MedTech Europe
from diagnosis to cure

Decarbonising Healthcare: How a Competitive MedTech Industry Can Contribute

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Context: MedTech's Starting Point

Health drives our lives—as individual citizens, and at a planetary and economic level.

"If Europe's ambitious climate targets are matched by a coherent plan to achieve them, decarbonisation will be an opportunity for Europe. But if we fail to coordinate our policies, there is a risk that it could run contrary to competitiveness—and ultimately be delayed or even rejected," stated Mario Draghi when presenting his report on the Future of European Competitiveness in September 2024.

Europe has set an ambitious framework to mitigate climate change impacts on human and planetary health. The EU Climate Law enacts a legally binding target to decarbonise its economy by 2050, subject to implementation through EU-wide regulations and national measures based on stringent 2030 and 2040 interim milestones. To meet the target, European industries are required to reduce greenhouse gas (GHG) emissions by 90%.[1] The remaining 10% of emissions would be offset to reach the 2050 climate goals.

As Europe is the fastest-warming continent, systemic healthcare system risks and climate change impacts on individual citizens' health are on the rise.[2] So are climate change impacts on industry's production sites and increasingly vulnerable supply chains, besides companies' ability to source necessary input materials and components,[3] as well as to attract talent and skilled workers.[4] Investing in climate resilience and building resilient and sustainable healthcare systems are key for sustainable prosperity and economic security. This requires a robust, competitive, innovation-driven, and enabled medical technology industry. The EU Competitiveness Compass and Clean Industrial Deal[5] promote joint decarbonisation and competitiveness plans for an economy that will be ready to withstand climate change impacts and turn challenges into environmental, social, and economic opportunities for all.

MedTech Europe fully supports these ambitions and is committed to helping healthcare systems and member companies decarbonise while increasing overall system resilience and global competitiveness. The decarbonisation journey for the MedTech sector must take account of the fact that MedTech is a highly regulated industry and a sector for which patient and user safety continue to be the North Star.

In this report, we identify how a competitive MedTech industry can support healthcare ecosystems to decarbonise, showcasing the potential of innovative technologies and describing the barriers, opportunities, and decarbonisation levers for MedTech companies to implement.

In this report, we define MedTech companies as those that derive a significant share of their revenue (>20%) from the sale of MedTech products and that are SMEs or larger firms (i.e., have >10 employees and a turnover or balance sheet of >2 million euros annually).

We lay out the key pillars of a roadmap and enabling framework for the sector to reach net zero emissions by 2050, in line with a 1.5-degree Celsius emissions reduction pathway.

1. *Regulation (EU) 2021/1119 of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ("European Climate Law").*
2. *European Environment Agency, First EU Climate Risk Assessment (EUCRA) Report, March 2024.*
3. *Global Resources Outlook 2024 | Resource Panel; World Economic Forum_The_Global_Risks_Report_2024.pdf*
4. *The EIB Climate Survey: Attitudes towards climate change adaptation (2022), European Investment Bank (EIB).*
5. *EU Competitiveness Compass, January 2029, which explicitly acknowledges that "investing in life sciences holds significant potential for boosting competitiveness across multiple sectors";*
   Clean Industrial Deal of 26 February 2025.

Our definition of a net zero pathway aligns to the guidance of the Science-Based Targets Initiative's Net-Zero Standard.[6]

Scopes 1 and 2 are the emissions created in the direct operations of a company, in their use of heat, power, and fuels, while Scope 3 emissions are created upstream by suppliers' operations or downstream by customers during product use and at the end of life, including the waste disposal stage.

Key facts and figures: the strategic relevance of the Medical Technology Industry in Europe[7]

- MedTech is a highly diverse sector: There are more than 2 million medical technologies, spanning over more than 7,000 generic device groups. Medical technologies are available in hospitals, community care settings, and at home. They range from low-complexity, high-volume products, such as syringes or bandages, to highly complex equipment, including MRI machines or robotic-assisted surgery systems, to implants, in vitro diagnostics, and digital health technologies. Health has been identified as critical infrastructure under the EU Critical Entities Resilience Directive.[8] Without Medtech, no healthcare can be delivered.

- MedTech is a highly innovative sector: European medical technology industries in Europe file a patent every 30 minutes. The sector accounts for 8% of the total number of applications and thereby ranks the second-highest among all industrial sectors in Europe. Despite this innovation leadership in Europe, companies increasingly choose other geographical locations for their first regulatory approval. This productivity gap risks negatively impacting patients' access to sustainable life-saving and life-sustaining technologies.

- MedTech is a driver of future sustainable growth and competitiveness: MedTech is a €160 billion European industry (€600 billion globally), accounting for around 1% of European GDP and 880,000 direct employees. Expenditure on medical technology per capita in Europe is at around €304.[9] Austerity schemes, slow uptake of value-based procurement, and other operational shortcomings, including late payments or clawbacks, increasingly discourage sustainability innovation in the sector.

- MedTech is an SME-dominated industry: There are more than 37,000 medical technology companies in Europe, 90% of which are SMEs that are more likely to depend on additional support measures and effective guidance for a successful net-zero transition.

This report reflects the current environment for MedTech companies and therefore does not account for potential changes, such as geopolitical or geographic changes. Major healthcare trends, including digitalisation, robotics, or ambulatory care, may influence the individual decarbonisation trajectory of MedTech companies in the future.

6. *Science-Based Targets Net Zero Standard.*
7. *MedTech Europe Facts and Figures 2024.*
8. *Directive (EU) 2022/2557 of 14 December 2022 on the resilience of critical entities and repealing Council Directive 2008/114/EC.*

Executive Summary

Climate, health, and competitiveness are intrinsically linked. As governments, the healthcare system, and the public recognise the climate crisis as one of the greatest threats to global health, medical technology companies have an opportunity to boost climate action in healthcare and create an economic advantage while improving their environmental performance and attractiveness for future talent. As climate impacts increase, climate resilience at the production site and healthcare facility level and timely adaptation measures become indispensable for securing today's high standards of healthcare delivery. Making significant progress on carbon emissions reductions can be less costly than some may assume. It can also be increasingly attractive in the face of the mounting carbon cost of inaction as a result of impending European taxes and fines[10] as well as global climate change impacts at the industrial production site, supply chain, and workforce level.[11]

As with most other sectors, within the medical technology sector, there is willingness to act while progress remains mixed: Scope 3 emissions represent the greatest challenge, while progress is noted on Scopes 1 and 2. Overall, however, more needs to be done to reach a 1.5-degree pathway. This report presents actionable measures that MedTech companies can take to step up and get on track with necessary emissions reductions in a cost-efficient manner and in line with the existing regulatory framework. It equally outlines those actions that will be harder for the MedTech sector to achieve on its own—be it from an economic, regulatory, technical, or wider geopolitical standpoint. The detailed enabling framework for a net zero roadmap laid out in this report shows a prioritised view of the key levers for emissions reductions in the short term. It also shows those that require engagement with regulators, policymakers, payers, suppliers, and providers to enable system change in the net zero transition. Taken as a whole, this enabling pathway aims at unlocking and accelerating the full pathway to net zero in this highly complex and regulated sector.

The actions required to decarbonise MedTech can be considered along several related dimensions: regulatory and supply chain complexity, time, cost, and the financing mechanisms needed (see "Appendix: Analysis Methodology" for more details).

- 40% of emissions can be abated cost-effectively by MedTech companies and their supply chain[12] and without the need to file regulatory recertification requests: As in other industries, the majority of MedTech emissions are driven by Scope 3, i.e., emissions that are beyond the operational control of MedTech companies. Scope 1 and 2 emissions represent only 5–10%. Analysis shows that 45–55% of emissions lie with raw material extraction and reprocessing in the supply chain, 15–20% in the use phase, 10–20% in the end-of-life stage, and 5–10% in packaging.[13] This means that much of the emissions reduction potential must be driven by the broader MedTech value chain.

