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Coal, Oil and Gas Going into Extra Time

The Narrative of Abated Fossil Fuels Threatens to Undermine the Paris Climate Targets
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The upcoming United Nations Climate Change Conference in Dubai (COP28) will see a new round of battle regarding the call to phase out fossil fuels. Intense debates have taken place in Germany and the European Union (EU) to determine positions in the run-up to the conference. The main point of contention is whether to call for a complete global phase-out of all fossil fuels or only for a phase-down of their unabated use, that is, without additional abatement measures such as carbon capture and storage (CCS). The role of abated fossil fuels in a net-zero economy is very controversial. In the long run, it will depend on several factors, including the effective deployment and scale-up of CCS, the capture rates achieved therein and the availability of carbon dioxide removal (CDR) technologies to address residual emissions. CCS is unlikely to make a significant contribution to urgently needed greenhouse gas reductions in the power sector by 2030. Whether the decision in Dubai will deliver a credible signal to rapidly reduce fossil fuel emissions depends in no small part on a precise, science-based definition of the scale of emission reductions required for fossil fuels to be considered as abated in line with the temperature goal of the Paris Agreement.

Fossil fuel use – the burning of coal, oil and gas – is responsible for the majority of greenhouse gases emitted worldwide, and hence the root of the climate crisis. This is the basis for the longstanding call for a global phase-out of all fossil fuels, which many ambitious countries and civil society groups want to see enshrined in the key outcomes of the United Nations Climate Change Conference in Dubai in December 2023. Recently, this discussion has grown in complexity due to its focus on differentiating between unabated and abated fossil fuel use. A COP28 decision on the future of fossil fuel use would send an important signal. Neverthe-

less, it marks the beginning rather than the end of a serious debate on the roles that CCS as an abatement technology, carbon management strategies and fossil resources may play in a net-zero emissions future.

Fossil fuels in 1.5 degree pathways

To halt the global temperature rise and limit it to 1.5 degrees Celsius by the end of the century, global CO₂ emissions must fall to net zero by around mid-century and then become net negative, according to the latest report from the Intergovernmental Panel



on Climate Change (IPCC). Taking action in the current decade is crucial to achieve this. By 2030, CO₂ emissions have to be reduced by 48 per cent compared to 2019 in via 1.5 degree pathways with no or limited overshoot. According to the IPCC, a net-zero energy system will require a substantial reduction in total fossil fuel use, minimising the use of unabated fossil fuels, and the use of CCS in the remaining fossil fuel system. Emissions from the continued operation of the existing fossil fuel infrastructure without additional abatement measures would exceed the remaining carbon budget for 1.5 degrees. To keep the Paris temperature goal within reach, coal-fired power generation will need to be rapidly and significantly reduced, and oil and gas use will have to peak and decline as well. Many of the modelled pathways assessed by the IPCC rely on CCS and CDR being deployed on a very large scale in order to reach ambitious targets. If carbon sequestration technologies are limited to levels deemed feasible by experts, the share of fossil fuels, especially gas, in the energy mix declines much faster and to lower absolute levels.

In the recently published update of its Net Zero Roadmap, the International Energy Agency (IEA) projects that oil and gas production will decline by around 2 per cent per year until 2030, and then by 4 to 5 per cent per year until 2050. Therefore, in a 1.5 degree scenario, no new oil and gas fields would need to be developed to meet demand. Instead, investment in the fossil fuel industry would be limited to maintaining existing production and minimising emissions from its operations.

The incoming COP President, Sultan Ahmed Al Jaber of the United Arab Emirates (UAE), head of the national oil company ADNOC, stated that phasing down the demand for, and supply of, all fossil fuels is inevitable and essential. At the same time, he stresses the need to invest in reducing emissions within the existing fossil fuel system. To achieve the goal of an energy system that is free of unabated fossil fuels by mid-century, all available technologies and solutions must be scaled-up, now.

A complete phase-out of all fossil fuels for both energy and material use, for example in the chemical industry, is not actually reflected in scientific mitigation scenarios. In political terms, however, the demand is highly symbolic. The exact wording of the COP decision on phase-down vs. phase-out and unabated vs. all fossil fuels and the resulting narrative is of great importance for the future of the fossil fuel economy. This will be seen as a signal regarding the fate of investment in new fossil fuel infrastructure, but also an indicator about the extent to which abated fossil fuels will be included in mitigation policies or sustainable investment guidelines, and whether the costly construction of CCS infrastructure should be publicly funded.

