



Sustainability in the Aerospace and Defense industry

Imagining a new future

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Foreword

The world faces the challenging task of slowing the rate of climate change and ultimately reversing it. The Aerospace and Defense (A&D) industry must play its full part in contributing to this massive and complex problem. Fortunately, executives in the sector are not only aware of what is being demanded of them but are also changing their strategies to meet the goal of net-zero carbon emissions by 2050.

KPMG International explores the scale of the challenges facing A&D companies and the steps they need to take if they are to meet their environmental, social and governance (ESG) commitments over the next 25 years. The route to success will be difficult, but as our report makes clear, the industry is determined to do the right thing.

For readers who are searching for ways to navigate the journey to a carbon-free future, this report contains the following points:

- A&D companies face a situation in which the demand for air travel is expected to grow rapidly while the industry will have to reduce carbon emissions between now and 2050.
- The challenge includes how the sector needs new technologies to meet the sustainability targets. A&D companies must transform their operations to maximize the benefits of the technologies, while the cost of technological change must be made more manageable.

- A&D manufacturers may not be able to reach their goals unless they integrate carbon reduction strategies throughout their ecosystems, including collaborating with their competitors. This is particularly important within their hugely complex supply chains.
- Governments will play a key role in guiding the A&D industry down the path toward net-zero. The European Commission, for example, is placing stringent decarbonization targets on aerospace companies. Defense companies' carbon targets, however, are likely to be less constrained by their government customers, but manufacturers are expected to push forward anyway to decarbonize as quickly as possible.
- The report ends by considering three points executives should seek to bear in mind as they plan ahead: building a climate-aware corporate culture; aligning decarbonization goals with enterprise strategy and developing a plan for the next 25 years.

KPMG International hopes readers will find these insights useful as they move forward to build a new future for their company and the industry.



Grant McDonald

Global Head of Aerospace and Defense
KPMG International

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A&D companies face an enormous challenge to meet their decarbonization and ESG commitments. Aviation has contributed about 4 percent to global warming to date¹ and is responsible for about 14 percent of greenhouse gas (GHG) emissions from transport.² The defense industry and the global armed forces produce 6 percent of GHG emissions.³

The challenge for the industry is expected to grow: demand for air transport is likely to increase GHG emissions by 300 percent between 2005 and 2050, according to the European Commission.⁴ “The European Green Deal calls for carbon neutrality by 2050 and the aviation sector must contribute to this reduction. Our biggest challenge is that we need time to decarbonize our industry,” says Charlotte Dieutre, Vice President of Corporate Social Responsibility, Diversity and Inclusion at Safran.

The coming decades will require massive changes for A&D companies, their suppliers and customers to meet growing demand for goods and services without compromising their ESG commitments. Value chains are designed to satisfy seemingly insatiable requirements, both civilian and military, and in the future they must do so in a sustainable fashion.

How can companies do both?

“There are no short-cut answers as it’s a question of understanding that dealing with climate change is not a sideline project,” says Michael Hayes, Global Head of Renewable Energy, KPMG International.

“The world is accelerating to low carbon faster than many are aware and customer sentiment is shifting quickly. Once consumers accept the reality of what’s happening and start demanding higher standards, companies that don’t embrace it will be left behind.”

The demands on A&D companies are significant because industry leaders face the challenge of achieving multiple transformations at the same time. They must continue the drive to achieve the benefits of Industry 4.0 and on top of this, there is the need to make substantial reductions in carbon emissions alongside achieving other ESG goals, including workplace diversity. For defense contractors, while meeting their decarbonization goals, there is the added requirement to ramp up production in the face of growing geopolitical tensions.

This report seeks to address the way forward for the industry and the urgent need to adopt a strategy that integrates decarbonization and ESG goals into an enterprise-wide business model designed for long-term sustainability. This will entail large investments in new technologies, close collaboration within and among ecosystems, a total enhancement of workforce preparedness, and the development of a climate-aware corporate culture.

¹ “Quantifying aviation’s contribution to global warming,” Milan Klöwer et al, Environmental Research Letters, November 2021. See also: “Aviation is responsible for 3.5 percent of climate change, study finds,” NOAA Research News, September 2020.

² “Reducing emissions from aviation,” European Commission, July 2021

³ “Estimating the Military’s Global Greenhouse Gas Emissions”, Scientists for Global Responsibility, November 2022

⁴ *ibid*, European Commission, July 2021.



