BOARD GUIDANCE FOR COMPANY CLIMATE OPPORTUNITIES

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Abstract

The major research question of this paper is whether net-zero pledges are a dangerous trap for boards of directors' guidance and monitoring of their companies' climate activities and opportunities. There is no current consensus on how to do so. Professor Bob Garatt is the Director at Good Governance Development Ltd, a London External Examiner at Gulf Cooperation Council Board Development Institute. He recommended the following research paper as an important and wise caveat that all boards need to consider as an antidote to easy ESG (environmental, social and governance) rhetoric and accounting. Dyke, Watson, and Knorr (2021), in their paper, "Climate Scientists: Concept of Net-Zero is a Dangerous Trap" provide guidance for boards to assess their companies' climate activities and opportunities. Their research is summarized in two sections of this paper. This paper expands our five prior research papers, which focused upon specific board responsibilities for various aspects of climate impacts on their companies. To avoid this dangerous trap of net-zero pledges, our current paper provides an overall climate perspective for boards, providing guidance for the board of directors' responsibilities for assessing the role of their companies in climate activities and opportunities. It is critical for boards to develop guidance and actions for monitoring companies' climate activities and opportunities.

Keywords: Board Governance, Climate Guidance, Climate Opportunities

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1. INTRODUCTION

Professor Bob Garatt is the Director at Good Governance Development Ltd, a London External Examiner at Gulf Cooperation Council Board Development Institute. He recommended the following research paper as an important and wise caveat that all boards need to consider as an antidote to easy ESG (environmental, social and governance) rhetoric and accounting. The paper by three environmental scientist professors at UK universities is "Climate Scientists: Concept of Net-Zero is a Dangerous Trap" (Dyke, Watson, & Knorr, 2021).

The major research question of this paper is whether net-zero pledges are a dangerous trap for boards of directors' guidance and monitoring of their companies' climate activities and opportunities. To avoid this trap, our paper provides an overall climate perspective for boards, providing guidance for the board of directors' responsibilities for assessing the role of their companies in climate

activities and opportunities. It is critical for boards to develop guidance and actions for monitoring companies' climate activities and opportunities.

Gina McCarthy, the first-ever U.S. national climate advisor, observed: "I have witnessed a paradigm shift: The private sector no longer sees climate action as a source of job losses, but rather as an opportunity for job creation and economic revitalization" (McCarthy, 2022). Public and private investments in research and development have fueled the growth of clean technologies, driving down the costs and attracting industry. Since 2010, the cost of solar energy has decreased by 85%, wind energy by 59% onshore and 71% offshore, and lithium-ion batteries by 89%. As technologies advanced and companies saw the potential to profit, the private sector looked to the government for clear signals and sound policies. The most aggressive action on climate in U.S. history, the Inflation Reduction Act (IRA), was signed into law on August 12, 2022 (McCarthy, 2022). It is analyzed further in this paper.

Concerning such climate opportunities, McCarthy (2022) observed that every major automaker signed on to the U.S. president's goal of achieving 50% electric vehicle (E.V.) sales nationwide by 2030. In the last two years, companies have invested $85 billion in the manufacturing of electric vehicles, batteries, and E.V. chargers in the U.S. The U.S. is now on track to triple domestic solar manufacturing capacity by 2024 and in 2021, investors announced $2.2 billion in new funding for offshore wind supply chains. The U.S. manufacturing sector, which produces materials like steel and cement, has relied on a fossil-fuel-based system for nearly 200 years. Thus, reshaping the climate system means ensuring that these industrial workers get the training and resources to build a clean energy economy (McCarthy, 2022). Therefore, boards of directors need to be monitoring their companies for climate-based business opportunities.

The structure of this paper is as follows. The introduction discusses climate opportunities. The literature review in Section 2 cites board responsibilities for climate impacts on companies. Research methodology is a study of recent developments in climate opportunities in Section 3. Net-zero pledges critique such pledges, as dangerous traps in Section 4, the results are discussed in Section 5. Climate greenwashing threats must be monitored by boards of directors, as stated in Section 6. Climate monitoring examples in the energy industry are provided in Section 7. Board monitoring of net-zero emissions accounting is elaborated in Section 8. Climate opportunities are discussed in Section 9 with various guidelines for board monitoring. Conclusions summarize board guidance for their companies climate opportunities in Section 10.

2. LITERATURE REVIEW

This paper expands our five prior research papers which focused on board responsibilities for various aspects of climate impacts on companies. This paper goes beyond these research papers' topics to an overall climate perspective for boards, providing guidance for the board of directors' responsibilities for assessing the role of their companies in climate activities and opportunities, as opposed to easy ESG rhetoric and accounting.

In order of most recent publications, the first prior research paper focused on guidance for board self-assessment for climate governance. Guidelines for boards to oversee company climate plans were offered. The major recommendation of this paper was that boards use the key areas of the Climate Action 100+ Net Zero Benchmark initiative to assess company climate plans. The key areas were climate governance, decarbonization strategy, net zero greenhouse gas (GHG) emissions, and GHG reduction targets. It is critical for boards to develop an effective climate governance structure and ensure that a company takes appropriate strategic decisions to manage climate-related risks (Grove, Clouse, & Xu, 2022a).

The second prior research paper focused on the challenges for boards of directors in helping their companies manage, assess, and track performance with ESG measures. Currently, there are no required ESG measures, just a variety of choices that make comparisons and analyses very challenging for boards, management, and other stakeholders. A measurement theory perspective, which focuses on valid, reliable, and operational measurement techniques, was advocated for use by management and boards in applying and assessing various ESG measures. If ESG measures are required by national, jurisdictional securities regulatory authorities, such as the U.S. Securities and Exchange Commission, boards would have specific benchmarks, targets, and reports to meet the challenge of managing ESG pledges and measures (Grove, Clouse, & Xu, 2022b).