Fossil fuels and the UNFCCC

In the context of the United Nations Framework Convention on Climate Change (UNFCCC), it has long been impossible to explicitly address the role of fossil fuels. The countries of the Organization of the Petroleum Exporting Countries (OPEC) and Russia, in particular, have been adamant in their opposition to sectoral and fuel-specific language. Their position is that the UNFCCC mandate does not cover the use of specific energy sources, but only the resulting emissions. Other fora, such as the G20 and G7, have also failed to agree on phasing out fossil fuels. In their communiqués, the term “unabated” is used in this context, along with ill-defined goals such as “sustainable and clean energy systems”.

When COP26 in Glasgow (2021) called for a phase-down of coal-fired power generation and the elimination of inefficient fossil fuel subsidies, it was the first time that language explicitly naming fossil fuels was included in a UNFCCC decision text. Since then, there has been an increasing struggle to formulate a target that meets scientific requirements while being politically viable.

In addition to the debates about the time horizon and the distinction between industrialised and developing countries, the lines

of conflict also concern the differentiated treatment of coal, oil and gas. Large emerging economies such as India, China and Indonesia, citing historical responsibility and equity, are critical of calls for phasing out fossil fuels in general, and also opposed to singling out coal-fired power generation, which is particularly harmful to the climate. In this context, India's initiatives in Glasgow (COP26) and Sharm El Sheikh (COP27) to phase down all fossil fuels also served to highlight the bias of many developed countries, especially the United States.

The distinction between unabated and abated fossil fuel use has given the phase-out debate a new focus. The latter refers to reducing emissions both during the production phase of fossil fuels, primarily by avoiding volatile methane, and during their use, primarily by capturing and storing CO₂ from process and waste gas streams from large point sources such as power plants and industrial facilities.

The net-zero strategies of major emitters such as the United States, China and Canada, as well as many scientific mitigation scenarios rely heavily on CCS (see SWP Comment 38/2023). However, the technology, albeit being the subject of intensive research for decades, has so far failed to live up to expectations in practice. In particular, it currently has no role in decarbonising power generation, which is also crucial for rapid emission reductions in other sectors. According to the Global CCS Institute, only one commercial-scale power plant with CCS was in operation worldwide at the end of 2022.

At COP28, the first Global Stocktake under the Paris Agreement will be completed. The aim is to review the collective progress towards achieving the climate targets and encourage the subsequent strengthening of national commitments. Due to the massive ambition and implementation gap, the focus of the debate has shifted towards short-term measures in order to course-correct. The substantial advancements in solar and wind energy, as well as in electricity storage technology, lend further support to manifold calls to prioritise renewable energy sources

and swiftly phase out coal-fired power generation.

The EU is advocating for a clear signal at COP28 to restrict the deployment of CCS to those sectors where no viable mitigation options exist or are prohibitively expensive. Many ambitious nations, especially from Small Island Developing States and Northern Europe, still favour a complete phase-out of all fossil fuels. There is deep concern that limiting a phase-out to "unabated" fossil fuels would send the wrong signal and further delay the urgent changes needed in investment and infrastructure priorities.

Emission-reduced use of fossil fuels

To evaluate the limiting of a phase-out to unabated fossil fuels through the lens of ambitious climate goals, three key dimensions must be considered. Firstly, there needs to be a clear definition of the level of emission reductions required for fossil fuels to be considered as abated in line with the Paris temperature goal. Secondly, it is crucial to clarify the feasible scope of practical CCS applications and determine the extent to which they can reduce emissions, as well as the factors limiting reductions. And thirdly, in view of the dwindling remaining carbon budget, it is essential to determine the time frames in which these contributions could be realised.

