).

To capture struggles for hegemony in the field of energy policy, we draw on the (neo-) Gramscian concept of the *political project*, defined as an aggregation of goals, practices, strategies and policies presented as solutions to specific problems or crises (Bieling and Steinhilber 2000, 34–38). We conceive the transition to a South African hydrogen economy as a political project in response to climate, energy and economic crises. While there is almost unanimous consensus on the desirability of such an economy, a closer look reveals struggles between competing social forces that attempt to shape the emerging hydrogen sector according to their interests. To analyse these struggles, we draw on the concept of *political initiatives* – alliances between actors and their interests, narratives and strategies that are competing to shape the political project of South Africa's hydrogen transition (Bieling and Steinhilber 2000, 36). (Neo-)Gramscian theory stresses that political projects and political initiatives cannot be detached from their context, such as the capitalist mode of production and its concrete spatio-temporal form, institutions, modes of regulation, the global division of labour and neocolonial structures (Bieling and Steinhilber 2000; Cox 1993, 56f.). These contextual conditions both shape and are shaped by contestations about political projects.

To operationalise the analysis of how political initiatives struggle over the political project of South Africa's hydrogen transition, we draw on HMPA. The approach focuses on how different groups of actors compete to influence policy-making in the context of fundamental political-economic formations, societal tensions and crisis tendencies (Schneider et al. 2023, 119; Brand et al. 2022, 179f., 285). Following HMPA's research strategy (Brand et al. 2022, 288), we start by situating the political project of South Africa's hydrogen transition within the political-economic structures of global capitalism, South Africa's minerals-energy complex (MEC), and the country's energy policy landscape. We then conduct a systematic analysis of competing political initiatives using material obtained from 20 expert interviews conducted in South Africa in November 2022,<sup>1</sup> participant observation at the 2022 Green Hydrogen Summit in Cape Town, and key documents from relevant stakeholders, including policy documents, reports, press statements and public speeches. Through a qualitative content analysis (Schreier 2012), we identify four political initiatives and analyse these in terms of actors, problem perceptions, goals, strategies, alliances, discourses and narratives, and conflicts and tensions. Finally, we explore how the power dynamics among the competing political initiatives influence the trajectory of the political project of South Africa's hydrogen transition.

## **The emerging global hydrogen market and South Africa's energy landscape**

While hydrogen is a colourless gas, colour labels are commonly attached to indicate production methods. 'Green hydrogen', generated through electrolysis utilising solar and

wind power, stands in contrast to ‘grey hydrogen’, derived from fossil gas. ‘Blue hydrogen’ is also produced from fossil gas but includes carbon capture and storage. Blue hydrogen is often misleadingly labelled low-carbon or climate-neutral hydrogen, even though research indicates that due to methane leakages its global warming potential is even greater than burning gas and coal directly (Howarth and Jacobson 2021).

The global push for green and blue hydrogen arises amid multiple climate, energy, economic and geopolitical crises. The hegemonial strategies of the EU and Germany respond to the climate crisis by pushing hydrogen as integral for reaching climate neutrality, to the energy crisis by securing access to additional energy supplies, to geopolitical crises by diversifying and securing energy imports, and to economic crises by creating new investment opportunities for over-accumulated capital. The emergence of green hydrogen as a new commodity frontier (Moore 2000) creates a global market that engulfs new territories and organises the transfer of energy resources from peripheral and semi-peripheral regions to the imperial centres.

A global hydrogen market already exists. However, 99% of current hydrogen production relies on fossil fuels (IEA 2022b). A low-carbon hydrogen market is anticipated to emerge by 2030, supplying up to 10 megatons (Mt) of blue hydrogen and 14 Mt of green hydrogen, which equates to global electrolyser capacities comparable to Latin America’s total renewable energy capacity (IEA 2022a, 5). The global hydrogen economy is envisioned as a transnationally and regionally networked, centralised energy system that is highly technology- and capital-intensive and requires extensive resources, including land, energy, water, and the development of new pipeline, port and shipping infrastructure. Multinational gas, energy and industrial corporations are feverishly advocating for a global hydrogen economy, and major governments, including the EU, Germany, Japan, China, USA and Australia, have released hydrogen strategies. In the context of Russia’s war on Ukraine, the EU has increased its hydrogen targets, with the REPowerEU plan now aiming for domestic production of 10 Mt of green and blue hydrogen and an equal volume of imports by 2030. The national hydrogen strategy of Germany, the EU’s largest hydrogen consumer, emphasises imports even more strongly and strives for global leadership in hydrogen technologies. The German government has identified South Africa as one of the key target economies for this endeavour.