- A further ~50% abatement potential is currently difficult to achieve:

  - 25–30% face some element of regulatory and economic challenges before full implementation is possible.

  - 15–20% have no regulatory consideration, but the technologies are still immature and very costly.

  - 10% are both expensive and require extensive regulatory changes before implementation.

9. *MedTech Europe's "The European Medical Technology Industry in Figures 2023" report.*
10. *Carbon costs associated with ETS and CBAM are likely to impact some critical input materials to MedTech devices and would therefore increasingly raise COGS beyond 2030.*
11. *The Cost of Inaction: A CEO Guide to Navigating Climate Risk*

    World Economic Forum; World Economic Forum_The_Global_Risks_ Report_2024.pdf;

    Global Resources Outlook 2024 | Resource Panel: https://www.resourcepanel.org/reports/global-resources-outlook-2024
12. *Renewable Power Generation Costs in 2023, IRENA, 2023: "Renewable power generation has become the default source of least-cost new power generation. The progress made in 2023 is a significant step toward transitioning to a system based on energy efficiency and renewable technologies.";*

    Renewable energy—powering a safer future | United Nations: https://www.un.org/en/climatechange/raising-ambition/renewable-energy

Tapping into the 40% emissions reduction potential starts with implementing efficiency measures, including through network and transport routing optimisation, energy management systems and digitalisation, and switching own operations to green power and heat.

The 2025 Annual EU Single Market Report[14] particularly confirms synergies to be gained with digitalisation. Regarding the impact of industrial ecosystems on the environment, the report found that "The health industrial ecosystem saw the sharpest drop (of around 60%) in material extraction over the period 2017–2022, mainly due to the shift towards digitalisation and to technological advancements in pharmaceuticals and medical devices." Disease prevention and preventive care also show significant efficiency and emission savings potentials.[15]

MedTech companies can also incentivise suppliers to decarbonise their operations by educating them, implementing tender criteria, or rewarding those who show progress.[16] However, it has to be acknowledged that MedTech is not the primary customer for many of the global suppliers, which limits influence and can potentially raise supply chain costs. This report provides a call to joint action for companies, supply chain actors, policymakers, and healthcare system actors to collaborate to tap into these levers as a matter of priority. Unlocking the full potential of these levers requires speed and scale in global green power capacity and availability. It calls for modern, clean energy systems to be rolled out at the EU and global level and underlines the importance of implementing the global commitment to triple energy efficiency and renewable energy[17] to enable the rapid decarbonisation of the MedTech sector and healthcare systems overall.

Beyond the initial 40%, companies can deploy design levers across their products and packaging, except sterile packaging, to reduce a further 25–30% of carbon emissions. These include dematerialisation, designing for efficiency, more circularity following the "10-Rs strategy" which promotes reuse, repair, recycling, remanufacturing and reprocessing.

These levers are often already possible in new designs but are much harder to embed in existing products due to regulatory and/or financial hurdles. Companies can engage with regulators on how regulation can facilitate rather than impede action, while also pulling levers today where barriers are lower. Harmonising requirements across countries and regions can support decarbonisation, getting to scale and reducing costs.

~15–20% of abatement involves technologies that are unfeasible today, in particular from an economic perspective due to low technological maturity and/or very high cost. These include nascent technologies for upstream decarbonisation of raw materials, such as high-temperature heat in the operations of chemicals companies, carbon capture, or new zero-carbon transport fuels. They are allowed from a regulatory system perspective, but MedTech companies will struggle to drive suppliers to adopt these solutions without significant scale-up in government incentives, and without pooling demand from many end sectors sourcing similar materials.

The final ~10% of the pathway is equally or more expensive but also blocked by regulation today, including the use of new, low-CO2 materials in certain products (e.g., bioplastics) or the introduction of entirely new production processes for key materials used in products (such as the use of cullets in glass). Discussion and collaboration are needed between MedTech companies and regulators to remove these barriers and enable action. More support from governments to drive technological scaling and cost reduction will also be critical.

Given the specific complexities of the MedTech

13. *Please see Part IV of this report regarding "Collaboration as Key Catalyst for Accelerating Action": Decarbonising healthcare requires system change with all actors collaborating and taking coordinated action.*
14. *Annual Single Market and Competitiveness Report, European Commission, January 2025.*
15. *Study on Greenhouse Gas emissions of the Belgian Healthcare Sector, ghg-emissions-of-the-belgian-health-care-sector.pdf: In contrast to hospitals, "providers of preventive care" and "Health care system administration and financing" have the smallest shares, contributing only 1% (133 ktCO2e) and 2% (170 ktCO2e), respectively;*

    The potential for reducing greenhouse gas emissions through disease prevention: a secondary analysis of data from the CREDENCE trial—ScienceDirect: https://www.sciencedirect.com/science/article/pii/S254251962400281X
16. *Successful examples of decarbonising heat and power at low cost are provided later in this report, acknowledging that this is more difficult to do in some geographies and requiring barriers to fall rapidly.*
17. *Global Renewables and Energy Efficiency Pledge, COP28, November 2023.*
18. *The hidden concept and the beauty of multiple "R" in the framework of waste strategies development reflecting to circular economy principles"—ScienceDirect;*

    Circular Economy Action Plan—European Commission.

Understanding the Stakes of Decarbonising MedTech—and a Way to Overcome Them

Progress across the industry is often impacted by the many complexities and challenges faced in decarbonising a highly regulated sector, such as the medical technology sector.

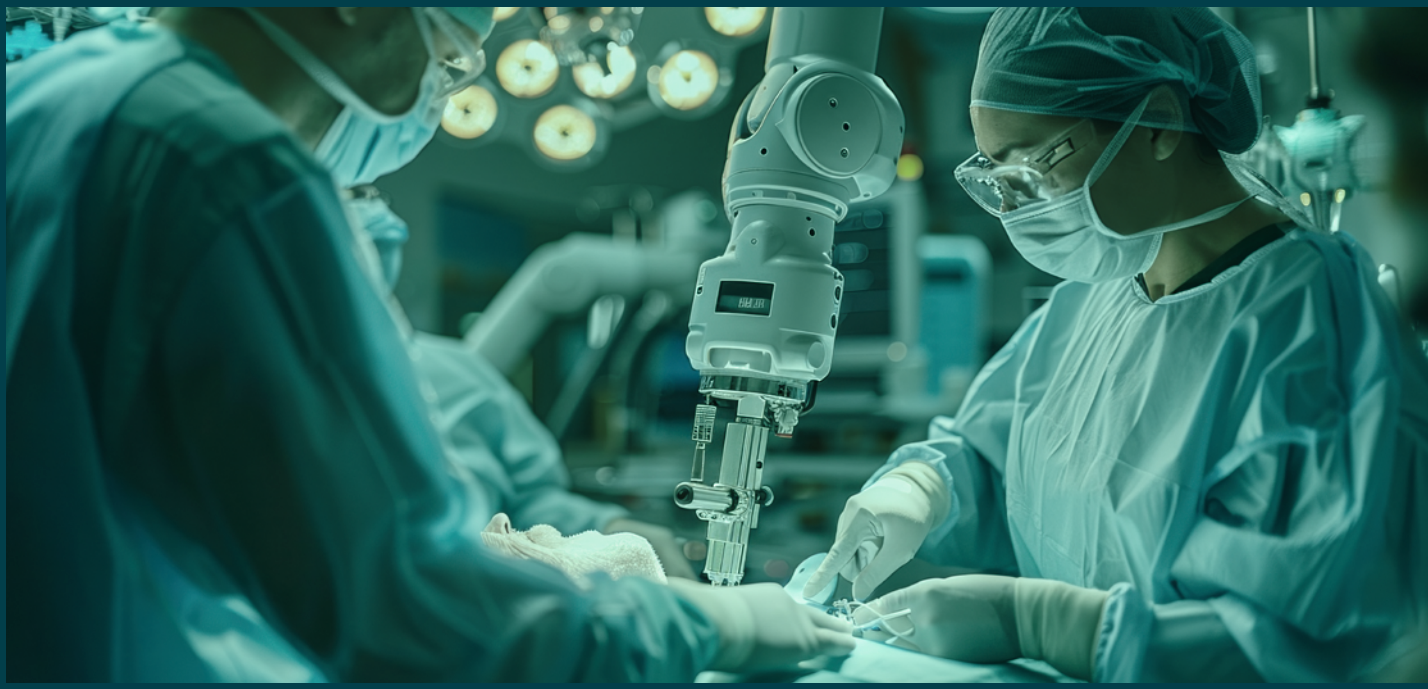
There is uncertainty on which solutions to prioritise and a lack of clarity stemming from regulatory hurdles as well as the cost and time to overcome them.

