



Committee Secretariat
Legislative Scrutiny Committee
Legislative Assembly of the Northern Territory
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30 March 2026

To the Committee Secretariat,

Submission of the Environment Centre NT to the Legislative Scrutiny Committee on the *Pipelines and Petroleum Legislation Amendment (Industry Development) Bill 2026*

1. The Environment Centre NT (**ECNT**) is the peak community sector environment organisation in the Northern Territory, raising awareness amongst community, government, and industry about environmental issues, and supporting community members to participate in decision making processes and action.
2. ECNT appreciates the opportunity to provide a submission to the Legislative Scrutiny Committee on the *Pipelines and Petroleum Legislation Amendment (Industry Development) Bill 2026* (the **Pipeline and Petroleum Bill**).
3. The Explanatory Statement to the Pipeline and Petroleum Bill makes clear the purpose and intent of the Bill, being “to promote and enable industry development in key onshore gas projects in the Beetaloo Sub-basin, and support and facilitate broader carbon capture and storage initiatives by allowing carbon dioxide to be transmitted through pipelines in the Territory”.
4. ECNT notes that the Pipeline and Petroleum Bill:
 - a. contains a high degree of technical complexity, seeking to substantively amend three separate pieces of legislation;
 - b. applies to an industry which is controversial, has significant climate, environment and public health impacts, and about which the public has demonstrated a high degree of concern over many years;
 - c. appears to undermine environmental protections for gas and carbon dioxide pipelines in a number of key respects, including by creating enabling provisions whereby operators and projects may be exempted from the regulatory scheme altogether by the Minister;
 - d. creates a new and ineffective regulatory regime for an unproven and environmentally risky new industry in the Northern Territory (being the transport of carbon dioxide via pipeline for carbon capture and storage);
 - e. appears to have the effect of undermining the rights of native title holders in some circumstances;
 - f. was not subject to public consultation prior to its introduction.
5. Given the above factors, and the short turnaround time of one week within which to provide submissions to this inquiry, we request that the Scrutiny Committee hold a public hearing to ensure that Territorians have a forum in which to adequately express their views about the Pipeline and Petroleum Bill.



6. In the very short time available between introduction of the Bill and the deadline for providing submissions to the Scrutiny Committee, it has not been possible for ECNT to prepare a detailed submission on the Pipeline and Petroleum Bill.
7. In this brief submission, ECNT raises a number of high-level concerns, and reserves the right to make additional comments and recommendations for amendments at a public hearing, if one is scheduled.
8. ECNT makes the following recommendations:
 - (a) The Legislative Assembly should not pass the Pipeline and Petroleum Bill in its current form;
 - (b) The Pipeline and Petroleum Bill should be amended in line with the recommendations and concerns outlined below;
 - (c) The Pipeline and Petroleum Bill does not have sufficient regard to the rights of and liberties of individuals, including traditional Aboriginal owners; and
 - (d) The Pipeline and Petroleum Bill does not have sufficient regard to the institution of Parliament, due to the rushed nature of the consultation and the potential conflict with inconsistent Commonwealth legislation.
9. The Pipeline and Petroleum Bill amends the existing *Energy Pipelines Act 1981* (which regulates gas pipelines) to enable regulation of the transport of carbon dioxide streams for the purposes of carbon capture and storage. This is not something to be done lightly. Carbon capture and storage (CCS) is a new and highly technically challenging industry in the Northern Territory, with a long history of repeated technical failures elsewhere, and there is little to no expertise in the NT Government with respect to its regulation.
10. ECNT notes that CCS is an unproven technology at scale, which:
 - a. Masks the harmful carbon emissions from the underlying source, enabling that source to continue operating rather than being replaced altogether;
 - b. Generates additional risks, impacts and costs associated with CCS infrastructure, such as pipelines;
 - c. Exacerbates global warming by boosting oil and gas production and prolonging the fossil fuel era.
11. [Analysis](#) by the Institute for Energy Economics and Financial Analysis world's largest CCS project, at Chevron's Gorgon LNG facility in Western Australia, has repeatedly failed to store the carbon dioxide predicted, reporting the lowest amount of carbon dioxide captured ever last year since its inception in 2019. It notes that Gorgon CCS captured only a fraction of the total emissions from its adjoining LNG plant, noting CCS' history of technical challenges and underperformance. ECNT also **attaches** a briefing paper from the Centre for International Environmental Law, "Confronting the Myth of Carbon-Free Fossil Fuels: Why Carbon Capture is not a Climate Solution", detailing the reasons why carbon capture technologies do not work and are not a climate solution.
12. There are significant risks to the environment, climate and human health associated with CCS and the transport of carbon dioxide including:
 - a. It can lead to the release of various toxic pollutants other than carbon dioxide (for example PM2.5, nitrogen oxide and ammonia);
 - b. It requires the carbon dioxide to be compressed to a liquid or supercritical state so that it is dense enough to transport through a pipeline. Pipelines must be built to specific

