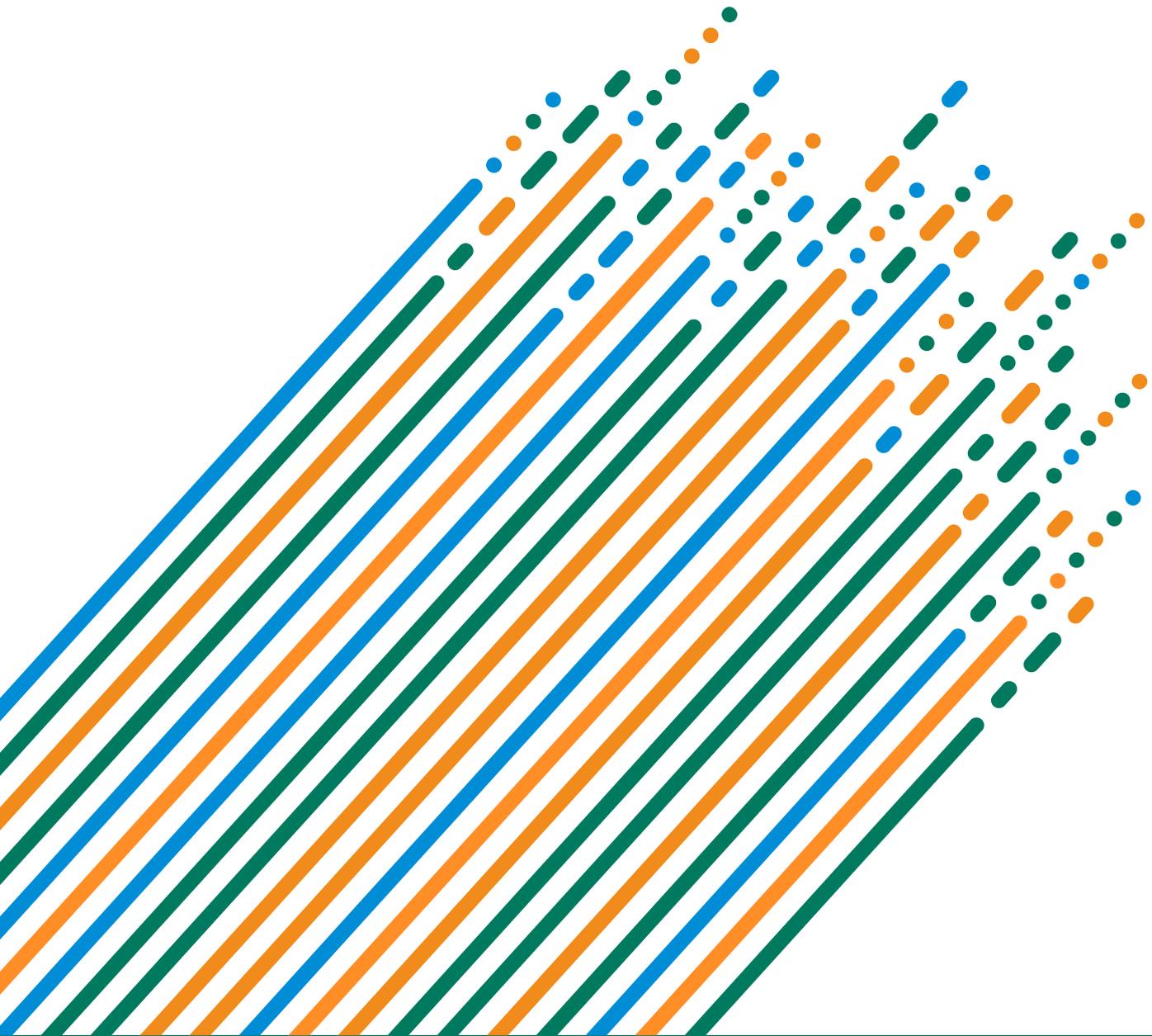
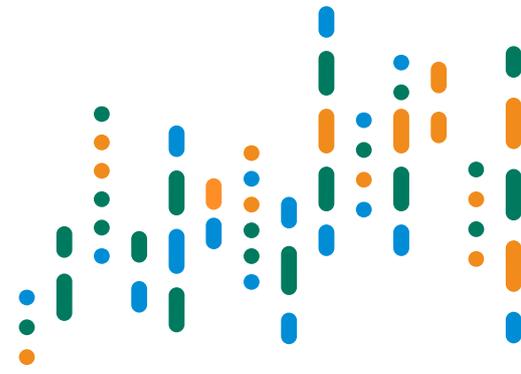


The Decarbonization Imperative: An Executive Primer





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Executive Summary

The *Decarbonization Imperative: An Executive Primer* explores six climate uncertainties shaping the future and driving corporate decarbonization and six essential responses that companies need to pursue to navigate the transition to net zero. The publication comes amidst a flurry of climate action, at the same time as COP27 in Egypt seeks to advance the Paris Agreement's goals, with climate change impacts empirically worsening, and while the world wrestles with energy and climate-related complications brought about by Russia's invasion of Ukraine and the ongoing effects of the COVID-19 pandemic.

In these circumstances, the private sector is accelerating decarbonization efforts, in part by setting aggressive climate commitments. Greater ambition should be welcomed given the scale of the climate crisis. However, doubts are emerging over whether these commitments will produce the decarbonization required to achieve the ambitions enshrined in the Paris Agreement. To improve performance and deliver on their promises, companies will need to rethink their business approach.

Six uncertainties define the environment in which companies must do this recalibrating. These uncertainties will be familiar to many readers, although their intricacies and interconnections may not be. As such, this primer explores the six in combination to help companies better respond to them.

- **Financial Risk & Opportunity:**
Companies must broaden their knowledge of climate-related financial risks and the opportunities that the net zero transition presents.
- **Shareholders:**
Shareholders continue to drive decarbonization, however, they themselves now face climate and broader ESG critiques.
- **Stakeholders:**
With stakeholders increasingly demanding climate action, companies are exposed to both greenwashing and greenhushing risks.
- **Policy:**
New polices and regulations require corporate response, but still do not do enough to enable and accelerate action to the level required to achieve global climate goals.
- **Geopolitics:**
While disruptive geopolitical events will boost fossil fuel demand in the short-term, they will accelerate the energy transition in the long-term.
- **Technology:**
As low carbon technologies advance ever-more rapidly, companies must integrate them into operations and quicken the pace at which they develop new solutions.

Because uncertainty complicates action, companies must prepare themselves to navigate unpredictability as they decarbonize. This primer helps with navigation by presenting a blueprint for climate action across six essential response areas.

- **Reflect:**
Companies must start by assessing risks and opportunities, setting ambitious science-based goals, and designing a comprehensive decarbonization strategy that aligns with core business objectives.
- **Implement:**
Operationalize your strategy with the help of roadmaps and implementation plans. Prioritize and pursue emissions reductions based on their abatement effectiveness and feasibility.
- **Redesign:**
Identify, develop, and deploy new products and services that take advantage of climate-related market opportunities and provide emissions reductions through circular models.
- **Redeploy:**
Revise your approach to capital projects and readjust corporate structures and holdings to align with your climate commitments.
- **Digitize:**
Maximize the power of digital technologies by employing solutions to optimize your operations for emissions reductions, maximize energy efficiency gains, and improve climate-related assessments and planning.
- **Transform:**
Incorporate decarbonization into your corporate governance and culture by establishing a clear governance structure and equipping employees with necessary skills and knowledge.