The MedTech sector will need to pull all levers to reduce emissions to net zero. Given that companies cannot invest in all decarbonisation solutions immediately, some debate about which solutions to prioritise to maximise impact is essential. The "right" solution to prioritise for maximum decarbonisation impact is highly product-, company-, and location-specific. This is compounded by a lack of concrete data from which to empirically trade off the benefits of decarbonisation levers, as a company would typically do in other investment cases.

There are further practical realities that impact possible decarbonisation progress in the medical technology sector, such as the following:

- Complex, globally intertwined supply chains that can be up to 30 tiers from materials to the final device and the often limited market power of MedTech companies
- The challenge of gathering reliable, accurate, and specific data, especially regarding Scope 3
- A lack of alternative technologies and materials and long product development cycles, mandatory testing, and clinical trials that impact timelines of redesign
- Insufficient synchronisation of regulatory system rules and horizontal sustainability legislation
- The structure of the industry: Over 90% of MedTech companies are SMEs that require particular support measures and tools
- Simultaneously improving sustainability, patient safety, and product efficiency performances

Consequently, the debate over lever prioritisation has often led to paralysis rather than progress, even with limited time left for getting on a 2050 net-zero pathway. Whilst acknowledging the complexity that exists, this report seeks to stimulate system change and aims to help companies to identify actionable steps to overcome this complexity. It also shows which broader framework conditions are needed, in cooperation with other healthcare system and supply chain actors.



sector, which is highly regulated, with most emissions falling outside of the direct control of MedTech companies themselves (90–95% of carbon emissions are Scope 3), and the presence of many SMEs (~90% of 37,000 MedTech companies in Europe),[19] a systemic approach will be needed to foster change. The sector must work together with regulators and all healthcare system actors to clarify what will be needed from policymakers and each actor in the system. Collaboration can help scale newer technologies, while supporting standard-setting and harmonised action across the supply chain for common materials.

For example, a key lever to reduce emissions overall is through more effective preventative measures and more engagement with clinicians to ensure effective product use and disease management. MedTech companies can promote more efficiency in health systems overall by providing information that clinicians can use to make informed decisions about effective treatment, and they can innovate to help clinicians make fewer mistakes, driving better patient outcomes, less waste, lower overall cost, and environmental impact.

We present this report to lay out the rationale and enabling framework for a roadmap for decarbonising healthcare and the contribution of a competitive MedTech industry. Given the heterogeneity of the sector, a case-by-case approach is critical to identifying the applicability of the different decarbonisation levers for individual MedTech companies, depending on their specific product portfolio. This report explains key stakes and pain points to be overcome, targeted steps ecosystem actors need to take to drive system change, and why joint decarbonisation and competitiveness planning is imperative. Some companies are already gaining a competitive advantage through decarbonisation, and with the proper enabling framework for building net-zero-resilient healthcare systems, more opportunity awaits, for the planet and the healthcare industry, but first and foremost for patients.

Part I – The Climate, Health, and Competitiveness Nexus

The climate crisis drives a health crisis; MedTech should act to improve health outcomes

In 2015 in Paris, nearly all countries agreed to limit global warming to well below 2 degrees Celsius, with the ambition to reach 1.5 degrees, but emissions continue to rise. The world is already approaching a 1.5-degree rise, with climate-related disasters increasingly damaging both society and business—including healthcare. Regulators are working to limit emissions through the European Union's 2050 net-zero targets and related European Green Deal implementation measures, including reinforced renewable energy and energy-efficiency legislation next to new sustainable products regulation and reinforced waste policy legislation, such as on batteries or packaging. Other initiatives include the Corporate Sustainability Reporting Directive, Corporate Sustainability Due Diligence Directive, EU Taxonomy, and new Carbon Border Adjustment Mechanism and reinforced Emission Trading System (ETS) legislation.[20] While the EU steadily decreases its emissions[21] globally, action is insufficient to avert the worst impacts.

19. *MedTech Europe, Facts and Figures 2024, PDF*
20. *Corporate Sustainability Reporting Directive (EU) 2022/2464 (CSRD), Carbon Border Adjustment Mechanism Regulation (EU) 2023/956 (CBAM), Emissions Trading System Directive 2003/87/EC (ETS).*
21. *EU Climate Progress Report 2024: The EU has steadily decreased its greenhouse gas emissions since 1990. In 2023, net emissions were 37% below 1990 levels. The EU's GDP has grown by 68% over the same period. The EU achieved a net 8% reduction in greenhouse gas emissions in 2023 compared to the previous year. This marks the largest annual reduction in decades (excluding the exceptional, temporary decline due to the pandemic in 2020), a cut largely driven by the growth in renewable energy generation and fall in coal and gas use.*

The grave implications of the climate crisis for health are increasingly recognised. In 2021, the World Health Organisation launched its Alliance for Transformative Action on Climate and Health (ATACH), the OECD currently hosts a health and climate working group,[22] and in 2023 the Conference of the Parties (COP28) featured a first-ever Health Day. COP29 scheduled the second Health Day on November 18, 2024. Research predicts 250,000 additional deaths per year between 2030 and 2050[23] from climate-change-induced undernutrition, malaria, diarrhoea, and heat stress. There is a clear need for all sectors to contribute to limiting emissions, to minimising climate change impacts and the damage to human health, and resultant increasing systemic risks on healthcare systems in particular.[24] With respect to competitiveness, the Draghi Report[25] equally places decarbonisation at the core of its industrial master plan, promoting a combination of horizontal and vertical measures, which would tailor action to the circumstances of a given sector.

The impetus for global healthcare to decarbonise is clear – it produces 2.5 gigatonnes of greenhouse gases, around 5% of the world's GHG emissions. If healthcare were a country, it would have the fifth highest greenhouse gas emission footprint.[26] It contributes twice as many emissions as international shipping.

Healthcare is therefore facing pressure to act. The EU was the world's fourth largest greenhouse gas emitter in 2023, after China (30.1%), the United States (11.3%), and India (7.8%).[27] The EU's share in the world greenhouse gas emissions fell from 15.2% in 1990 to 6.0% in 2023. Healthcare drives 5–10% of national emissions in the EU.[28] In the UK, the National Health System (NHS) is responsible for around 4% of England's total carbon footprint and 40% of public sector emissions.[29] In the U.S., the health sector is responsible for approximately 8.5% of U.S. carbon emissions, though total U.S. global greenhouse gas emissions rank higher than in the EU.[30] The share is lower in developing countries, such as India (1%), due to lower healthcare activity and spending.[31] Without action, healthcare emissions will rise as access improves.