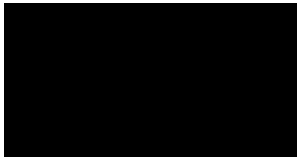


- standards to accommodate the high pressures needed to contain carbon dioxide as a highly condensed and hazardous substance for transport;
- c. Unlike gas or oil pipelines, the risk from a carbon dioxide rupture is not combustion, but asphyxiation. Carbon dioxide is heavily pressurized and denser than air, so if a pipeline bursts, large volumes can be released extremely quickly and stay close to the ground, threatening people in a wide radius from the release. This happened in Sattaria, Mississippi, where dozens of residents were hospitalised when a CO₂ pipeline ruptured.
 - d. The safe operation of carbon dioxide pipelines faces regulatory and knowledge gaps. For example, in the US, there are gaps in regulations related to the corrosive and potentially harmful characteristics of wet or impure streams of carbon dioxide.
13. Despite the above complexity and risk of harm, there are scant provisions to protect the environment and public health in the Bill, and nothing that addresses the technical complexities and risks of CCS technologies specifically. The Bill simply amends the existing Act to enable carbon dioxide pipelines to be regulated via the legislation. There is little transparency or public accountability regarding decision-making under the proposed arrangements (including an absence of provisions for the public to be consulted about proposed pipelines and their impacts). There are few references to environmental or public health protections. The amendments are manifestly inadequate as a means of regulating CCS.
 14. The Pipeline and Petroleum Bill also significantly erodes environmental protections and transparency for pipelines more generally.
 15. The Pipeline and Petroleum Bill appears to exempt certain pipelines (including “a pipeline that forms part of a gas distribution line or network”) from the regulatory regime altogether, by stating that these pipelines do not require a pipeline licence under the Act. It may also undermine the rights of native title holders by removing the requirement to obtain tenure for such pipelines (which would ordinarily comprise a “future act” under the *Native Title Act*). This exemption should be removed.
 16. The Pipeline and Petroleum Bill introduces a new requirement to publish a notice about an application for a pipeline licence on the department’s website (as well as in the Gazette and paper). This does not go far enough. There are no provisions for public consultation about pipeline licences, or requiring the Minister to take into account the public’s views. Given the climate, environmental and public health risks associated with pipelines, there should be provisions requiring comprehensive public consultation consistent with (for example) the Petroleum (Environment) Regulations.
 17. The provisions regarding pipeline management plans (the key regulatory document that governs pipelines) are not prescriptive enough and give pipeline operators wide latitude to self-select the standards that they will comply with. There is only a requirement that pipeline management plans comply with “good industry practice and the standards specified in the plan”. There is no requirement to comply with any specific standards and codes, for example with respect to the construction and operation of compressor stations or the fugitive emissions monitoring. There are no policies guiding the approval of CCS in the Northern Territory, or the exercise of the powers granted under the Act. The Bill should be amended to require specific environmental outcomes to be achieved, and enforceable codes of practice and policies developed to guide the development and approval of pipeline management plans.



18. The Bill also enables regulations to be created which would empower the Minister to determine that a pipeline management plan is not needed at all, or would give the Minister a broad power to exempt a licensee from the requirement to comply with a pipeline management plan. This could mean that pipelines (for gas or carbon dioxide) may conceivably lack any regulatory oversight whatsoever. The Bill should be amended to require compliance with objective standards and codes in accordance with industry best practice, and the provisions enabling the Minister to exempt pipelines from requirements to produce pipeline management plans should be removed.
19. The Pipeline and Petroleum Bill also amends the *Petroleum Act 1984*. It amends sections 42 and 56 of the Act by inserting provisions that allows petroleum that is recovered under another petroleum permit or licence to be accepted into a licence area for processing, refining, storing or transporting the petroleum. This purports to expand the rights attaching to petroleum tenure, in a way that may undermine the rights of native title holders and/or be inconsistent with Commonwealth legislation (namely, the *Aboriginal Land Rights (Northern Territory) Act 1976* and the *Native Title Act 1993*). These provisions should be removed.
20. Similarly, provisions enabling the amalgamation of retention licences in the *Petroleum Act 1984* may undermine the rights of native title holders and/or be inconsistent with Commonwealth legislation (namely, the *Aboriginal Land Rights (Northern Territory) Act 1976* and the *Native Title Act 1993*). These provisions should be removed.

Yours sincerely



Kirsty Howey
Executive Director
Environment Centre NT

Why Carbon Capture Is Not a Climate Solution

The world is confronting a climate emergency. Avoiding climate catastrophe requires immediate and dramatic reductions in greenhouse gas (GHG) emissions that are possible only with a significant investment of public resources in proven mitigation measures, beginning with eliminating fossil fuel use and halting deforestation. Carbon capture and storage (CCS) and carbon capture, utilization, and storage (CCUS) will not address these core drivers of the climate crisis or meaningfully reduce GHG emissions, and should not distract from real climate solutions.

CCS and CCUS technologies are not only *unnecessary* for the rapid transformation required to keep warming under 1.5°C, they *delay* that transformation, providing the fossil fuel industry with a license to continue polluting. This brief argues that carbon capture technologies:

- Do not remove carbon from the atmosphere, and in fact worsen the climate crisis when used to boost oil production.
- Have not been proven feasible or economic at scale and can only contain a fraction of source emissions.
- Prolong dependence on fossil fuels and delay their replacement with renewable alternatives.
- Create environmental, health, and safety risks for communities saddled with CCS infrastructure, such as pipelines and underground storage.

CCS Isn't Carbon Negative, or Even Carbon Neutral

CCS and CCUS refer to processes that collect or “capture” carbon dioxide generated by high-emitting activities — such as coal- and gas-fired power production or plastics manufacturing — and then transport those captured emissions to sites where they are either used for industrial processes or stored underground.¹

CCS does not *remove* carbon from the atmosphere, although it is often erroneously conflated with “CO₂ removal” or “negative emission” technology. At best, CCS prevents some emissions caused by the combustion of carbon-based fuels from reaching the atmosphere — provided that the captured gases are not later released.

In practice, however, CCS masks the harmful carbon emissions from the underlying source, enabling that source to continue operating rather than being replaced altogether, while creating additional risks, impacts, and costs associated with the CCS infrastructure itself. Moreover, the injection of captured carbon into oil wells to enhance oil recovery — the most pervasive use of CCS today — exacerbates global warming by boosting oil production and prolonging the fossil fuel era.²

Large-Scale CCS is Neither Viable Nor Necessary

The unproven scalability of CCS technologies and their prohibitive costs mean they cannot play any significant role in the rapid reduction of global emissions necessary to limit warming to 1.5°C. Despite the existence of the technology for decades and billions of dollars in government subsidies to date, deployment of CCS at scale still faces insurmountable challenges of feasibility, effectiveness, and expense.

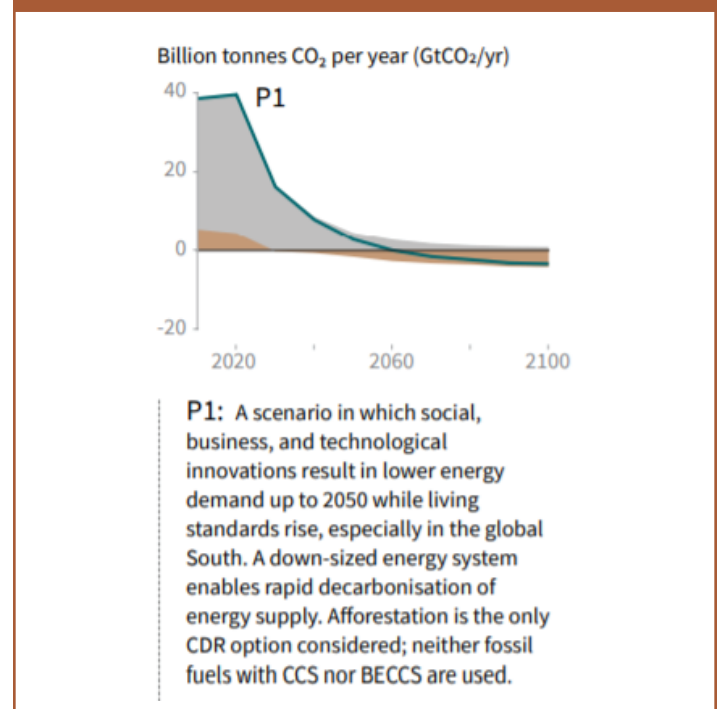
Existing CCS facilities capture less than 1 percent of global carbon emissions. The 28 CCS facilities currently operating globally have a capacity to capture only 0.1 percent of fossil fuel emissions, or 37 megatons of CO₂ annually. Of that capacity, just 19 percent, or 7 megatons, is being captured for actual geological sequestration.³ The vast majority, as discussed ahead, is being used to produce more oil.