The third prior research paper analyzed the board of directors' responsibilities for monitoring their companies' commitments to net zero emissions goals, practices, and performances by their companies. Such challenges were elaborated with the following topics: overview of climate risk, current climate lawsuits and board risks, European Union (EU) climate deal, carbon inserts, carbon offsets, carbon credits for agriculture, climate disclosure metrics, global bank greenwashing, and conclusions. This research paper found that a major challenge for boards was to determine whether their companies were really trying to reach zero net emissions or just doing greenwashing. If the International Organization of Securities Commissions Organization (IOSCO) could establish climate disclosure metrics for public companies, an investigation by boards for this greenwashing challenge would be facilitated (Grove & Clouse, 2021a).

The fourth prior research paper analyzed boards of directors' responsibilities for monitoring their companies' commitments to renewable energy, i.e., are companies and their boards making significant efforts, or just greenwashing? This paper argued that boards have corporate social responsibilities for renewable energy commitments, especially in response to activist investors, like BlackRock, Vanguard, and State Street Global Advisors. It developed boards' responsibilities for assessing renewable energy commitments and for monitoring any greenwashing by their companies with implications for corporate governance (Grove & Clouse, 2021b).

The fifth prior research paper stated that management, boards of directors, investors, and stakeholders should be investigating climate change risks for their companies. For example, there may be increasing operating costs, such as higher compliance costs or increased insurance premiums, due to the physical impacts of climate change and increasing water scarcity and reputational risks. However, there may also be climate opportunities, particularly focused on consumers, linked to increased revenue through demand for low-carbon products, services, and better competitive position to reflect shifting consumer preferences. There may be opportunities linked to operations focused on reduced operating costs with efficiency gains (Grove, Clouse, & Xu, 2021).

Several papers have discussed general climate issues without focusing on related board responsibilities, such as renewable energy commitments, climate change risk, green banking practices, corporate social responsibility (CSR) reporting, and related impacts on financial performance. For example, Raghunandan and Rajgopal (2021) studied the Business Roundtable (BRT) companies that had signed the Statement of the Purpose of a Corporation when it was issued in August 2019. The research empirically tested whether these signatory firms exhibited superior treatment of employees and the environment relative to non-signatory peer firms within their industries. The research found that signatory firms had higher rates of environmental and labor violations per various U.S. regulatory agencies. Also, these signatory firms had higher levels of carbon emissions. Thus, these BRT companies appear to be greenwashing their own various stakeholders with the acquiescence of their boards of directors.

Sekarlangit and Wardhani (2021) empirically examined the impact of board characteristics on Sustainable Development Goal (SDG) disclosures. The results showed that the level of SDG disclosure was positively related to the percentage of attendance of board directors' meetings and the existence of CSR committees.

Lahjie, Natoli, and Zuhair (2021) examined the impact of corporate governance (CG) on CSR. Their results showed that a lack of CG in monitoring and supervisory mechanisms, as well as a high concentration of managerial ownership, can significantly contribute to low levels of CSR. Gelmini and Vola (2021) investigated integrated reporting and environmental disclosures for the impact on natural capital where a new geological era, the Anthropocene, or the Age of Humans, has been entered. They analyzed the extent and type of information that can be provided on natural capital with integrated reporting and its efficacy to really enhance sustainability practices.

Wukich (2020) investigated if the detriment to environmental disclosures because of CEO power was different for outcome versus intention-oriented disclosure characteristics in a sample of 2,200 U.S. publicly traded companies. This research found that powerful CEOs' suppression of the most comparable outcome-based environmental disclosures (effectiveness) was greater than the suppression of other environmental disclosures. Malik and Yadav (2020) aimed to explain whether the declaration of sustainability ratings contributes to the stock market reaction in emerging markets. They showed that the announcement of sustainability ratings was not regarded by investors with a great deal of interest, and there is inherent indifference to such news in these emerging stock markets. Longo and Tenuta (2020) assessed sustainability at different levels of environmental, economic, and socio-institutional detail, using the triple-bottom-line approach. A Sustainable Irrigation Index was built to monitor and assess the sustainability of irrigation activities and policies and was applied successfully in a case study.

Rainero and Modarelli (2020) showed the crucial role of CSR promotional activities as an anti-crisis solution during the recent COVID-19 pandemic, based on a sample of 208 respondents. Corporate reputation and image were enhanced. Bonuedi, Ofori, and Simpson (2020) found that CSR reporting was used in correcting negative perceptions and stakeholder skepticism. However, there was very little information on the existence of mechanisms that promote the implementation of stakeholder management policies at the firm level. Firmansyah and Estutik (2020) found that environmental responsibility and social responsibility disclosures were negatively associated with tax aggressiveness. However, corporate governance failed to strengthen these negative influences.

Another empirical study examined the relationship between the firms' environmental and economic performance. Hayami et al. (2015) employed the input-output methodology to study the generation of waste material and GHG in the manufacturing supply chains in Japan. They found that assemblers with suppliers producing less waste and GHG had a better economic performance. The results suggest that encouraging suppliers to reduce waste output can lead to internal green products, increase cost savings, and enhance competitive advantage.

Issues that still need further research include investigating the impact of specific board characteristics on monitoring company climate activities and proactive climate strategies and opportunities. Also, four prerequisites for the emergence of stakeholder capitalism in a country have been discussed (Govorun & Kostyuk, 2022). Such prerequisites could be investigated as factors for companies that are developing proactive climate strategies and opportunities.

3. STUDY FRAMEWORK

Boards of directors have been called upon to navigate the challenges presented by climate changes that are fundamental to the success and sustainability of their companies. However, there remains a dearth of guidance to assist directors in their duty to understand and address climate-related opportunities. This paper studies recent developments in such climate opportunities and provides a foundational framework to enhance boards' climate competence in equipping them with right tools to effectively analyze climate opportunities. Specifically, our paper analyzes net-zero proposals with possible greenwashing, lays out guidance for boards to conduct their own climate activities assessment, and offers useful guidance to assess their companies' climate opportunities.

Our information sources include academic research studies, primarily *Corporate Ownership and Control* (6 articles), *Corporate Board: Role, Duties and Composition* (4 articles), plus other academic journals (9 articles), and 12 *Bloomberg Green Newsletters*, 2 *Carbon Tracker* reports, 2 *World Economic Forum* newsletters, and 5 *New York Times* articles. Another method would be to draw on prior literature and develop an analytical framework on the role of boards in climate governance (Short, 2009).

