Resource Extraction Cost-benefit Debates in South Africa: Contesting the Environmental Economics of Offshore Gas Extraction

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Abstract

Can cost-benefit analyses change the terms of debate over resource utilisation – in political and civil society and the state, among environmentalists, in the courts, and especially with respect to community, grassroots-feminist, labour and youth activists opposed to extractive industries and in particular, fossil fuels? Since late 2021, hundreds of protests against gas exploration along the coastline of KwaZulu-Natal, the Eastern Cape, Western Cape and Northern Cape, which is the site of debate in this paper, have helped society better consider fossil fuel costs and benefits. There are revealing controversies regarding the application of natural capital accounting (especially the Gaborone Declaration), overdue reforms to Gross Domestic Product national accounts, the 'Social Cost of Carbon' (and related carbon taxation and liability accounting), and intergenerational sustainable development calculations (such as the Hartwick Rule). In some cases, Environmental Impact Assessments allow for such narratives, but more important was a court case in 2022, *Sustaining the Wild Coast et al. versus Shell et al.*, initially won by community critics of offshore gas (although subsequently being considered on appeal). On all these terrains, dangers of technicism and legalism abound, but if conceptualised with care, the merits of a broader, multi-scale *environmental-economic* consideration of the extractive industries could ultimately be foundational in resistance narratives and practices.

Keywords: climate change, full-cost accounting, gas, natural capital, oil, resource depletion

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Introduction

Plans to explore for and exploit gas in South Africa – onshore and offshore – are proliferating, especially with government's May 2023 decision to promote emergency Karpowership supply of Liquefied Natural Gas (LNG) in the ports of Richards Bay, Coega and Saldanha. Supply of the LNG in the coming years could be arranged through offshore South African, Mozambican or Namibian sources, given that there are potentially two hundred billion oil-barrel-equivalents available, largely from Cabo Delgado's Rovuma fields. To be sure, resistance has risen, not only to 'Blood Methane' extraction opposed by the Cabo Delgado guerrilla group Al-Shabaab (Bond 2022a), but – as discussed below – in the form of widespread protests and court challenges to South African offshore gas exploration. This paper considers environmental-economic and climate-justice aspects of that resistance, specifically whether cost-benefit analyses improve our understanding of resource utilisation when it comes to the potential development of a major new energy source, methane gas, which is a greenhouse gas far more potent than carbon dioxide (CO2).

The National Business Initiative's (2022) promotional work on gas highlights both the main projects underway across the region, and the associated infrastructure required (Figure 1). PetroSA (2021) has carved out offshore and onshore blocks for exploration and exploitation, while the Council for Scientific and Industrial Research's (CSIR 2014) gas-pipeline website records 'potential resources of approximately 9 billion barrels oil and 11 billion barrels oil equivalent of gas. In order to realise the potential of the gas reserves in the country and to contribute to the transition to a low carbon economy, the Operation Phakisa Offshore Oil and Gas Lab has set a target of achieving 30 exploration wells in the next 10 years [2014-23]'. However in retrospect, Phakisa's failures are profound, particularly insofar as its 2014 origins were overly influenced by major fossil fuel firms; it was drawn up hurriedly (over six weeks) by McKinsey (at a time the consultancy engaged in alleged acts of fraud, theft and corruption at co-sponsoring agency Transnet, according to the National Prosecuting Authority); and its environmental components were lacking in rigour (in similar ways to the treatment of fossil fuels discussed below) (Bond 2019, Masweneng 2022). Moreover, CSIR scientists promoting gas pipelines fail to acknowledge that the Intergovernmental Panel on Climate Change and nearly all other climate experts agree that a 'transition to a low carbon economy' must *not* include

reliance upon a greenhouse gas, methane, that is *80 times more potent over a twenty-year period* than CO2 (Rathi 2022).

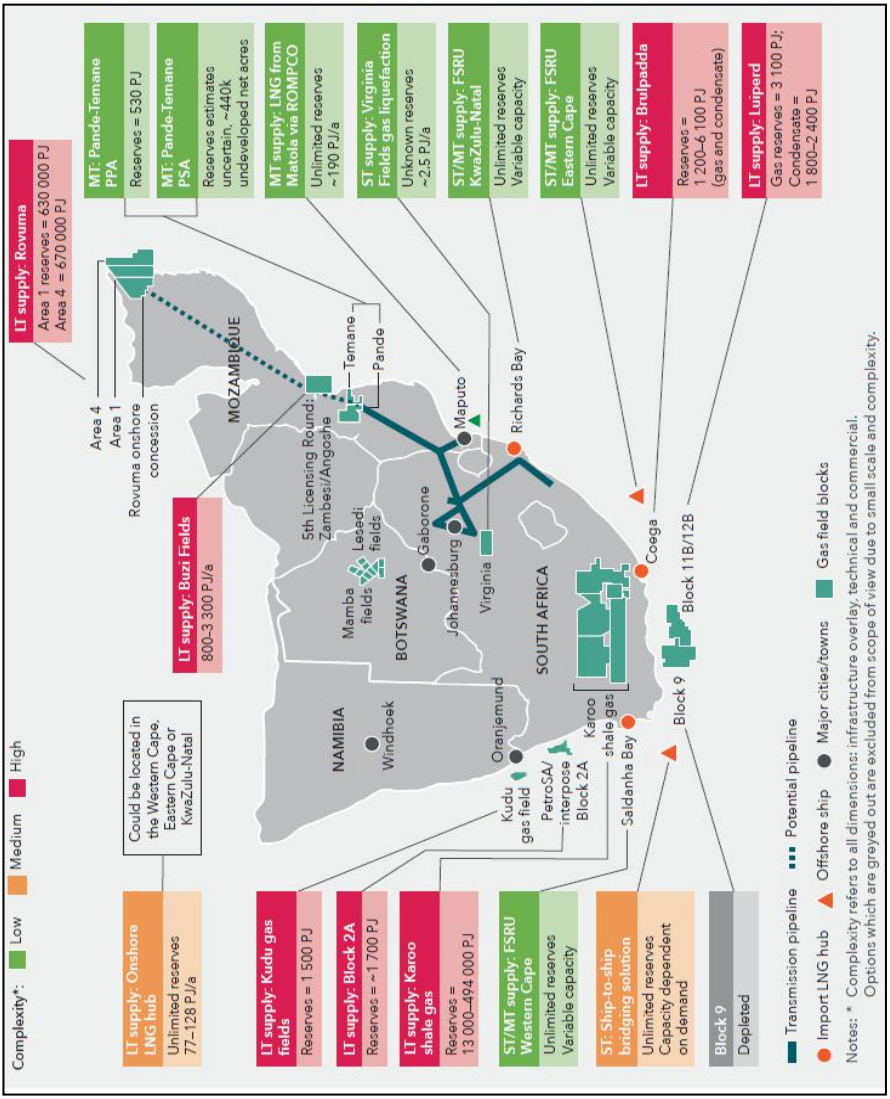

Figure 1: Southern African gas projects including infrastructure
Source: National Business Initiative (2022)

Methane leaks into the atmosphere during the exploration, extraction, processing, transport, storage and combustion stages, creating major short-term warming effects during this most crucial period for global climate policy and concrete emissions-reductions. The United Nations Environment Programme (2021) calls for urgent methane cuts of at least 45 percent by 2030 so as to not breach the 2-degree increase in temperature that would set off runaway climate change. The Western powers initiated a 'Global Methane Pledge' at the Glasgow 2021 United Nations climate summit and since then a majority of the world's countries signed the pledge, albeit not South Africa (Climate and Clean Air Coalition 2021). By pursing gas-fired electricity – whether in Eskom's proposed generators (such as Richards Bay for 3000MW or the Karpowerships' 1200MW) – South Africa's climate-related liabilities will rise. With it, South Africa faces the prospects of climate-related trade and financial sanctions, not only from Western economies. Even Xi Jinping imposed prohibitive sanctions against new Chinese coal-fired power plants on the Belt and Road Initiative in September 2021, thus halting what was originally (in 2018) envisaged to be a 4600MW coal-fired power plant at the Musina-Makhado Special Economic Zone (Cronje 2022).