CCS pilot projects have repeatedly overpromised and underdelivered. The Petra Nova carbon capture facility installed at a coal-fired power station near Houston, Texas, in 2017 illustrates the failure of CCS to deliver meaningful emissions reductions and the folly of deploying CCS in service of fossil fuel extraction and use.

During its operation, the CCS system only captured 7 percent of the power plant’s total CO₂ emissions, well below the company’s promises to reduce CO₂ emissions by 90 percent.⁴ The captured carbon from Petra Nova had been used for enhanced oil recovery, but the 2020 collapse in oil price and demand rendered this uneconomic. The CCS operation and the gas plant used to power it have been shut down indefinitely, leaving the coal-fired plant as emissions-intensive as ever.⁵

The surest approach to avoiding climate catastrophe does not involve CCS. According to the Intergovernmental Panel on Climate Change (IPCC), the emissions reduction pathway with the best chance of keeping warming at or below 1.5°C makes *limited to no* use of engineered carbon capture technologies. This pathway involves a rapid phaseout of fossil fuels along with limited carbon removal by *natural sources* such as reforestation

FIGURE 1
IPCC 1.5°C Pathway 1



Graphic Source: IPCC

and enhanced soil carbon uptake.⁶ The IPCC points to “uncertainty in the future deployment of CCS,”⁷ and cautions against reliance on the technology, given “concerns about storage safety and cost”⁸ and the “non-negligible risk of carbon dioxide leakage from geological storage and the carbon dioxide transport infrastructure.”⁹

In January 2021, the 1,500 member-organizations of Climate Action Network (CAN) International adopted a shared position statement that the largest network of climate organizations worldwide “does not consider currently envisioned CCS applications as proven sustainable climate solutions.” The organizations warned that CCS “risks distracting from the need to take concerted action across multiple sectors in the near-term to dramatically reduce emissions.” Accordingly, CAN urged that “[a]ll government subsidies, loans, grants, tax credit, incentives, and financial support for fossil fuels and technologies that use or otherwise support the continued use of fossil fuels, including CCS, should be phased out as soon as possible.”¹⁰

A 1.5°C pathway is possible without CCS. By transitioning the transportation, industry, and building sectors to 100 percent clean, renewable energy through rapid

electrification and phase out of fossil fuels, and enhancing natural carbon sequestration through improved land management and restoration, it is possible to keep warming at or below 1.5° C *without* CCS.¹¹

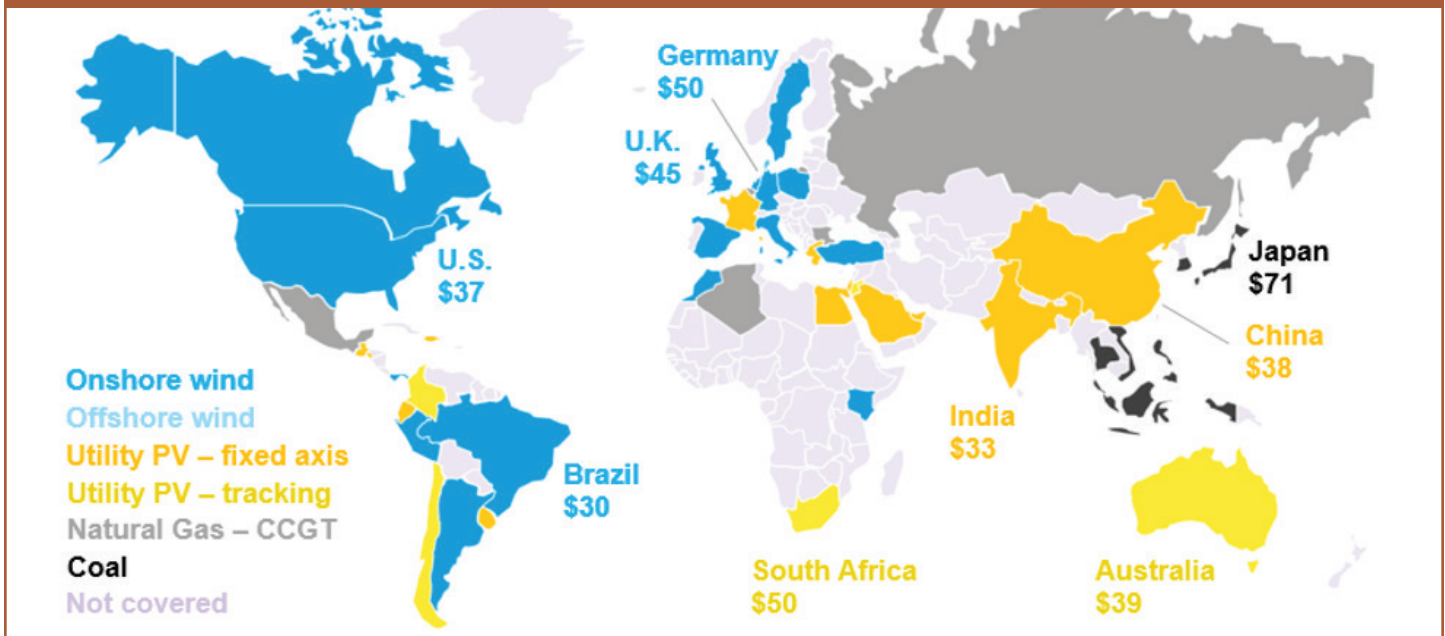
Clean energy is also cheaper energy. Plummeting renewable energy costs are rapidly making electrification with clean sources like solar and wind less expensive than producing power with fossil fuels.¹² A 2020 analysis by Bloomberg New Energy Finance found that solar and wind are already the cheapest energy sources for two-thirds of the world’s population. Rapidly declining costs make renewable energy cheaper than continuing to operate existing coal and gas facilities in many places.¹³