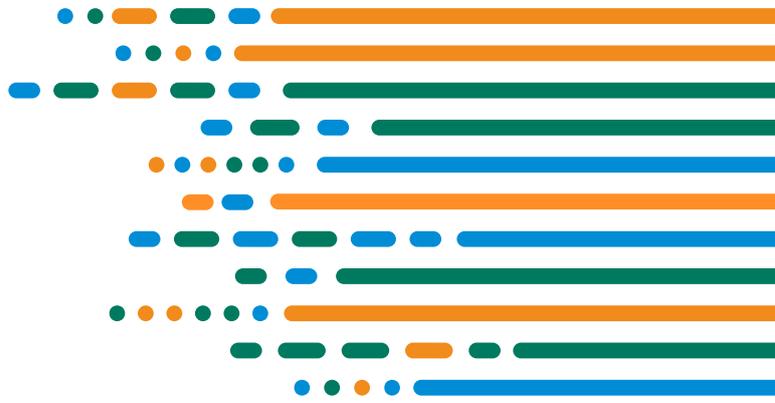
By adopting this blueprint and its recommendations, companies will be better equipped to implement comprehensive and effective decarbonization plans that will support the low carbon energy transition and improve their own performance. Adoption will not be easy given the enormous scale of transformation required for the economy and individual businesses, but companies must act, both to address climate change broadly and to help ensure their own future success in a marketplace set to be transformed by the transition to a net zero economy.

1. Introduction

Climate targets are proliferating as companies and governments react to the climate crisis. However, time is running out to reach the Paris Agreement goals, and recent climate-related events such as flooding in Pakistan and droughts in China, Europe, and the United States show that even less than 1.5°C of warming presents tremendous risk.

While increasing climate ambition and target setting from companies and governments is positive, doubts about implementation feasibility are rising given the scale of the task. The International Monetary Fund estimates that \$6-10 trillion in additional public and private investment (equivalent to 6-10 percent of global GDP) is needed in the next decade alone to reach net zero emissions by 2050, demonstrating the magnitude of the transformation.¹

Accusations of greenwashing are rising too. According to one estimate, the net zero commitments of the world's 25 largest companies will only reduce their emissions by 40 percent on average.² Ratings organizations and standards-setting bodies are being accused by critics of "lending credibility to low quality and misleading targets" that they believe validate corporate propaganda.³ With such allegations and growing scrutiny of wider Environmental, Social, Governance (ESG) initiatives, many corporate leaders have become noticeably quieter about promoting climate commitments even if they continue to pursue them vigorously behind the scenes.



While increasing climate ambition and target setting from companies and governments is positive, doubts about implementation feasibility are rising.

Companies clearly must improve climate performance and evidence of impact. But at the same time, ambitious decarbonization commitments, especially net zero goals, should be welcomed even when they are announced ahead of detailed implementation plans. Implementation plans must of course drive action at a speed aligned with the ambition of the Paris Agreement, but the urgency of the challenge means that companies need to embrace even decarbonization challenges they don't yet know how to overcome.

Decarbonization of the global economy will require companies to fundamentally rethink how they do business. This makes it critical that executive boards and corporate leaders up and down value chains possess the climate-related expertise necessary to imagine and then do this. Such expertise is not widespread today.

This briefing examines the uncertainties and drivers that are shaping private sector climate thinking and presents a blueprint for action in the form of six essential responses that corporate executives and board directors need to understand and undertake to lead their companies through the energy transition.

Board oversight of climate topics is becoming more common within the largest global corporations and some other leading companies. According to one study, 90 percent of the world’s 166 largest corporate GHG emitters now have some level of board oversight of climate change.⁴ CDP added a new question to its 2022 climate change questionnaire asking companies to disclose if at least one board member has climate-related competence, another sign of increasing expectations.⁵ Though response data for this new question is not yet available, companies are likely to be cautious in claiming they already have the required knowledge and skills, especially given that the 2022 Taskforce on Climate-Related Financial Disclosures (TCFD) Status Report found that only 29 percent of TCFD-aligned disclosures report on board climate oversight.⁶ This wariness is understandable; after all, no one has previously led an organization, let alone the global economy, all the way through decarbonization to net zero.

An August 2022 publication, *Net Zero: Obstacles and Catalysts for Business Climate Action*, developed in partnership between ERM and the Environmental Defense Fund (EDF), determined via survey that two of the top four internal catalysts companies need in order to accelerate climate action are increased executive engagement and greater climate-related expertise among leaders.⁷ *The Decarbonization Imperative* attempts to help close the leadership competency gap those responses imply. The briefing examines the uncertainties and drivers that are shaping private sector climate thinking as well as the challenges they pose to corporate decision-makers, and presents a blueprint for action in the form of six essential responses that corporate executives and board directors need to understand and undertake to lead their companies through the energy transition. The analysis and recommendations are supported by case studies from the public domain and from ERM’s work with clients on decarbonization.

Factors driving business decarbonization



Financial Risk
& Opportunity



Shareholders



Stakeholders



Policy



Geopolitics



Technology

Six essential response areas

1



Reflect

2



Implement

3



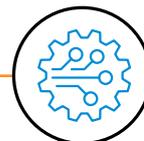
Redesign

4



Redeploy

5



Digitize

6



Transform

2. Six Climate Uncertainties



From growing financial risk and opportunity to multiplying decarbonization policies and regulations, many factors are driving businesses to decarbonize. Yet how these drivers will evolve is often uncertain. Here we explore the six uncertainties that we believe matter most. While these will be familiar to many companies, the urgency of action that they demand and the ways they interconnect are too often overlooked or delayed. This chapter explores what the uncertainties are, how companies are reacting, and the key developments companies need to understand today and watch for in future if they are to appropriately respond.



2.1. Financial Risk & Opportunity

Climate-related financial risks are a major driver of decarbonization. Companies need to act fast to improve their understanding of these risks, but they must also grasp the opportunities that the transition presents.

With frameworks such as the TCFD entering the corporate mainstream, many major companies now assess climate-related financial risks and opportunities. According to the 2022 TCFD Status Report, 61 percent of TCFD-aligned disclosures report on risks and opportunities, up from 42 percent in 2019.⁸ However, the robustness of these assessments must increase if the private sector is to cope with the sheer scale of the climate crisis. Especially on the opportunity side, companies need more and better data to strengthen the business case for decarbonization.

According to Swiss Re, climate change could reduce global GDP by as much as 18 percent by 2050 if temperatures rise by 3.2°C.⁹ In addition to physical impacts, companies also face many other climate-related risks, from loss of standing with investors due to ESG ratings downgrades, to potential customer losses as more value

chain partners require Scope 3 disclosures and value chain climate risk assessments.