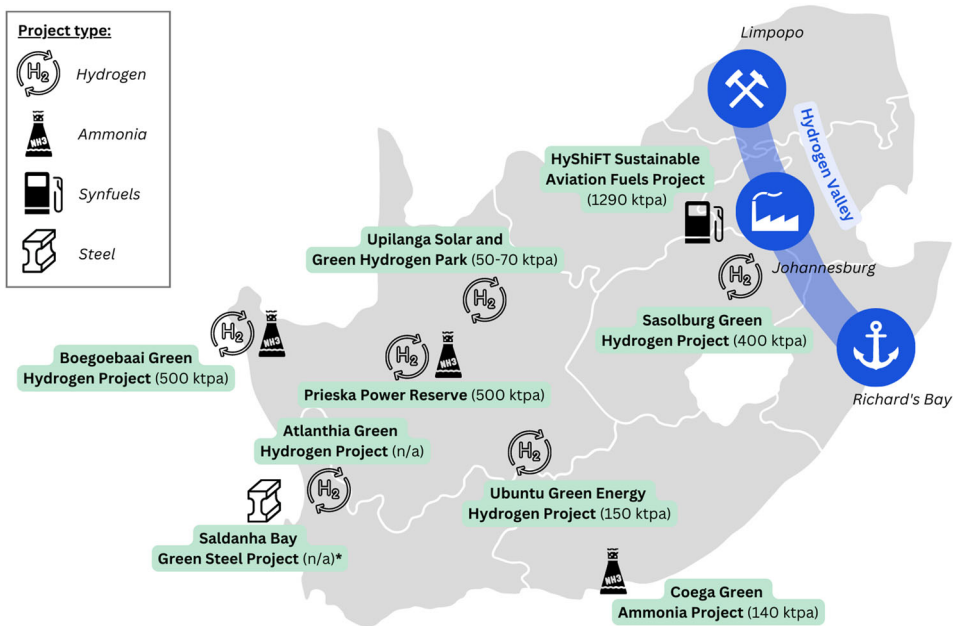
In South Africa, coal dominates the country’s energy sector due to the MEC, an accumulation regime of state-sponsored fossil capitalism established during the apartheid era. Centred around the state-owned electricity utility Eskom and the formerly state-owned petrochemical giant Sasol, the MEC ensures inexpensive energy to mining and other industries (Fine and Rustomjee 1996). The South African state is strongly aligned with the interests of domestic and foreign energy, industry and mining capital, which has persisted even after apartheid (Baker, Newell, and Philips 2014). This accumulation regime is currently in crisis as South Africa struggles with unreliable power supply, frequent load shedding,<sup>2</sup> escalating electricity prices, and financial mismanagement at Eskom. Rising electricity tariffs and load reduction<sup>3</sup> exacerbate energy poverty and have a disproportionate impact on impoverished households and racialised communities. As one of the largest carbon emitters, South Africa faces increasing pressure to phase out coal, with the government planning to reduce coal’s contribution to the energy mix from 91.5% to 59% by 2030, and to reach climate neutrality by 2050 (DMRE 2019). The MEC’s inability to deliver reliable, low-cost and low-carbon energy

weakens its legitimacy as it is increasingly difficult to portray its interests as the general interests of capital and society (Baker, Newell, and Philips 2014). In response, incremental changes have taken place with private investments into renewable energy, supported by the government's Renewable Independent Power Producer Programme, the liberalisation of the power sector with the unbundling of Eskom, and initiatives for a just transition (Hanto et al. 2022; Müller and Claar 2021). Consequently, the contours of a green capitalist hegemony project, led by transnational and finance capital, have become discernible. However, the MEC continues to dominate South Africa's energy policy and its path dependencies, and the power of incumbents provides strong resistance to a green capitalist transition (Baker 2015). In recent years, hydrogen has emerged as a new political project at the nexus of energy, industrial and minerals policy in South Africa, one that may come to play a central role in the contested and fragmented transition to a green capitalist accumulation regime.

South Africa has very favourable conditions for a green hydrogen sector. These include abundant solar and wind resources that allow for low-cost green hydrogen production at 1.8–2.0 US\$/kg (Roos and Wright 2021, 6), potential industrial beneficiaries in platinum mining, petrochemicals, transport and steel, and Sasol's existing Fischer-Tropsch technology and facilities for synthetic fuels production which already produce grey hydrogen. Early initiatives were spearheaded by the platinum industry and the Department of Science and Innovation (DSI), that in 2007 initiated the research and development strategy Hydrogen South Africa. Recently, the focus on green hydrogen has intensified and a broader vision has been articulated which attempts to capture 4% of the global green hydrogen market share (Salma and Tsafos 2022). The DSI launched the Hydrogen Society Roadmap in 2021 that focuses on both blue and green hydrogen, targets 15 GW of electrolyser capacity by 2040, and intends to tap into emerging export markets. The roadmap also focuses on domestic applications of green hydrogen, domestic linkages with existing industries, such as platinum, steel and fertiliser, and developing new industries, such as electrolyser and fuel cell production. Prominent projects include a Hydrogen Valley connecting the platinum belt in Limpopo to the industrial Gauteng area and the coastal ports in Richards Bay (DSI 2021b). In addition, there are plans for various hydrogen projects, such as in the Northern Cape with Sasol's export-oriented Boegoebaai green ammonia project and in Gauteng with its HyShiFT project for synthetic aviation fuels production for export to Germany (Figure 1). The forthcoming Green Hydrogen Commercialisation Strategy, drafted by the Department of Trade, Industry and Competition (DTIC), will provide an integrative policy framework that replaces the Hydrogen Society Roadmap as South Africa's national hydrogen strategy.