Similarly, plummeting costs are quickly making battery storage a cheaper option for ensuring grid reliability than new gas peaker plants.¹⁴ The US Energy Information Administration (EIA) projects that renewables will account for 71 percent of new US electricity generating capacity in 2021.¹⁵

The failure to account for the energy transition’s market and technological disruptions to coal- and gas-fired power plants means not only that they are outcompeted

FIGURE 2

Cheapest Source of New Bulk Electricity Generation by Country



Source: BloombergNEF. Note: Levelized cost of energy (LCOE) calculations exclude subsidies or tax credits. Graph shows benchmark LCOE for each country in US dollars per megawatt-hour. CCGT: Combined-cycle gas turbine.



Photo by Fabrice Duprez via Pixabay

by alternatives and systematically overvalued,¹⁶ but also that “the overwhelming majority of these conventional facilities will become financially unviable and their assets stranded over the next decade or so.”¹⁷ Tacking CCS onto these soon-to-be stranded power plants is as economically ill-founded as it is environmentally unsound.

From a purely economic perspective, CCS does not make sense. Economists and energy analysts note that CCS projects are “prohibitively expensive compared to other GHG emissions mitigation options, such as renewable energy and energy storage technologies.”¹⁸ Adding CCS onto a fossil-fueled power plant inevitably makes operating the underlying source more expensive. As the authors of the energy transition study summarized above observed, “Coal and gas power plants with integrated carbon capture and storage (CCS) are doubly mispriced (overvalued).”¹⁹ With coal- and gas-fired power stations already becoming more costly than renewable alternatives, adding CCS simply makes them even less economic and even less necessary.

A recent assessment of the economic viability of using CCS with gas-fired power plants demonstrates this reality, noting that mature carbon capture technologies are poorly suited to gas and pose an even larger energy penalty for fossil gas than for coal.²⁰ For a new-build gas-fired plant, CCS could more than double the construction costs and increase the cost of energy produced (known as levelized cost of energy) by up to 61 percent.²¹

As a result, CCS is not economic for gas-fired power plants even when it takes full advantage of existing federal subsidies, as discussed below, and when the captured carbon is used to produce more oil.²² The authors of the study proposed a solution of injecting even more federal funding into CCS.

The simpler, surer, and cheaper solution is to end this and similar subsidies for the fossil fuel economy and invest the savings in accelerating the transition to clean energy.

Even for the Hard-to-Decarbonize Industrial Sector, CCS Is Not the Answer

The industrial sector accounted for 27 percent of US GHG emissions in 2019.²³ As the rationale for wide CCS deployment in the energy sector rapidly fades, CCS proponents are increasingly arguing that CCS will be needed to reduce emissions in heavy-emitting industries like steel, cement, petrochemicals, and aluminum. While the challenges to decarbonizing these industries are real, the potential for CCS to contribute to major emission reductions is routinely and often dramatically overstated. All too frequently, the advocacy for industrial CCS overlooks or downplays considerations like cost, alternatives to fossil fuel inputs, and the risks posed by transporting and storing captured carbon underground.

Applying CCS to high-emitting industrial activities, like petrochemical, steel, or cement manufacturing, is not economical.

GHG emissions from these industries come from a diverse array of sources, including electricity consumption, on-site fossil fuel combustion, and process emissions, which make installing and operating CCS even more complex and generally more costly than it is in the power sector.

A recent analysis co-authored by a Chevron researcher highlights how these costs and complexities weaken the case for significant CCS deployment in the industrial sector. Beginning with a candidate pool of more than 1,500 US industrial facilities identified by the Environmental Protection Agency, the researchers immediately eliminated nearly 700 facilities, accounting for roughly half of all US industrial emissions, because the industries involved — including oil, gas, and coal production — “are not suitable for carbon capture retrofit.”²⁴ By contrast, a transition away from fossil fuels would dramatically curtail such emissions.

From the remaining 656 facilities, the researchers identified only 123 facilities, less than 10 percent of the 1,500 facilities in the initial pool, that could capture carbon economically, even with full use of available federal subsidies and enhanced oil recovery.²⁵ And among that

handful of facilities, many major sources of GHG emissions could not be captured.

For example, the petroleum refining industry is the largest source of industrial emissions other than fossil fuel production itself, yet less than 19 percent of refinery emissions were amenable to carbon capture. For metals processing, including steel, only a quarter of process emissions were amenable to CCS.²⁶ In total, the researchers identified only 68.5 metric tons of CO₂ per year from industrial process emissions that could be economically captured,²⁷ representing just 8 percent of all industrial emissions in the US.

Even this figure significantly overstates the potential of CCS in the industrial sector because the analysis excluded the indirect energy inputs that account for the largest single component of industrial sector emissions.²⁸ The authors did so on the grounds that the energy provided comes from the electrical grid, meaning associated emissions can be reduced more directly through other means, such as renewable energy.

Renewable sources for electricity and heat can dramatically reduce industrial emissions. Most industrial sector emissions are created by burning fossil fuels to produce the electricity and heat that power

FIGURE 3
Breakdown of the Number of Facilities and Their Emissions by Industrial Sector, Type of Emissions, and CO₂ Capture Potential

	refining ^a	chemicals	bioethanol	metals	minerals	pulp & paper	total
All Facilities in the Continuous U.S. Non-Suppliers of CO ₂							
number of facilities	123	360	174	289	369	214	1529
total emissions [MtCO ₂ -eq/yr]	163	138	60	93	114	38	606
SC ^b [MtCO ₂ -eq/yr]	101	70	19	55	30	28	303
PE ^b [MtCO ₂ -eq/yr]	57	68	41 ^c	37	84	10	297 ^c
Facilities Considered for Carbon Capture Retrofit							
Number of facilities	97	104	174	118	163	0	656
total emissions [MtCO ₂ -eq/yr]	163	82	60	73	96	0	473
SC ^b [MtCO ₂ -eq/yr]	107	39	19	45	15	0	225
PE ^b [MtCO ₂ -eq/yr]	56	39	39	27	81	0	242
captured emissions [MtCO ₂ /yr]	40	26	37	19	72	0	195
Facilities Qualifying for the 45Q Tax Credit							
number of facilities	75	62	155	37	129	0	458
captured emissions [MtCO ₂ /yr]	39	24	36	17	71	0	188

^aRefining category includes the emissions from the refining process and the hydrogen production at refineries. ^bSC = emissions from stationary combustion; PE = process emissions. ^cProcess emissions from the ethanol industry are not reported by the EPA, the total process emissions reported by the EPA would thus equal to 256 MtCO₂/yr. In addition, this number excludes emissions from wastewater treatment and landfills that are not studied for point-source carbon capture in this work. Details are available in the [Supporting Information](#).