“The challenges faced by the industry are significant but can be met with the support of the A&D ecosystem. A collaborative strategy is needed, not only within the A&D industry supply chain but with government and regulatory support, as well as working with adjacent sectors such as energy and mining. The focus needs to be on creating robust business models that generate sufficient returns to enable accelerated investment in decarbonization technologies. It will take more time, but progress is being made and the industry is up to the task” says Grant McDonald, Global A&D Leader, KPMG International.

“

The focus needs to be on creating robust business models that generate sufficient returns to enable accelerated investment in decarbonization technologies. It will take more time, but progress is being made and the industry is up to the task.”

Grant McDonald

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The A&D industry has faced challenges in the recent past including the economic fallout of the pandemic and growing geopolitical conflicts, yet rarely has it needed to change so quickly and in so many ways. From KPMG International's point of view, the sector faces three key challenges:

Technology

A&D companies are in tremendous need of new technologies and to find a way of reducing the cost of this know-how. Hayes says the high expense is becoming a big obstacle to transformation, particularly when looking beyond 2040. "Transition plans force us to recognize where we really are and the challenge to get to net zero. The more we can do with technology, the better," Hayes says.

Transformation

Many underestimate the extent and depth of the change needed in A&D companies, because it is easy to set a target for decarbonization, but much more difficult to hit it. "When it comes to net zero, companies are asking, what are we taking on here? They're genuinely concerned," he says.

Disconnect

The biggest challenge, Hayes says, is the wide gap between the cost of a decarbonization strategy, in some cases many billions of dollars, and the value created for stakeholders, investors in particular. "Despite all the talk about solutions, this remains a real issue," says Hayes.



The biggest challenge is the wide gap between the cost of a decarbonization strategy and the value created for stakeholders.

Mike Hayes

Climate Change and Decarbonization Leader
Global Head of Renewable Energy, KPMG International

Many executives agree about the scale of the task. "All of these innovations will be extremely challenging and expensive to industrialize, requiring significant flows of capital from multiple sources," says Kevin Craven, CEO of ADS. "In the area of commercial aviation, the flying public will need to play a significant role in funding this transition from which we all benefit and wish to see implemented quickly, but no-one likes paying more. Governments have a large and important role to play in avoiding market failures and de-risking early technology adoption, and mechanisms will need to be found to do this on an internationally collaborative basis, which is a huge political challenge."





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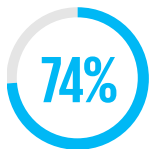




To measure the progress of the industry in reducing its carbon footprint, KPMG International analyzed the relevant public announcements regarding net-zero and ESG targets of 22 of the largest A&D companies by market capitalization (for a geographic analysis of companies and accompanying charts, see page 19). The analysis found that:



of the companies have either set or achieved their short-term Scope 1 and 2 reduction targets.



are disclosing their Scope 1, 2 and 3 emissions.

In terms of medium- and long-term targets,



are committed to net-zero carbon emissions by 2050 and 27 percent have not yet set net-zero targets.



of the companies are engaging with suppliers to reduce Scope 3 emissions and 18 percent are planning to include suppliers in decarbonization practices.



In addition, each company was assigned a score, based on whether they have established various climate-related targets (three points), partially done so (two), and not done so (one). The average score of the 11 European firms is 17.7 points, slightly ahead of companies from the US and Canada, with 16.2 points. The average for all 22 companies is 16.6. These numbers offer potential insights into how individual companies and countries can benchmark their progress against their peers. To go deeper, however, A&D firms will have to focus on helping to transform the carbon footprint of their ecosystems.



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In October 2021, the International Air Transport Association resolved to achieve net-zero carbon emissions by 2050.⁵ “Achieving net zero emissions will be a huge challenge. The aviation industry must progressively reduce its emissions while accommodating the growing demand of a world that is eager to fly,” the IATA says. If the industry is to achieve it, multiple decarbonization solutions will have to be implemented simultaneously: technology innovation in aircraft design, new fuels such as sustainable aviation fuel (SAF)⁶ efficiency improvements in airports and air traffic management, and many other measures.