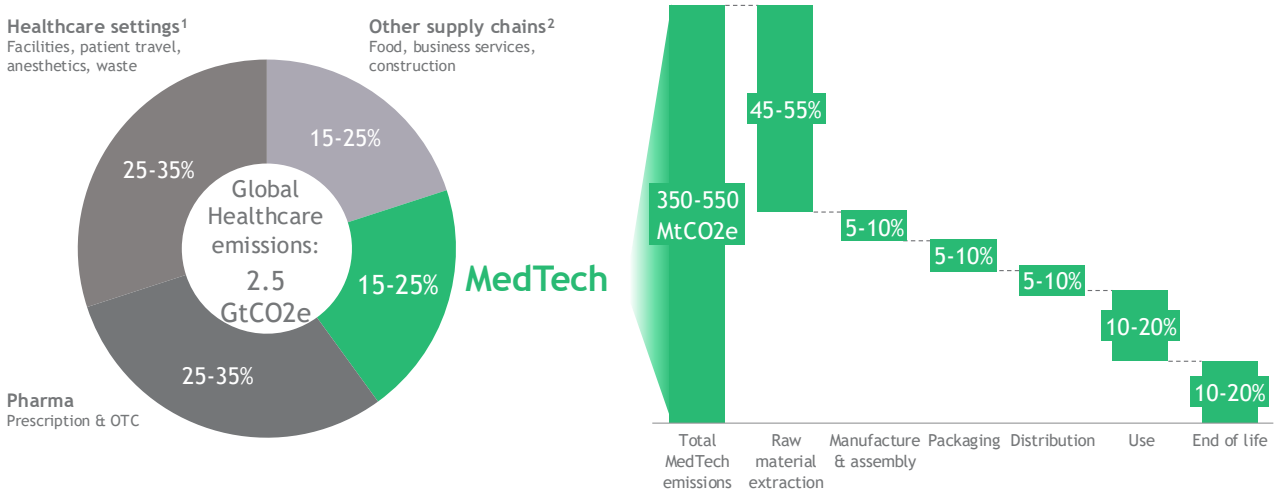
Within global healthcare, MedTech drives 15–25%[32] of total GHG emissions, equivalent to 1% of all global emissions (greater than France[33]), with emissions across the value chain weighted towards the upstream supply chain (raw material inputs). Decarbonising MedTech globally is a crucial step in decarbonising healthcare and limiting global warming to well below 2°C, as laid out in the Paris Agreement. At the same time, decarbonisation pathways need to boost innovation and the global competitiveness of the medical technology sector to ensure continuous access to life-saving and life-sustaining technologies for patients and practitioners. It will be important to ensure that health systems are financially resilient to invest in sustainable healthcare infrastructure.

22. *See OECD Network of Foundations.*
23. *World Health Organisation article, 2023.*
24. *European Environment Agency, First EU Climate Risk Assessment (EUCRA) Report, March 2024.*
25. *Report on the Future of European Competitiveness, by Mario Draghi, September 2024.*
26. *Health Care's climate footprint, Healthcare Without Harm and ARUP, 2019.*
27. *EDGAR—The Emissions Database for Global Atmospheric Research, Report 2024.*
28. *See, for example, Healthcare cited as driving 5% of Belgium emissions in ghg-emissions-of-the-belgian-health-care-sector.pdf*
29. *Net zero care: what will it take? | The Health Foundation.*
30. *Key Actions to Reduce Greenhouse Gas Emissions by U.S. Hospitals and Health Systems—National Academy of Medicine;*

    Environmental Effects of Healthcare | Commonwealth Fund.
31. *And also as a result of Western countries having already decarbonised a portion of their economies via deindustrialisation. Lancet Countdown report, 2023;*

    EU Commission Emissions Database for Global Atmospheric Research (EDGAR).
32. *Triangulation using different methods and sources. See Appendix: MedTech Emissions Baseline for details.*
33. *EU Commission, Emissions Database for Global Atmospheric Research (2023).*

Exhibit 1 | Globally, MedTech contributes 15–25% emissions end-to-end



1. Excluding share, (<5%) driven by MedTech in power use and waste generation. 2. Includes process emissions from supply chains, as well as emissions from indirect spend such as maintenance, professional services, and business travel.

Note: Emissions contribution reflects emission created in MedTech value chain (by suppliers to MedTech companies), product use (in e.g., care settings) and end of life (e.g., in incineration of devices); Source: Healthcare Without Harm (2019), NHS (2020), SMI (2022), Company sustainability reports, Danish Energy Saving Trust (2011), Evaluate market data (2023), BCG analysis.

Decarbonisation can be a source of competitive advantage for MedTech companies

Decarbonisation is not only inextricably linked to the mission of MedTech companies to improve public health; it also provides an opportunity for competitive advantage given increasing pressure to decarbonise from customers, investors, employees, and regulators.

Customers increasingly are emphasising sustainability in tenders. Britain's NHS has stated that in 2027 it will cease purchasing from suppliers not aligned with a net zero path.[34] Customers in Europe, and increasingly the U.S., are asking medical technology manufacturers to report on sustainability in tenders.

Likewise, outside North America, investors are factoring sustainability into capital allocation. Tufts University research in 2023 found that 79% of investors had adopted sustainable investment policies, up from just 20% five years prior.[35]

Employees are factoring sustainability into career choices. A study by IBM suggests that two-thirds of the workforce are more likely to accept a job with an organisation they consider environmentally sustainable.[36]

Regulatory limits on emissions are appearing as governments are increasingly trying to meet their Nationally Determined Contributions (NDCs). They are mandating reporting, taxing high-carbon industries, restricting the use of certain chemicals, and promoting circularity. (See Appendix)

Executives are feeling pressure in public opinion. Competitive dynamics are prompting them to "keep up with" the sustainability accolades of their peers. As the topic gets more airtime in public forums, more CEOs see the need to lead.[37]

Companies that emphasise sustainability will see positive wins. They will reap rewards in public tenders, create new revenue streams, and gain operational efficiency.

34. *NHS, Net Zero Supplier Roadmap; the NHS also in 2023 introduced "Evergreen," a standardised supplier sustainability self-assessment tool, which will become a mandatory step for suppliers to the NHS by 2030.*
35. *The Fletcher School at Tufts University & Deloitte, Investor trust in sustainability data, 2024.*
36. *IBM Institute for Business Value, "Sustainability at a turning point".*
37. *Alliance of CEO Climate Leaders —Members, World Economic Forum.*

They will attract investors and talented employees and be better prepared for heightened regulation.

Their capabilities will enable them to respond and differentiate in public tenders weighted towards sustainability, alongside quality and price.

They can consider new business opportunities from maintenance services, recycling and takeback schemes, and reprocessed devices (in circumstances where it is viable, permitted by regulation, shown to reduce emissions and have a viable business case).

They can gain efficiency, and reduce costs, because they design out waste from products and packaging and invest in greener, cheaper energy sources.

Recycling programs pave the way to develop and build the infrastructure to promote broader circularity opportunities longer-term that do not exist today and that also help to improve robustness and resilience in the value chain.

As for capital, investors are increasingly interested in sustainability efforts. They can follow disclosures from public companies complying with reporting rules, while privately owned companies have seen their sustainability actions attracting attention.

Decarbonising also strengthens an employee value proposition. A company's commitment to sustainability is becoming a critical factor in recruiting and retaining talent.[38] A demonstrated commitment to sustainability matters even more in a purpose-driven sector such as healthcare.