Beyond risk, the private sector's understanding of climate-related financial opportunities is improving. According to one study, transitioning to renewable energy could save up to \$12 trillion globally by 2050; similarly, GDP found that European companies investing in emissions-reduction initiatives expect bottom-line contributions of more than €40 billion (\$39.8 billion) from associated cost savings.^{10,11} In many cases, simple steps such as implementing energy efficiency measures can significantly improve the bottom line. For example, IBM implemented 936 energy conservation projects in 2021 that saved \$9.9 million.¹²

The electric vehicles (EVs) market provides a great example of the financial opportunities presented by the transition. Ford Motor Company is making a \$50 billion investment in electrification through 2026 as it works to develop zero-emissions versions of its most popular vehicles.¹³ Through the investment, the company is hoping to produce more than 2 million EVs annually and generate a 10 percent adjusted operating profit margin by 2026, a substantial increase over its 7.3 percent margin in 2021.¹⁴

What to Watch:



- Opportunities to create new, higher revenue-generating products and services stemming from implementation of new climate-related policies. For example, the European Union's REPowerEU Plan proposal to raise its 2030 energy efficiency target to 13 percent could create opportunities for companies to sell more energy-efficient products.¹⁵
- Opportunities to access additional clean energy funding through related subsidies, such as those in China, which were set at \$607 million in 2022, and tax incentives, e.g., Costa Rica's tax reductions for electric vehicle owners.^{16,17}
- Economic risks of physical climate change impacts, particularly for those companies in climate-exposed sectors (agriculture, forestry, fishery, energy, and tourism).¹⁸



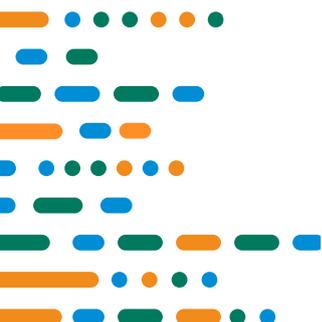
2.2. Shareholders

Shareholders have been major advocates of decarbonization, but they are increasingly having to field criticism from both sides of the aisle. On the one hand, they are called out for not being ambitious enough, while on the other hand, they face backlash from more conservative governments and consumers in some regions.

Shareholder groups are a key medium through which investors make their voices heard and collectively push the private sector to transition to net zero. For example, the Institutional Investors Group on Climate Change (IIGCC) calls on companies to disclose their net zero transition plans, Climate Action 100+ convenes investors that focus on the largest corporate emitters, and the Glasgow Financial Alliance for Net Zero (GFANZ) provides a forum to address sector-specific decarbonization challenges.^{19,20,21}

Although powerful, these groups and individual financial firms have faced recent criticism. On the one hand, finance sector climate commitments have been accused of not going far enough. For instance, HSBC was criticized for not including capital market activities (where the majority of fossil fuel financing is sourced) within its oil and gas and power and utilities sector climate commitments.²² On the other hand, investors are being accused by more conservative actors of going too far. For example, BlackRock has been called out by Republican-dominated U.S. states including Louisiana, Missouri, Texas, and West Virginia, where lawmakers have taken steps to limit their involvement with the asset manager, arguing that its climate and broader ESG positions are unreasonable and potentially harmful to businesses in those regions.²³

While most major banks have set net zero targets for their portfolios, achieving them will



be a long and complicated process. Reports recently surfaced that several major banks have threatened to pull out of GFANZ, apparently fearing litigation over the alliance's stringent climate commitments. This is just one of many examples of the kind of hurdles that all parties will need to overcome to decarbonize the global economy.²⁴

However, the overall path that the lenders and investors are on is clear, and they will continue to be a major force accelerating decarbonization. As of October 2022, U.S. shareholders voted in favor of twenty-four GHG emissions-related proposals compared to only five in 2021.²⁵ Of these twenty-four, seven passed. Recently, Equinor shareholders voted 97.53 percent in favor of the company's energy transition plan to achieve net zero emissions by 2050, while at Boeing 91 percent of shareholders approved a proposal requiring the company to publish a report outlining its progress toward achieving net zero across its Scope 1, 2, and 3 emissions.^{26,27}

What to Watch:



- Growing numbers of climate- and ESG-related shareholder proposals in the upcoming proxy season.
- Government actions at COP27 after more than 500 institutional investors representing \$39 trillion in assets called on governments to increase their climate ambitions in September 2022.²⁸
- Anti-ESG shareholder actions such as Texas' move to prohibit local and state government from working with companies who boycott fossil fuels, which could complicate decarbonization efforts.²⁹



2.3. Stakeholders

Rising stakeholder demands for climate action and disclosure mean companies must eschew greenwashing and greenhushing.

While climate- and ESG-related pressure is not new, the increasing sophistication and intensity of stakeholder scrutiny presents a new reality for many companies. NGOs, media, standard-setting bodies, and other stakeholders are taking active steps to ensure that companies are "walking the talk" and will follow up ambitious statements with action.

The growing importance of climate change to stakeholders can be at least partially attributed to the success of civic movements such as Fridays for the Future, the global youth initiative founded by Greta Thunberg, and the Extinction Rebellion, an initiative that uses non-violent direct action and civil disobedience to accelerate climate action.^{30,31}

In March 2022, the UN launched the High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities to develop a framework for assessing the objectives, measurement, and reporting of net zero goals of non-state entities and to create processes for verifying and accounting for progress against these goals.³² This group's launch followed a February 2022 hearing in the U.S. House's Committee on Oversight and Reform investigating whether the climate commitments of oil and gas companies appropriately contribute to climate change mitigation, or if they are instances of greenwashing designed to minimize their contribution to negative climate change impacts.³³

Concerns over greenwashing have led to a new phenomenon known as greenhushing, which occurs when companies fearful of ESG-related criticism pull back on associated disclosures.³⁴ This practice is likely to backfire

given increasing expectations for disclosure such as new standards from the International Sustainability Standards Board (ISSB).

Companies that heed stakeholder expectations can be rewarded in multiple ways. In one example, Burger King responded to consumer demands for plant-based products by partnering with Impossible Foods to offer a plant-based version of its mainstay Whopper®.³⁵ This partnership paid off with the chain seeing six percent sales growth in the quarter after the Impossible Whopper® launch, which it partially attributed to this new item on the menu.³⁶

Acting on climate can also help attract and retain talent. One survey of c-suite executives found that more than 75 percent believe corporate climate change policies have an impact on talent attraction and retention.³⁷ Another survey found that 71 percent of employees and employment seekers across nine countries believe that environmentally sustainable companies are more attractive employers.³⁸

What to Watch:



- Rising demands and scrutiny of climate-related claims by consumers, employees, and government agencies such as advertising regulators.
- Continuing scrutiny of climate commitments, especially net zero goals, by independent experts and NGOs.
- Emerging ESG disclosure standards and regulations like the new ISSB disclosure standards that will require more comprehensive disclosures relating to climate-related risk and opportunity management and climate commitments.³⁹



2.4. Policy

Policies and regulations are changing rapidly, but not fast enough to enable transformation of private sector business models at the speed required to meet global net zero goals.

In a recent survey of US-headquartered companies conducted by ERM and EDF, half of respondents identified policy and regulation as the external drivers most able to accelerate corporate decarbonization.⁴⁰ While policies and regulations are changing, they are not evolving at the speed required to turbocharge transformation of the global economy.