A full-cost accounting of methane gas as a source of South African energy has not been carried out, but should be addressed as part of a public interest agenda that includes the unfolding climate catastrophe, as well as factors associated with natural capital depletion (i.e., the wasting of non-renewable resources), and the rights of future generations to (non-combustible) hydrocarbons (i.e., using fossil fuels not to burn but instead as material inputs such as lubricants). Opportunities regularly arise to address these concerns with the South African government through Environmental Impact Assessments (EIAs), which are required for fossil fuel and other environmentally-harmful projects (Finkeldey 2023). But firms engaged in offshore gas exploration typically ignore the downstream greenhouse gases generated from their upstream fossil fuel projects – i.e., the resulting 'Scope 3 emissions' associated with fossil fuel combustion and leakage – because they are not yet required disclosures. Nor does the South African government address corporate Scope 3 emissions, notwithstanding an impressive rise in voluntary reporting by major South African firms (Datt *et al.* 2022).

In contrast, the most promising site to date in which to utilise environmental economics and climate-justice narratives to challenge offshore gas and oil drilling by TotalEnergies, Shell, PetroSA and Impact Africa (a local oil firm owned largely by Hosken Consolidated Investments

HCI and chaired by HCI's Johnny Copelyn) was the High Court in Makhanda (Grahamstown). There and in the Cape Town High Court, battles over injunctions against offshore gas exploration were waged between November 2021 and September 2022, with six of the judges' seven decisions in favour of the oil companies' opponents, including in the case reviewed below. The environmental and community plaintiffs, supported by lawyers from the Legal Resources Centre and Richard Spoor and Associates, regularly filed urgent interdicts against seismic blasting, in part because of procedurally-inadequate consultations with affected parties and in part because of the potential for damage to marine life.

However, it was only in April-May 2022, in an appeal process associated with *Sustaining the Wild Coast NPC and Others v Minister of Mineral Resources and Energy and Others*, that two other interrelated factors entered the courts: potential damage to the climatic system if several billion barrel-equivalents of gas and oil were to be drilled and combusted, and the economic costs and benefits of the extraction process. The main gas-exploration defense in the first round of appeals came from Robert Wilde (2022), Impact Africa's Chief Financial Officer, in an affidavit to the Grahamstown High Court. He was later backed, in a second round of affidavits in May 2022, by well-known business consultant and economic commentator Azar Jammine (2022). My own role in the debate came in response, via two affidavits to the High Court requested by the Legal Resources Centre (Bond 2022b). These covered a wide set of economic concerns which are the subject of the pages below, utilising rudimentary discourse analysis of contrasting positions:

- the costs of non-renewable resource depletion (i.e., both a decline in current sovereign wealth as well as the rights of future generations to have access to hydrocarbons);
- the appropriate application of the 'Social Cost of Carbon' (i.e., damages that can be estimated from climate change induced by CO2 and methane emissions);
- the threat of climate sanctions (i.e., tariffs applied at borders) against South African exports due to the high carbon content of their embedded energy;
- the problem of the South African economy's commodity export dependency during notorious boom and bust cycles;

- the potential for 'stranded' methane-gas investment assets (i.e., 'unburnable fossil fuels') on the order of R200 billion for basic methane gas processing;
- the potency of methane in a context in which a Western-led initiative aims to cut emissions of the gas by at least 30 percent this coming decade; and
- the benefits of an alternative strategy for energy based on renewables and energy storage as well as demand-side management of electricity consumption.

The following pages consider these features of a debate that is long overdue in an economy suffering extremely high carbon intensity. South Africa's typical annual emissions of 500 megatonnes of greenhouse gases – used to generate annual Gross Domestic Product (GDP) of close to $420 billion, by 60 million inhabitants – rank the economy amongst the world's five highest major polluters, measured by emissions/GDP/capita (Bond 2023). What has been termed the 'Minerals-Energy Complex' and South Africa's high-carbon economic development leave society and businesses alike in an extremely vulnerable position, at a time politicians and energy system managers are urgently seeking concessional finance to bring down Eskom's debt in exchange for retiring coal-fired power plants early (Bond 2022d). However, in that process, government and Eskom have pleaded the case for a kind of decarbonisation that, in turn, would lead to the electricity generation system's *gassification*, unless reversed by countervailing arguments and pressure, including against the current search for offshore gas.

Applying Theories and Principles of Climate Justice to Offshore Gas Exploration

The broad perspective adopted below, is based on the 'climate justice' traditions of research, advocacy and activism (Klein 2014), which should contribute much more to South Africans' consideration of offshore gas, especially if those traditions are conjoined with 'sustainable development' and environmental-economic analysis. The latter are important when assessing 'natural capital' depletion (Solow 1974, Hartwick 1977, the World Bank 2017 and 2021) and the 'Social Cost of Carbon' (Kikstra *et al.* 2021), as explained below. The climate justice narrative is well developed in a

country that in 2011 hosted the United Nations Climate Summit, but where nevertheless grassroots activists have had to regularly contest the state and capital given the persistence of so much historical racial, gender, class and generational injustice (Bond 2012 and 2022d).

The theoretical roots of climate justice arise from activism: specifically, the environmental justice movement's concern with equity, especially in the wake of 1980s race-based toxic waste exposures and citizen mobilisations (Bullard 1990). The 1990s witnessed climate advocacy by especially Latin American social movements and NGOs (such as Accion Ecologica in Quito) which, by 2004, had assisted the Durban Group for Climate Justice to formulate the first international critique of market strategies within climate policy (Bond 2012). In subsequent years, academics have proceeded to explore procedural, recognition, distributive, compensatory, restitutive and corrective aspects of climate justice (Glasgow Caledonian University Centre for Climate Justice 2019).

But the essence of the theoretical framing is found in the application of core climate-justice principles, often by civil society activists and allied scholars, to six policy areas:

- *Cut greenhouse gases*: adopt sufficiently ambitious and binding global greenhouse gas emissions reduction requirements so as to keep temperatures below 1.5C, ensure the cuts are fairly distributed, impose accountability mechanisms including substantial penalties, and incorporate military, maritime and air-transport sectoral emissions;
- *Transition gracefully*: ensure job-rich 'Just Transitions' from carbon-addicted economies for all affected workers and communities in what, during decarbonization, become radically transformed – and increasingly localized, public- and worker-controlled – systems for energy, transport, tourism, agriculture, urbanization, production, consumption and disposal;
- *Redress social injustices*: empower oppressed constituencies in racial-justice, Indigenous, Global South, feminist, LGBTQI and especially youth communities, and provide formal rights for nature, for climate migrants and refugees, and for future generations;
- *Manage green technology as a global public good*: allow dissemination of climate-friendly technology and localized production

techniques without IP restrictions, commit to universal clean-energy and public transit access, adopt far-reaching agricultural and food-sovereignty reforms, avoid tech-fix 'False Solutions' based on geoengineering fantasies, timber-plantation sequestration, dangerous genetic modification or nuclear energy, and prevent damaging 'extractivist' supplies of Green Economy mineral inputs that wreck local ecosystems;

- *Leave fossil fuels underground*: compel owners or managers of oil, gas and coal reserves to cease new exploration (and most current extraction), simultaneously revalue their 'unburnable carbon' accordingly – to be accounted as 'stranded assets' – and end trillions of dollars' worth of annual government fossil fuel subsidies;
- *Finance planetary and social survival*: apply carbon taxation and pricing judiciously (not with regressive results, such as the taxes that caused revolts by working-class French and Ecuadoreans in 2018-19), dispense with failed emissions trading and offset gimmickry, replace debt-based finance with grants, and honor historical responsibilities for the 'climate debt' that large emitters owe so as to fully cover 1) 'loss and damage' reparations, 2) costs of climate-proofing adaptation and resilience, and 3) compensation for the low-emissions countries' use of carbon space now precluded from being utilized, thanks to high-emitter overuse (Bond 2022d).