The costs of decarbonisation are falling, while the carbon costs of inaction are rising.

Many companies are concerned with the cost of decarbonising, but careful analysis of key levers reveals that much can be done in a cost-efficient manner, and longer-term, green technologies will become more economical.

Many of the levers that are critical to the decarbonisation pathway for MedTech companies, and their suppliers, can be cost-saving. These include efficiency measures, optimising routing, switching from fossil to green energy (notwithstanding that green energy comes at a premium in some markets), and switching transport modes. Redesign of products and packaging can in some cases save costs by reducing the amount of material used but often faces regulatory hurdles, especially for primary packaging. Primary packaging takes approximately three years to validate due to the needs for aging testing. Decarbonising upstream input materials can be more expensive, requiring technologies that remain subscale today and/or face significant regulatory blockers.

Part III of this report fully reviews the cost and regulatory challenge of individual decarbonisation levers. But overall, the carbon cost of decarbonising MedTech products (to the point of sale) would amount to an average of 5% of total cost of goods sold (COGS) across a range of product types.

(See Exhibit: Cost of Decarbonising the Product Supply Chain and see Appendix: Analysis Methodology for more details)

While still costly, decarbonisation of the upstream supply chain does not require an order-of-magnitude price increase for MedTech products.

Investments in decarbonisation levers need to be appropriately sequenced, with the most economic and impactful levers prioritised and enabled through appropriate support from governments and regulators. If the ecosystem works together, cost should not inhibit reduction of GHG emissions.

Moreover, the carbon costs of inaction are rapidly mounting,[39] especially for MedTech companies doing business in Europe. If MedTech companies do not decarbonise their operations (Scope 1 and 2) and upstream emissions (Scope 3), they may face cost implications from the EU Emission Trading System (ETS)[40] and Carbon Border Adjustment Mechanism (CBAM)[41] carbon pricing mechanisms, which apply to energy sectors and input materials (steel, aluminium), respectively. Analysis of regulatory and physical risks to companies that fail to move on

38. *IBM Institute for Business Value, "Sustainability at a turning point".*
39. *The Cost of Inaction: A CEO Guide to Navigating Climate Risk, World Economic Forum, December 2024.*
40. *Emissions Trading Scheme (see appendix for more details).*
41. *Carbon Border Adjustment Mechanism (see appendix for more details).*

Exhibit 2 | Upstream abatement can be achieved at low extra cost

Extra cost as % of COGS from abating product supply chain emissions[1] for an example product

Large equipment	Mid-size equipment	Implantables	Instruments	Consumables
+6%	+6%	+3%	+1%	+5%

1. Excluding abatement of emissions in use and end-of-life emissions. Excluding design levers; abatement costs calculated for current supply chain emissions.

Source: BCG analysis.

sustainability suggests that these risks in a plausible worst-case scenario could amount to 10–25% of operating profit[42] for a given MedTech company by 2035.

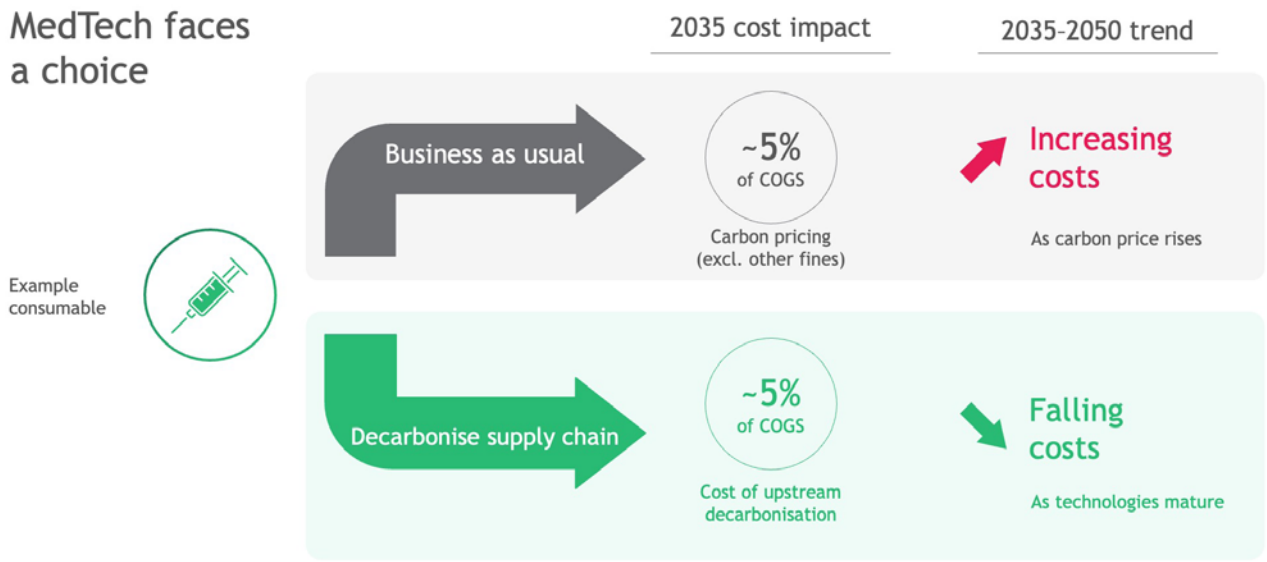
An analysis of a sample medical consumable shows that by 2035 the carbon cost of inaction due to carbon pricing alone (excluding any other fines, supply chain disruption costs, etc.) can equal the cost of decarbonising the upstream supply chain (excluding any costs associated with product disposal or R&D/regulatory system cost). This is because the raw input materials that are highest-carbon and most costly to decarbonise are typically a relatively low share of COGS for MedTech companies. Therefore, even increasing the costs of those raw material inputs considerably, the impact on overall COGS will remain low in a scenario in which those costs are passed through the value chain without added markup (see exhibit "Cost of Decarbonising the Product Supply Chain" for more details). Weighed against these costs of upstream decarbonisation, the costs of inaction involve the carbon pricing impacts of CBAM and ETS, which impact high-emitting raw material inputs like steel, aluminium, and energy and transport fuels. After 2035, decarbonisation will quickly become the cheaper option with the price paid per ton of carbon by producers in heavy industrial sectors (e.g., steel, aluminium) forecast to more than triple from 2030 to 2040.[43]

MedTech companies that start to position themselves for this shift today will be able to reap first-mover benefits besides reputational wins. Successfully engaging suppliers to decarbonise takes time, though, as will some product design and business model changes. Without prompt action, they may not decarbonise in time to avoid higher costs.

42. See Appendix: Risks of inaction breakdown.

43. Using IEA Net Zero 2050 base case scenario; other countries are also considering, or are in the process of, implementing carbon pricing schemes and carbon border adjustment regimes, highlighting the need to decarbonise, as detailed in the World Bank's up-to-date Carbon Pricing Dashboard.

Exhibit 3 | Cost of decarbonising upstream supply chain is comparable to carbon cost of inaction by 2035 due to carbon pricing; in long run likely to be cheaper



Source: BCG analysis.