Photo by HHakim via iStockphoto

manufacturing processes. Thus, decarbonizing the electricity grid by shifting to renewable sources provides the most direct route to slashing emissions in these industries. For example, the World Economic Forum estimates that 60 percent of carbon emissions from electricity-intensive aluminum production could be eliminated simply by producing that electricity from renewable sources.²⁹ In March 2021, a report by the International Aluminum Institute agreed that decarbonizing electricity grids provides the surest, most direct, and likely most cost-effective pathway to significant emission reductions in this energy-intensive industry.³⁰

As currently equipped, the industrial sector uses fossil fuels not only for electricity, but for the heat that fuels industrial processes. Fossil fuel combustion for that heat accounts for about 58 percent of US industrial emissions and about 10 percent of overall global GHG emissions.³¹ Electricity from clean power sources like solar and wind has the potential to provide low-carbon heat to many industrial systems.³²

Concentrated solar thermal systems, for example, use solar energy for generating heat. One company has demonstrated this system works for reaching temperatures of more than 1,000°C.³³ From the heat used in kilns during the process of making cement,³⁴ to the high energy demand from electricity that goes into producing aluminum,³⁵ clean sources of electricity could displace fossil fuels consumed in a growing array of industrial processes, dramatically curtailing the largest single source of industrial GHG emissions and, with it, the purported benefits of CCS deployment in those industries.

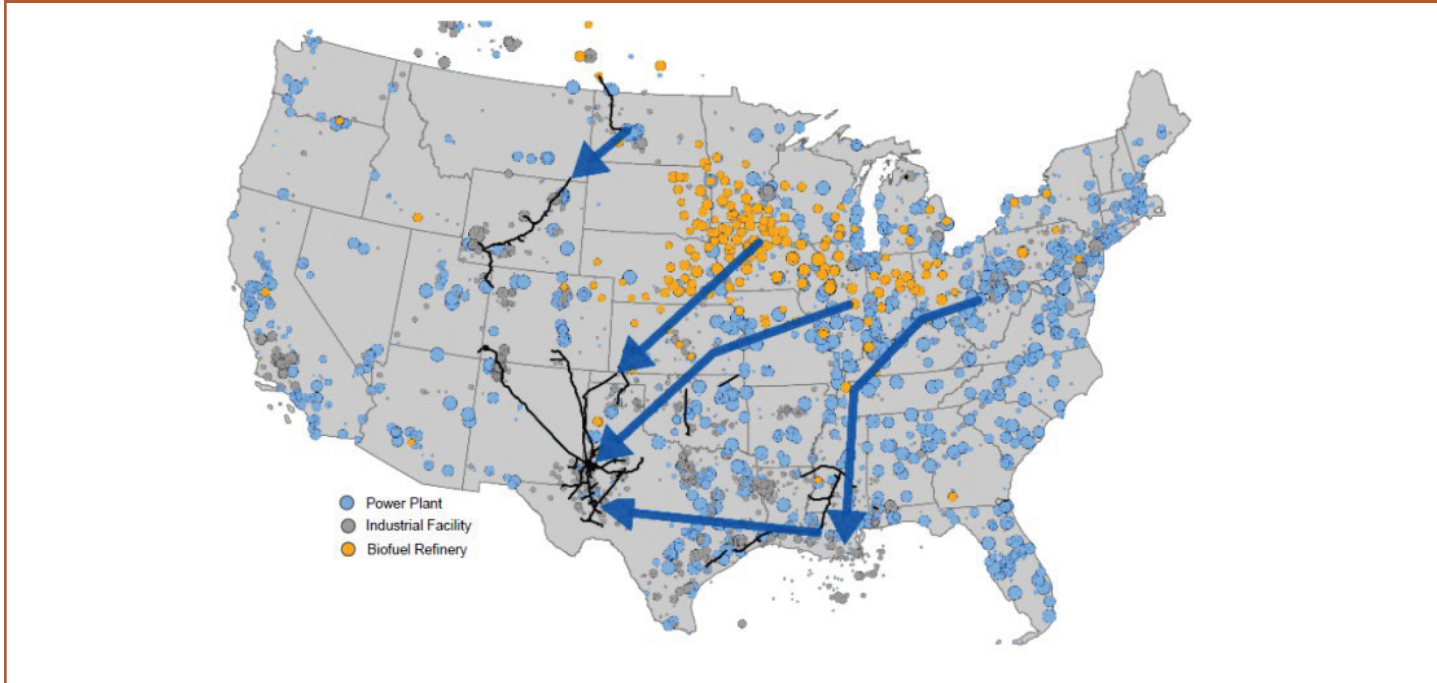
CCS obscures the role of reduction, reuse, and recycling in lowering industrial emissions. Proponents of industrial CCS routinely ignore that one of the most effective ways to reduce industrial emissions from high-emitting sectors like steel, aluminum, and plastics is to reuse existing materials, increase recycling rates, and produce less of the virgin material that is the major driver of emissions. This contrast is particularly notable in the case of plastics and petrochemicals, where the fracking boom of the last decade has driven a massive build-out of new plastics infrastructure even as communities around the world recognize that we need to reduce, not increase, our production and use of disposable plastics.