Globally, 137 out of 198 countries had set net zero emissions targets covering 83 percent of global emissions at the time of writing.⁴¹ Long a climate laggard, the United States recently passed the Inflation Reduction Act (IRA), which significantly increases the likelihood that the country will reduce its GHG emissions by half from 2005 levels by 2030 and reach net zero by 2050.⁴² In Europe, the European Union passed the European Climate Law, which affirmed its aspiration to achieve climate neutrality by 2050, while China has committed to reach net zero before 2060.^{43,44}

Despite these signals, global warming is likely to reach 1.8°C by 2100 even if countries achieve their Nationally Determined Contributions (as defined under the Paris Agreement) and net zero commitments.⁴⁵ Major policy gaps include means to accelerate energy, industry, transportation, and building decarbonization, reducing food system emissions, and delivering the financial resources required to enable a low carbon economy.⁴⁶

Because of this gap, companies must be forthcoming on where they stand on climate action. For instance, British multinational oil and gas company bp outlines a comprehensive list of its climate policy ambitions to ensure the

company's policy advocacy and lobbying are aligned with the Paris Agreement.⁴⁷ Similarly, corporate members of the Climate Leadership Council, which includes companies such as BHP, General Motors, Proctor & Gamble, and TotalEnergies, have been calling on U.S. policymakers to establish a carbon price and return the revenues to Americans in the form of a carbon dividend.⁴⁸

What to Watch:



- Emerging climate-related disclosure regulations such as the U.S. SEC's proposed climate disclosure rule and the European Financial Reporting Advisory Group's (EFRAG) European Sustainability Reporting Standards (ESRS).^{49,50}
- National climate action laws entering into force like the Inflation Reduction Act in the U.S. and the European Union's European Climate Law.⁵¹
- GHG emissions pricing initiatives in place like Korea's Emissions Trading Scheme (KETS) and those in development like Botswana's carbon tax.^{52,53}
- Policy developments in major emerging economies such as China, India, and Brazil likely to influence action beyond those nations' borders. For example, India recently set two ambitious 2030 climate goals: reducing the emissions intensity of its GDP by 45 percent from 2005 levels, and installing non-fossil fuel energy resources equivalent to 50 percent of its installed cumulative electric power capacity.⁵⁴



2.5. Geopolitics

Geopolitical events shape global climate efforts. While potentially increasing reliance on fossil fuels in the short-term, in the long run, geopolitical disruptions often help accelerate the energy transition.

Navigating geopolitics has always been part of doing business, and recent events have only reinforced this rule. Russia's invasion of Ukraine is likely to have an unprecedented impact on how countries and companies source energy as they seek out alternative energy supplies unconstrained by the whims of petrostates.

The war in Ukraine has put a spotlight on energy security issues, especially as they relate to natural gas and oil, and in the long run will likely accelerate the global transition away from fossil fuels. After Russia's invasion, clean energy funds saw \$642 million in inflows in March of 2022 after three months of declines.⁵⁵ Capital investments in renewables are also projected to be higher than upstream oil and gas investments for the first time ever in 2022.⁵⁶ Furthermore, the European Union (EU) published its REPowerEU plan in May of this year, which aims to achieve European energy independence from Russia before 2030 through energy efficiency gains, renewable energy buildouts, and energy source diversification.⁵⁷

Events in Asia are also impacting the energy transition. Solar panel production in China has been upended by the country's zero-covid policy, and the global supply of this essential technology will continue to be constrained, at least in the short-term.⁵⁸ The energy transition's reliance on Taiwanese-produced semiconductors to power many clean energy technologies is another area complicated by China-related developments. Concerns that China may seek to annex Taiwan, which produces 92 percent of the world's most advanced semiconductors, highlight the vulnerability of the global semi-conductor supply chain.⁵⁹

Apple presents a good example of how geopolitical factors are shaping corporate operations and decision-making. More than 90 percent of Apple products are currently produced in China, which makes it vulnerable to geopolitical flare-ups involving that superpower. With relations between the U.S. and China chilling, the company has begun to diversify its supply chain, and it is now producing iPhone 14s in India as well as AirPods and MacBooks in Vietnam.⁶⁰

What to Watch:



- Continuing impacts of Russia's war in Ukraine including new policies aimed at spurring the energy transition and diversifying energy supplies such as the EU's REPowerEU plan.⁶¹
- Energy transition-critical supply chain disruptions such as the U.S.'s recent move to restrict the export, development, and manufacturing of advanced Chinese semiconductors.⁶²
- Growing clean energy investments as countries and companies respond to energy security concerns related to Russia's invasion of Ukraine and its restrictions on natural gas exports to Europe.



2.6. Technology

As low carbon technologies advance at speed, companies must increase their understanding of how to select and operationalize existing technologies and simultaneously accelerate efforts to bring new solutions to the market.

Scaling uptake of the most advanced decarbonization technologies available today and rapidly innovating others will be key to meeting corporate climate commitments. However, most companies lack the knowledge required to integrate existing solutions into their operations, and they can struggle to raise funds to develop technologies that are not yet available.

Rapidly falling costs and increasing demand help make the business case for the use of low carbon technologies. For instance, in 2021, the cost of electricity produced from solar photovoltaics fell by 13 percent from 2020, by 15 percent for onshore wind, and by 13 percent for offshore wind.⁶³

In addition to renewables, hydrogen is another technology with potential to play a critical role in the green energy transition. Worth \$1 billion in 2021, the green hydrogen market is projected to grow to \$72 billion by 2030.⁶⁴ This dramatic growth signals significant market opportunities and could make decarbonization easier for companies in hard-to-abate sectors like steel. Multinational steel manufacturer ArcelorMittal is looking to replace the natural gas used in the traditional iron-making process with hydrogen, which, if produced from a net zero process, would enable net zero production.⁶⁵

Despite costs falling and markets growing, decarbonization technology investment must increase precipitously. The World Economic Forum found that investments in breakthrough technologies such as bioenergy, carbon capture, utilization, and storage (CCUS), and hydrogen must be ten times larger in 2030 than in 2020 if the world is to achieve net zero by 2050.⁶⁶

Partnerships will be key to scaling investments in breakthrough technologies. In Europe, groups of companies are creating “industrial clusters” to pool resources and expertise to support CCUS and hydrogen technology development.

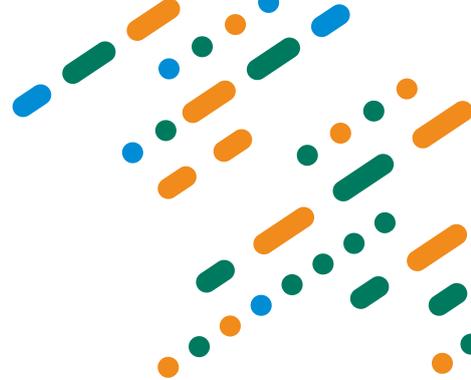
One example of an effective partnership in the UK is a collaboration between ITM Power, Orsted, and Element Energy (an ERM Group company) to assess the feasibility of bulk, low-cost renewable hydrogen production through gigawatt scale polymer electrolyte membrane (PEM) electrolysis. Their assessment found that employing this technology through ITM Power’s Gigastack system could produce renewable hydrogen at a more than 50 percent relative cost savings when compared to current renewable hydrogen production methods.⁶⁷

What to Watch:



- Schemes to scale the uptake of technologies to decarbonize hard-to-abate sectors such as the U.S. Department of Energy’s H2@Scale initiative, which aims to scale up hydrogen production and utilization for decarbonization.⁶⁸
- Clean energy technology breakthroughs such as modular nuclear reactors, which Canada and France recently announced investment plans for, or direct carbon capture technologies, in which companies including Microsoft and United Airlines have invested.^{69,70,71,72}
- Further reductions in the price of renewables driven by policies and regulations and continuing private investment.
- Policy incentives to spur decarbonization such as the Inflation Reduction Act’s clean energy tax credit extensions and Japan’s solar energy project rebate program.^{73,74}





3. A Blueprint for Action

The factors considered in Chapter 2 above, Six Climate Uncertainties, beg questions including: What new financial risks and opportunities will emerge? Which types of disclosures will investors demand next? What other leadership expectations will stakeholders – from consumers and employees to citizens and communities – demand the private sector embrace to help address the climate crisis? How fast will government policy evolve and how hard will it be to comply? What geopolitical events will speed or slow progress? And what technologies will scale quickly and cheaply enough to be implemented globally?