4. STUDY RESULTS: NET-ZERO PLEDGES

The three climate scientist authors, who have more than 80 years of climate change experience, criticized the current consensus that if we deploy mass tree planting, high-tech direct air capture devices, and other carbon dioxide removal techniques at the same time as reducing our burning of fossil fuels, we can more rapidly halt global warming and achieve net-zero by 2050. Unfortunately, they concluded that in practice such consensus helps perpetrate a belief in technological salvation and has diminished the sense of urgency surrounding the need to curb emissions now. They have arrived at the painful realization that the idea of net-zero has licensed a recklessly cavalier "burn now, pay later" approach which has seen carbon emissions continue to soar (Dyke et al., 2021). This 2021 conclusion was reached even before additional carbon emissions were created by the Russian incursion into Ukraine. An energy industry paper elaborated on this painful climate realization in analyzing coal comeback and continued fossil fuel financing (Grove & Clouse, 2022).

The biggest implementation barrier to carbon capture and storage technology is cost. Retrofitting carbon scrubbers on existing power stations, building the infrastructure to pipe captured carbon, and developing suitable geological storage sites require huge amounts of money. Consequently, the only application of carbon capture and storage in actual operation is to inject trapped gas from oil wells into oil reservoirs as enhanced oil recovery schemes. There is still no capture of carbon dioxide from any coal-fired power plant with captured carbon being stored underground. Climate researchers keep running the same COP (coefficient of performance: the amount of cooling or energy displaced divided by the amount of energy consumed) experiments and CO_2 keeps rising faster. What did Einstein say about doing the same thing over and over and expecting a different result? (Dyke et al., 2021).

As the mirage of each magical technical solution disappears, such as carbon capture and storage, another equally unworkable alternative pops up to take its place. The next one is already on the horizon and it is even more ghastly. Once we realize net-zero will not happen in time or even at all, geoengineering, the deliberate and large-scale intervention in the Earth's climate system will probably be invoked as the solution to limit temperature increases. The most researched geoengineering idea is solar radiation management: the injection of millions of tons of sulphuryl acid into the stratosphere that will reflect some of the Sun's energy away from the Earth. The U.S. National Academies of Sciences has recommended allocating up to $200 million over the next five years to explore how geoengineering could be deployed and regulated. There is nothing wrong or dangerous about the various carbon dioxide removal proposals. The problems come when it is assumed that these projects can be deployed at a vast scale. Such assumptions effectively serve as blank cheques for the continued burning of fossil fuels and the acceleration of habitat destruction (Dyke et al., 2021).

For example, in late July 2022, the Democratic Republic of Congo, home to one of the largest old-growth rainforests on Earth, second in size only to the Amazon, is auctioning 30 oil and gas blocks, which are vast parcels of land. Its goal is to become the new destination for oil investments. Tosi Mpanu, the nation's lead representative on climate issues, said: "Our priority is to earn enough revenue to help finance programs to reduce poverty and generate economic growth. Our priority is not to save the planet" (Searcey & Maclean, 2022), even though the Congo endorsed the 10-year agreement to protect its rainforest at the 2021 global climate summit in Glasgow. The French oil company Total said it did not intend to bid. The American oil company Chevron did not respond to a request to comment, and other major oil companies also declined to comment (Searcey & Maclean, 2022).

Similarly, there is also ongoing deforestation of the Amazon for financial reasons. Climate scientists say such energy developments can destroy precious rainforests and peatlands, which provide one of the last lines of defense for a planet struggling to limit rising temperatures. Such actions also reflect the global shift from fighting climate change to a scramble for fossil fuels, ignited by the Russo-Ukrainian war with American and EU bans on Russian oil and EU reductions on Russian gas, including a call to ration natural gas in Europe. For energy security, Norway, a leading advocate for saving forests, is increasing oil production with plans for more offshore drilling. Although President Biden had pledged to help wean the world from fossil fuels, he recently traveled to Saudi Arabia where he raised the need for more oil production (Searcey & Maclean, 2022).

5. DISCUSSION: STILL CRITICAL FINDINGS OF THE NET-ZERO STUDY

The most interesting and still critical findings of this net-zero study were summarized by each of the three climate scientist authors as follows (Dyke et al., 2021):

1. *James Dyke:* "It's astonishing how the continual absence of any credible carbon removal technology seems to never affect net-zero policies. Whatever is thrown at it, net-zero carries on without a dent in the fender. We have all been subject to a form of gaslighting. Whether it's BECCS (bioenergy with carbon capture and storage), afforestation, direct air capture, or carbon absorbing unicorns, the assumption is that net-zero will work because it has to work. But beyond fine words and glossy brochures, there is nothing there. The emperor has no clothes".

2. *Wolfgang Knorr:* "The predecessor to net-zero was and still is called offsetting. The massive amount of offsetting needed for staying within safe climate limits cannot be met by leaving nature alone. It demands fast growing, mostly alien species that are cut down often and regularly with devasting consequences for biodiversity. We are already seeing the beginning of it in European forests. I am scared almost more by the consequences of net-zero than by those of climate warming".

3. *Robert Watson:* "Relying on untested carbon dioxide removal mechanisms to achieve the Paris targets when we have the technologies to transition away from fossil fuels today is plain wrong and foolhardy. The youth of today and future generations will look back in horror that our generation gambled with catastrophic changes in climate and biodiversity for the sake of cheap fossil fuel when cost effective and socially acceptable alternatives were available. I'm ashamed of our repeated failures".

Possibly such net-zero caveat conclusions are why Greta Thunberg, the youthful climate activist, called the 2021 Glasgow climate conference with all the net-zero pledges by countries and companies just a greenwashing and green-wishing conference. A senior climate scientist involved with the United Nations (UN) Integrated Panel on Climate Change concluded that we were heading beyond 3 degrees Celsius by the end of this century, rather than being able to limit global warming to 1.5 degrees Celsius by mid-century. Rather than stabilize, global emissions of carbon dioxide have increased by 60% since 1992 (Dyke et al., 2021).