Flying toward net zero

IATA indicates that a net-zero target by 2050 will require a range of measures including the maximum elimination of emissions at source, as well as carbon-offsetting and carbon-capture technologies

According to the Intergovernmental Panel on Climate Change, simply eliminating emissions will not be enough if the world is to reach net-zero carbon emissions by 2050; removing CO2 from the atmosphere will also be necessary. To achieve this, Airbus has partnered with Carbon Engineering, a Canadian company and 1PointFive, its US partner, to directly capture CO2 from the air by pre-purchasing thousands of tons of carbon removals a year.⁷

Direct air capture with carbon storage is but one of many enhancements that will take years to develop at scale. Technological changes in A&D have to take into account product lifecycles that last decades so the introduction of more energy-efficient aircraft cannot happen overnight, certainly not as fast as in, say, the automotive industry.⁸



65% Sustainable Aviation Fuel (SAF)



19% Offsets and carbon capture



13% New technology, electric and hydrogen



3% Infrastructure and operational efficiencies



Source: IATA

⁵ “Net-zero carbon emissions by 2050,” IATA, 4 October 2021

⁶ “Sustainable aviation fuel: ready for lift off?” KPMG, November 2022

⁷ “Direct air carbon capture and storage for aviation, explained,” Airbus, July 2022

⁸ “Auto leaders prepare to seize big opportunities,” KPMG, December 2022



There are no radical technology options currently available to decarbonize aviation quickly. Consider some of the constraints on improvements in fuel efficiency:

- Biofuels and SAF produced from feedstock may produce lower lifecycle emissions than using kerosene but are unlikely to be available in sufficient quantities to make a significant contribution in the short- to medium-term.⁹
- Electric aircraft are unlikely to be available for anything other than very short journeys until after 2050.

- Zero-carbon kerosene is technically possible to make using captured CO2 and hydrogen produced with renewable electricity, but it is not currently being produced at a commercial scale.

Decarbonization of A&D will require technological, financial, and business cooperation among ecosystems on an unprecedented scale. Safran is partnering with GE Aviation, for example, on a technology development program to reduce fuel consumption and carbon dioxide emissions by 20 percent from jet engines that could enter service by the mid-2030s.¹⁰ Their development partnership began in 1974 and has been extended to 2050.

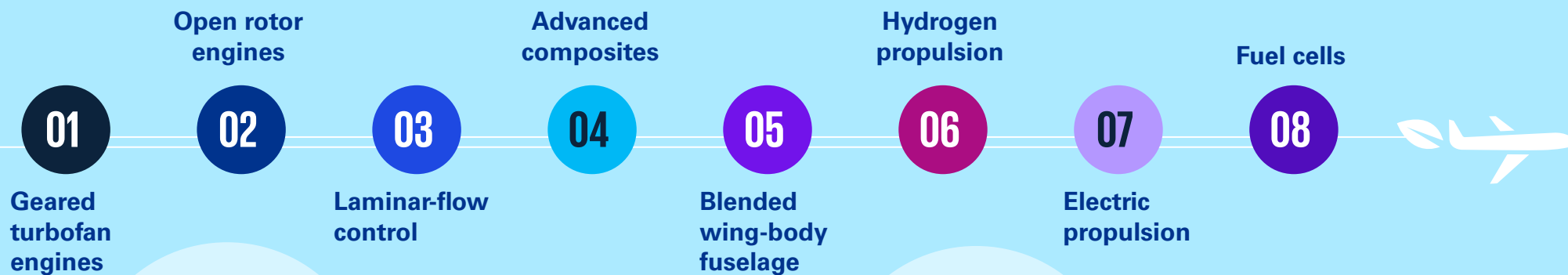
This is just one example of the collaboration occurring throughout the sector, but much more is needed. The industry’s supply chain is among the most complex in the world. Many of the suppliers will have to be involved in the net-zero effort.

⁹ “Estimating sustainable aviation fuel feedstock availability to meet growing European Union demand,” International Council on Clean Transportation, March 2021

¹⁰ “GE Aviation and Safran launch advanced technology demonstration program for sustainable engines,” press release, GE, June 14, 2021.

Propelling the future

Some of aviation’s decarbonization technologies under development include:





“The key challenge is to reduce the carbon footprint of the entire value chain, to go upstream as well as downstream,” says Jeremie Joos, ESG Reporting & ESG Transformation Lead, KPMG in France. “It starts with the fabrication of many small parts, often made with rare metals that must be extracted, forged, manufactured, and delivered, using a significant amount of energy. The A&D industry must work end to end to fund the carbon transition of the whole value chain.”