Cost of Decarbonising the Product Supply Chain

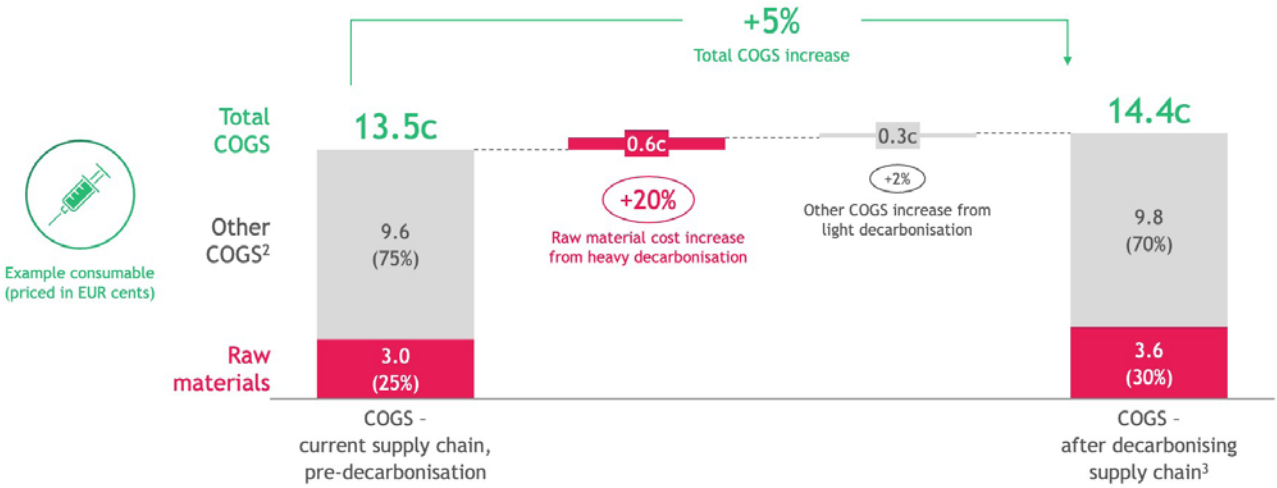
Raw materials drive the majority of MedTech supply chain emissions (and a large share of overall MedTech emissions), but they are a relatively low proportion of COGS. The relatively high costs to decarbonise raw materials therefore have a small total impact on overall COGS.

Taking the example of consumables:

- Most supply chain emissions are in raw material extraction and processing, and these steps require costly decarbonisation technologies, increasing their costs by 20%.
- However, since these early steps drive only 25% of COGS, even a 20% increase in cost here translates to 4% total impact on COGS.
- Other value chain steps are less emitting and their decarbonisation is cheaper, but they drive a higher proportion of COGS, resulting in a cost of 2% COGS to decarbonise those steps.
- Total net increase in COGS is hence just over 5%.
- This analysis assumes that the costs of decarbonising are passed through the value chain to MedTech companies without additional mark-ups by suppliers along the value chain (i.e., are treated as "open book" costs).

Exhibit 4 | COGS increase from decarbonising supply chain is low (up to 5%); emissions are mostly in raw materials, which often make up small portion of cost

COGS for current supply chain and 2030 decarbonized supply chain, using example consumable product | EUR cents



1. Supply chain only, does not include product use or end-of-life; 2. Includes manufacturing, overheads, logistics, packaging; 3. 2030 costs.

Examples of Competitive Advantage from Sustainability Leaders

Differentiating to meet customer demand

- Philips' "Compressed Sense" MRI acceleration engine, with AI-based software, enables scans to be completed 50% faster, using less energy while scanning more patients in a day. Philips collaborates with hospitals in strategic partnerships that specify energy or emissions savings targets, such as its partnership with the Champalimaud Foundation that requires 50% emissions savings on products over a five-year period.

- Ambu use second-generation bio-based feedstock (such as used cooking oil) for a lower carbon bioplastic, which they include in the handle of their single-use endoscopes. In doing so, they have mitigated cost increases for their products whilst guaranteeing greater supply chain certainty on bioplastics for the next 10 to 15 years due to their supply commitments. Their performance on sustainability and quality has led to tender wins in the Nordics despite a higher price point.

- "Hospitals are already paying for waste removal services—we are looking at potential novel revenues from collection and recycling rather than landfill or incineration." —Ambu

- "We have started to see customers and tendering authorities make purchasing decisions based on environmental sustainability." —ResMed

- "In Norway, sustainability parameters can account for 30% of a tender decision." —Mölnlycke

- "In Europe, we see more questions on sustainability in tenders than anywhere else in the world." —Becton Dickinson

- As of 2024, Johnson & Johnson MedTech hospital recycling programs for single-use medical devices were active in a total of 14 countries in Europe and New Zealand. The program allows hospitals to recycle specific metal and plastic components from certain J&J MedTech single-use instruments.

Pioneering new revenue streams

- In financial year 2023, 480,000 used parts were returned to Siemens Healthineers' logistics department, of which half were repaired and reused. The Return Centre of the Medical Electronics division achieved CO2e savings of ~11,300 tons in one year by repairing 30,000 parts—"11,000 printed circuit board assemblies, 13,000 electronic components, and 6,000 computers." This equates to a new value of goods of around EUR 92 million.

- Ambu is piloting a takeback program for their single-use products to test feasibility, with the aim to scale up the recycling and sell materials to other industries.

- Stryker's Sustainability Solutions Business is a leading provider of reprocessing in the global healthcare market, helping extend the life of thousands of medical devices that would otherwise be disposed of after a single use. After carefully reprocessing devices, Stryker resells them at discounted rates—making them not only more sustainable, but also more accessible economically. In 2023, Stryker's Sustainability Solutions helped their customers divert more than 5 million pounds of waste from the landfill through our reprocessing programs, saving 3,250 customers approximately $238 million.

Increasing efficiency and lowering cost

- At one site, Philips switched from on-site natural gas heating to CO2-neutral district heating. The shift reduced annual heating costs by 30% and carbon emissions by 770 tons.

- "We evaluate asset replacements on a case-by-case basis to ensure we meet our overall energy needs while reducing our environmental footprint." —Boston Scientific

- Since 2005, Johnson & Johnson has allocated up to $40 million per year in capital relief through its CO2 Capital Relief Program for energy projects at its sites that demonstrate potential CO2 savings and a financial return.

- "Becton Dickinson Frage (Spain), the key plant in Europe, operating 100% on renewable energy sources, reduced energy consumption by 25% in five years through efficiency projects and installed solar panels covering 100% of its Distribution Center roofs, supplying 10% of its power needs."

- "In FY24, Medtronic reduced 52% of its GHG emission intensity in its operations. We sourced more than 57% total electricity use in renewable electricity. We also produced nearly 21,000 MWh of renewable energy from 23 on-site systems, five of which were completed in FY24. Moreover, we completed construction of four natural gas trigeneration systems."

Part II – The State of MedTech Decarbonisation

As with many sectors, despite growing pressure to decarbonise and clear examples of sustainability leadership, the MedTech sector has a lot more work to do if it is to achieve a 1.5-degree pathway.

There is quite a divergence in maturity across the sector. Whilst leading companies perform strongly on readiness for change, transparency, optimising, and enabling their organisations, others are further behind. Engaging suppliers is a particular weakness for all companies considering highly complex, global supply chains and the often limited market power of MedTech companies. Medical technologies differ vastly in terms of complexity. It is not uncommon for routinely used devices to have hundreds or thousands of components. Supply chains can be up to 30 tiers from materials to the final device.

Even leading firms face constraints in pushing ecosystems through investing in sector-level solutions (which takes concrete action, going beyond raising awareness) and participating in buying groups. MedTech participation in collaborative efforts, such as Collaborative for Healthcare Action to Reduce MedTech Emissions (CHARME),[44] the Clean Energy Buyers Association (CEBA),[45] or the Medical Equipment Proactive Alliance for Sustainable Healthcare (MEPA),[46] are examples of collaborations that should be replicated and scaled to deliver meaningful emissions reductions.