These three climate scientists jointly concluded that the only way to keep humanity safe is immediate and sustained radical cuts to greenhouse gas emissions in a socially just way. The path to disastrous climate change is paved with feasibility studies and impact assessments. Rather than acknowledge the seriousness of our situation, we instead continue to participate in the fantasy of net-zero. Current net-zero policies will not keep warming to 1.5 degrees Celsius because they were never intended to. They were and still are driven by the need to protect business as usual, not the climate. If we want to keep people safe, then large and sustained cuts to carbon emissions need to happen now. That guideline is the very simple, key test that must be applied to all climate policies. The time for wishful thinking is over (Dyke et al., 2021). Thus, this caveat to net-zero policies represents climate challenges and business opportunities for companies that boards can help guide.

6. CLIMATE GREENWASHING THREATS

When monitoring the climate activities of companies, Carbon Tracker, a UK research nonprofit organization, highlighted three practices that boards of directors and investors might consider as caveats or red flags for greenwashing net-zero pledges (Carbon Tracker, 2022):

1. Companies should not sell off polluting assets just to create space for new fossil-fuel investments. It points to the International Energy Agency's mid-century net-zero scenario, which calls for an end to new oil and gas fields as of 2021, no new fossil-fuel boilers by 2025, and an end to new internal combustion car sales by 2035.

2. Companies should not rely unduly on emission mitigation technologies, a broad category created to include all kinds of carbon capture, direct air capture, forestry, and oceans.

3. Fast-moving carbon offset markets are attracting scrutiny and should not be over-used.

Carbon Tracker's emphasis on what is covered in companies' net-zero pledges and the details of their pathways to achieve them is supported by the UN Intergovernmental Panel on Climate Change's 2022 report (Pörtner et al., 2022) on preventing dangerous global warming. The report said that the rate at which emissions fall is an extremely influential factor in determining how hot the earth will become. It concluded that the Paris Agreement goal of limiting warming to 1.5 degrees Celsius is all but out of reach unless the world accelerates cuts to emissions, which are still rising, especially with the Russo-Ukrainian war, so they peak at the latest before 2025 (Pörtner et al., 2022).

Carbon Tracker pointed out that a key red flag for possible companies' greenwashing of their net-zero emissions commitments was their use of carbon offsets. What if Chevron or Shell or BP could offset some of their emission damage by paying Brazil or others not to cut down trees? For countries and companies following the Paris climate accord, offsets are a cheap alternative to actually reducing fossil fuel use. Two decades of research have found that carbon offsets have not and will not deliver the climate benefit they promise (Song, 2019).

For example, one researcher used satellite imagery to see how much of a forest remained in a preservation project that started selling credits in 2013. Four years later, only half of the project areas were forested. In case after case, this researcher found that carbon credits had not offset the amount of pollution they were supposed to, or they had brought gains that were quickly reversed or that could not be accurately measured, to begin with. Ultimately, the polluters got a free pass to keep emitting carbon dioxide, but the forest preservation that was supposed to balance the ledger either never came or did not last (Song, 2019).

Of the ten largest U.S. companies by market value, only four, all technology companies, have announced plans to reduce their emissions to net-zero by 2050: Apple, Microsoft, Amazon, and Facebook. A fifth one, another technology company, Alphabet's Google, has a goal to become carbon-free by 2030. The other five largest market value companies, JPMorgan Chase, Johnson & Johnson, Walmart, Mastercard, and Bank of America, all have pledged to fully offset their scope 1 (direct) and scope 2 (indirect) GHG emissions but not their scope 3 (third party) GHG emissions. Promising to achieve net-zero emissions is one thing. Actually doing it is quite another. The way many companies seek to achieve net-zero emissions by purchasing carbon offsets is increasingly being seen as another form of greenwashing (Quinson, 2021).

Boards should monitor their companies for using the loophole of carbon offsets. Since there is no national or global oversight of how the term, zero net or net-zero, is used, loopholes exist. One of the biggest loopholes in net-zero pledges is using carbon offsets as a replacement for cutting

emissions. The most common examples are planting trees or protecting forests, rather than reducing reliance on oil, coal, and methane (Mackenzie, 2021). Many companies choose to do so because it is cheaper than reducing their own direct scope 1 or indirect scope 2 emissions. Companies should always prioritize reducing their own emissions and only use such carbon offsets for activities that cannot be decarbonized through technology (Rathi, 2021).

Boards should also monitor their companies for using the non-loophole of carbon inserts. Carbon inserts occur when an organization invests in sustainable practices within its own supply chain to reduce its scope 3 GHG emissions versus carbon offsets where an organization pays for projects to capture GHG emissions emitted somewhere else. Carbon inserts support the implementation of practices, often through tree planting and agroforestry projects, that sequester carbon, promote climate resilience, protect biodiversity, and restore ecosystems. Carbon inserting represents actions taken by an organization to fight climate change within its own value chain in a manner that generates multiple positive sustainable impacts. Carbon insert projects provide a much more holistic approach than carbon offsets because they consider more than just carbon sequestration, but the entire ecosystem as well as the communities and farmers. Some carbon inserts organizations, such as the PUR Project, work with third parties to verify and audit their projects (Conscious Life & Style, 2020).

Boards of directors, investors, and other stakeholders need to understand and monitor the differences between carbon inserts and carbon offsets, especially for possible greenwashing. For example, the Netherlands advertising watchdog, the Advertising Code Committee, ruled on August 26, 2021, that a Shell advertising campaign that said its customers can offset the carbon emissions from their fuel purchases was misleading, i.e., carbon inserts for Shell's scope 3 GHG emissions by the customers in its supply chain. The Shell commercial was misleading because it gave the impression that its customers can achieve carbon-neutral driving by paying only 1 extra euro cent per liter of gasoline. Shell said it would use the proceeds to plant trees and re-absorb carbon dioxide from the atmosphere, i.e., carbon offsets. However, it could not prove it was fully offsetting such carbon emissions as part of its zero-net emissions pledge by 2050, i.e., a greenwashing issue (Hurst & Baazil, 2021).