### **The political project of South Africa's hydrogen transition**

Within rapidly evolving hydrogen developments, different actors struggle over the shape of the political project of South Africa's hydrogen transition. The competing initiatives envisage different hydrogen pathways, each related to different long-term impacts, ranging from the reproduction of neocolonial patterns and global inequalities to potentially challenging established power structures and contributing to energy justice and a just transition. We systematise four political initiatives – the *green extractivist*, *green developmentalist*, *fossilist* and *socio-ecological*.



**Figure 1.** Map of the Hydrogen Valley and planned green hydrogen projects designated as Strategic Integrated Projects (SIPs) by the South African government; hydrogen production capacity by 2050 in parentheses.

Source: data from DTIC 2022, IEA 2022c.

### **The green extractivist initiative**

The green extractivist initiative focuses on green hydrogen and strives to develop South Africa into an export economy for supplying Europe with green hydrogen and related low value-added products, such as green ammonia (i2; i3; South African Presidency 2022). The initiative is driven by both domestic and foreign governments and businesses that – albeit with different motivations – share an export orientation. International governments and state apparatuses, including European governments and Germany in particular, the European Commission, the European Investment Bank, and other development banks aim to expand the global hydrogen market and develop South Africa into ‘Europe’s main power station’ (i2; i11). Next to securing access to new markets, they support multinational corporations in exporting hydrogen technologies and decarbonising their operations. Other important actors are private international businesses in the energy, industrial, technology and transport sectors, including Enertrag, Thyssen-Krupp, Siemens, Linde, Port of Rotterdam, ArcelorMittal and Enel (i1; i2; i5; i7; i10; i11). These companies share interests in securing cheap access to green commodities, expanding into the South African market and profiting from massive public subsidies. While international players wield strong influence, the South African government – especially the Presidency, key ministries such as the DTIC, and local development agencies and finance institutions – as well as South African parastatal and private companies, such as Sasol, Mahlako and African Rainbow Energy and Power, also play a crucial role, aiming to attract foreign investments and gain export revenues (i2; i9).

The green extractivist initiative pursues three strategies: establishing international hydrogen-related governance arenas and partnerships; facilitating business–government dialogue; and reducing economic risks in the South African hydrogen market. The first strategy involves establishing and reshaping international governance platforms to facilitate collaboration between international and South African governments and businesses to secure political and financial support (i10; i11; N1). These platforms include high-level summits, energy policy forums, international climate conferences and international partnerships, such as the energy partnership between South Africa and Germany, which facilitates inter-ministerial dialogue on establishing bilateral green hydrogen trade (i10). This strategy achieves several objectives. First, the South African government signals its readiness to become a global exporter of hydrogen by ‘promoting South Africa as a green hydrogen investment destination of choice’ (N1) and ‘essentially trying to attract the interest [of investors] into South Africa’ (i3). Second, these platforms allow international stakeholders to enter South Africa to participate in market development and influence policy decisions, such as the terms for funding or standard-setting for hydrogen export products. Third, the strategy secures international public and private financing from the German development bank (KfW), the European Investment Bank, through the Just Energy Transition Partnership between the G7 and South Africa, as well as from a US\$1 billion green hydrogen fund set up by South Africa, the Netherlands and Denmark. International funding comes with strings attached. It is oriented towards donor interests in producing hydrogen for export and mainly consists of interest-bearing loans instead of grants (i2; South African Presidency 2022). For instance, almost half of the green hydrogen funding allocated in the South African government’s Just Energy Transition Investment Plan is devoted to building port infrastructure and a third is assigned to financing the export commodities green hydrogen and green ammonia (South African Presidency 2022, 97).

The second strategy pursues business–government dialogue through which private corporations can lobby for business-friendly regulatory and investment environments (i3; i11). In addition, state actors set up public–private partnerships (DSI 2021a) and facilitate ‘match-making’ between private businesses (i10; i11). For instance, the German development agency through its H2.SA programme facilitates private sector involvement by coordinating project developers, banks, off-takers and South African ministries (i10). These dialogue-oriented strategies allow private corporations to communicate their interests and shape an investment-friendly regulatory framework.

The third strategy pursues policy, regulatory and fiscal measures that facilitate private investment and reduce associated economic risks. To this end, the South African government aims to create an enabling policy environment through national hydrogen policy frameworks (DSI 2021a; DTIC 2022), as well as a business-friendly regulatory environment through liberalisation and privatisation in the energy sector, the creation of special economic zones and tax reliefs, and fast tracks for so-called Strategic Integrated Projects that circumvent environmental impact assessments and public consultations (i2; i11; N1; DSI 2021a; DTIC 2022). Moreover, the government contributes to building the infrastructure needed for producing and transporting hydrogen, such as electrical grids, roads and ports (i7; DSI 2021a; South African Presidency 2022), and sets aside publicly owned land for hydrogen projects – often against the interests of local communities (i7). A key part of reducing economic risks is state actors pursuing fiscal de-risking strategies



by providing access to funding for international buyers and sellers, and establishing investment guarantees, pricing subsidies and purchase agreements (i12; i18; DSI 2021a, 87ff.). For example, the German government de-risks projects through its key finance instrument, H2Global, which pays the difference between demand and supply price (i10; i12; i19).