The latter two principles are considered in detail in the pages ahead, especially where the narrative moves from a pro-gas analysis relying only upon claims of (narrow) benefits, to the contested concept of sustainable development, to the fusion of climate justice and environmental economics attempted in my own testimony to the Makhanda court (Bond 2022b). At the global scale, these principles are increasingly important for powerful climate advocacy, whether in the policy-making and legislative processes, courts of law or public consciousness-raising.

A dialectical friction between climate justice principles and environmental-economic approaches to cost-benefit analysis can assist in transcending what is sometimes a tempting dismissal of the 'pricing of nature' by environmentalists on the one hand, and on the other, the typical rejection of the overarching requirements of genuine sustainability and social justice by orthodox economists (Bond 2022d).

Impact Africa's Economic Defense of Offshore Gas Exploration

In testimony in favour of Impact's exploration bid, Wilde's (2022) statements included several unsupported claims as to 'unparalleled potential national and regional benefits', such as that 'The [African] continent's experience is that natural resources (especially in the form of crude oil and gas) contribute substantially to sustainable development in many countries… There are countries in the African continent which base an entire economy on petroleum alone'. Second, Wilde (2022) insisted that if the exploratory seismic blasting and extraction did not go ahead, there would be 'extensive loss of potential public revenue from the exploration and extraction of petroleum. Indeed, a unique and significant opportunity would be lost to the fiscus … the potential economic loss to South Africa would be in the order of billions of US dollars'.

Yet as argued in more detail below, Wilde's basic premise – that resource extraction is a source of net wealth – is incorrect, and his analysis is strikingly incomplete. The major problem that sets South Africa apart as the world's most unequal country, is that once diamonds and gold were discovered in Kimberley and in Johannesburg, the society's wealthiest individuals worked closely with multinational corporations to draw these natural resources from the ground, monetise them, and then ultimately remove most of the resulting financial assets from South Africa. This is termed 'unequal ecological exchange,' i.e. when inadequate compensation is given to a society for surrender of its raw materials, since these are not sold at fair value (Bond and Basu 2021). Most notoriously, the Rhodes and Oppenheimer empires extracted large shares of the world's diamonds and gold from South Africa, with insufficient reinvestment to assure sustainability. This super-exploitative extraction process sets South Africa and many other African economies apart from, especially, Canada, Australia, the United States and Norway, which all have found means of recirculating resource wealth to governments (especially in Norway's case) or to local corporate shareholders (in the others).

When considering the inter-generational dynamics of a national state's public balance sheet, a major problem arises here: South Africa's natural resource depletion is proceeding at the cost of what can be assessed as 'sustainable development.' The most widely accepted definition is from the United Nations World Commission on Environment and Development

(WCED 1987): sustainability 'seeks to meet the needs of the present without compromising the ability of future generations to meet their own needs', because:

> current extractive systems within the world economy draw too heavily, too quickly, on already overdrawn environmental resource accounts to be affordable far into the future without bankrupting those accounts. They may show profit on the balance sheets of our generation, but our children will inherit the losses. We borrow environmental capital from future generations with no intention or prospect of repaying. They may damn us for our spendthrift ways, but they can never collect on our debt to them. We act as we do because we can get away with it: future generations do not vote; they have no political or financial power; they cannot challenge our decisions. (WCED 1987)

This essential problem – natural capital depletion – was simply not recognised by Wilde, and as a result his assessment of benefits to Africa from fossil fuel and other natural resource extraction was incorrect. The World Bank's *Changing Wealth of Nations* series of books has, since 2008, revealed two basic features of sustainable development that Wilde ignores: the *ne*t costing of such resources once the *depletion* of the wealth is considered using natural capital accounting, and the impact of that extraction upon future generations, once climate cost accounting is considered.

There have been numerous calculations of South Africa's natural capital, including partial accounts conducted sector by sector by Statistics South Africa (StatsSA 2019). Most have been conducted through the World Bank, and in country-by-country surveys, the most recent *Little Green Data Book* (for 2017) offers estimates of South Africa's mineral depletion, energy (mainly coal) depletion and immediate CO2 damage can be collectively costed at 6.8 percent of GDP each year, resulting in a *net negative wealth account*. (The incomplete Bank methodology – especially in omitting platinum and diamonds, for example – left mineral depletion measured at just 1.1 percent of GDP, far below what it is in reality, as we shall see. And the CO2 damage assessment is conservative, not only by adopting a $60/tonne Social Cost of Carbon measure, but by ignoring Scope 3 emissions.)

Wilde's (2022) affidavit was based only upon the *gross benefits* of extracting natural resources, ignoring several crucial costs that the World Bank (2017) provided. One is resource depletion, in which only if the 'Hartwick Rule' is satisfied, should extraction proceed. John Hartwick (1977) worked with Nobel Prize laureate Robert Solow (1974) at the Massachusetts Institute of Technology, and they concluded that consumption can be maintained 'sustainably' only if the values of nonrenewable resources are continuously reinvested – e.g., in productive capital through higher gross fixed capital investment or in human capital through higher education subsidies – rather than used for consumption. Inherited capital should be kept at least constant when a mineral (or other nonrenewable resource) is extracted – thereby reducing a country's mineral wealth – by way of that economy creating or investing in another asset of at least the same value as the mineral that is depleted. The Hartwick Rule is one way to implement the WCED's Intergenerational Equity principle. The field of environmental economics has also provided a 'sustainable yield' principle: only consume an amount that does not endanger the capital. And, in most countries (including South Africa as a result of the Mineral and Petroleum Resources Development Act 28 of 2002), natural resources – including forests, streams, beaches, oceans, atmosphere, and minerals – are owned by the state as trustee for future generations.

Disputed Costings of Climate Damage and Resource Depletion

The World Bank's 2021 *Changing Wealth of Nations* calculates net costs and benefits as 'Adjusted Net Savings,' and finds that Africa, in comparison to other regions of the world, suffered the greatest comparative loss of wealth from 1995-2019 due to environmental-economic factors. In such cases, which include South Africa (Figure 2), the WCED and Hartwick Rule – as well as stewardship more generally – have not been respected. The situation has now reached a critical stage, insofar as the climate crisis requires an additional costing which Wilde (2022) neglected but Jammine (2022) attempted: the Social Cost of Carbon, i.e., damage from emissions to the economy and society. When in 2017 the Bank's *Little Green Data Book* estimated such damage, it did so on the basis of $60/tonne of greenhouse gases. Using the same $60/tonne costing of CO2 damage four years later

(notwithstanding fast-rising knowledge of the extent of climate change's costs), International Monetary Fund (IMF) staff economists estimated the annual harm caused by South Africa's greenhouse gas emissions to be $50.56 billion (R780 billion) (Parry *et al.* 2021). These are calculated as being both implicit and explicit subsidies to fossil fuel producers, especially when the state fails to impose an economically-'efficient' price on coal. In contrast to such costs, South Africa's carbon price – the main tax especially on major emitters – is as low as $0.35/tonne, due to decades of sustained political pressure from extractive and high-energy-consuming industries (Bond 2012, 2022c, 2023).