Even for aluminum, which is already heavily recycled, increasing the recycling of scrap metal could avoid 200 million tons of GHG emissions per year.³⁶ Replacing virgin steel with increased use of scrap metal or direct reduced iron also has high potential to reduce emissions from steel production — potential that should be tapped, given that CCS technology for steel remains immature and economically unproven, according to industry analysis.³⁷

Applying CCS to industrial sources requires massive infrastructure buildout. Even assuming carbon can be captured effectively and economically from an industrial process, that does not assure it can be safely sequestered. The geographic distribution of CO₂ storage sites is a limiting factor for CCS deployment in industry.³⁸ The overwhelming majority of industrial facilities including those in high-emitting industries like cement, steel, and aluminum, were sited to ensure access to critical

FIGURE 4

Map of CO₂-Emitting Facilities Compared to Viable Geological Storage Sites



Elizabeth Abramson, Regional Carbon Capture and Transport Opportunities for Storage in Louisiana. Presentation to “Developing CCUS Projects in Louisiana and the Gulf Coast” (USDOE/USEA/GCCSI) November 17, 2020. https://www.globalccsinstitute.com/wp-content/uploads/2020/11/PPT-LA_Day-1-and-Day-2.pdf at slide 42.

resources like steam, electricity, water, and end markets, not carbon storage.

Accordingly, only a small fraction of existing or proposed facilities in these sectors are located in areas suitable for CO₂ storage. Storing carbon captured from such facilities would demand a vast network of new pipelines, some running hundreds of miles, and carrying hazardous CO₂ through populated areas.

Transporting carbon to storage sites and injecting it underground involves further risks and costs. As discussed more fully below, this reality means that the growing risks of carbon capture will be borne disproportionately by the few communities already living near concentrations of both heavy industry and potential storage or injection sites.

CCS Perpetuates Fossil Fuel Systems and Impacts

By design, CCS enables an underlying emissions-generating activity to continue — by capturing some of the CO₂ it would otherwise emit. The promise of CCS is

being used to rationalize — and subsidize — continued investment in fossil fuel infrastructure that would lock in emissions of CO₂ and other pollutants for decades to come.

Even in its idealized form, CCS only prevents a fraction of emissions from the underlying source.

At every stage of their lifecycle, including extraction, refining, transport, use, and disposal, fossil fuels release a wide array of pollutants, many of which pose known or suspected hazards to humans and the environment. For example, a study released in February 2021 by Harvard University and University College London researchers found that fine particulate matter (PM_{2.5}) from burning fossil fuels is responsible for millions of deaths worldwide. In 2018, approximately one in five deaths overall, or 8.7 million premature deaths, were linked to PM_{2.5} pollution from fossil fuels.³⁹

CCS does nothing to address these hazards.⁴⁰ Indeed, by requiring greater use of fossil fuels to power the CCS process itself, CCS may actually exacerbate them. In the energy sector, there is compelling evidence that the negative climate, environmental, and health impacts of adding carbon capture to fossil fuels are substantially

greater than simply replacing fossil fuels altogether with clean alternatives.⁴¹ As discussed more fully above, the deployment of industrial CCS raises similar concerns.

Using captured carbon to produce still more fossil fuels accelerates the climate crisis. At present, carbon capture is not economically viable without enhanced oil recovery or the production of combustible fuels, making the technology inseparable from the fossil economy. Enhanced oil recovery (EOR) is a technique through which CO₂ — either from natural sources or captured carbon — is injected into underground oil reservoirs to boost oil and gas production from old wells. In essence, CO₂ waste products from a fossil fuel-burning activity are used to generate more fossil fuels, propping up the unsustainable fossil fuel energy system.

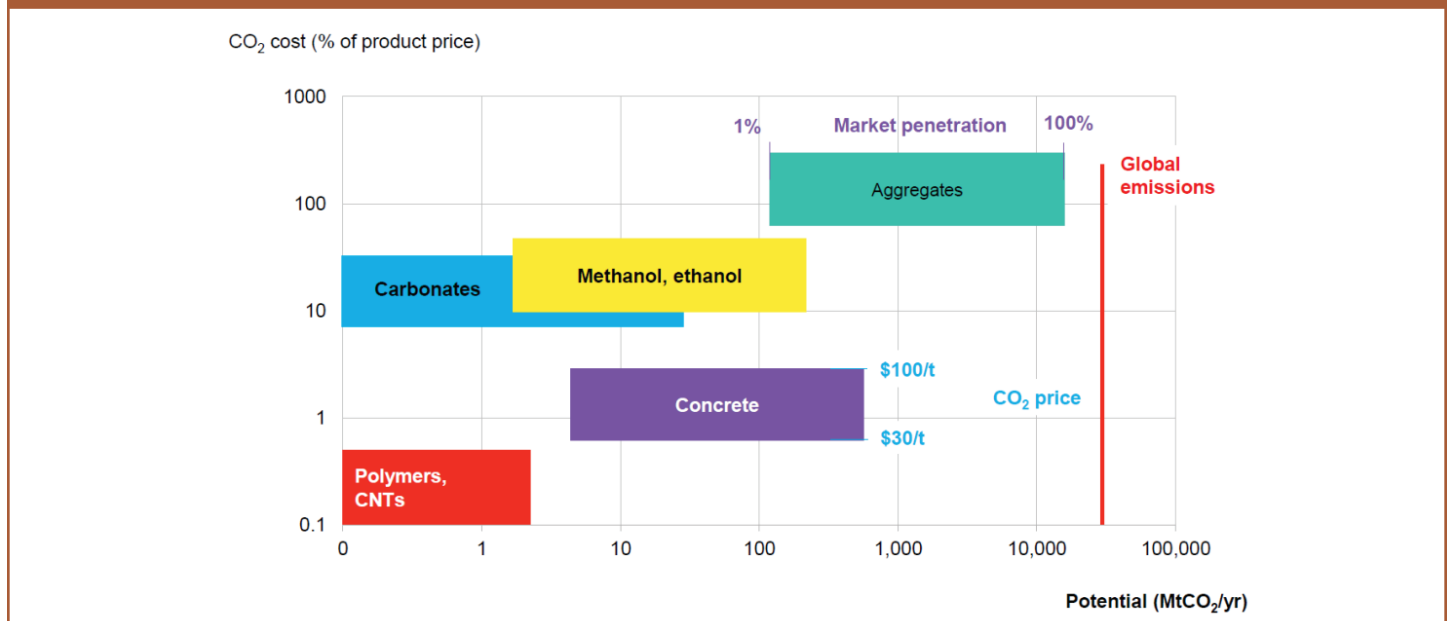
More than 80 percent of all CCS capacity deployed to date has been used for EOR.⁴² And the majority of CCS projects in active development also incorporate EOR. The US Department of Energy estimates this could result in up to 48 billion additional barrels of oil used in the US alone by 2030.⁴³ This is disastrous from a climate mitigation perspective, since it will result in more oil extracted and more carbon emissions from the oil burned. The emissions impact from burning oil produced with CO₂ + EOR is currently excluded from lifecycle anal-

yses touting the technology.⁴⁴ While the resulting CO₂ emissions may be invisible to carbon accountants, their presence in the atmosphere and their impact on the climate remains real and significant.