The three strategies follow an extractivist logic, enabling international governments and businesses to inscribe their interests, centred around gaining access to new energy resources and markets, into the South African hydrogen economy. Material concessions, such as granting access to finance, contribute to this, as does the coercion embedded in the uneven structures of global trade and finance. This is accompanied by a rhetoric of economic opportunities for South Africa by ‘providing new export potential’ (South African Presidency 2022, 90; also i2; i3; N1). While the South African government hopes to benefit from attracting international investment and strengthening its competitiveness (i2; i3; N1; South African Presidency 2022), the green extractivist initiative is reproducing neocolonial patterns with the ‘re-primarisation’ of the economy towards low value-added products, an unequal division of labour, and communities being dispossessed of their land.

### ***The green developmentalist initiative***

Instead of focusing on export, the green developmentalist initiative aims to create and capture more economic value in South Africa, using green hydrogen domestically for decarbonisation and establishing local industries in higher segments of the hydrogen value chain (i1; i3; i4). If successful, this would allow for a just transition centred around job creation and socio-economic benefits (i17; i19). In contrast to green extractivism, the green developmentalist initiative pursues green industrial policy to prevent ‘selling off our resources’ (i9) and avoid ‘falling victim to the kind of extractive approach to industrial policy in the past’ (i1). The initiative is driven by domestic forces, including the mining industry that explores new markets for platinum and automotive industries, as well as steel and chemicals industries that seek to decarbonise their operations and build new green industrial value chains to maintain access to international markets. It is supported by research and development (R&D) fostered by the DSI, as well as industrial policy developed by the DTIC and the state-owned Industrial Development Corporation.

The green developmentalist initiative recognises that South Africa’s carbon-intensive industry faces significant challenges due to shifts in global trade rules and global market demand (i3; i8; i9; i10; N1). Carbon-intensive exports, such as iron, steel and chemicals, risk losing competitiveness due to carbon tariffs imposed by the EU’s Carbon Border Adjustment Mechanism (i8; i10; N1). South Africa’s automotive sector anticipates diminishing demand as the UK and EU, its two primary export markets, plan to phase out internal combustion engine vehicles by 2030 and 2035, respectively in response to climate fears (i1; i13; N1). This will also adversely affect South Africa’s platinum industry, which heavily depends on the global automotive sector’s demand for platinum-based catalysts for combustion engines (i3; i9; i17; i20). Recognising the ‘high cost of doing nothing’ (i10) for South African industry, one of the green developmentalist initiative’s main objectives is to protect existing industries (i1; i10; i15). This should be done by

using green hydrogen to decarbonise domestic industries (i1; i3; DSI 2021a; DTIC 2022), producing green products that will maintain access to international markets (i1; i4; i9; DSI 2021a; DTIC 2022), and offsetting demand losses in platinum mining by exploring new market opportunities in the hydrogen economy (i19; i20; DSI 2021a, 2021b; DTIC 2022). A second objective is to establish new manufacturing industries and value chains in the green hydrogen economy. This includes the manufacture of fuel cells, electrolyzers and components for solar and wind farms, the development of a green fertiliser industry, and the promotion of further platinum refining to increase its economic value (i2; i3; i6; i12; N1; DSI 2021a). This is seen as achievable because South Africa possesses several economic advantages, such as high solar and wind potential, a strong industrial base, technological advantages with Sasol's proprietary Fischer-Tropsch technology, and the world's largest reserves of platinum, a critical mineral for hydrogen-based fuel cells and electrolyzers (i1; i3; i9; i17).

The green developmentalist initiative pursues three strategies – research and development (R&D), cluster building, and piggybacking – to achieve these objectives. The platinum industry was a major early driver of R&D in hydrogen-related products, searching for new platinum markets (i3; i12; i20). In 2008, the DSI (formerly Department of Science and Technology) launched its Hydrogen South Africa (HySA) research programme to advance R&D into hydrogen fuel-cell technologies in collaboration with platinum companies, several universities, and state-run research centres such as the Centre for Scientific and Industrial Research. The R&D strategy positioned South Africa 'at the forefront of innovation, technology and expertise' (i2) and created technical expertise, commercialised new products and increased competitiveness for local hydrogen companies by developing platinum-based catalysts for fuel cells, designing fuel cell-powered vehicles, and initiating hydrogen pilot projects (i2; i3; DSI 2021a).

A second strategy focuses on establishing the Hydrogen Valley, an industrial cluster that spans the platinum mines in Limpopo, industrial areas in Gauteng, and the port in Richards Bay (DSI 2021b; i10; N1). Following up on HySA, in 2021 the DSI published a feasibility study for the Hydrogen Valley together with its corporate partners Anglo American, Engie and Bambile Energy (DSI 2021b). Shortly after, the DSI launched its hydrogen roadmap that focused on the Hydrogen Valley as 'a catalytic project' intended to 'kickstart the hydrogen economy in South Africa' (DSI 2021a, K). Funds for several pilot projects are provided by South Africa's state-owned public finance institution, the Industrial Development Corporation (i1; i12). Seeking to attract additional private finance into the Hydrogen Valley, the cluster strategy aims to reduce off-take risks with readily available industrial customers and cost savings from shared infrastructure and economies of scale (i12; DSI 2021b).