In making this case, the IMF not only assumed an excessively low Social Cost of Carbon, but also relied upon an irresponsible assumption: climate policy should target the Paris Climate Agreement's 2 degree Celsius target (instead of the stated 1.5 degree target that would ensure future generations' survival). Hence the price of carbon damage is vastly underestimated. Indeed, researchers Jarmo Kikstra *et al.* (2021) suggest that due to feedback loops, the actual climate-related price of a tonne of emission is closer to $3000/ton (Kikstra *et al.* 2021).

Analyses by Kikstra *et al.* (2021) are more compelling, when considering a genuine Social Cost of Carbon, because, as the University College London (2021) summary of their research explained, 'when taking more robust climate science and updated models into account, this new study suggests that the economic damage could in fact be over $3,000 per tonne of CO2'. (In contrast, the much lower Social Cost of Carbon figures cited by Jammine 2022 – $147 to $349 per tonne – emanated not from the World Bank, as he claimed, but instead from an early part of the Kikstra *et al.* paper, less than a quarter of the way through the 15,150-word analysis. This range of costs is then followed – in Kikstra *et al.* 2021 – by many more thousands of words about why even $349/tonne is a vast underestimate, since there are crucial additional factors still to incorporate: 'persistence of economic damages', 'annual temperature variability' and 'alternative climate and socioeconomic scenarios'. Hence an estimate of $3000/tonne is provided by these researchers.)

The full gamut of emissions that this Social Cost of Carbon would apply to, should include not only those associated with immediate activities in South Africa, but also – as the United States Environmental Protection Agency (2023) defines Scope 3 emissions – emanating from 'activities from

assets not owned or controlled by the reporting organisation, but that the organisation indirectly affects in its value chain'.

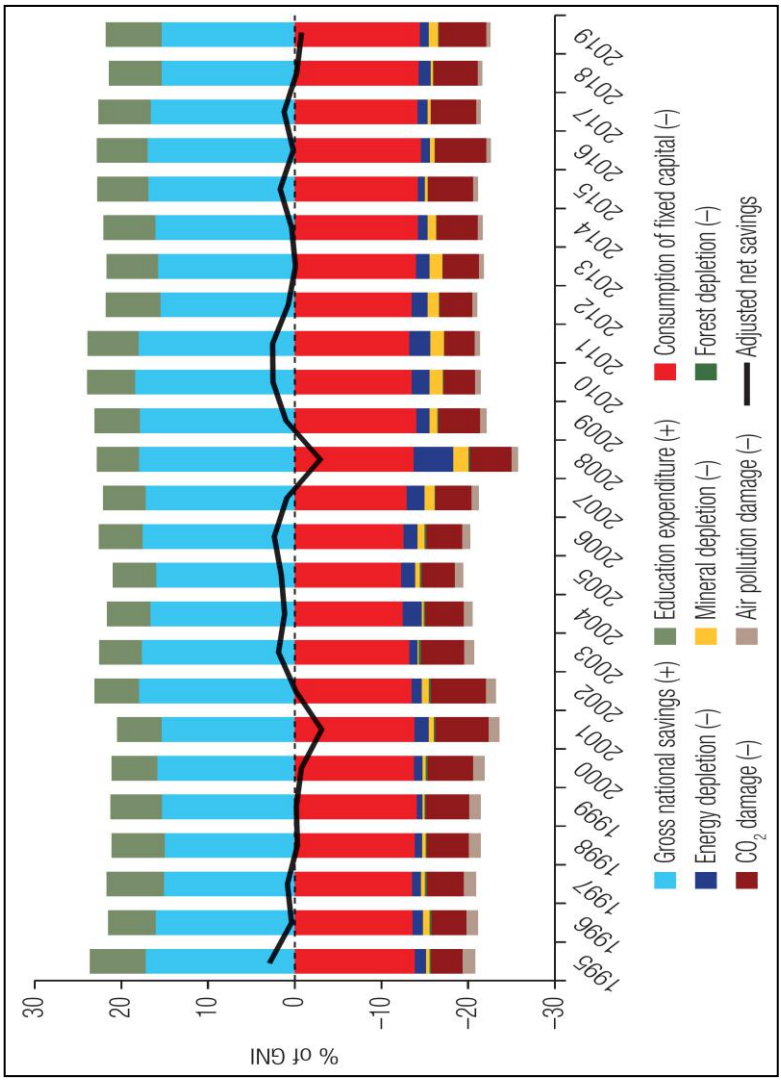

Figure 2: South Africa's decomposition of Adjusted Net Savings, 1995-2019 (albeit with mineral depletion not inclusive of platinum and diamonds)
Source: World Bank (2021)

The obvious way in which such emissions could be added to South Africa's annual output, is via the 50-80 million tonnes of annual coal exports, but in addition, Scope 3 would include emissions from combustion of South Africa's offshore gas and oil deposits. This is not merely a national regulatory matter, but also increasingly associated with shareholder reporting (Datt *et al.* 2022). For example, as a typical large Johannesburg firm (Lewis Group furniture) put it, 'Partial assessment of Scope 3 emissions is accepted practice and is compliant with the GHG protocol …' (Lewis Group 2023).

Wilde (2022) was unfamiliar with greenhouse gas emissions, natural capital accounting (i.e., calculating the *net* wealth effect following nonrenewable-resource depletion) and the National Environmental Management Act's commitment to the 'polluter pays' principle. Thus, he failed to acknowledge losses to future generations not only due to depletion, but also due to damage projected from converting billions of barrels of fossil fuel equivalents into Greenhouse Gas emissions. And although Jammine (2022) accepted these principles, he did not take them to their logical conclusion; consider as a thought exercise, the $147 to $349 per tonne Social Cost of Carbon he endorsed. The damages of the offshore gas project's resulting emissions are still extremely high: the low end of Jammine's preferred estimate would still leave aggregate emissions costs of $153 billion, and $363 billion at the high end, which are far higher than gross benefits. Hence even with these partial cost estimates, the exploration process still does not make sense from a full-cost accounting perspective, as discussed below. And because such calculations suggest a net negative cost, Jammine (2022) simply dismisses as 'spurious' a methodology widely accepted as vital to resource analysis by environmental economists:

> On a more philosophical level, many of these assumptions in determining social accounting of the carbon footprint are fairly vague and often quite subjective. Whilst the message of depleting national resources in the short to medium term at the expense of environmental costs in the longer term might be a valid consideration, the underlying assumptions surrounding such assessments can be called into question. There is still far too much uncertainty surrounding these issues to justify a decision on whether or not to proceed with a project of this nature based on such vague assessments (Jammine 2022).

Given the record of underdevelopment and pollution caused by gas and oil extraction across Africa, including South Africa, it is fanciful to assume that 'massive social upliftment' would result. That aside, in a section of his affidavit entitled, 'Defence against Criticism of Sustainable Development through Oil and Gas', Jammine (2022) does attempt to address depletion arguments, albeit ignoring the basic premise behind natural capital accounting: the failure of current economic measures – especially GDP – to correctly measure flows of not only income but wealth associated with non-renewable resource extraction (including fossil fuels). The Gaborone Declaration (2012) signed in 2012 by then Minister Edna Molewa does, in contrast, recognise GDP's 'limitations as a measure of well-being and sustainable growth', and mandates that natural capital should from now on be included in 'national accounting and corporate planning'. Jammine (2022) attempted to rebut the need to calculate natural capital stock changes and to address the negative wealth implications of extraction, by arguing there is a positive *net* impact simply because other aspects of South Africa's economy have risen (especially the finance, insurance and real estate sector, whose share of GDP soared from 12 to 22 percent since 1994):

> … the World Bank's Changing Wealth of Nations report 2021 calculates that 'Adjusted Net Savings' for South Africa, as distinct from the whole of Africa has on average, been sustained from 1955-2019 …. The World Bank's newer measure of sustainability is defined as the 'Change in Wealth Per Capita' over time. Their 2021 report calculates that South Africa's Wealth per capita increased from 1995 to 2018 ….