There are other uncertainties and questions beyond those discussed here – not least which climate-related events might cause cascading and potentially irreversible impacts, like the melting of permafrost or the collapse of a major ice sheet in Antarctica or Greenland – but the six presented were chosen because of their near-universal relevance to businesses of all sizes and in all geographies today.

Chapter 3, A Blueprint for Action, outlines how companies can best prepare themselves to navigate uncertainty. The blueprint does not respond to each individual driver in Chapter 2, but instead offers companies a framework for climate action designed to help them navigate any scenario. When companies adopt the blueprint and develop everything recommended – from climate strategy and goals, through opportunity prioritization and operational implementation, to product and service redesign and portfolio adjustment, through digital enablement and the change management necessary to support employees and maintain a resilient culture – they will find themselves better prepared for the uncertainties recognizable today and better able to adapt to future unknowns.

With so many factors driving business decarbonization and the landscape shifting rapidly, developing a comprehensive and effective decarbonization plan – and putting it into practice – requires significant commitment, resources, innovation, and time on the part of business leaders. Based on ERM’s work with clients, research, and expert input, the blueprint proposes companies prepare to meet uncertainty by embracing six essential response elements:

- **Reflect**
- **Implement**
- **Redesign**
- **Redeploy**
- **Digitize**
- **Transform**



3.1. Reflect

Robust analysis of where a company is and reflection on where it wants to go is at the core of setting strategy.

Decarbonization strategies set end goals regarding climate change and chart how the company will get there. While strategy-setting is unique to each company, a well-planned and executed process usually involves at least these steps:

- Assess climate-related risks and opportunities.
- Set climate goals.
- Design a climate strategy and define overarching principles to guide your approach.

Key components of the assessment phase are landscape analysis and peer benchmarking, which are both effective tools for identifying the areas where a company is already leading and the gaps where action is needed the most. Scenario analysis of climate-related risks and opportunities is also an essential step in preparation for setting strategy.

ERM has worked with a broad range of companies on the assessment of risks and opportunities, including in the Asia-Pacific region which is already suffering from severe climate impacts. For instance, ERM's assessment of Central Retail Corporation PCL (CRC), one of Thailand's largest retailers, identified water stress, floods, and extreme heat as the most significant physical risks it is facing, and demand for low carbon products and increased stakeholder appreciation for climate responsible businesses as its most significant transition opportunities.

All of these activities help lay the groundwork for setting comprehensive, science-based goals, which are at the core of strong decarbonization strategy. Robust climate goals must be informed by the latest science, include all value chain emissions, and define interim targets in addition to long-term commitments. Unfortunately, corporate net zero commitments often don't meet these criteria. For instance, according to analysis of 166 of the largest corporate GHG emitters, only 17 percent have set medium-term targets which are aligned with the International Energy Agency's 1.5°C scenario and cover all material emissions, and just 42 percent have comprehensive net zero by 2050 or sooner commitments that cover all GHG emissions including Scope 3.⁷⁵

Robust climate goals must be informed by the latest science, include all value chain emissions, and define interim targets in addition to long-term goals.

The use of offsets also needs to be incorporated into goal-setting efforts. While offsets should never dilute efforts to decarbonize value chains, investment in carbon credits such as Natural Climate Solutions (which deliver social and biodiversity benefits in addition to addressing carbon) will be essential for achieving global emissions reduction targets.⁷⁶

The process of designing a robust strategy rests heavily on goals but must also include detailed roadmaps that will help translate strategy into action on the ground as well as more holistic principles to underpin a company's approach to climate. For instance, Japanese automobile manufacturer Nissan Motor Corporation strives to achieve a "Symbiosis of People, Vehicles, and Nature" with its overarching environmental philosophy encompassing three major action areas: energy (higher efficiency and renewable), resources (reduced use and recycling), and social & economic activities (within levels nature can absorb).⁷⁷

An essential element of climate strategy design is its alignment with the core corporate strategy. However, it is also a step that many companies find difficult. According to research ERM conducted with EDF, developing and delivering a climate strategy that connects climate goals with broader business objectives is the step that companies most struggle with on their net zero journey.⁷⁸ In many cases, aligning the two might require entirely reimagining the business model.

While it is a complicated process, if done right, it has potential to deliver immense benefits. For instance, Italian power company Enel has successfully transformed its business model into one that produces more than 50 percent of its electricity from renewables after predominantly using fossil fuels throughout its history. With 46 GW of installed capacity, Enel is now the world's number one private renewables operator with a presence in more than 30 countries on five continents.⁷⁹



3.2. Implement

After the Reflect phase has enabled risk and opportunity assessment, goal setting, and strategy design, companies should focus on implementation.

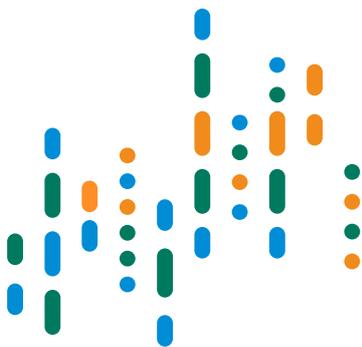
Translating strategy into action is not simple. In our research with EDF, 92 percent of surveyed companies reported facing challenges when putting net zero commitments into practice. In fact, most businesses struggle to translate high-level strategy and commitments into operational plans and actions on the ground, with only 19 percent of surveyed companies reporting they had launched a fully-costed and fully-funded decarbonization effort.⁸⁰

Many factors determine how successful businesses are at operationalizing decarbonization strategy and goals. To achieve desired outcomes, companies need to produce detailed roadmaps and implementation plans that can be embedded across all core business functions and operations. Crucially, all these efforts must receive adequate resources and investment.

One of the most critical steps is having the full view of emissions and then identifying and implementing measures to effectively reduce them to target levels. ERM recommends emphasizing the following steps in this work:

- Conduct a GHG emissions inventory.
- Prioritize decarbonization opportunities.
- Implement decarbonization action plans.
- Publish climate-related disclosures.

Companies should first conduct a GHG emissions inventory to determine their baseline emissions. Using the results, they can identify and prioritize decarbonization opportunities. For instance, ERM is helping MedcoEnergi, an



Indonesian oil and gas company, identify and prioritize decarbonization opportunities for its key assets as it works toward net zero. As part of its work, ERM has engaged MedcoEnergi teams at different assets to better understand their emissions and is developing a marginal abatement cost curve (MACC) tool to determine the feasibility of different opportunities. The results of this feasibility study will be used to prioritize decarbonization options.