Lastly, a piggyback strategy seeks to build green industries on the foundation of an export-oriented hydrogen sector (i3; i4; i12; DTIC 2022). This approach has become more relevant due to the COVID-19-induced economic recession, South Africa's increasing debt and difficulties in accessing capital markets, and major economies ramping up their hydrogen import targets. Subsequently, proponents of the green developmentalist initiative are aligning with the green extractivist initiative to shift their focus towards export and global finance, instead of a limited domestic market without the ability to pay price premiums for green hydrogen (i1; i18; DTIC 2022; Sasol 2021). As one interviewee commented, 'we don't have strong business cases [for the domestic market], we

don't have an ability to pay back' (i1). From this follows a two-step approach: first prioritising export-oriented projects to tap into available funding and demand; then catering to the domestic market and developing local value chains (i3). For example, Sasol and steelmaker ArcelorMittal are seeking initial investment for producing green iron for export to Europe, where it would be manufactured into green steel, before potentially producing green steel directly in South Africa at a later stage (i15; i19). This strategic shift is reflected in South Africa's national hydrogen strategy, the Green Hydrogen Commercialisation Strategy.

With these three strategies, the green developmentalist initiative aims to use green hydrogen for domestic purposes and capture more economic value in South Africa. As such, it challenges the green extractivist initiative and provides an alternative development model that could position South Africa as a global green industry leader, instead of merely an exporter of energy resources. It remains to be seen if the strategy of building green industries on the back of an export-oriented hydrogen sector will succeed due to the path dependencies of such an extractivist approach.

### ***The fossilist initiative***

The fossilist initiative aims to preserve the status quo of the fossil fuel-based energy system, prioritising grey and blue hydrogen over green hydrogen. The heavily state-sponsored private petrochemical company Sasol – a major player in the initiative, and producer and consumer of coal, oil and gas – faces major risks from the transition away from fossil fuels (i1; i2; i4; i19). Although Sasol also embraces green hydrogen, the corporation admits that current production costs – presently five to eight times higher than those of fossil hydrogen – prohibit completely switching to green hydrogen in the near term (i9; Sasol 2021, 12). Facing pressures to transform its coal-based fuel and hydrogen production amid the gradual phase-out of coal in South Africa, Sasol is primarily turning to fossil gas coupled with carbon capture, utilisation and storage (CCUS) technologies to prevent stranded assets (i7; i15; i17; i19). The corporation has allies in the MEC, with the Department of Minerals and Energy Resources (DMRE) clearly prioritising fossil-based hydrogen. Its minister, Gwede Mantashe, refused to sign the US\$1 billion green hydrogen deal with the Netherlands and Denmark in June 2023 and staunchly defends fossil fuels with anti-imperialist rhetoric (i1; i2): 'We don't jump, we don't swing like a pendulum from one extreme to the other' (Steyn 2021). Trade unions face a dilemma, with concerns about deindustrialisation and job losses meaning that they often adopt defensive stances when fossil fuel industries come under transition pressures (i2; i8; i13).

The fossilist initiative's primary strategy is protecting existing assets and maximising business-as-usual while expanding fossil fuel infrastructure (i1; i2; i6; i19). A key element is switching from coal to fossil gas, portraying it as a 'cleaner alternative feedstock' and a 'key transition fuel'. This is a central pillar of Sasol's decarbonisation strategy (Sasol 2022a, 4, 22; i1; i3; i16). Sasol executive Priscillah Mabelane asserts: '[W]e believe gas will play a pivotal role for a much longer period into the future' (Thukwana 2023). To secure gas supplies, Sasol aims to expand its controversial gas production in Mozambique, explore fracking opportunities in South Africa, and build new gas pipelines and terminals (Sasol 2022a; i14). By 2030, Sasol aims for

an increased fossil gas intake of 40 to 60 PJ/a,<sup>4</sup> reducing its coal consumption by 25% (Sasol 2022a, 3).

A second focus of the fossilist strategy is on blue hydrogen, involving R&D into CCUS and direct air capture technologies. While these are currently deemed too expensive and unproven in South Africa (Sasol 2022a), the fossilist initiative sees potential in using CCUS to produce blue hydrogen (i1; i15; i17; i19). The Hydrogen Society Roadmap envisions blue hydrogen for a medium-term period in the ‘transition from grey to blue to green hydrogen’ (DSI 2021a: 63), including measures such as pilot projects for CCUS on a national scale. In addition, Sasol and the DMRE are jointly implementing a World Bank-funded pilot CCUS project adjacent to Sasol’s Secunda plant, exploring the possibility of storing CO<sub>2</sub> in old mines (i9; DMRE 2021).