Upon closer inspection, however, the November 2021 World Bank report actually supports the case that SA's non-renewable natural resource wealth is not only poorly managed, but is rapidly shrinking. This is especially true, first, in relation to other economies, including most so-called 'resource-cursed' countries; second, over time; and third, in view of new information about reliance upon such wealth depletion when the price (and market value) of such wealth becomes highly volatile, as is the case at present. As Jammine (2022) argued, a new definition means Adjusted Net Savings is no longer the Bank's primary natural-capital accounting tool. While this is true, however, there is a crucial sentence in the 2021 report that Jammine (2022) neglected to reveal to the court: due to commodity price volatility and nonrenewable

resource depletion, 'mineral wealth in South Africa went from US$60 billion in 1995 to US$100 billion in 2010 but dropped to US$45 billion in 2018, driven in part by a decline in the country's gold production' (World Bank 2021: 203-04).

Moreover, the Bank (2021) report dramatically underestimated the decline in South Africa's wealth, because its methodology for counting metals and minerals does not include platinum group metals, manganese and chrome (where in all three cases, South Africa has led the world for most of the period under discussion), nor zirconium, vanadium and titanium (where South Africa is the world's second highest producer), nor diamonds. (The Bank counts bauxuite, copper, gold, iron ore, lead, nickel, phosphate, silver, tin and zinc.) Even without several valuable minerals, South Africa is revealed as a major net loser of non-renewable resource wealth. Only Zimbabwe, Botswana and the Republic of Congo have worse records of declining mineral wealth, with the Central African Republic in the same category (World Bank 2021: 204).

The Economics of Resource Booms and Busts

South Africa also scores very poorly in relation to peers when it comes to managing commodity price booms and busts (World Bank 2021). Over time, as the commodity bubble burst in the 2015-2018 period, South Africa's net wealth shrunk markedly. From 2020-2022, in the wake of COVID-19 lockdowns ending, that wealth soared because of a fossil fuel boom, due largely to international market disruptions. All indications are that this was temporary, having peaked in May 2022 in the wake of Russia's invasion of Ukraine, with the resulting sanctions and likelihood that the conflict will lead to a major short-term shift by European gas consumers to renewable (or even nuclear) energy sources, thus leading to substantial price cuts in natural gas, from the peak mid-2022 $9/MMtu level, to around $2.20 in early 2023 (Figure 3).

The World Bank stresses the need for an economy's resilience – especially through better state budgetary management but also by reducing dependency on non-renewable resource exports – as the downside of a commodity price cycle emerges:

> when the commodity boom ended and oil prices dropped, countries that

depended on these oil rents experienced an impact on their public finances. This negative impact also had consequences for the net interest on that debt, increasing the deficit of the primary balance in countries including Russia and South Africa.

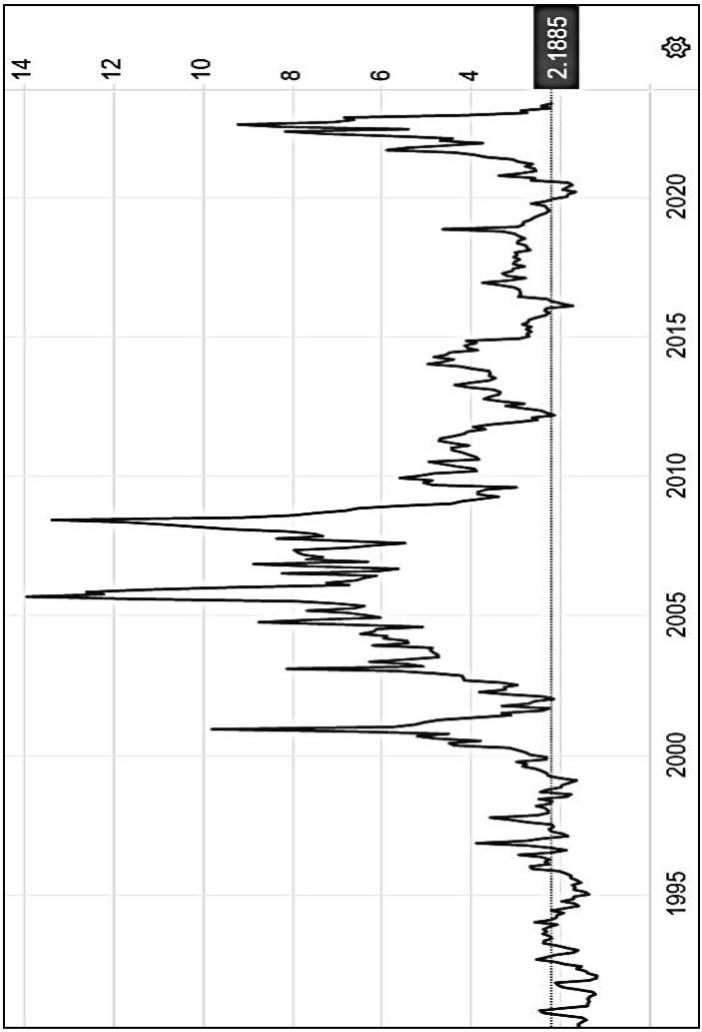

Figure 3: Natural gas price fluctuations ($/MMBtu), 1990-2023
Source: Trading Economics 2023

There is an additional inter-generational point worth reiterating about South Africa's fossil fuel resources, in terms of the costs of resource depletion to society's descendants. There are many vital uses of hydrocarbons – including CH4, methane gas – whose *non-combustion* value will rise over time, given that in addition to fuel for energy and transport, hydrocarbons are vital in petrochemical products such as synthetic materials, pharmaceutical and medicinal products, lubricants and other oils, tarmac and necessary plastics. To the extent that methane emissions can be limited in future generations' higher-technology extraction and processing systems, the future utilisation of South Africa's hydrocarbon stocks should not be curtailed by abuse of the sort envisaged by oil and gas companies, driven by short-term profitability.

The rights of future generations to having hydrocarbons left intact are therefore not only in preventing their combustion – in turn mitigating against climate catastrophe – but in their use not as fossil fuels but as vital petrochemical products. That means that whether below the land or oceans, South Africa's stock of hydrocarbons should not now be depleted. As noted earlier, a strong logic exists for intergenerational cost-benefit analysis to be conducted, along the lines of the Hartwick Rule for extraction, and for all the reasons above, current extraction of methane gas for combustion would fail.

Confronted with this information, Jammine (2022) does provide the following concession: 'the message of depleting national resources in the short to medium term at the expense of environmental costs in the longer term might be a valid consideration'. That 'might be' valid consideration becomes even more explicit when considering, additionally, adverse impacts of 'stranded assets' in the form of fossil fuel infrastructure that will stand idle, plus trade sanctions against export products whose embedded energy is mainly generated by fossil fuels.

Stranded Fossil Assets

A gas-based energy industry requires an extremely expensive, multi-decade infrastructure dedicated to exploration, processing, transport (e.g. expensive, unreliable pipelines) and combustion. Offshore extraction entails many marine conservation risks, and methane leaks are a major source of greenhouse gases. The International Institute for Sustainable Development (2022) estimated infrastructural costs associated with the most basic attempts

to provide methane gas infrastructure – including gas plants, floating storage and regasification units, Liquefied Natural Gas terminals and pipelines – in the R185-270 billion range (Table 1). Even without cost and time overruns, corruption and other drawbacks, the infrastructure would quickly assume the status of stranded asset, given the need to halt methane gas emissions.