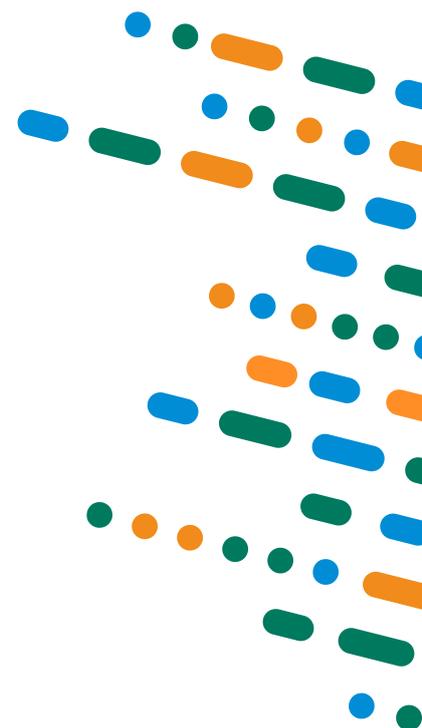
As companies sort decarbonization choices, they must remain cognizant of their emissions profile (i.e., which Scope composes most of their emissions). For most companies, their largest emissions will be Scope 3, which are on average 11.4 times larger than Scope 1 and 2 emissions combined.^{81,82} However, our research with EDF revealed that reducing Scope 3 emissions is one of the biggest climate action challenges companies face given the lack of control they have over them.

In a survey of U.S. companies conducted by ERM and the Environmental Defense Fund, 92 percent of respondents reported facing challenges when putting net zero commitments into practice.⁸³

While decarbonization across all Scopes is challenging, especially for companies with complex supply chains and those in hard-to-abate industries, developing and implementing comprehensive decarbonization action plans can make the process easier. For instance, Holcim, a Swiss-based building materials and aggregates company, began its Scope 3 decarbonization journey in 2020 by quantifying and categorizing its Scope 3 emissions. From this data, the company created specific action plans to operationalize these commitments such as optimizing shipping routes and loads and replacing fossil fuels with alternative biofuels.⁸⁴ Together, these actions will help the company achieve net zero Scope 3 emissions by 2050.

In another example of decarbonization action plans, ERM supported Electricity Generating PCL (EGCO), Thailand's first Independent Power Producer, in developing its carbon neutral roadmap, which is divided into three time horizons: Readiness Building 2022-2030; Investment Optimization 2030-2040; and Carbon Neutral 2040-2050. The first phase seeks to build decarbonization readiness and conduct technology feasibility studies. In the second and third phases, EGCO will grow its clean energy capacity and expand its carbon capture and storage adoption across its carbon intensive power plants.

With assessment converted to operational roadmaps and plans, companies need to develop systems to track and report progress in ways that meet the climate-related disclosure expectations of regulators, investors, and other stakeholders. One of the most widely used frameworks for climate-related disclosures is TCFD, whose recommendations are tailored to help companies publish "decision-useful, forward-looking information" in their financial reporting.⁸⁵





3.3. Redesign

Redesigning products and services is a critical step in achieving effective decarbonization of the private sector and reaching global net zero emissions goals.

According to the Ellen McArthur Foundation, more than 45 percent of global emissions are associated with making products, meaning circular economy approaches will be critical to reducing the carbon footprint associated with manufacturing.⁸⁶ Redesigning the ways we produce and consume, however, will take time. As companies redesign their businesses, they must consider that mainstream adoption of low

carbon products and services may be slow. They also must be open to embracing the new ways of working that will be required to align their portfolio with their climate commitments and to develop the kinds of partnerships needed to scale action.

This three-step process helps guide companies' redesign efforts:

- Identify and prioritize climate-related market opportunities.
- Develop new products or services to meet identified market opportunities.
- Demonstrate your low carbon credentials.

Proposed approach for designing products aligned with circular principles

Define the opportunity



Develop your product



Demonstrate your low carbon credentials



To begin, companies must identify and prioritize attractive climate-related market opportunities, a process that should take into account the ease with which a company can enter the identified market, and how well identified opportunities align with a company's business model and existing products and services. After identifying such opportunities, companies must develop their new climate-related products or services accompanied by an effective market entry strategy.

While all sectors will have to develop new products and services through a climate impact lens, redesign is especially important for companies in hard-to-abate sectors like cement, steel, and energy. Because of the nature of their operations, these sectors' future viability relies disproportionately on their ability to transform their business model away from carbon-intensive products and processes. According to the Ellen McArthur Foundation, when applied to four key industrial materials (cement, steel, plastic, and aluminium), circular economy strategies could help cut their emissions by 40 percent by 2050.⁸⁷

Many companies in hard-to-abate sectors are already reimagining their products and services for decarbonization. Dow aims to use circular solutions to support its goal to reduce GHG emissions by 15 percent by 2030 from a 2020 baseline and to achieve carbon neutrality by 2050. Dow's solutions center on using fewer resources to manufacture its products, partnering to reduce waste by rethinking business models, and working with customers to design products to extend their life.⁸⁸

While all sectors will have to develop new products and services through a climate impact lens, redesign is especially important for companies in hard-to-abate sectors like cement, steel, and energy.

In another hard-to-abate industry, aluminium producer Novelis' use of recycled aluminium helps it reduce emissions across its value chain as it works toward carbon neutrality by 2050 or sooner. Currently, 57 percent of its inputs are recycled aluminium, which uses 5 percent of the energy used to create primary aluminium, and emits as little as half a ton of carbon dioxide compared to the four to 20 tons of carbon dioxide needed to produce equivalent primary aluminium.⁸⁹

After identifying market opportunities and developing new products and services, companies will need to demonstrate their low carbon credentials by validating that these offerings contribute to decarbonization. The most direct way to do so is using assurance standards and schemes such as Carbon Trust's Product carbon footprint label, which confirms that a company is tracking and reducing a product's emissions.⁹⁰



3.4. Redeploy

In addition to reflection, implementation, and redesign, many companies will need to revise their approach to capital projects and readjust their corporate structure and holdings through mergers, acquisitions, and divestments.

Although frequently associated with heavy industry, capital projects matter to companies in all sectors and can be thought of as any project involving significant investment, a long lifespan, and complex development. These characteristics mean that such projects generally take time to implement, making it imperative that companies revise approaches now to ensure their capital projects align with their decarbonization commitments and avoid carbon lock-in.

While critically important, revising approaches to capital projects and readjusting corporate structures and holdings in line with decarbonization plans is challenging. Only five percent of the over 150 Climate Action 100+ focus companies have committed to align their capex strategies with their climate commitments.⁹¹ Surmounting this requires acting with climate in mind across four redeployment-focused steps:

- Plan and design capital projects for climate-related risks.
- Build capital projects in a way that minimizes emissions and increases climate resiliency.
- Operate capital projects in an emissions-efficient manner and reduce end-of-life climate impacts.
- Readjust your corporate structure and holdings for decarbonization through mergers, acquisitions, and divestments.