A third element of the fossilist strategy is to delay a fast coal phase-out by offering captured CO<sub>2</sub> from coal combustion as feedstock for hydrogen-based fuels and chemicals (i2; i4; i6). For instance, the CoalCO<sub>2</sub>-X project – a collaboration of the DSI, German Federal Ministry of Education and Research, and South African company PPC Cement – is experimenting with capturing CO<sub>2</sub> from coal-fired boilers for use as feedstock for green ammonia production (DSI 2021a, 72). The fossilist initiative therefore attempts to position ‘coal as a bridge technology’ in the hydrogen economy (Csepei n.d.).

As one interviewee remarked, ‘the colour of hydrogen is ambiguous territory in South Africa’s policy landscape’ (i1). Although the fossilist initiative is not very visible in the public debate around green hydrogen, gas and petrochemical companies orient their corporate strategies towards grey and blue hydrogen (i1; i15; i17; i19). Behind closed doors, Sasol urges the South African government to weaken emission standards, the carbon tax and the climate change bill (i9; i19), and lobbies the EU to relax its green hydrogen criteria, which would permit the partial use of fossil fuels for green hydrogen production and fossil CO<sub>2</sub> for green fuel and chemicals production (Sasol 2022b; i17). The fossilist initiative pursues a dual strategy: it rhetorically embraces green hydrogen while simultaneously prolonging a fossil fuel-based development model, thus protecting the entrenched power of fossil fuel companies within the MEC. As one interviewee commented, ‘[Sasol] will do what they can to continue with some levels of fossil fuels; in their DNA is fossil fuels’ (i1). This strategy has been linked to greenwashing: ‘[Sasol] can argue that they use grey hydrogen for fuels, making it a little bit more circular; making it a little bit more renewable with green hydrogen; but some people also argue that this is greenwashing’ (i9).

### ***The socio-ecological initiative***

In response to the hydrogen rush, a socio-ecological initiative is taking shape among marginalised groups in society, including environmental NGOs, environmental justice organisations, community-based organisations, climate and energy justice activists, and climate-conscious progressive trade unionists. Though different approaches co-exist, the common goal is to counter the extractivist logic of an export-oriented hydrogen economy and prevent negative impacts on communities.

In the context of the severe energy crisis, energy justice activists primarily critique that green hydrogen creates electricity distribution conflicts if energy resources are diverted

away from the people. This would lead to a two-tier energy system, in which stable, low-cost and clean electricity is made available for green hydrogen exports, while the majority of South Africans do not benefit, instead relying on an unstable, expensive and polluting national power system (i2; i6; i7; i16). This is seen to create ‘islands of [energy] richness in a sea of [energy] poverty’ (i19), undermining social cohesion: ‘If I’m sitting in a township knowing that Germany is buying renewable energy from South Africa at [US]\$3 cents a kilowatt hour and I’m paying [US]\$15 cents for coal ... you tell me how you would feel’ (i5).

Another key critique involves environmental injustices associated with the potential negative socio-ecological impacts of hydrogen projects, such as water scarcity and restricted water access, destruction of marine ecosystems through port infrastructure and desalination facilities, environmental pollution from platinum mining for hydrogen technologies, and the lack of binding socio-environmental standards (i2; i4; i14; i20). As the racialised history of land dispossessions during apartheid reverberates in present-day South Africa, large-scale land acquisitions for solar and wind farms may create new land conflicts (i4; i6; i10; i14). Alleged employment benefits are uncertain as jobs available to South Africans would likely be precarious and short-term construction work (i7; i18). In addition, procedural injustices result from the exclusion of NGOs and trade unions from policy-making and lack of rigorous consultation of affected communities (i4; i8; i14; i20). Activists also speak of ‘a new form of neocolonialism’ (i16), wherein South Africa exports energy resources to Europe and imports technologies from Europe (i6; i7; i20). This would ‘end up greening the European economy and making Europe seem like this healthy, non-polluted place, forgetting the historical pollution that led them to be a first-world country’ (i6). As one environmental justice activist points out, the green extractivist initiative ultimately ‘facilitates a decarbonisation of the Global North, but [inherits] a climate debt and climate financing that is not beneficial to Africans’ (i7).

Within the socio-ecological initiative, different positions co-exist regarding the potential role of green hydrogen in South Africa’s energy transition. Some NGOs and community-based organisations regard green hydrogen as a potentially important technology for the energy transition but see problems with implementation, and therefore are pursuing a reform-oriented approach that limits potential negative socio-ecological impacts (i4; i6). This involves advocacy for transparency and public participation in project and policy development, together with free, prior and informed consent, stringent social and environmental impact assessments, and due diligence procedures (i6; i7; i8; i14). Socio-economic demands include requirements for components to be sourced locally, secure jobs to be created, and export taxes and export revenues distributed to South African communities, ‘making green hydrogen accessible ... not at the expense of certain communities’ (i7). Through capacity building and research, NGOs are developing positions and strategies on green hydrogen, in addition to organising workshops for local communities affected by green hydrogen projects to advocate for their rights and interests (i7; i6; i7; i8; i20). NGOs call on political and corporate leaders and ‘remind the decision-makers, remind the industries, remind the companies: ... there’s actually people there and you actually need to consider them’ (i6). However, due to a lack of formal participation opportunities, strategies to directly influence policy processes are less developed (i2). To strengthen and coordinate activities, networks and platforms have been established, such as the H2Watch network (i8; i14).