Project	**Component**	**Capital Cost Estimate (R bn)**
1. Initial Coega Development Corporation (CDC) project	1,000 MW gas plant	12.5
	Floating storage and regasification unit (FSRU) LNG terminal	9.5
2. IRP 2019 capacity of 2,000 MW (assume located at CDC)	2,000 MW gas plant	25
Sub-total for IRP 2019		**47**
3. Richards Bay	3,000 MW CCGT Eskom	37.5
	FSRU LNG terminal	9.5
4. Saldanha Bay and Atlantis	FSRU LNG terminal	8.5
	Pipeline to Atlantis	1.75
	1,500 MW Atlantis plant	18.75
5. Pipeline network	Connect LNG terminals and inland to Gauteng from	32–117.5
	Richards Bay, approximately 2,350 km.	

6. Increase gas-to-power capacity at Richards Bay	2,000 MW gas plant	25
7. Increase LNG imports at Richards Bay	Second FSRU	4.7
Total		**184.7–270.2**

Table 1: Estimated capital costs for South Africa's gas-to-power infrastructure
Source: International Institute for Sustainable Development (2022)

These costings are conservative, as judged by all major construction projects which in South Africa are typically subject to substantial time- and cost-overruns. For example, in a prior fossil-fuel mega-project (from 2008-19), the Transnet New Multi-Product Pipeline witnessed:

- cost overruns from R12.7 billion to R30.4 billion, and delays of 6 years (National Planning Commission 2020);
- charges of racism in pipeline siting (Bond 2015);
- hundreds of pipeline breaks – mostly due to oil 'bunkering' theft (Timse 2022) – which is also a problem with methane gas, even in the United States (Barlow 2009); and
- corruption by Transnet officials and private sector contractors (Pheto 2021).

The Costs of Climate Sanctions

It has become increasingly vital to consider a full range of costs – including adverse downstream economic implications – along with benefits when it comes to fossil fuel emissions. One simple reason to engage in broad-based accounting is the point made by President Cyril Ramaphosa in late 2021, explaining the danger to the economy of further greenhouse gas emissions (well before the April 12 2022 flooding that killed an estimate 500 residents of Durban and surrounds). Ramaphosa (2021) referenced the 'Carbon Border Adjustment Mechanism' (CBAM) that will be imposed by Western importers of South African goods, in a Presidential newsletter advocating a

low-carbon economy and Just Transition for affected workers and communities:

> As our trading partners pursue the goal of net-zero carbon emissions, they are likely to increase restrictions on the import of goods produced using carbon-intensive energy. Because so much of our industry depends on coal-generated electricity, we are likely to find that the products we export to various countries face trade barriers and, in addition, con-sumers in those countries may be less willing to buy our products.

Currently, the South African economy has an export production system that is exceptionally fossil addicted, with very low employment and net-wealth returns on the greenhouse gases emitted, given the major component of exports that are represented by carbon-intensive smelted metals or deep-mining outputs (drawing upon non-renewable mineral resources). In 2021, the economy's main exports were platinum ($24.5 billion), gold ($20.1 billion), iron ore ($7.68 billion), diamonds ($7.02 billion), and coal ($6.72 billion), with South Africa retaining its rank as the world's leading exporter of platinum, manganese ore ($2.9 billion), chromium ore ($1.83 billion), precious metal ore ($1.78 billion) and titanium ore ($501 million) (Observatory of Economic Complexity 2023). In a World Institute for Economic Development Research analysis (Arndt *et al.* 2011), the South African economy's climate-destructive biases were pinpointed: 'Carbon intensity is found to be high for exports but low for major employing sectors… carbon pricing policies (without border tax adjustments) would adversely affect export earnings, but should not disproportionately hurt workers or poorer households'. With South Africa still emitting around 500 million tonnes/year of greenhouse gases (including those related to forestry and land use), the climate impact alone (at $3000/tonne) – not including many other factors such as local pollution – would be 3.6 times more damaging than South Africa's 2022 GDP of $420 billion. Climate-related trade disincentives will include increased carbon taxation based on high-CO2 components of local production as well as the distance traveled by goods either through shipping or air transport. The South African Treasury (Momoniat 2021) recognised this in a briefing to parliament, in which several sectors were identified as especially vulnerable: iron and steel, cement,

fertilizers, aluminium and electricity – but eventually CBAM tariffs will affect all exported products.

Jammine's (2022) affidavit completely ignores this broader economic threat, one that many well-informed South Africans (and Eskom's main customers such as South32 and Anglo American) are increasingly concerned about: 'climate sanctions' that will apply to large parts of the export economy. As Isaah Mhlanga (2022), chief economist at AlexanderForbes, argued,

> SA must cut carbon emissions quickly — to protect its own economy: Carbon taxes will be levied and markets will be closed to those goods that have a high carbon content… Beyond self-protection, SA will need to decarbonise faster to protect its exports, and thus economic growth. This is necessary because it's a matter of time before carbon taxes are levied on all sorts of goods, and markets will be closed to those goods that have a high carbon content. Even though SA has not contributed the largest share of carbon emissions by global standards, it must adjust at the fastest rate possible, not necessarily to be a leader in efforts to move to net zero, but to protect its economic interests.

Exaggerated Benefits

The Shell-Impact gas exploration assumes that when it comes to the benefit side of the equation, anticipated revenues can be estimated at the mid-2022 (highly overinflated) gas price of more than $9 per million British thermal units (MMBtu), i.e. the point at which the debate occurred in the Makhanda High Court. If there are really four billion barrels of gas available in the Shell-Impact exploration zone, the net present value of that gas would be $162 billion. However, if the price had peaked at that point, and then declined to a quarter of the 2022 peak a year later, i.e. just over $2/MMBtu (Figure 3), the value of the gas shrinks to $40 billion.

However, that amount is the potential gross income. As for net income, there are major costs to extraction, still to be determined by local drilling conditions, fixed capital costs including (rising) interest rates, operating expenses, taxes and royalties and liabilities for local ecological damage and natural capital depletion. To consider simply the global ecolo-

gical damage to climate stability caused by methane emissions, a barrel-equivalent of gas generates 236 kg of CO2-equivalents when burned, or 0.26 tons, so the four billion barrels would generate 1.04 billion tonne-equivalents of GHG emissions. The cost of burning these, to current and future generations, is astronomical. At $3000/tonne, the $3.120 trillion damage from the anticipated gas find exceeds benefits (priced in mid-2023 at $2.2/MMBtu, or $40 billion), by a factor of 78.

There are, to be sure, many additional benefits that would follow from a major gas extraction and processing industry. These include an infusion of Foreign Direct Investment and trade which bring in needed foreign exchange; tax and royalty earnings; the potential for Black Economic Empowerment (though in Impact's case, ownership and control by a white male – Johnny Copelyn – has been controversial, leading to retraction of his firm's BEE status); skills transfer; and the diffusion of new technologies.

However, a raft of other negative aspects of such investments should also be included, especially given the role of Shell in corrupting, polluting and underdeveloping states and economies like Nigeria's, as observed in U.S. State Department cables published by WikiLeaks (Martin 2010) and in many other revelations. Copelyn's own political influence was reflected in his (undisclosed) substantial political campaign contributions to Ramaphosa in 2017 (Cowan and Tandwa 2019) and a prior incident where his television network was caught bribing the then minister of economic development with favourable television coverage of a mega-dam project (Bond 2014). In addition to corruption, such mega-projects also introduce tensions that often lead to community unrest and labour strikes. There is often extreme commodity price volatility in the fossil fuel sector (Figure 3). Firms like Shell are notorious for not only profit repatriation (thus undermining the initial benefits of foreign exchange infusion), but also tax avoidance and Illicit Financial Flows (Okojie 2018). Other typical adverse effects of resource-extractive industries include worsening inequality, labour migrancy, disease and gendered oppression, land dispossession, and ecological problems (in this case potentially associated with marine life and eco-tourism).