Proponents of CCUS argue that “[t]he most efficient strategy to reduce the concentration of CO₂ in the atmosphere is to convert it to useful chemicals and fuels.”⁴⁵ But such proposals confront a fundamental challenge: global emissions of CO₂ are orders of magnitude greater than global demand for CO₂ in products. In 2018, the world emitted more than 37 billion tons of CO₂ and other GHGs from fossil fuel combustion for energy and industry.⁴⁶ By contrast, it used just 230 million tons of CO₂ for commercial purposes — equal to just 0.5 percent of total annual emissions. Two uses alone — EOR and fertilizer production — account for more than 85 percent of all CO₂ consumed globally.⁴⁷ All other commercial and industrial uses combined account for just 20 million tons of CO₂ each year, a mere drop in the bucket.

The touted uses of CO₂ are also unviable. Using captured carbon to produce combustible fuels, including via EOR, defeats any climate mitigation purpose, as the fuels release the carbon back into the atmosphere. Transforming CO₂ into chemicals requires massive

FIGURE 5
CO₂ Utilization Markets and Sensitivity to CO₂ Prices



BNEF Executive Factbook 2021 at 56: <https://assets.bbhub.io/professional/sites/24/BNEF-2021-Executive-Factbook.pdf>

amounts of energy, which is why only a handful of commercialized chemicals use CO₂ in significant quantities.⁴⁸ Technologies for embedding captured carbon in plastics, for example, are currently confined to laboratory environments, and neither technologically nor economically proven at scale.⁴⁹ Just as importantly, using captured carbon to increase production of plastics — which are themselves made from fossil fuels — would compound the plastics crisis while doing little to address the climate crisis.⁵⁰ Proposals to store captured carbon in concrete are no more promising. Storing 1 pound of CO₂ requires 100 times its weight in concrete when embedded in cement mix and over 1,000 times its weight when embedded in standard concrete blocks.⁵¹ Embedding coal combustion wastes or industrial slag in concrete does not eliminate smokestack emissions and increases risks of toxic leaching from the treated materials.⁵² Just as using captured carbon to produce more oil increases emissions, embedding industrial wastes into new products does nothing to curb emissions from the activity that generated the waste.

CCS subsidies end up in oil industry pockets. The tax credit for CCS projects (under Section 45Q of the

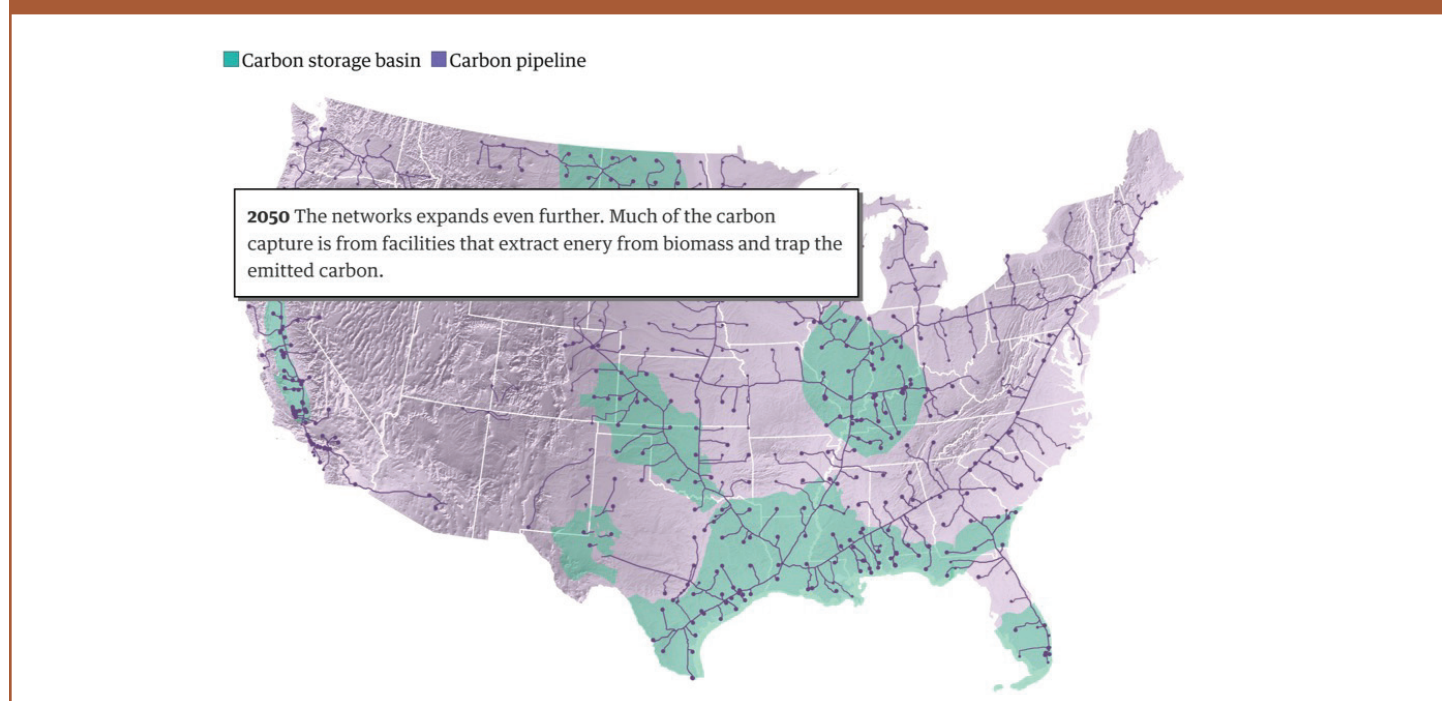
US Internal Revenue Code, which Congress extended in December 2020) is the main federal policy support for CCS. Its biggest beneficiaries are oil companies that claim the credit for injecting carbon into underground oil deposits to produce more oil, through EOR.⁵³ The tax credit thus functions as a fossil fuel subsidy.⁵⁴

Moreover, the lack of adequate monitoring of CCS activities means claimed credits may be based on little more than hot air, not on stored carbon.⁵⁵ For example, an investigation by the US Treasury’s Inspector General for Tax Administration found that fossil fuel companies improperly claimed nearly \$900 million in tax credits under Section 45Q.⁵⁶