Some energy justice activists, who view the green hydrogen debate as diverting attention from the more pressing issue of energy poverty, take a more antagonistic position, attempting to shift the energy transition debate towards energy justice and make hydrogen ‘a second-level discussion’ (i2). Going beyond demands for benefit-sharing, safeguards and participation, such activists demand an end to energy imperialism, advocate for democratised and decentralised renewable energy systems under community ownership, and demand the repayment of climate debt by the global North (i5; i6; i7; i14). Whether green hydrogen should play a role at all is contentious, with some seeing limited potential for green hydrogen, especially together with community-owned renewable energy, while others staunchly oppose green hydrogen as ‘a false solution for an energy transition’ (i7). Strategies include campaigns and protests to shift the debate towards energy justice (i6; i7), lobbying the government and participating in multistakeholder commissions, such as the Presidential Climate Commission (i2), and building broad alliances among NGOs, community-based organisations and trade unions around an energy and climate justice agenda (i6; see also Satgar 2015).

The socio-ecological initiative addresses systemic injustices and strives for a just energy transition. While some lean towards transformative approaches of energy justice and energy democracy, others follow reform-oriented approaches of preventing negative impacts and securing community benefits from hydrogen projects. However, as marginalised groups are currently exploring and solidifying positions and strategies, the approaches and priorities of actors within this initiative oftentimes overlap.

### **Struggles for hegemony in the South African hydrogen transition**

This analysis shows how various political initiatives – green extractivist, green developmentalist, fossilist and socio-ecological – struggle over the political project of establishing a hydrogen economy in South Africa. Each initiative comprises different actors, interests and strategies. The distinctive structure of South Africa’s hydrogen sector emerges from power asymmetries and power struggles among these competing initiatives and is anticipated to materialise in uneven, fragmented and contradictory forms, containing elements from all four initiatives to varying degrees.

Currently, the political project of South Africa’s hydrogen transition reflects a strong export orientation, particularly towards Europe and Germany, thereby incorporating key elements of the green extractivist initiative. Several factors contribute to South Africa prioritising a developmental model of green extractivism, including coercive elements due to Europe’s neo-imperialist pursuit of energy resources, South Africa’s dependence on foreign investment to alleviate debt pressures, and the country’s subordinate position in global financial markets. As hegemony is based not only on coercion but also on consent, concessions and alliances, factors also include promises of economic growth and development, material incentives such as access to funding, and the support of parts of South Africa’s political elite that represent the interests of domestic capital aligned with an export-oriented accumulation regime. Green extractivism manifests as a new type of energy colonialism, as South Africa’s sovereign policy space is shrinking, and the country is relegated to the role of exporter of low value-added products and importer of expensive technologies. This dynamic intensifies unequal ecological

exchange, with resources and profits leaving the country, while South Africa risks growing indebtedness and internalises socio-ecological costs, such as land, water and energy injustices related to hydrogen production (Müller, Tunn, and Kalt 2022). The promise of green hydrogen imports also allows polluting industries in the global North to greenwash their operations while evading calls to move away from a logic of infinite growth and the relocation of energy-intensive industries to sun- and wind-rich regions in the global South (Konzeptwerk Neue Ökonomie 2022).

However, the green extractivist initiative is dominant but not hegemonic and there are splits within the state. On one side, the deeply entrenched state and corporate power in the MEC, through the fossilist initiative, opposes the ecological modernisation of South Africa's economy and seeks to stabilise the fossil capitalist accumulation model. On the other, green extractivism is challenged by the green developmentalist initiative that seeks greater state control over South Africa's hydrogen sector to foster green industrialisation in order to capture more economic value and socio-economic benefits in South Africa. The initiative's relative strength arises from the presence of powerful industrial and mining capital factions, resource, infrastructural and technological advantages, and recent advances in R&D. Its potential, however, is limited due to economic dependencies, global trade rules and macrofinancial frameworks that restrict sovereign industrial development, a lack of regional coordination for "delinking" – that is to say, the refusal to submit national development-strategy to the imperatives of "globalization" (Amin 1987, 435), and the state's constrained ability to discipline private capital. If green developmentalism came to dominate South Africa's hydrogen transition, it could reduce the country's economic, financial and technological dependencies in the global economy and increase the chances for more inclusive development, high-quality jobs and just transition. However, green industrialisation driven by the private sector would lead to economic value generated in South Africa being transferred abroad by multinational corporations or captured by the domestic capitalist class, with most South Africans not benefiting. This scenario underscores the necessity for radical eco-socialist strategies that wrest control of the hydrogen economy from capitalist forces to build a green hydrogen economy under public or social ownership (Treat 2023; Gabor and Sylla 2023, 22–24). Indeed, while some view reducing structural dependencies and achieving economic sovereignty as a pathway towards decolonisation, others contend that green industrialisation reproduces a Western developmental model rooted in colonial modernity (e.g. Kolinjivadi and Kothari 2022).