The Potency of Methane Gas in False-decarbonisation

The coal-based maldevelopment of South Africa's energy system has done enormous damage, locking in the economy to an extremely destructive

system. In 2021, Eskom began advertising its decarbonisation strategy, but unfortunately it entailed inclusion of two major methane gas generators, at Richards Bay (3000 MW costing R70 billion) and at the Komati coal-fired power station (1000 MW costing R15 billion). In late 2022, as Komati coal was being decommissioned, the latter received a $500 million World Bank loan and visit from Bank president David Malpass, just prior to the Sharm El-Sheikh United Nations climate summit.

Given the potential that Eskom may follow through with these ambitious plans, representing 44 percent of its capital investment plan, perhaps even drawing in Just Energy Transition Partnership financing, it is vital to recall that methane is not a 'clean' source of energy. Jammine (2022), too, had also insisted that methane is preferable to sources of CO2 emissions:

> Even if it is considered a fossil fuel and thereby a pollutant, natural gas is far less of a pollutant than the other primary sources of fossil fuel energy, viz., coal and oil. Gas lacks the sulfur dioxide and nitrogen oxide emissions of coal and the high carbon footprint of transporting heavy quantities of the mineral. The share of CO2 emitted through the use of natural gas as a percentage of energy produced is around 57 percent of CO2 emitted by coal and 73 percent and 76 percent of that emitted by diesel and petrol, respectively. In the case of liquefied petroleum gas (LPG), the polluting effect is some 17 percent higher than that of natural gas but still leaves it at a far lower pollutant level than coal, and the same applies to some extent to oil. The conclusion is that a switch towards natural gas as a source of energy away from dependence on coal or oil would enhance South Africa's clean energy footprint.

Jammine (2022) thereby ignored latest research – as reported at the time by Bloomberg (Rathi 2022), in an article entitled, 'The case against methane emissions keeps getting stronger' – warning of the dangers of CH4 emissions. In the critical next 20 years, these are measured as at last 80 times more potent a greenhouse gas than CO2 (Rathi 2022). The urgent need to reduce methane emissions by at least 45 percent during the 2020s so as to prevent global warming in excess of 2 degrees is not in question, for example at the United Nations Environment Programme, which observes important public health co-benefits: 'switching away from gas would reduce carbon

dioxide and volatile organic compound emissions' that are causes of additional threats to public health (United Nations Environment Programme 2021).

In turn, pressure to make cuts of at least 30 percent this decade led to a Western-initiated 'Global Methane Pledge' at the November 2021 United Nations Framework Convention on Climate Change in Glasgow, one signed by more than 100 countries including most of central and west Africa (albeit not yet South Africa), based on a recognition in the Pledge that 'the energy sector has the greatest potential for targeted mitigation by 2030' (Climate and Clean Air Coalition 2021). As more attention is paid to this exceptionally-potent source of 17 percent of all global greenhouse gases, South Africa will be compelled to join, or face further penalties. Although in mid-2022 the European Union made an exemption for certain highly-regulated versions of methane gas in its typology of dirty energy, it is likely that future decisions will, like the Glasgow methane pledge, increasingly work against South Africa's gasification drive.

The Availability of Renewables, Energy Storage and Demand Management Alternatives

The costs of enhancing South Africa's fossil fuel supplies with offshore (or onshore) gas and oil deposits are enormous, as argued above. The alternatives to not only fossil fuel but also dangerous nuclear sources of energy (as well as regional mega-hydropower) include installation of renewable energy backed by major increases in environmentally-sound storage capacity, which should augment demand-side management, especially in relation to 'Minerals Energy Complex' (MEC) overutilisation of electricity. Jammine (2022) apparently has a limited understanding of such an energy policy, for he advises, 'Renewable energy has proved to be incapable of accommodating sufficient energy demand, given that solar and wind sources of energy are not available for much of a 24-hour day. Furthermore, the development of batteries to store such energy when wind and solar power generation are not available has not been quite as successful as hoped'. On this technical point, Jammine (2022) does not deny the claims by renewable energy proponents that wind and solar are less expensive (in terms of capital and running costs) than fossil fuels; instead, his concern is energy storage. Yet he appeared unfamiliar with innovative forms of storage,

aside from lithium or lead batteries. While sodium ion technologies to replace lithium are in process, there are currently also two far less invasive battery systems: pumped storage providing hydropower and molten salt providing thermal power in the vicinity of concentrated solar chimneys, such as the 100MW ACWA and 100MW Kathu plants in the Northern Cape (Invested 2022).

The former storage technique includes 2724 MW of natural power supply already available to Eskom in the form of pumped storage capacity, i.e. typically between 7 and 10 percent of the grid's power. Pumped storage is defined by Eskom (2021) as 'A lower and an upper reservoir with a power station/pumping plant between the two. During off-peak periods the reversible pumps/turbines use electricity to pump water from the lower to the upper reservoir. During periods of peak demand, water runs back into the lower reservoir through the turbines, generating electricity'. The 2724 MW already available in three pumped storage schemes – Ingula, Drakensburg and Palmiet – does not include Cape Town's 180 MW Steenbras municipal pumped storage capacity, which is a major factor in reducing the load-shedding stages faced by the country's second-largest city.

In addition, the firm that was historically Eskom's largest consumer, Anglo American (with current iron ore, platinum and diamond interests), recently committed to using 100 percent renewable energy plus storage by 2030 (Gernetzky 2022b). The largest current Eskom customer, BHP Billiton's South32 subsidiary – with the continent's largest metals smelter, Hillside (aluminium) at Richards Bay – invested $70 million in renewable sources to run a Brazilian aluminium smelter (Gernetzky 2022a), and in South Africa simultaneously began seeking zero-carbon alternatives (Mathews 2021). One of these, pumped storage at the proposed Tubatse scheme adjacent to De Hoop Dam, is being promoted specifically as a result of the threat of climate trade sanctions, according to *Mining Weekly* editor Martin Creamer (2022)*:* 'If the ASX- LSE- and JSE-listed South32 group is unable to secure an affordable source of low-carbon electricity for Hillside, this key KwaZulu-Natal smelter risks becoming uncompetitive in the international market over time, given the emergence of carbon border tariffs and end-user demand for green aluminium'.

In a national radio discussion, Creamer (2023) articulated an awareness of the ways mineral smelting guzzles scarce power:

> It is so important to get away from smelting. There are other ways of

> doing things. South Africa uses smelting across the board in the mining industry. Once you mine the ore, you smelt it. But it takes up an enormous amount of electricity and now all eyes are on Sedibelo in North West because it has moved away from smelting. It will use on 19 percent of our precious electricity compared with what is used for smelting by going the hydrometallurgical route. Hope are rising that once the Kell system is proven, and it should be soon, all the other smelters will follow this and stop squandering our electricity.

The squandering is so obvious a problem – and demand-side management so urgently needed as part of the solution – that when load-shedding began in 2008, Standard Bank's chief executive officer Derek Cooper told then-president Thabo Mbeki that, for the good of the country, Eskom should disconnect South32's power supply for smelting, so the rest of the economy could receive the scarce power (Wray 2008). Although ignored by Mbeki, Cooper was immediately praised by *FinWeek* editor Michael Coulson (2008):

> Those monsters are just about the least appropriate form of investment for South Africa's stage of economic development. Aluminium smelters use imported raw materials, create few permanent jobs and raise major environmental issues. As both their supporters and critics concede, they're in effect a way of exporting electricity – which is their largest single cost component.