Definition

A meaningful differentiation between the unabated and abated use of fossil fuels presupposes that the emission reduction rates for CCS and fugitive methane assumed in scientific model calculations are used as a basis and are then also achieved in practice. There is currently no global consensus for the minimum level of emission reductions at which fossil fuel use would be considered as abated. The closest thing to a definition is a footnote from the IPCC's *Sixth Assessment Report* stating "in this context, 'unabated fossil fuels' refers to fossil fuels produced

and used without interventions that substantially reduce the amount of [greenhouse gases] emitted throughout the life cycle; for example, capturing 90 per cent or more CO₂ from power plants, or 50 – 80 per cent of fugitive methane emissions from energy supply.”

A group of scientists involved in the IPCC report recently proposed the development of values that are consistent with a “Paris-compatible” definition for abated fossil fuels. To this end, they suggest a decrease of 90 to 95 per cent in CO₂ emissions from end-use and upstream fugitive methane emissions of less than 0.5 to 0.2 per cent of equivalent natural gas production. The experts highlight that, even with these rigorous objectives, the successful commercialisation of CDR is needed to offset residual emissions released with CO₂ capture rates below 100 per cent. Otherwise, a political framework would be necessary to incentivise and enforce near-complete CO₂ capture, which is technically very complex and costly (deep CCS).

Using captured CO₂ as a feedstock for materials or synthetic fuels (carbon capture and utilisation, CCU) or managing CO₂ in a closed loop requires specific and precise standards for the entire life cycle to avoid creating false incentives (see SWP Comment 29/2023). Without conceptual clarity and strict limits, the continued usage of fossil fuels with CCS or CCU can undermine ambitious mitigation efforts.

Reducing upstream emissions

Considerable emissions also occur during the production phase of coal, oil, and natural gas. Upstream emissions, which result from the extraction, transport and processing of oil and gas, currently account for around 15 per cent of greenhouse gases from the energy sector. Avoiding fugitive methane emissions can significantly and cost-effectively contribute to mitigation in the short term – in addition to electrifying processes, switching fuels and transitioning to renewable energies. The Global Methane Pledge is geared towards realising this poten-

tial, and COP28 President Al Jaber put further emphasis on it through his call for the fossil fuel industry to eliminate methane emissions from production by 2030.

CCS for industry and atmospheric CO₂ removal

Reducing emissions that result from the use of fossil fuels is considerably more complex. Although cost-effective alternatives to fossil fuels that do not produce CO₂ are increasingly available, particularly for electricity and heat generation, the CCS pathway is currently irreplaceable for eliminating emissions from some industrial processes. Capturing CO₂ as completely, energy-efficiently and cost-effectively as possible from emissions that are difficult to avoid in some industrial processes will be an important element of a climate-neutral economy. CCS is also a process component of many CDR approaches, for example in combination with bioenergy (BECCS) or direct air capture (DACCS).

Worldwide, commercial-scale CCS is almost exclusively used in industrial facilities – for example in the production of fertilisers, hydrogen and ethanol – and in the processing of natural gas, in which the separation of CO₂ is a necessary process step for developing the final product. As the initial gas mixture is generally purer and more concentrated than in combustion processes, CO₂ capture is more straightforward technically. The captured CO₂ is mainly used to increase the yield from oil fields (enhanced oil recovery), which is crucial for the economic viability of CCS applications. Although these processes reduce CO₂ emissions, they are not usually designed to minimise them. Especially in the oil and chemical industries, CCU and CCS are playing an increasingly important role in mitigation strategies.

CCS in the power sector

CO₂ transport and sequestration are considered as well-established technologies, at least for certain geological formations. By

contrast, the technology for capturing CO₂ from the flue gas of fossil-fuelled power plants, which has relatively low CO₂ concentrations and high amounts of suspended matter, is not yet fully developed. Combined with high costs and efficiency losses, this has led to the poor performance of CCS in the power sector to date. Especially in mitigation scenarios that allow for a relatively high, temporary overshoot of the 1.5 degree limit, significant amounts of fossil fuels with and without CCS in the energy system are still being projected for mid-century.

One underlying reason has to do with which political preferences and resulting market developments are expected for different regions of the world. Governments' decisions about future energy supply are not only based on environmental and cost considerations, but also take into account factors such as energy security, domestic resources, existing infrastructure and expertise, and the political economy of incumbent industries. Many countries in the Global South see it as their right to exploit (domestic) fossil resources – given their disparate historical responsibility for climate change – and are prioritising access to energy over climate protection.