To achieve the level of decarbonization required to stave off the worst of climate change, capital investment will need to rise precipitously. According to the International Energy Agency, decarbonization-related capital investment must grow from approximately \$2 trillion today to close to \$5 trillion by 2030 and \$4.5 trillion by 2050 if the world is to achieve net zero emissions by 2050. These investments must fund a major uptick in capital deployment for specific technologies. For example, the IEA says that renewables as a total share of global electricity generation must rise from 29 percent in 2020 to nearly 90 percent by 2050.⁹²

According to the International Energy Agency, renewables as a total share of global electricity must rise from 29 percent in 2020 to nearly 90 percent by 2050.

Companies need to take emissions and climate resiliency into consideration from the very initial stages of planning and design. New capital deployment, including for renewable energy sites, requires careful assessment of social and environmental impacts. For example, ERM recently developed the Environmental Impact Statement for Vineyard Wind 1, the first commercial-scale, offshore wind project in the U.S., which will serve as a template and model for all future offshore wind projects in the country.⁹³

Similarly, ERM helped Equinor select a site, develop a stakeholder engagement plan, and conduct ecological surveys for its Hydrogen to Humber (H2H) plant within the UK's East Coast Cluster. H2H will produce blue hydrogen from natural gas for use in nearby power plants and industrial facilities and capture production emissions for sequestration offshore in the North Sea. By 2030, H2H is projected to have captured and stored 8.25 million tons of CO₂ offshore.⁹⁴

Once a project is operational, companies must make every effort to minimize day-to-day emissions through operational efficiency measures. Companies also need to anticipate the end of projects' lifecycle and develop decommissioning strategies that reduces end-of-life climate impacts.

For many companies, rapidly delivering on decarbonization commitments and avoiding climate-related risk will also require adjusting their corporate structure and holdings, specifically through mergers and acquisitions of low carbon assets as well as thoughtful divestments of carbon intensive or climate vulnerable assets. For successful implementation of capital projects as well as portfolio adjustments, financial institutions have critical roles to play. Many financial institutions are accelerating funding for projects that reduce emissions. For instance, Bank of America has set emissions reduction targets for its financing activities in the auto manufacturing, energy, and power generation sectors.⁹⁵

Divestments of carbon intensive or climate vulnerable assets can help companies and investors reduce their climate change contributions and exposures. However, divestments can simply pass contributions and exposures on to the next organization, where they may not be managed well. To avoid this compounding overall climate impact while reducing it for one company, the Glasgow Financial Alliance for Net Zero (GFANZ) encourages companies and investors to pursue managed phaseout of carbon intensive assets by retiring them before the end of their lifecycle rather than selling them into situations where they continue high carbon operation.⁹⁶



3.5. Digitize

Digital tools will play a critical role in achieving global emissions goals by helping to optimize operations, maximize energy efficiency gains, and supporting performance tracking among many other ways.

According to the World Economic Forum, digital technologies could deliver one third of the emissions reductions required by 2030 to keep the world on track to limit global temperature rise to well below 2°C.

Digital tools support corporate climate action in many ways. Often digital tools are facilitators of climate action rather than direct solutions, enabling more efficient decarbonization by improving existing processes and efforts. While there are multiple ways that digital solutions facilitate and accelerate decarbonization, in this briefing we highlight the following three:

- Enable more efficient decarbonization by optimizing operations.
- Improve assessment of company exposure to climate-related risks and opportunities.
- Support climate-related performance tracking and disclosure.

Digital tools excel at helping companies reduce emissions through optimization of operations. Developing a digital decarbonization plan is foundational to realizing this benefit. That plan will outline and explain the role digital will play in reducing emissions and pinpoint the parts of operations and geographical locations where the most emissions reductions can be achieved.

OPEX, an ERM Group company, has developed one such tool for carbon intensive companies. Opex's 'emissions.AI' tool identifies hidden operational inefficiencies using engineering-first

principles, analytics, and artificial intelligence that, when addressed, can help companies optimize their energy use, lowering emissions and their associated costs by as much as 7.5 percent annually.⁹⁷

For instance, oil and gas exploration and production company Dana Petroleum enlisted OPEX to support its decarbonization efforts using emissions.AI. OPEX deployed the tool at Dana's floating production storage and offloading unit in the North Sea where it is generating granular emissions data. OPEX and ERM are also helping Dana develop an Emissions Reduction Action Plan, which will compile the emissions data from emissions.AI and help the company identify decarbonization opportunities.

ERM's emissions.AI tool identifies hidden operational inefficiencies using engineering-first principles, analytics, and artificial intelligence that, when addressed, can help companies optimize their energy use, lowering emissions and their associated costs by as much as 7.5 percent annually.

Digital tools can also help companies assess their exposure to climate-related risks and opportunities as part of scenario analysis. For example, ERM's Climate Risk, Impacts and Solutions Platform (CRISP) uses predictive analytics to help companies assess how vulnerable its assets are to climate change.

In addition to enabling more direct corporate climate action, digital tools play essential roles in supporting climate-related performance tracking and disclosure. The growing carbon accounting software industry is helping companies more accurately track and manage emissions as they decarbonize. Tracking emissions through these software platforms also makes climate-related disclosure easier by aggregating data from across an organization in one place.



3.6. Transform

The transformation required to achieve decarbonization goals is as much about people and culture as products and services or practices and processes.

Even with a climate strategy, implementation plan, revised product portfolio, new thinking about capital, and digital tools in place, most companies will need to undergo fulsome transformation to thrive in the future low carbon economy.

To effectively transform organizational culture and guide their people through the challenges of the net zero transition, companies need to embrace change management best practices to:

- Incorporate decarbonization into governance.
- Address climate-related knowledge and skills gaps among employees.
- Support employees and partners through the transformation.

By preparing a structured approach for addressing governance- and culture-related change, companies will be better positioned to quickly decarbonize and seize value creation opportunities. Well-designed change programs define how change will occur (e.g., integrating decarbonization thinking into broader business strategy), how change will be implemented (e.g., redesigning the organizational structure to deliver decarbonization), and how change will be embedded (e.g., by defining the actions core business functions need to take to achieve decarbonization commitments). Additionally, for change to take hold and stick, companies must mobilize their workforce by engaging them in the decarbonization journey and leveraging their expertise to scale impact.

Companies must incorporate decarbonization into governance to ensure appropriate oversight of implementation of climate commitments.

While the board of directors is ultimately responsible for governance, the exact structure and form of climate governance mechanisms will vary depending on company size and circumstance, and there are also critical management roles associated with governance.

As one example of how climate-related governance can work, Dow created a global program management office (PMO). Dow's PMO has four governance tracks: Scope 1 and 2 emissions, Scope 3 emissions, product benefits, and new ventures. The PMO also has taken responsibility for enabling platforms (e.g., initiatives that ensure consistent climate-related communications, metrics, and reporting) that help the tracks work in concert.⁹⁸ Dow's Climate Steering Team, which is comprised of business presidents and functional leaders, oversees both the PMO and the enabling platforms. To ensure consistent progress, Dow based the PMO's structure on other existing governance structures so that climate could be governed within their organizational matrix instead of outside of it.

In addition to strong governance, companies must equip their workforces with climate-related knowledge and skills to maximize the impact of their decarbonization-focused business transformation.