In mid-2022, (pro-corporate) *Business Day* columnist Michael Avery (2022) called on Eskom to 'mothball electricity-guzzling smelters'. In his formulation, there should be additional payments to South32 as compensation. Yet in 2013 even Parliamentarians were angered by South32's extremely low prices gained through apartheid-era Special Pricing Agreements (Pressly 2013). In 2022, General Industries Workers Union of South Africa president Mametlwe Sebei (2022) decried Eskom 'subsidising this mega-corporate which imports bauxite to make aluminium. This process is not only extremely carbon-intensive and capital-intensive (with few jobs), but the Australian firm mainly exports the aluminium as well as the profits'. All these examples suggest that the oft-articulated concerns of corporate South Africa (and Jammine 2022 and Wilde 2022) to *boost supply of base-load*

electricity – especially through gas-fired generation – are not necessarily economically sound, in comparison to quality control for energy users in the form of more active demand management.

Conclusion

The Makhanda High Court judgement on 1 September 2022, in *Sustaining the Wild Coast NPC and Others v Minister of Mineral Resources and Energy and Others*, prohibited Shell-Impact's gas exploration, acknowledging in the lengthy excerpt below that climate change is a crucial factor (while condemning the Department of Mineral Resources and Energy – the 'decision-maker' – for having initially approved the exploration):

> The intervening parties' contention that the decision-maker gave no proper consideration to the climate change impacts of the decision to grant the exploration right is an important factor to be considered in the process of granting an exploration right. Reliance for this contention, by the intervening parties, is placed on expert testimony showing that most of the discovered reserves of oil and gas cannot be burnt if we are to stay on the pathway to keep global average temperature increases below 1.5 degrees Celsius. Authorising new oil and gas exploration, with its goal of finding exploitable oil and/or gas reserves and consequently leading to production, is not consistent with South Africa complying with its international climate change commitments.
>
> According to the respondents, climate change considerations and the right to access food and livelihood are irrelevant when considering an application for an exploration right; these considerations are premature because they fall to be considered at a much later stage. On the authority of Director: Mineral Development, Gauteng Region and Another v Save the Vaal Environment and Others the processes are discrete stages in a single process that culminates in the production and combustion of oil and gas, and the emission of greenhouse gases that will exacerbate the climate crisis and impact communities' livelihoods and access to food.

> The respondents' thesis does not find support from Earthlife Africa Johannesburg v Minister of Environmental Affairs and Others, either, where Murphy J said: 'The absence of express provision in the statute requiring a climate change impact assessment does not entail that there is no legal duty to consider climate change as a relevant consideration …'. Had the decision-maker had the benefit of considering a comprehensive assessment of the need and desirability of exploring for new oil and gas reserves for climate change and the right to food perspective, the decision-maker may very well have concluded that the proposed exploration is neither needed nor desirable (*Sustaining the Wild Coast NPC and Others v Minister of Mineral Resources and Energy and Others* 2022).

The case was found worthy (by all parties) of a formal Appeal in December 2022, so it is possible that this judgement will be overturned in late 2023. The Impact economists arguing on behalf of exploiting South African offshore gas reserves made many elementary errors and failed to grapple with environmental-economic analysis. Not only Wilde (2022), but also Jammine's (2022) denial of the potential for stranded methane-gas investment assets on the order of R200 billion for basic methane gas processing together represent advocacy of what is, in reality, an enormous business risk. It can only be embarked upon by denying the costs of fossil fuels, and by ignoring the benefits of an alternative strategy for energy based on renewables and energy storage.

Additionally, a crucial cost that Impact's economists did not factor in, is the genuine threat of climate sanctions. Impact also failed to recognise the potency of methane in a context in which a Western-led initiative aims to cut emissions of the gas by at least 30 percent this coming decade. Moreover, the Impact economists downplayed include non-renewable resource depletion, which represents current sovereign wealth as well as the rights of future generations to have access to hydrocarbons. The detrimental role of commodity export dependency during notorious boom and busy is another factor. But the greatest cost, which will add to South Africa's climate-related liabilities for the so-called Loss & Damage experienced by so many others across the continent and world, is the Social Cost of Carbon. Whether using Jammine's low (and misinterpreted) suggested cost of $148-349/tonne, or a more realistic cost, there is no rational economic case to be made for further offshore gas extraction, in South Africa or anywhere.

Jammine (2022) rests his case for a net beneficial effect on the unspecified 'massive social upliftment' of the Eastern Cape. Yet in addition to his failure to demonstrate any viable trajectories for trickle-down of offshore gas wealth to this majority-rural province, he makes a fatal concession made along the way, which is that 'depleting national resources in the short to medium term at the expense of environmental costs in the longer term might be a valid consideration'. If it is, then these environmental costs should be contemplated seriously before not only regulatory agencies but also South Africa's judicial system (not dismissed as 'fairly vague' or 'subjective' as requested by Jammine). An alternative set of costs should be supplied, with an argument to show why they are superior to the latest published research. Because none of his own calculations are capable of rebutting the environmental cost analysis, based on both natural capital accounting for depleted wealth and the Social Cost of Carbon, Wilde (2022) and Jammine (2022) were left to make merely unsupported assertions.

In sum, the debate should be relatively clear: whether it is uneconomic to engage in further fossil fuel extraction and combustion, given externalised costs which will be increasingly internalised in trade with Western economies due to CBAM. Moreover, additional climate reparations payments are being awarded to victims of climate change, and additional obligations to cut GHG emissions are being imposed by courts directly on corporations, including Impact's partner Shell in The Netherlands. To illustrate the danger of ignoring costs and benefits in this manner, consider that in January 2022, Judge Rudolph Contrera of the Washington, DC U.S. District Court insisted that the full-cost accounting was not complete in the prior Donald Trump administration's permission to drill for offshore oil and gas. The Biden administration, had according to Judge Contrera, admitted that 'current programs fail to adequately incorporate consideration of climate impacts into leasing decisions or reflect the social costs of greenhouse gas emissions'. The judge determined that Trump's administration ignored 'new evidence demonstrat[ing] that existing operations in the Gulf of Mexico emit twice the amount of methane than previously thought' (Friends of Earth v. Haaland 2022).

Ultimately, perhaps, what is at stake is whether South African capitalists – and thought leaders like Jammine – are committed to reforming their system by internalising massive environmental and social externalities, i.e. identifying market imperfections and applying standard public-welfare economics such as 'polluter pays' logic. If so, a full-cost accounting would

logically lead to cancellation of further fossil-fuel projects. If not, apartheid-era and post-apartheid South African capitalism, with among the highest emissions/GDP/person rates in world history, will be recorded as *climate denialist.*

Indeed, on the one hand, Jammine (2022) does concede that South Africa should join the world by 'moving away from fossil fuels such as coal'. On the other hand, he also used the phrase, 'perceived ravages of climate change', an indication of skepticism about what scientists have long established as real, *not imagined*, ravages. Jammine's own life expectancy is too short for him to experience – in coming decades – the full impacts of what is anticipated to be a climate catastrophe with existential implications for organised human life. The 'perceived ravages' may appear as an ethereal presence on our current generation's laptops or televisions, sometimes far away from the damage. But for KwaZulu-Natal casualties of the April 11-12 2022 Rain Bomb, including an estimated 500 fatalities or missing persons, or for the countless wildfire, locust or drought victims in the western provinces of the country, including numerous municipal 'Day Zero' cases, there is a reality behind the 'perception' that is becoming increasingly unbearable. All polluters need to mitigate greenhouse gas pollution, but on a per capita basis, South Africa has an exceptionally inefficient economic system and one whose benefits have disproportionately gone to the country's wealthy white male population.

In short, the essence of Jammine's (2022) approach is summed up as follows: 'The development of oil and gas facilities domestically offers an excellent opportunity to effect a transition away from fossil fuels to renewable forms of energy …' – which is not only climate denialist, but is absolutely incorrect in every respect, *economically*. In contrast, leading activist Sinegugu Zukulu of Sustaining the Wild Coast put the case simply: 'Oil and gas will lead to more emissions, and in the face of climate change, this is wholly irresponsible. We as Amadiba people unanimously oppose this oil exploration and destruction of our sacred land' (Welz 2022).

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