There is a difference between a company meeting its own net-zero plan and contributing to efforts to meet the planet's global warming goals. For example, oil and gas companies have been selling their polluting assets to meet climate commitments. But it makes no difference to the atmosphere if private equity firms buy and operate them. Gavin McCormick, co-founder, and executive director of WattTime, a nonprofit organization that offers technology climate solutions, said: "The perspective is almost I can optimize my carbon footprint. That's going to increase everybody else's, but I get to claim I'm green" (Roston, 2022a).

Boards should monitor their companies for the use of emerging carbon removal technologies. However, such carbon removal options are more expensive than tree planting programs. One is using crushed minerals that accelerate a natural process. Another is burning biomass in power plants, then burying the produced carbon dioxide. There are also giant air filters that trap carbon dioxide, just like trees do, and then inject the carbon deep underground. While countries and companies are developing and using carbon dioxide removal techniques, they must first prioritize cutting their own carbon emissions (Rathi, 2022).

Another example is the emerging technology of carbon capture and storage (CCS) or sequestration which is the only scalable technology that removes carbon from the atmosphere and buries it deep underground. United Airlines has committed to a multimillion-dollar investment in a startup company that captures carbon using direct air capture (DAC) technology. This investment will help fund the first of several DAC plants that are expected to capture and store one million metric tons of CO_2 per year which is equivalent to planting 40 million trees. Carbon sequestration is a real and permanent solution (Kirby, 2020).

7. CLIMATE MONITORING: ENERGY INDUSTRY EXAMPLE

Carbon Tracker has issued an Absolute Impact annual report each year since first launched in 2020. The Carbon Tracker approach emphasizes stakeholder value beyond the specific conclusions reached about publicly traded oil and gas companies. Three questions that shape the report seek clarification for all publicly traded companies' commitments toward net-zero emissions. These key three questions are (Carbon Tracker, 2022):

1. Are life cycle or scope 3 GHG emissions included in the targets?

2. Are there interim targets before mid-century that require absolute cuts to pollution rates?

3. Are companies including emissions related to equity stakes in others' projects and crude oil they purchase from another company?

Scope 3 GHG emissions are very important for oil and gas companies since 85% of their emissions come from third-party end-users. A BlackRock commentary on climate-related shareholder proposals noted: "To effect change in scope 3 greenhouse gas emissions in a fair and balanced way, policy action by governments will be necessary. Companies cannot solve scope 3 on their own" (Roston, 2022b).

BlackRock is providing another antidote to easy ESG rhetoric and accounting. In a September 19, 2022, video conference, BlackRock CEO Larry Fink and the President of Ukraine Volodymyr Zelenskyy discussed how BlackRock Financial Markets Advisory could provide pro bono advice to the Ukrainian government on setting up a reconstruction fund in support of the recovery of the Ukrainian economy. This could include advice on the structure, investment process, governance, and use of proceeds for a fund. The goal of the fund would be to create an opportunity for both public and private investors to participate in reconstructing and rejuvenating the market economy in Ukraine by delivering fair and just returns to investors (The Presidential Office of Ukraine, 2022).

The Science Based Targets initiative (SBTi) is a collaboration between Carbon Disclosure Project, the United Nations Global Compact, World Resources Institute, and the Worldwide Fund for Nature. Since SBTi was established in 2015, more than 1,000 companies have joined this initiative which helps companies set emission reduction targets in line with climate science. In October 2021, SBTi developed and launched the world's first net-zero standard, providing the framework and tools for companies to set science-based net-zero targets and limit global temperature rise above pre-industrial levels to 1.5 degrees Celsius. SBTi's best practices for companies are to adopt transition plans covering scope 1, scope 2, and scope 3 emissions, set out short-term milestones, ensure effective board-level governance, and link executive compensation to the company's adopted milestones (Science Based Target Initiative, 2021). SBTi is still developing a policy for fossil-fuel companies so the Carbon Tracker Initiative's Absolute Impact reports are the key sources to analyze oil and gas companies' net-zero emissions commitments.

In the 2022 Absolute Impact report, 13 of the biggest 15 publicly traded oil and gas companies have revised (mainly reduced) climate targets since May 2021. The title of the 2022 report was "Why Oil and Gas Companies Need Credible Plans to Meet Climate Targets" (Carbon Tracker, 2022). The title of the 2021 report was "Why Oil and Gas Net-Zero Ambitions Are Not Enough" (Carbon Tracker, 2021). Together these reports reveal an industry without standardized policies shaped by climate science. Hopefully, SBTi will soon develop a specific framework for fossil-fuel companies. Using the three questions in the specific framework of the Carbon Tracker approach, the 2022 Absolute Impact report ranked these 15 publicly traded oil and gas companies, including the top 10 from last year's 2021 report, as follows (Carbon Tracker, 2022):

1. Eni (1st last year);
2. Repsol (6th last year);
3. Total (2nd last year);
4. BP (3rd last year);
5. Shell (4th last year);
6. Equinor (5th last year);
7. Occidental Petroleum (7th last year);
8. Chevron (9th last year);
9. Conoco-Phillips (8th last year);
10. EQT;
11. EDG Resources;
12. Devon;
13. Pioneer;
14. Suncor;
15. Exxon-Mobil (10th last year).

Eni took the top spot for best climate policies in all three years of the Absolute Impact reports. The Italian company has pledged to cut its absolute level of emissions by 35% by 2030, which is more ambitious than its previously stated goal of 25%, and it is also investing in carbon-capture facilities. An Eni spokesperson said the ranking confirmed the completeness of their carbonization strategy that focuses on new technologies and business models. Four European companies out of these 15 companies are pursuing absolute cuts. The four U.S. companies all trailed their major European counterparts. Occidental Petroleum, Chevron, Conoco-Phillips, and Exxon-Mobil were ranked 7th, 8th, 9th, and 15th, respectively.

The U.S. House of Representatives Committee on Oversight and Reform has been investigating Big Oil climate pledges. In September 2022, the Committee obtained a cache of emails, lobbying, and preparation materials for senior Big Oil executives after a year-long investigation. After the Committee reviewed these materials, Subcommittee Chair Ro Khana said: "Big Oil climate pledges rely on unproven technology, accounting gimmicks and misleading language to hide the reality" (Crowley & Natter, 2022). The Committee said the internal documents from Exxon-Mobil, Chevron, Shell, and BP revealed that their public promises to fight climate change amounted to greenwashing (Crowley & Natter, 2022).