Whether using abatement technologies for fossil fuels in the electricity and heating sectors is an attractive option also depends on the regional context. For Saudi Arabia, for example, it makes sense to exploit specific locational advantages to establish CCS hubs – such as high renewable energy potential, favourable geological conditions for CO₂ storage, integrated petrochemical value chains, existing transport infrastructure, and expertise in the oil and gas industry. The same applies to the US East Coast. In countries with a young power plant fleet, such as China and Vietnam, retrofitting existing coal-fired power plants with CCS would be particularly beneficial for mitigation. Indeed, China is currently investing heavily in CCU and CCS in the industrial and energy sectors. For many countries, the argument of increasing energy security by diversifying supply also plays an important

role. Accordingly, the number of planned CCS and CCU projects in the energy sector has risen sharply in recent years.

The net-zero challenge

CCS is limited to large stationary plants. For the decentralised use of fossil fuels, for example in internal combustion engines or boilers, there is currently no technical abatement option beyond improved efficiency. Even under optimistic assumptions about the overall capture rate of CCS, the continued use even of abated fossil fuels would be associated with significant residual emissions that would have to be offset by CDR on a large industrial scale. The energy, material and financial outlays required to build the resulting CCS and CDR infrastructure are some of the main arguments against the continued role of abated fossil fuels, particularly in the power sector.

The recently published IEA Net Zero Roadmap update also highlights the availability of CCS infrastructure at scale – or the lack thereof – as a central challenge. The development of CCS lags far behind the rate of deployment assumed in the scenario. According to the IEA, large-scale CCS plants, which usually have to be adapted to specific sites, are unlikely to see similarly favourable cost developments as modular renewables – even with increasing deployment.

The latest IPCC report draws similar conclusions. According to the Working Group III assessment, CCS deployment rates are far lower than those projected. Wind and solar energy, reductions in methane emissions from fossil fuel supply and demand-side measures are identified as the climate change options with the highest absolute and cost-effective potential up to 2030, by far. The potential of fossil fuels with CCS is estimated to be very low, at least until 2030, with significantly higher associated costs. In addition, the recently published IEA World Energy Outlook projects that production will peak for all fossil fuels before 2030 due to structural changes alone, even without additional measures beyond those required

by existing climate policy. In light of these developments, the question is how to incentivise and finance the development of CCS infrastructure for foreseeable, unavoidable applications and scales, without further delaying urgently needed near-term climate action – particularly in the power sector – and without encouraging the creation of overcapacity for coal, oil and gas.

Tug-of-war over the dominant narrative

The battle over the wording of the fossil fuel phase-out is also tied to the attempt to establish a narrative of the sustainable, climate-neutral use of fossil fuels being an alternative to renewable energy sources. The OPEC states in particular, with Saudi Arabia as their mouthpiece, are actively pursuing this. Internationally, the Kingdom is advocating a climate policy triad of “mitigation, abatement and removal”. This unusual division distinguishes between mitigation – whereby CO₂ emissions are avoided through the use of largely climate-neutral technologies such as solar, wind and nuclear energy, or through efficiency gains – and abatement, which involves reducing CO₂ emissions from the use of fossil fuels. It suggests that, with CCS and CDR, the climate-neutral use of fossil fuels is possible indefinitely. Hence, according to the nationally determined approach of the Paris Agreement, the choice should be left to individual countries, and no technology or energy source should be discriminated against or favoured. The narrative also paves the way for calls to promote and support all technologies equally.

Saudi Arabia itself is pursuing a “circular carbon economy” (CCE) approach, which it has been promoting internationally since its G20 Presidency in 2020. The CCE approach is based on the four pillars of “reduce, reuse, recycle and remove”. The “reduce” strand (analogous to mitigation) includes measures to reduce the amount of CO₂ that needs to be managed. The Kingdom attaches great importance to this sub-

pillar at the national level, for example by setting an ambitious target of 50 per cent renewable electricity generation by 2030. However, the focus of its political communication is clearly on the continued use of fossil fuels, which they say should be enabled through the development and deployment of alternative materials, synthetic fuels and hydrogen, combined with the expansion of CCS, CCU and CDR.