This will mean collaborating across the entire supply chain. Safran of France engaged 400 of its strategic suppliers in July 2022 to encourage them to align with the company's decarbonization objectives.¹¹ “The large suppliers are already on board and have a plan; we have 12 tier-1 companies, and we can monitor their progress every month. The big effort, though, is focused on the smaller suppliers,” says Safran’s Dieutre. “Many of them have never done a carbon assessment and don’t know the true impact of climate change on their business. So, we provide them with an assessment tool and training.” This is just the first step of an immense task, because Safran has 25,000 suppliers.

Joos says the decarbonization effort must align with other sectors, including the mining and metals companies producing the titanium, aluminum, graphite, nickel, and high-quality steel that are key to the performance of airplanes and other equipment. Rare earth minerals are also important elements used in aerospace and defense, as well as lithium, manganese, and cobalt used in batteries. These materials will be among those vital for decarbonization and their availability will depend on mining and metals companies. In a recent global KPMG survey, more than 400 mining and metals C-level executives were asked whether they were confident their industry could reconcile rapid output growth with sustainability goals. Optimists working in these critical materials outweigh pessimists six to one.¹²

A&D companies will be keen to diversify their sources of raw-materials supply, from both a geopolitical and business standpoint. For example, the Democratic Republic of the Congo supplies 70 percent of the world’s cobalt. Reducing reliance on one or two suppliers will take many years to accomplish. One potential source of minerals is space: companies are exploring the idea of extracting key resources from asteroids and the moon.¹³

¹¹ Safran gets its suppliers on board its decarbonization path,” Safran, July 27, 2022

¹² “Mission critical: Mining & metals companies and a carbon-free future,” KPMG, May 2023

¹³ “A galaxy of opportunities. Space: ESG’s next frontier,” KPMG, 2023





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The sector has, over the decades, experienced tremendous technological progress, because of collaboration within and among ecosystems of OEMs, engine manufacturers, defense suppliers and others. But the pressure to speed up decarbonization is significant. "The difference between collaboration before and now is that today, the scope of change will require a bigger shift in business models," says Joos. "If A&D companies, airlines and others don't accelerate changes in their business models, the repercussions may be severe. The risk is that, at some point, the civil aviation authorities may say, 'We will limit the number of flights per person, the number of flights between points A and B, or the number of aircraft the airlines can own.'"

In the defense industry, the governmental approach has been fairly different. "Defense departments are telling their suppliers, you may want to decarbonize, and we will do what we can to support you, but we will move at a pace that doesn't compromise our ability to deliver military outputs," says Maund.

Defense ministries have, though, issued a range of policies designed to reduce the impact of military operations on the climate. The Pentagon, for example, is elevating climate change as a national security priority, while integrating environmental considerations into policies, strategies, and partner engagements.¹⁴

However, the choice on whether to act may not always be within the militaries' control. Defense

policy makers are paying particularly close attention to the energy transition and how it may affect their future of energy choices. Currently, fossil fuels are readily available around the world, but in the future, it may not be possible to rely on fossil fuel availability, "and this could profoundly affect the delivery of military operations and equipment design," Maund says.

This is highly relevant in the maritime domain, where the shipping sector is coming under pressure to decarbonize. The International Maritime Organization has set the sector a target to reduce carbon intensity of all ships by at least 40 percent by 2030. This target is driving the exploration of a wide array of energy opportunities, including biofuels, e-fuels, LNG, battery electric and nuclear power.

"There isn't yet consensus on what the main solution will be or even if one energy type will dominate; but considering naval reliance on the global availability of fuel, militaries need to pay close attention to how the shipping energy transition will unfold and factor that into procurement decisions. In general, ministries of defense are going to need to be closely attuned to the energy decisions made by their industrial base to avoid losing their ability to be supported by their contractors," says Maund.

“With few exceptions, defense ministries have not imposed net-zero goals on their contractors, out of concern that it might compromise operational effectiveness.”

Shareef Maund

Account Sustainability Lead, KPMG in the UK

With risk comes opportunity, in the form of new technologies, such as the potential development of small modular reactors that could be compact enough to fit into a shipping container and be deployed on global operations, offering significant amounts of localized, clean power.¹⁵ Harnessing these technologies could have the double benefit of delivering decarbonization while also enhancing operational effectiveness. "Identifying and executing on these innovative opportunities is critical to driving change in the sector," Maund says.

Another possible route toward decarbonization is to separate assets and equipment that are not directly linked to mission-critical capabilities from those that focus decarbonization efforts where the potential risk to military capability is low. Combining this approach with exploiting innovative new energy technologies might be the basis for an effective decarbonization strategy in the defense industry.¹⁶

Whether militaries follow the private sector or lead through innovation, they will need to be more transparent about their green initiatives in what is a traditionally security-conscious industry. Many defense contractors are seeking more guidance on decarbonization from their government customers, so they can plan and invest appropriately.