Lastly, resistance comes from a civil society-led socio-ecological initiative. Some strive to strengthen socio-ecological standards and participatory elements in the hydrogen economy, thus pursuing a mode of inclusive and sustainable development. Others pursue a radical transformative approach rooted in principles of energy justice and energy democracy which could develop into counterhegemonic challenges to the capitalist energy transition in South Africa. This alternative model revolves around decarbonisation and just transition through the socialisation, democratisation and decentralisation of the energy system. Even though, to date, the socio-ecological initiative remains marginalised, it has the potential to mobilise large numbers of people due to the worsening energy crisis. The strengthening of energy and climate justice movements, together with cross-class alliances between climate-conscious trade unions and environmentalists with an awareness of class and race inequalities,

could drive counterhegemonic struggles for energy democracy, climate reparations and a radical just transition.

## Conclusion

The emerging hydrogen transition is contested. In analysing the early stages in the formation of a political project for developing South Africa's hydrogen economy, we identified competing political initiatives, made up of different actors, strategies and narratives that engage in political struggles to shape the emergent hydrogen sector according to their interests. The initiatives differ regarding production method (green, blue or grey hydrogen), developmental model (export- or domestic-oriented, private or public ownership, market-, state- or community-driven), and the distribution of costs and benefits, including economic value, developmental benefits and socio-ecological harms. The dominant initiative seeks to establish an extractivist hydrogen sector oriented towards the export of green hydrogen to Europe, while competing initiatives seek to protect the fossil fuel-based accumulation model, strive for green industrialisation, or struggle for energy justice.

From this case study, we derive several generalisations. First, our findings indicate that under prevailing global power relations, hydrogen transitions lead to green extractivism and enclave economies. Imperial powers aggressively pursue the scramble for energy resources from the global South to secure their geopolitical and geoeconomic positions of power, to protect and greenwash their polluting industries, and to keep countries in the global South in subordinate positions as resource providers. Contrary to dominant narratives of 'green growth', sustainable development and international partnerships on equal terms, this results in the reproduction of neocolonial dependencies, global inequalities, and unequal ecological exchange.

However, our results also show that the hydrogen future is contested and still unwritten. Green extractivism is not the only model for a hydrogen economy; there are many ways in which to imagine, design and engineer emerging hydrogen economies. Which hydrogen futures materialise and which transition pathways are taken depend on the outcomes of power struggles among the various political initiatives.

Finally, our findings indicate the potential for counterhegemonic energy futures. Green developmentalism resists the imperial hydrogen grab and instead relies on industrial policy to establish green industries in the global South. Going a step further, an eco-socialist approach would strengthen public control over the economy. Establishing sovereign green industries under public ownership would prevent profits from being captured by domestic and foreign capitalists and allow for the equitable redistribution of the benefits from the hydrogen economy to the people. In addition, potential for system change also emerges in struggles for energy justice. Bottom-up and people-centred just transitions could pursue rapid and equitable decarbonisation through the democratisation, decentralisation and socialisation of the energy sector. In line with the Manifesto for an Ecosocial Energy Transition of the Peoples of the Global South (2023), we conclude that a just global energy transition would require climate reparations and degrowth (i.e. downsizing of industries) in the global North, resistance to energy imperialism, as well as a new global economic and monetary order. This would unlock pathways for sovereign eco-socialist and decolonial energy transitions in the global South, including the realisation of Diop's vision of an African hydrogen revolution.



## Notes

1. The interviews have been anonymised and are cited in the text as i1,i2, etc. A complete list of interviews is provided at the end of this article.
2. Load shedding – deliberate, temporary power cuts due to insufficient capacity – has plagued South Africa since 2008, with the energy crisis intensifying to cause over 200 days of load shedding in 2022 (Thukwana 2023).
3. Load reduction refers to planned power cuts in times of electricity shortages that disproportionately take place in Black working-class communities.
4. PJ/a stands for petrajoules per annum, a unit to measure the consumption of large amounts of energy.

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## List of interviews

- i1: Energy consultancy, Cape Town, 21 November 2022
- i2: Political foundation, Johannesburg, 16 November 2022
- i3: Energy consultancy, Cape Town, 22 November 2022
- i4: International NGO, Cape Town, 28 November 2022
- i5: Independent energy expert, Johannesburg, 10 November 2022
- i6: Environmental justice NGO, Johannesburg, 14 November 2022
- i7: Environmental justice NGO, Cape Town, 25 November 2022
- i8: Labour activist, Cape Town, 30 November 2022
- i9: Climate think-tank, Johannesburg, 8 November 2022
- i10: International development agency, Johannesburg, 8 November 2022
- i11: Bilateral energy partnership, Johannesburg, 8 November 2022
- i12: Industrial Development Corporation, Johannesburg, 15 November 2022
- i13: Trade union federation, Cape Town, 24 November 2022
- i14: Political Foundation, Cape Town, 23 November 2022
- i15: Researcher, Cape Town, 23 November 2022
- i16: Environmental justice NGO, Johannesburg, 10 November 2022
- i17: Sasol, Johannesburg, 7 November 2022
- i18: Researcher, online, 14 November 2022
- i19: Journalist, online, 14 November 2022
- i20: Environmental justice NGO, Johannesburg, 15 November 2022
- N1: Personal notes from observation at the Green Hydrogen Summit, Cape Town, 28–30 November 2022.