TCFD provides clear guidance on climate-related governance outlining the roles that board members and management should play in managing associated risks and opportunities.⁹⁹ Shell reports in line with TCFD recommendations and is an example of a company with a well-defined climate-related governance process. Shell's Board ultimately oversees its climate change management through its Safety, Environment, and Sustainability, Remuneration, and Audit committees. Under the board, the CEO (who is an executive member of the board)

manages Shell's climate change strategy with implementation and monitoring support from senior leaders and management committees for capital investment and carbon reporting.¹⁰⁰

In addition to strong governance, companies must equip their workforces with the climate-related knowledge and skills needed to maximize the impact of their decarbonization-focused business transformation. Companies should focus on expanding knowledge through education efforts so that employees understand what decarbonization will require from them. For instance, insurance company AXA has established a 'Climate Academy,' which aspires to train all of its employees on climate-related issues by 2023.¹⁰¹

Companies must also help employees manage the workplace disruption wrought by transformation. Supporting employees is critical to maintaining cohesive corporate culture and building internal buy-in for climate action, for instance when fears of job transfers and/or layoffs grow within companies preparing to decarbonize. Support involves retraining employees for the new roles suited to the low carbon economy. For example, Danish energy company Ørsted recently partnered with North America's Building Trades Unions (NABTU) to construct offshore wind farms using union workforces.¹⁰² Through the partnership, Ørsted will train and create apprenticeships to equip union contractors and subcontractors involved in its projects with the skills required to be successful in the offshore wind industry.

Blueprint for Action: What to Prioritize



Reflect



Set interim and long-term climate commitments in line with the Paris Agreement's 1.5°C ambition.

Design a decarbonization strategy that outlines how you will achieve your climate commitments, defines how you will approach decarbonization, and aligns with your overall business strategy.

Implement



Operationalize strategy and goals with the help of detailed roadmaps and implementation plans.

Conduct a comprehensive GHG emissions inventory and prioritize and pursue reduction opportunities based on abatement effectiveness as well as economic and technological feasibility.

Redesign



Identify attractive climate-related market opportunities for existing and new products and services.

Develop a product or service to meet identified opportunities and create a market entry strategy.

Redeploy



Develop a capital project deployment strategy that accounts for physical and transition climate-related risks, minimizes emissions, and reduces end-of-life climate impacts.

Adjust your portfolio through low carbon-focused mergers and acquisitions and divestments of carbon intensive or climate vulnerable assets in ways that align with your climate strategy.

Digitize



Optimize operations for emissions reductions and energy efficiency gains with digital tools.

Improve climate-related planning and disclosure by using digital tools to assess your exposure to climate-related risks and opportunities.

Transform



Incorporate climate action into corporate governance by establishing clear structures and processes for decarbonization.

Equip employees with the climate-related knowledge and skills needed to support decarbonization through targeted education and training.





4. Conclusion

The Decarbonization Imperative: An Executive Primer emphasizes the urgency of private sector action to help address the climate crisis, explores information and knowledge gaps that cause hesitation, and presents a blueprint for the kinds of corporate reaction and response required to create momentum.

With multiple milestones critical to keeping the ambition of the Paris Agreement in reach so near, acknowledging the gravity of the moment is increasingly straightforward for many leaders across all sectors of society.

Grappling with the uncertainties accompanying the drivers that shape Chapter 2 of this report – Financial Risk & Opportunity, Shareholders, Stakeholders, Policy, Geopolitics, and Technology – is more difficult, but critical to progress on the climate agenda and to the future success of individual companies and their leaders. Business leaders need to grasp that the uncertainties discussed in this paper will shape the future context in which companies must decarbonize.

The points above – the notions that addressing the climate crisis and business as a growing concern are now wholly intertwined, and that climate uncertainties are shaping the future – give reason for optimism. Said differently, those who adopt the blueprint for action outlined in Chapter 3 of this briefing will have the opportunity to support the low carbon energy transition while also building the adaptability and resilience their organizations will need to survive it.

The prescription in the blueprint is not mild. It demands new approaches to strategy and goal setting, operations, product and service portfolios, capital expenditure, and digital, plus tremendous care managing the profound change that transformation will impose on leaders at all levels of corporations, from boards and the ranks of senior executives to operational and frontline workers. But the years and decades ahead will not be tranquil either – they will be some of the most tempestuous, difficult, dynamic, and competitive that the private sector has ever experienced, making business leadership’s understanding and application of climate an essential competency.

While the urgency of the climate emergency and the scale and pace of change needed mean business leaders must increase climate knowledge and understanding rapidly, the same factors convey why business action cannot be delayed. Companies must start on the decarbonization journey immediately, even if they are unsure of the specific path they will take and where it will ultimately lead. Adopting the blueprint outlined in this publication will generate the corporate confidence required to begin and accelerate progress along the way.

With *The Decarbonization Imperative: An Executive Primer* being published in November 2022 during COP27, the so-called ‘Implementation COP,’ we urge every company to embrace the imperative to apply this blueprint or another framework and commence the work of future-proofing their business against the impacts of the low carbon transition while contributing to development of the net zero economy targeted by 2050.



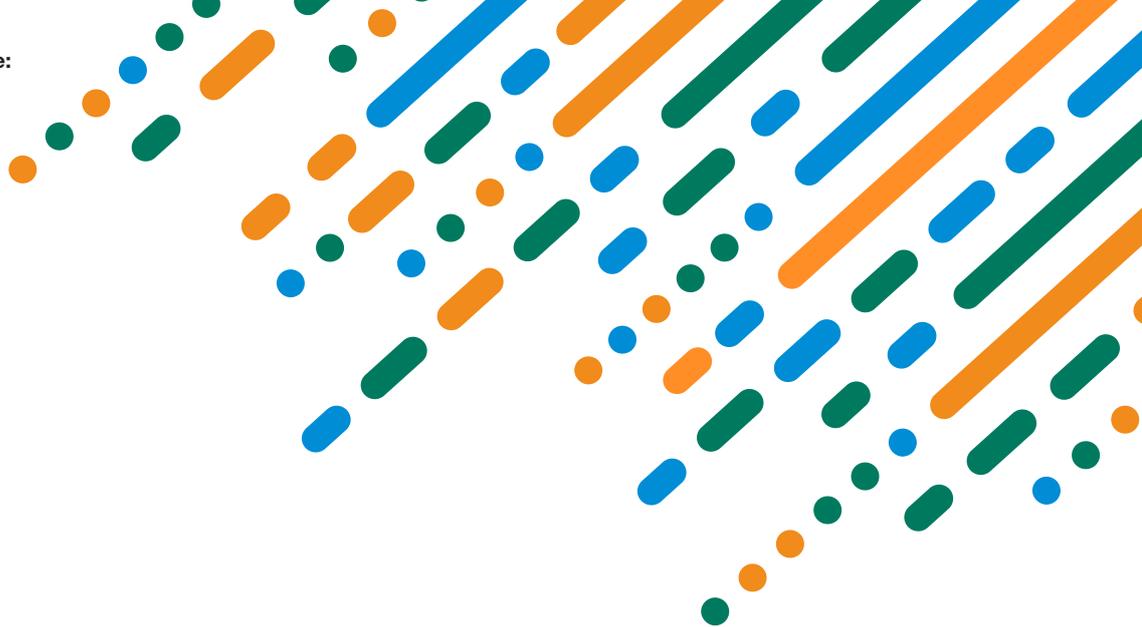
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