¹⁴ "Tackling the climate crisis," US Department of Defense

¹⁵ "Advanced small modular reactors," Office of Nuclear Energy, US Department of Energy

¹⁶ "The greening of defence," KPMG, 2021.



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The A&D industry’s progress on decarbonization was slow in the late 2010s, but programs have ramped up recently, says Mike Hayes, observing that companies in the sector have recently been among the more active in pursuit of net-zero goals. Executives have focused on Scope 1 and 2 emissions which cover carbon emissions from sources an organization owns or controls directly and indirectly when the energy it purchases is produced.”

One of the less difficult solutions is renewable power, especially through power purchase agreements, in which a third-party developer installs, owns, and operates an energy system on a customer’s property.

In the future, the focus will be on SAF¹⁷ and new propulsion technologies, although, as noted earlier, aviation will be competing with other sources of demand for waste feedstocks, such as incineration and bioenergy with carbon capture and storage.¹⁸ Electricity and hydrogen will also be key sources of energy for aerospace. “There is a whole issue around not just reducing costs but building consumer confidence that the transition will work.

Customers are one of the most powerful stakeholder voices in the climate-change campaign,” Mike Hayes says.

Company executives understand this will require a fundamental transformation across the entire enterprise. The list of aims is long. “They need to think about net zero goals, capital allocation, nature and biodiversity, employee diversity, equity and inclusion, human rights, and sustainable supply chains. Both management and boards understand they need to tackle all those issues and simultaneously respond to different stakeholders,” says Mike Hayes.

It will require change management and upskilling, as well as enhancements to reporting and accounting, as well as managing the governance challenge of avoiding charges of “greenwashing.” In Hayes’s view, ESG is becoming a “people and planet” concept, focusing on climate change, the effect on biodiversity and on communities. “All these must be integrated into strategy, embracing these goals from the top of the enterprise to the bottom. Businesses that recognize this reality will undergo a transformation,” he says.

“Further strong collaboration at an international level is needed to build a decisive action plan to further accelerate the pace of change at an overall systems level,” says Craven of ADS. “Improving connections between industries that have not previously worked closely together is a key part of that, particularly with the oil and gas industry and capital markets, as well as the aviation customer and the aerospace manufacturers.”

¹⁷ “Sustainable aviation fuel,” KPMG, January 18, 2023

¹⁸ “Boeing boss cools hopes for sustainable aviation fuels,” Financial Times, May 22, 2023

¹⁹ “KPMG Launches Net Zero Urban Program,” kommunikasjon.ntb.no, November 17, 2022

A forum for collaboration

To achieve net-zero goals, A&D companies and others should be seeking to develop new technologies rapidly and in ways that cut the cost of existing technologies. To speed up the process, innovators, industrialists, and investors must collaborate much more than they do today. KPMG International is designing a global digital platform called a decarbonization innovation exchange,¹⁹ that is designed to help bring together these teams in a virtual space where they can discuss their needs and possible solutions. This digital forum could potentially enhance transparency and enable decarbonization ideas to be tested and developed quickly.





Mapping the Sustainability of Aerospace and Defense

To measure the progress of the industry in reducing its carbon footprint, KPMG International analyzed the relevant public announcements regarding net-zero and ESG targets of 22 of the largest A&D companies by market capitalization.

Reduction of scope 1 and 2 emissions



- Of the 20 companies with a clear target, 8 are US headquartered followed by France (4), UK and Germany (2 each)
- Two companies based in the UK and India do not have clear scope 1 and 2 emission reduction targets

Reduction of absolute scope 1, 2 and 3 emissions



- Eleven companies have set clear goals to reduce the absolute scope 1, 2 and 3 emissions.
- Of these 11, four US headquartered companies lead the way, followed closely by several European companies.
- There are 11 companies that do not have mature targets with respect to scope 1, 2 and 3 emission reductions. These are evenly distributed across US, Europe and Asia

Ambition to achieve net zero across scopes 1, 2 and 3 by 2050



- Eleven companies have set goals to achieve net zero across scopes 1, 2 and 3 by 2050.
- Europe based entities are leading the way; others are still working on revising their goals to achieve net zero by 2050

Actively engaging with suppliers to reduce scope 3 emissions



- There is a wide gap among European companies when it comes to being actively engaged with suppliers to reduce scope 3 emissions
 - 11 of them are aligned and closely working with suppliers
 - 7 of them are still sorting out ways to be more active
- 4 companies intend to work with suppliers to find more efficient methods to reduce scope 3 emissions.