44. *https://www.sustainablepurchasing.org/charme.*
45. *https://cebuyers.org/about/ceba-members/*
46. *https://www.mepaalliance.org/; The Medical Equipment Proactive Alliance for Sustainable Healthcare (MEPA) is an example of how industry works with purchasers and healthcare professionals to set incentives for emissions reduction via procurement criteria.*

BCG surveyed 50 MedTech Europe members across six dimensions of sustainability maturity:

1. Getting ready: general preparedness, willingness, and ability to change.

2. Creating transparency and setting ambition: thoroughness in baselining emissions across Scopes 1–3 and setting targets in line with a 1.5–degree rise in global temperature.

3. Rethinking design and process: pulling process decarbonisation levers, such as switching to green power and heat, and designing products and packaging to minimise impacts.

4. Engaging suppliers: setting supplier targets or co-investing in decarbonisation.

5. Pushing ecosystems: participating in industry initiatives and buying groups.

6. Enabling the organisation: investing in supportive teams, resources, and tools.

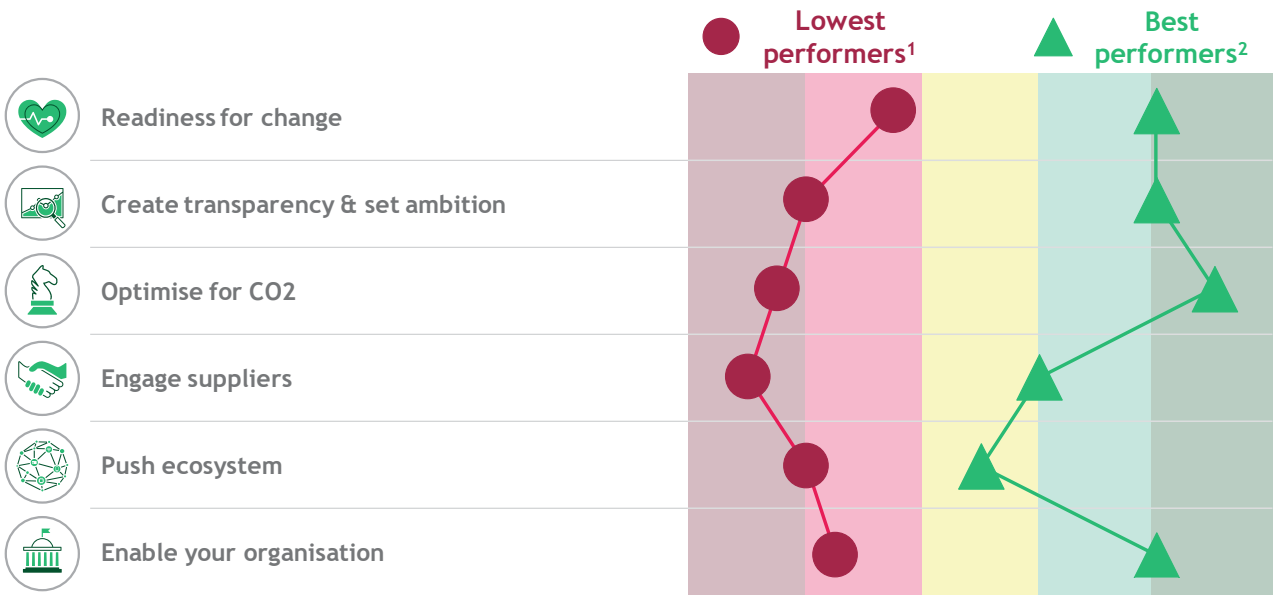
Companies reported initiatives across all dimensions, and BCG assessed the results against industry best practice.

Best-in-class transparency and ambition requires a granular baseline for Scopes 1–3 with activity-based or supplier-generated primary data for Scope 3 and standardised product lifecycle assessments that enable fair comparisons of products. Leading companies also have science-based targets for all scopes in line with the 1.5-degree pathway.

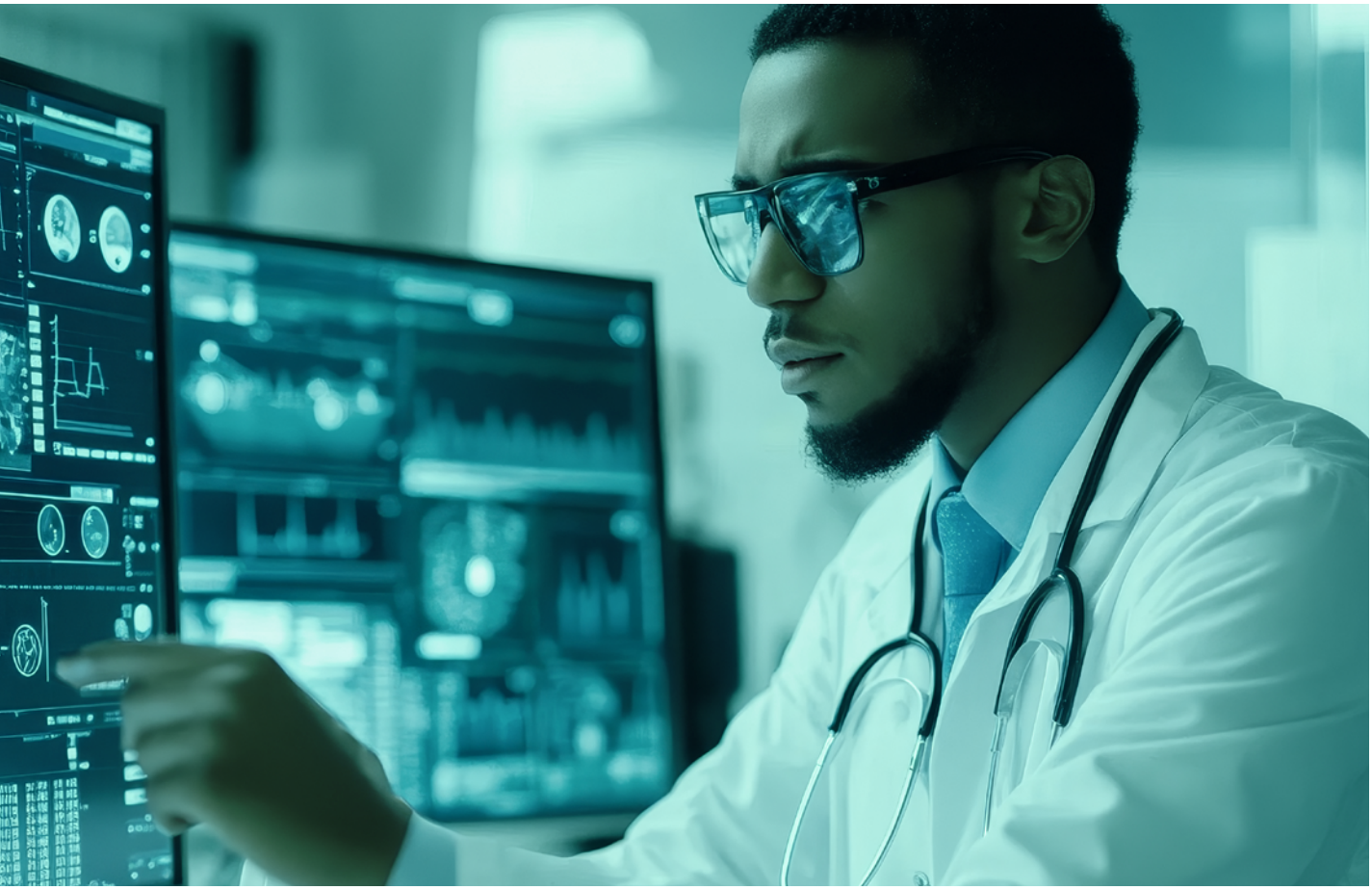
The exhibit below shows the sector has more work to do, especially in Scope 3, which is critical as suppliers and customers determine most of MedTech's emissions. Whilst some companies are incorporating environmental considerations into supplier codes of conduct, few systematically monitor supplier performance against sustainability key performance indicators (KPIs), embed sustainability into tender criteria, or work with suppliers on specific green solutions (e.g., via co-funded pilots). Companies could also do more to collaborate with peers, to deploy green technologies at scale, and to develop the tools and capabilities to decarbonise.