The oil and gas industry faces the daunting task to hit its net-zero goals, especially the ones that include scope 3 GHG emissions in their goals. Such companies include the major European oil companies in order of their 2022 rankings, Eni, Repsol, Total, Shell, and Equinor, but the only major U.S. oil company is the seventh-ranked Occidental Petroleum (Quinson, 2021). For example, Italy's Eni is buying into the U.K. offshore wind projects, developed by Norway's Equinor, which also has U.S. offshore wind projects. The Spanish firm Repsol is devoting 40% of its capital expenditures to low-carbon projects. France's Total is planning to increase its renewable energy capacity five-fold over the next four years. In the first quarter of 2020, Equinor had more earnings from renewables than from its oil and gas exploration and production. Such renewables earnings came from asset rotation or "farm downs", i.e., the selling of renewable assets at various stages of development to new owners, such as Eni and BP. Thus, Eni and BP are paying Equinor for taking on the earlier stages of developing offshore wind projects, like the well-established strategy of major oil companies buying oil fields, initially discovered, and developed by small oil companies (Bullard, 2021).

Major oil companies are also implementing carbon capture projects, aided by government subsidies. For example, in 2021, the Netherlands government told a consortium of four companies, Shell, Exxon-Mobil, Air Liquide, and Air Products Chemicals, that it will spend as much as $2.6 billion in the coming years to put some of their carbon emissions underground. The Port of Rotterdam project could sequester 2.5 million metric tons of carbon dioxide annually by storing it in depleted gas fields in the seabed. This project will trap pollution from the four companies' oil refineries and hydrogen production plants in a shared network, called the hub approach. The gases will then be compressed and transported by pipes off the coast and pumped into a sandstone reservoir three kilometers below the seabed that once held natural gas. The Netherlands subsidy is designed to prevent the four companies from incurring losses in building this hub (Mathis & Rathi, 2021).

8. BOARD MONITORING OF NET-ZERO EMISSIONS ACCOUNTING

More than 5,200 companies have pledged to cut their GHG pollution to reach net-zero by 2050, many by canceling out emissions with forestry or other projects that remove CO_2 from the air. However, as

the corporate net-zero phenomena powers on, critics, especially some climate scientists, say the less sense it makes, and it may do more harm than good. Their reasoning is simple: the only net-zero goal that matters is the one that applies to the entire planet. Companies can help but they cannot be net-zero as their pledges are more directly based on arithmetic than geochemistry, according to Carbone 4, a French consultancy that works with companies measuring their emissions and deciding what to do about them. It said the idea of a carbon-neutral company is fundamentally dubious. Similarly, the French Agency for Ecological Transition wrote that nobody should claim to be carbon neutral. Also, the UN Secretary-General has launched a group of experts to look at non-national net-zero pledges (Roston, 2022a).

Carbone 4 is skeptical about any organization achieving net-zero status. At the heart of its skepticism are carbon offsets or purchases that grant the right to claim emission reductions generated by CO_2 drawdown projects operating elsewhere. The firm advises its clients not to include investments in CO_2 reductions through forestry or other means in its emissions accounting, even though doing so makes the company look better in trying to achieve net-zero emissions. Instead, the firm advises its clients to account for their climate efforts in three distinct categories (Carbone 4, 2022):

1. Emissions reductions drawing at least in part on the framework established by SBTi.

2. Avoided emissions or how a company's products or services might contribute to decarbonization elsewhere.

3. Financing or the removal of CO_2 from the atmosphere.

Carbone 4 provides several reasons why it separates carbon offsets from corporate emissions accounting. It is skeptical that corporate net-zero plans, added up, will lead to global net-zero. Also, when purchased carbon offsets are subtracted from company carbon accounting, it obscures the actual pollution rate, which matters the most. SBTi has the same views on carbon offsets. Carbone 4 emphasizes that only on a global or regional level can drawing down CO_2 physically neutralize past emissions, leading to net-zero. Companies that deliberately ignore that point in their own strategy or marketing are being disingenuous. Both the Paris Agreement and the UN Intergovernmental Panel on Climate Change repeatedly refer to global net-zero. Instead of focusing upon just their own net-zero targets, companies should see themselves and act as making contributions to a shared global goal of net-zero. Unfortunately, many corporations spend vast sums on 1) lobbying against science-based climate policy, 2) political contributions to elected officials who block climate legislation, and 3) the whole category of professional services, such as law, lobbying, and advertising firms, that have yet to measure their own emissions, let alone set targets for reduction (Roston, 2022a).

None of these political activities by companies are reflected in standard emissions accounting, nor do they count against a company's own net-zero accounting. Yet such activities undermine the global effort to get to net-zero. Derik Broekhoff, a senior scientist at the Stockholm Environmental Institute, wrote: "Companies that are truly committed to achieving net-zero need to support climate policies at all governmental and international levels that advance an equitable, comprehensive, and coordinated global transition" (Roston, 2022a). Boards need to monitor their companies' behavior in these political climate activities and net-zero accounting.

9. CLIMATE OPPORTUNITIES

The 2022 World Economic Forum (WEF) Annual Meeting in Davos provided three guidelines to be applied to all climate policies. These three guidelines for energy independence and business opportunities are greater electrification, digitization, and zero-carbon energy. This trio of existing scalable technologies is available right now for mass rollouts and can reduce energy demand while replacing fossil fuels with zero-carbon energy (Clayton, 2022). Boards should apply these three guidelines to monitor their companies' energy independence and climate business opportunities.

First, electricity is the most efficient form of energy, and we should electrify every process we can. It is cleaner and increasingly more cost-effective to cook without gas, heat buildings without oil, and fuel cars without gasoline. For example, an electric motor converts 85% of electrical energy into mechanical energy. Internal combustion engines only convert 40%. Energy Sage, a digital marketplace for solar, found that U.S. E.V. drivers spent 3.5 times less on fuel than regular drivers in March 2022. Energy efficiency is not limited to better insulation and better building designs and it is not just about replacing old HVAC (heating, ventilation, and cooling) systems with heat pumps.