The push for carbon capture and storage primarily benefits the fossil fuel industry. The most vocal and active proponents of CCS are oil and gas, petrochemical, and utility companies. They tout the necessity and promise of carbon capture to protect a business model that is contributing to climate catastrophe.⁵⁷

In addition to investing directly in carbon capture ventures, companies in the fossil fuel industry promote

FIGURE 6
Map of Proposed US CO₂ Pipeline Network



Oliver Milman, Alvin Chang & Rashida Kamal, The race to Zero: can America reach net-zero emissions by 2050. The Guardian (March 15, 2021). <https://www.theguardian.com/us-news/2021/mar/15/race-to-zero-america-emissions-climate-crisis>

CCS advocacy, research, and policy through an array of corporate consortia, industry-government working groups, and funding partnerships with universities. For example, the Global CCS Institute, an international think tank dedicated to accelerating CCS deployment, includes various coal, oil and gas, and energy and utility companies as members, and a handful of national and sub-national governments.⁵⁸ Corporate polluters benefit from promoting CCS, while the environmental and community impacts of scaling up the CCS industry are too often ignored.

CCS Poses a Growing and Poorly Understood Threat to Communities & the Environment

Scaling up the technology and infrastructure required to capture, compress, transport, and store CO₂ entails significant risks.⁵⁹ Whether paired with fossil fuel power plants or industrial manufacturing, CCS technology demands massive infrastructure buildout. In terms of scale, it is estimated the CCS industry and associated infrastructure would need to be two to four times larger by 2050 than the current global oil industry.⁶⁰ As the IPCC has noted, extensive deployment of CCS “will require a large network of pipelines.”⁶¹ To date, the heavy environmental footprint and safety and health hazards⁶² associated with CCS infrastructure have been largely overlooked.⁶³

The transportation of compressed CO₂ raises a host of health and safety concerns. Especially when moved over long distances and/or through heavily populated areas, piping CO₂ poses risks similar to those associated with fossil fuel pipelines, from land disturbance and water contamination to the danger of explosions and other accidents. These risks are rarely disclosed or discussed in public discussion of CCS.

Effective transport through pipelines requires that CO₂ be shipped at very high pressure and extremely low temperatures, demanding pipelines capable of withstanding those conditions. The presence of moisture or contaminants can make this condensed CO₂ corrosive to the steel in those pipelines, increasing the risk of leaks, ruptures, and potentially catastrophic running fractures.

Because of the intense pressures involved, explosive decompression of a CO₂ pipeline releases more gas, more quickly, than an equivalent explosion in a gas pipeline.⁶⁴ Video recordings of pipeline failure tests under controlled conditions demonstrate that even a modest rupture can spread freezing CO₂ over a wide area within seconds.⁶⁵ The emergence of a running pipeline rupture could extend impacts the entire length of a pipeline segment.⁶⁶

As a paper published by the Institution of Chemical Engineers Symposium cautions: “The combination of the massive amount of CO₂ released in a relatively short period of time, the resulting dense cloud followed by solid discharge and its slow sublimation will pose a major challenge to safety practitioners when dealing with the hazards associated with the failure of pressurized CO₂ pipelines.”⁶⁷

The IPCC recognizes that “carbon dioxide leaking from a pipeline forms a potential physiological hazard for humans and animals.”⁶⁸ These risks take several forms.

The explosive rupture of a pipeline and its associated shockwave pose immediate physical risks to nearby people and property. In areas closest to the pipeline, a release of CO₂ can quickly drop temperatures to minus 60°C, coating the surrounding area with super-cold dry ice.⁶⁹ At high concentrations, CO₂ is a toxic gas and an



CO₂ cloud from a rupture test performed at DNV GL Spadeadam, Photo: DNV GL

'Foaming at the mouth': First responders describe scene after pipeline rupture, gas leak

Sarah Fowler The Clarion-Ledger

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Photo Credit: Mississippi Emergency Management Agency

asphyxiant capable of causing “rapid ‘circulatory insufficiency’, coma and death.”⁷⁰ And potential contaminants in CO₂ streams, such as hydrogen sulfide (H₂S) can dramatically compound these risks.⁷¹

Accidents are inevitable as CO₂ pipelines are increasingly built in populated areas. In February 2020, a 24-inch high-pressure pipeline containing carbon dioxide and sulfur dioxide ruptured in Yazoo County, Mississippi. According to the Mississippi Emergency Management Agency, more than 300 residents were evacuated and⁴⁶ dozens were hospitalized.⁷² The pipeline owner, Denbury Enterprises, operates hundreds of miles of CO₂ pipelines in the Gulf Coast and Rocky Mountain regions. At least two Denbury pipelines run through the heavily polluted petrochemical corridor known as Cancer Alley,⁷³ predominately populated by communities of color.

These safety hazards and environmental risks fall disproportionately on marginalized communities. Fossil fuel and petrochemical infrastructure, and the threats to health and public safety that infrastructure creates, already overburden Black, Brown, and Indigenous communities. The deployment of CCS threatens to significantly increase these risks, particularly in the regions being most heavily targeted for new CCS buildouts.

Both the Gulf Coast of Texas and Cancer Alley in southern Louisiana have been widely touted as poten-

tial epicenters for industrial CCS development due to existing concentrations of oil, gas, and petrochemical infrastructure, along with oil fields and salt domes that are the most viable injection and storage sites.⁷⁴ CCS proposals in other regions also focus on areas where energy and industrial infrastructure are concentrated, which are typically in or adjacent to poor neighborhoods and communities of color. The expansion of CCS would add a significant new source of pollution and safety risks in Black, Brown, and Indigenous communities already suffering the disproportionate and deadly impacts of environmental racism.

Conclusion

CCS and CCUS are not only unnecessary, ineffective, uneconomic, and unsafe; the technologies are also exceptionally risky, prop up the fossil fuel industry and carbon-intensive industrial activities, and distract from the urgent task of transitioning away from fossil fuels at a time when the US and the world must dramatically accelerate that transition. These technologies, and the dangerous myth they perpetuate of climate-safe fossil fuels, have no place in US climate policies and financing. Such policies should focus instead on phasing out fossil fuels and implementing proven climate mitigation strategies on an urgent, comprehensive basis, reflecting their fundamental importance for this and all future generations.

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