Source(s): Company annual reports,, CSR reports





Set science-based targets aligned 1.50C scenario



- Ten companies are committed to the Science-Based Target initiative (SBTi). A further seven companies have not yet decided whether to align with SBTi
- Five European companies will soon start the SBTi certification process to substantiate an action plan for a low-carbon future.

Disclosure of GHG emission (including Scope 1, 2 and 3) with material scope 3 category



- 16 companies mandated public disclosures of their scope 1, 2 and 3 emissions with scope 3 material category, whereas 6 companies have made only scope 1 and 2 disclosure.
- Majority of the companies are situated in the US followed by Europe.

Climate-related financial disclosures to identify risks and opportunities (TCFD)



- 10 companies have performed the Task Force on Climate Related Financial Disclosures (TCFD) analysis, developed climate strategies based on the identified risks and opportunities. 7 companies have signed up for principles of TCFD and 5 companies have not yet made any disclosures on the same.
- Majority of these companies are headquartered in the US and the UK.

Source(s): Company annual reports,, CSR reports

Fully aligned
 Partially aligned
 Not aligned





KPMG International global analysis results:

95%



have either set or achieved their short-term scope 1 and 2 reduction targets.

47%

of the companies are engaging with suppliers to reduce scope 3 emissions and

21%



are planning to include suppliers in decarbonization practices. Seventy-four percent are disclosing their scope 1, 2 and 3 emissions.

In terms of medium- and long-term targets,

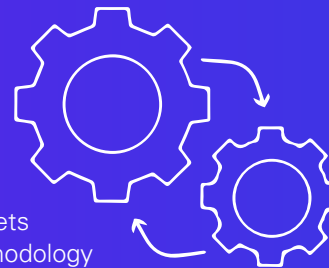
47%



of the companies are committed to net-zero carbon emissions by 2050 and 26 percent have not yet set net-zero targets.

An additional

21%



have defined their targets according to SBTi methodology and are awaiting approval from the organization.

More than half,

53%



are aligned with the

Science-Based Target Initiatives²⁰

42%



of companies have performed analysis based on the Task Force on Climate-Related Financial Disclosure to assess climate risk. Thirty-seven percent have requested TCFD analysis and so have not yet made any disclosures.

²⁰ More information can be found at sciencebasedtargets.org





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This report recommends that A&D companies take an integrated approach to decarbonization and ESG goals if it is to meet the environmental and social targets between now and 2050.

Based on our research and the input from subject matter experts, there are three points executives should bear in mind as they plan.



A climate-aware culture

Enterprises should seek to change the organizational mindset from top to bottom and this, in turn, will require designing incentives and changes to processes across the entire enterprise, beginning with corporate leadership. All major decisions and policies should be based on risk and opportunity assessments that consider the impact of climate change on the company and the growing stakeholder demands for decarbonization.



Align with the mission

Once these assessments have been made and thoroughly vetted, make sure the resulting choices — in terms of manpower, investments, alliances, and M&A — reflect the core goals of the company. A key decision will be to decide which energy source or sources are going to enable the enterprise to maximize the opportunities and mitigate the risks, while delivering the decarbonization required to reach net-zero emissions by 2050.



Pace of change

A&D companies are being called upon to plan more than 25 years into the future, amid an ever-changing business environment. Decarbonization strategies will need to be reassessed regularly. Progress will not be linear and should be planned for. Business remodeling will probably start slowly, as supply chains gear up and technology is leveraged. As time proceeds, net-zero and ESG activities will gather pace and become more hectic towards the end of this 25-year timeframe.



There is a consensus among A&D corporate leaders that although the sector faces some unique issues, it cannot insulate itself from the climate-induced changes affecting all industries. "This involves not only the engagement of Europe, but also other parts of the world, such as the US and China," says Dieutre of Safran. "We have engaged partners and sectors around the world and this topic needs to be discussed as we keep in mind the global and systemic aspects of climate change."

McDonald noted, "At the end of the day, however, the business decisions will have to be made by executives at individual companies. The carbon future is in their hands. It will take an enormous effort on the part of every employee, from top to bottom, to ensure the A&D industry meets its environmental goals".

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