Second, digital intelligence makes massive amounts of invisible energy waste visible. With artificial intelligence and other software, it's possible to create loT-enabled "fitness trackers" for homes, office buildings, data centers, factories, and infrastructure. When efficient machines operate within efficient systems, the result is digitized energy efficiency. By creating a digital thread across any facility's lifecycle, it becomes possible to build carbon-negative data centers. For example, a digitized office building in Grenoble, France uses one-tenth of an average building's energy consumption.

Third, zero-carbon energy primarily relies on sun and wind energy which can be generated on-site through a microgrid and distributed energy resources or purchased from the power grid. Batteries are being improved for better storage of such energy. You can gain energy independence by locking in decentralized access, long-term pricing, or both.

Do these three solutions exist at scale? There are two WEF recommended tests (Clayton, 2022):

1. Do these solutions exist at scale? Unlike other cleantech solutions, the answer is a clear yes. These are proven technologies that are widely in use already.

2. Do these solutions actually solve the challenges we face? According to the latest energy and emissions models, there is hope.

On decarbonization, three feasible pathways for net-zero by 2050 are each built on the same trio solution set of electrification, digitized energy efficiency, and zero-carbon energy (Clayton, 2022):

1. The International Energy Agency's Net Zero Emissions by 2050 scenario found that global gross domestic product expands by over 40% by 2030.

2. The Schneider Sustainability Research Institute's Net Zero Emissions by 2050 model found that digitized and electrified homes can save homeowners 10–30% on electric bills.

3. The U.S. think tank, Rewiring America, scenario found that embarking on a national effort to expand this trio of solutions would save U.S. households up to $2,585 on annual energy costs while creating 25 million good jobs over the next 15 years.

At the 2022 WEF meeting, Annette Clayton, CEO, Schneider Electric North America, summarized: "Although there are no overnight fixes for the energy and climate crises we face today, there is a technologically viable fix for both: electrification, digitized efficiency, and zero-carbon energy. But we have to act immediately. It's no longer a question of destination but of speed and scale" (Clayton, 2022). Her climate warning was foreshadowed by MIT economist Rudiger Dornbusch's Law: "A crisis takes a much longer time coming than you think, and then it happens much faster than you would have thought" (Krugman, 2022c).

Delaying Dornbusch's Law, the U.S. IRA was passed by Congress in August 2022. It was reached by a compromise between Chuck Schumer, the leader of the U.S. Senate, and the coal-country West Virginia senator, Joe Manchin, who had previously opposed U.S. federal government efforts to pass a more expensive bill. This $437 billion bill allows roughly $374 billion in climate and energy spending over ten years in direct funding, loans, and loan guarantees (Wasson, Dennis, & Davison, 2022). The IRA represents many business climate opportunities for companies that boards should monitor and provide guidance.

Five key IRA takeaways by a Princeton University REPEAT Project released on August 4, 2022, are (Hirji, 2022):

1. This new Act brings the U.S. much closer to meeting its climate goals. The $374 billion of climate spending would cut U.S. emissions roughly 42% below 2005 levels by 2030, or by 3.8 billion metric tons of carbon dioxide equivalent. Before this Act, the U.S. was on track to cut its emissions by only about 30%, depending on the analysis. This Act gets the U.S. much closer to where it needs to be.

2. Most of the emissions reductions will come from the power and transportation sectors: 24% from power, 19% from transportation, and 9% from other industries. This Act cuts U.S. emissions primarily by accelerating the deployment of clean energy (wind and solar) and electric vehicles, due to tax credits for wind, solar, and battery technologies.

3. The use of carbon capture would go up 13-fold. This Act is projected to increase the use of carbon capture and storage technologies by a multiplier of 13 by 2030. The tax incentives will make carbon capture a viable economic option for the most heavily emitting technologies, including steel, cement, coal, and natural gas plants.

4. This Act would lead to more emissions reductions than added emissions, even though it would greenlight new oil and gas drilling. The investments in wind and solar and the electric vehicle tax credits would cut emissions between 870 to 1,150 million metric tons of carbon dioxide equivalent by 2030. Meanwhile, the provisions to expand oil and gas production could increase emissions up to 50 million metric tons so for every ton of emissions added, 24 tons of emissions would be avoided.

5. This Act would bring health benefits. Using EPA's benefit-per-ton estimates, the think tank Energy Innovation translated the drop in carbon and other air pollution emissions to impacts on human health. It found that this Act could avoid up to 3,900 deaths, up to 100,000 asthma attacks, and up to 417,000 lost workdays by 2030.

Senator Manchin receives more political contributions from the U.S. energy industry than any other member of Congress (Krugman, 2022b). Exxon Mobil CEO Darren Woods said: "We're pleased with the broader recognition that a more comprehensive set of solutions is needed to go through the energy transition" (Crowley, 2022). He was happy that oil and gas featured prominently in this Inflation Reduction Act and that it was not exclusively focused on solar and wind. This $374 billion deal included several items on Exxon's wish list, such as locking in lease sales and even pairing renewable rights to oil and gas lease sales (Crowley, 2022).

Bill Gates commented: "The Inflation Reduction Act's passage through Congress is nothing short of extraordinary and may be the single most important piece of climate legislation in American history. It represents our best chance to build an energy future that is cleaner, cheaper, and more secure. The $374 billion investment will spark innovation, drive job creation, and reduce energy prices and emissions" (Gates, 2022). This Inflation Reduction Act is by far the biggest financial commitment the U.S. government has ever made to fight climate change. The emissions reductions that will result from this law will be roughly the same as eliminating the annual planet-warming pollution of France and Germany combined, or about 2.5% of the total global GHG output. It might be just about enough to revive the Paris Climate Agreement's goal of limiting global warming to 1.5 degrees Celsius (Rathi & Dlouhy, 2022).