The UAE’s action programme for its upcoming COP Presidency calls for “accelerating a just and orderly energy transition and drastically reducing emissions by 2030”. The UAE is focusing on renewable-energy expansion targets and energy-efficiency improvements, as well as reducing the emissions intensity of fossil fuels, particularly by reducing associated fugitive methane. The Emirates are expending considerable political capital to commit the oil and gas industry to making a substantial contribution to climate change mitigation. The goal of securing commitments from as many major oil and gas companies as possible is at the heart of their multi-sectoral climate action agenda. COP President Al Jaber’s call for the world to use only the cleanest oil and gas possible may also be read as a message from the Gulf States, which feature relatively low upstream emissions, to fossil fuel producers with higher emission intensities. In addition to countries with outdated production infrastructure, this would also include those that rely on unconventional sources such as shale gas and oil sands.

The stance of the two oil states – Saudi Arabia and the UAE – that the existing system must be decarbonised while the new system is being built is entirely consistent with the urgency required by science. However, emphasising the narrative of the climate-neutral use of fossil fuels can give rise to the impression that this is a tactic to prolong the fossil fuel business model at the expense of climate protection, rather than a mitigation strategy. This notion undermines the legitimate goal of moving CCS technology from its current weak position towards the required performance level and

greater deployment through a concerted push in research, development and investment incentives. Harnessing the current momentum without creating perverse incentives for continued investment in fossil fuels will be a difficult balancing act beyond the Dubai conference.

In its joint negotiating position for COP28, the EU has developed a differentiation that seeks to address this dilemma and also bridge internal dissent within the bloc. It points out that the transition to a net-zero economy in line with the 1.5 degree target requires a global phase-out of unabated fossil fuel use and a reduction in the consumption of all fossil fuels before the end of this decade. Accordingly, the energy sector should be largely free of fossil fuels well before 2050, and power generation should be fully or largely decarbonised by the 2030s, leaving no room for new coal-fired power plants. Given the limited availability of abatement technologies, the EU claims they should be deployed in sectors that are difficult to decarbonise. CDR should contribute to negative emissions – not delay climate action in sectors where there are effective and cost-efficient alternatives.

Outlook

COP28 is of particular importance due to the Global Stocktake and the unprecedented integration of the fossil fuel industry, which is being promoted by the Presidency. Given the geopolitical situation, it is very unlikely that Dubai will produce a major breakthrough with a clear signal for a rapid phase-out of fossil fuels. The question about the role of fossil resources in a net-zero economy will occupy the global community for a long time to come. If a compromise can be found along the lines put forward by the EU, this would at least set a course in the direction of the rapid reduction of fossil emissions deemed necessary by science. A certain openness to regionally specific solutions and the use of abated fossil resources

as a feedstock for materials would be maintained without unduly upgrading the CCS pathway, especially in the short term.

Beyond the COP decision, there is an urgent need for more transparency and honesty when it comes to short- and medium-term contributions and the emissions intensity of different technology pathways. The assumptions used in modelled pathways should be made explicit and subjected to a reality check, including the IPCC's assessment. In order to evaluate risks and appropriately prioritise mitigation over abatement, it would be very helpful to identify conditional pathways that outline future developments based on a high or limited availability of CCS and CDR. To prevent further polarisation of the debate and increase feasibility, governance mechanisms for carbon management should be geared towards minimising residual emissions (see SWP Comment 29/2023).

In addition to conceptual clarity and science-based definitions for abated fossil fuels, it is particularly important to find cross-sector solutions that consider emissions on a life-cycle basis. The strategic goal of climate neutrality needs to be taken into account, as emissions intensity alone is often not an appropriate metric to incentivise the necessary structural changes. Shifting emissions beyond the boundaries of one's own sector, product or national inventory can lead to pathways that appear to be climate-neutral in accounting terms but do not actually reduce emissions significantly in the long term. In this context, the fossil fuel industry's credibility would be enhanced if it explicitly addressed the emissions that result from the end-use of its products and presented clear transition plans.

COP28 President Al Jaber often speaks of pragmatic solutions and recently called for "separating fact from fiction" when it comes to climate action. In the context of reducing emissions from the use of fossil fuels through abatement technologies, this would be a necessary, if not sufficient, step towards a net-zero economy.

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