Gates said that many of the technologies needed to reach net-zero either do not exist, or are in the early stages of development, or are still too expensive to scale-up. More mature technologies, like solar, wind, and electric vehicles, must be deployed more quickly to help build a modern, reliable power grid so all can have access to affordable, abundant, and clean energy. Through new and expanded tax credits (10 more years for wind and solar), this Act will ensure that critical climate solutions have sustained support to develop into new industries and enable private capital to supercharge our clean energy future. Many of the most promising technologies in the clean energy economy will require similar skills and expertise possessed by today's coal, oil, and gas workers which will help ensure a fair transition (Gates, 2022). Paul Krugman, a Nobel Prize economics winner, agreed with Gates' assessments and summarized: "The good news is that the legislation passed, and the world is a more hopeful place than it was just a few weeks ago" (Krugman, 2022a).

The WEF also agreed with Bill Gates' conclusions and stated that the IRA is the most meaningful climate bill ever passed in the U.S. and has the potential to significantly curb the country's GHG emissions over the next few years. The WEF commented that the IRA is an important step in the transition to clean energy and highlighted the following major benefits of the IRA (Yazdani, 2022) which also represent business climate opportunities:

1. The IRA incentivizes multiple clean energy sources, such as $100 million for offshore wind generation projects, and disincentivizes the closure of existing nuclear power plants with production tax credits. The IRA also provides $1.5 billion to the Environmental Protection Agency to support methane monitoring and reduction efforts.

2. The IRA gives clean hydrogen a significant boost which is perhaps the most important new area of clean energy investment incentivization. The IRA provides a base credit of $0.60 per kilogram of hydrogen produced and mandates a well-to-gate approach to measure the lifecycle emissions.

3. The IRA has the potential to positively impact the world although its impact on the clean energy transition within and outside the U.S. is difficult to predict. However, its Investment Tax Credits and Production Tax Credits for clean energy generation remove prior uncertainty and unpredictability for solar and wind projects. Its second-order consequences could have major benefits, like Germany's Energiewende, which played a critical role in substantially reducing the cost of solar panels worldwide over the last decade.

Wood Mackenzie, a global research and consultancy business focusing on natural resources, did an in-depth analysis of the IRA and concluded that it is one of the largest U.S. energy sector public investments in history. To understand the potential of the IRA, Wood Mackenzie interviewed experts and research teams from across the electric power, renewable energy, oil, natural gas, transport, battery raw material, electric vehicle hydrogen, and carbon capture and storage industries. Highlights from this in-depth analysis follow Seiple (2022) which also represents board guidance for company climate opportunities:

1. Total investment in renewables will reach $1.2 trillion through 2035. The IRA will bring some much-needed long-term certainty to the renewables sector with annual investment rising from around $40 billion now to $80 billion by the end of the decade. That means that by 2035, 67% of power generation could come from carbon-free sources.

2. Solar will be a major beneficiary. Based on modeling, the solar incentives will result in a 67% increase in solar additions between 2022 and 2032.

3. Subsidies should help to alleviate some of the strain on the wind industry. The IRA's tax credit extension will help to alleviate some of the financial uncertainty that has created a shadow for many developers. This added certainty could increase incremental wind capacity additions by 45 gigawatts (GW) or 43% through 2030.

4. The IRA unlocks a $160 billion market in energy storage. The ten-year market outlook for energy storage will balloon to 135 GW, which equates to over $160 billion of investment through 2031. At the heart of the IRA is an extension of investment tax credits that now includes standalone storage as a qualified technology.

5. The IRA delivers a boost to emerging decarbonization technologies, including hydrogen and electric vehicles. IRA incentives accelerate technologies that can scale now and set the stage for emerging technologies, from carbon capture, utilization, and storage (CCUS) and biofuels to low carbon hydrogen and EVs. This will open up longer dated decarbonization opportunities.

6. A slew of new hydrogen projects is ahead. The IRA reintroduces a production tax credit for clean hydrogen which rewards early movers. One of the most important aspects of the IRA related to hydrogen is a time limit on when projects must go forward to quality for the higher levels of subsidy. Forecasts show that the capital costs of hydrogen production technologies should reduce significantly in the next five to ten years.

7. The domestic EV market could become more resilient. New IRA rules aim to de-risk battery supply. Tax credits will be available to vehicles operating on batteries that were manufactured in the U.S. Ultimately the enduring legacy of the IRA in terms of clean vehicles will be increasing U.S. manufacturing jobs and making the U.S. battery supply chain more secure.

10. CONCLUSION

Boards have many strategies concerning responsibilities for monitoring and assessing their companies' climate activities and business opportunities. As the U.S. national climate advisor observed, there is a paradigm shift. The private sector no longer sees climate action as a source of job losses but as an opportunity for job creation and economic revitalization.

Correspondingly, the major research question and related conclusion for boards' responsibilities concerning companies' climate operations is to use net-zero pledges, not as a dangerous caveat, but for guidance and monitoring of their companies' climate activities and opportunities. This conclusion was elaborated in this paper.

If not conscientious about monitoring their companies' climate activities, boards could wind up with their companies' public promises to fight climate change just being greenwashing. For example, the U.S. Committee on Oversight and Reform concluded that Big Oil companies' climate solutions just relied upon unproven technology, accounting gimmicks, and misleading language to hide the reality.

Such climate research efforts are important because a comprehensive and systematic understanding of this emergent body of inquiry is ongoing. Our paper is limited to the fundamental analysis of boards' responsibilities to monitor company climate activities and to provide guidance for company climate opportunities. Future research could empirically investigate the impact of specific boards' characteristics for monitoring company climate activities and proactive climate strategies and opportunities.

Dmytro Govorun and Alex Kostyuk, Virtus Global Center for Corporate Governance executives, provide guidance for future research in this area by

emphasizing four prerequisites for the emergence of stakeholder capitalism in a country: profitable companies, owners with intentions to reinvest profits, shareholder activism as a movement, and independent directors as an institution (Govorun & Kostyuk, 2022). Such prerequisites could be investigated as factors for companies that are developing proactive climate strategies and opportunities. For example, they elaborate combining the third and fourth prerequisites in the emergence of stakeholder capitalism as a developed institute of independent directors in a country, who with their independent judgment, should ensure a balance of stakeholders' interests, especially climate strategies and opportunities.

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