Exhibit 5 | Willingness to change but mixed progress: Scope 3 is the greatest challenge, progress noted on Scopes 1+2

Exhibit 6 | Large gap between best and lowest performers in most dimensions



1. Average maturity of bottom 20% of respondents within subcategory; 2. Average maturity of top 20% of respondents within subcategory.



Willingness to Change but Mixed Progress: Scope 3 is the Greatest Challenge on the 1.5-Degree Pathway

Getting ready for change

- Most (>85% of survey respondents) acknowledge the need for change, seeing sustainability as an opportunity or risk for their business, but only 46% say it is a priority for the leadership.
- Companies vary significantly by region, often driven by the increasing pressure from customers and investors. This is especially true for those headquartered in Europe and other companies with Europe-based operations.
- In other regions, particularly in North America, a lack of investor interest in sustainability lowers the incentive to make strides.

Creating transparency and setting ambition

- Most companies disclose Scopes 1+2 (96%) emissions but have weak disclosure of Scope 3 emissions (59% of respondents report key subcategories, and most of those use a basic spend-based approach rather than a sophisticated activity-based approach).
- Companies identify a lack of effective tools for tracking supplier data, which currently keeps them from tracking Scope 3 emissions.
- Target setting is weak, with only 45% of respondents having set science-based targets.

Rethinking processes and design

- Almost all companies (90%) use some renewable energy in their own operations, but they are overall farther behind in sourcing green power in Asia and Latin America than in Europe or the U.S.
- There has been far less progress in switching from natural gas to alternative green heat solutions (34%) or switching to greener transport fuels (50%).
- Regarding design, companies are still starting the journey; most are emphasising resource efficiency (77%) or switching to alternative materials (55%).
- Switching to alternative materials is often difficult because suitable materials often do not exist and/or need to scale, cost too much, or require a lengthy regulatory approval.
- Only half of respondents have embedded sustainability in product redesign. Progress is highest in European companies (90%).
- Progress comes slowly, as changes must fit normal product redesign timelines, safety requirements, and customer expectations.

Engaging suppliers

- This work is nascent, focused on codes of conduct and trainings, with little "consequence management" or concrete support for suppliers.
- 18% set sustainability KPIs for suppliers, and only 2% of respondents have engaged in comprehensive programs.
- Companies report a highly fragmented supplier base, which they are struggling to engage individually, with little leverage by acting alone considering their often limited buying power as single companies.

Pushing ecosystems

- Some MedTech companies are participating in ecosystem initiatives, but few (4%) are leading these and only 10% are co-investing in green solutions.

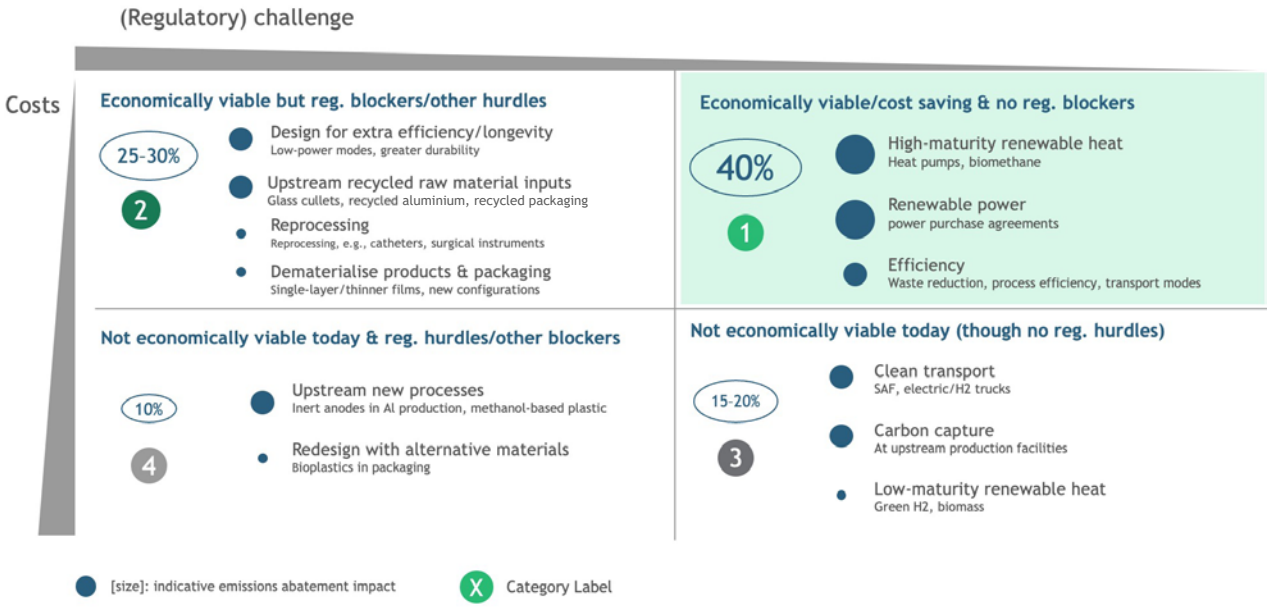
Part III – Taking Action: The MedTech Pathway to Net Zero by 2050

Levers for decarbonisation: economics and feasibility

Considering the need for urgent action and existing regulatory system challenges, the pathway to net zero for the MedTech sector could start with actions that MedTech companies can take short-term to begin decarbonising at minimal cost and without regulatory barriers. Going beyond requires system change, with MedTech companies, governments, the EU, and notified bodies working together to unlock the pathway for the remaining emissions reductions to achieve net zero. Patient and user safety must not be compromised, hence properly managing the transition in healthcare involves guaranteeing access for patients to MedTech solutions throughout the various pathway steps.

The exhibit below shows a framework for prioritising actions, showing which are (1) cost-effective and feasible today, including from a technical, regulatory, and time perspective, (2) cost-effective but requiring the removal of some regulatory and/or other challenges, (3) feasible but not economically viable today while challenging to implement with suppliers, and (4) expensive while encountering regulatory blockers and/or other hurdles. Please see also the roadmap for implementation later in the report, which details phasing/implementation timescales and important framework conditions that have to be in place for these levers to unlock abatement potential.

Exhibit 7 | Four categories of MedTech abatement levers—key levers that MedTech companies should focus on in the near term include renewable power, high-maturity renewable heat, and efficiency



Important Notes

1. Only 5 to 10% are within the manufacturing and assembly of medical technologies at the end of the value chain, and therefore within the direct control of medical technology manufacturers. The rest of the emissions reduction potential needs to be delivered by suppliers and customers switching their energy to renewable sources and putting in place efficiency. 45–55% of emission potentials lie with raw material extraction and reprocessing in the supply chain, 15–20% in the use phase, 10–20% in the end-of-life stage, and 5–10% in packaging. Part IV of this report explains further the need for collaboration across the healthcare system to unlock system change.

2. Circularity in healthcare knows no one-size-fits-all: in the spirit of the 10-Rs Strategies for the Circular Economy, maximising the lifetime value of products while minimising the use of materials and resources and eliminating waste can have many different forms in the highly diverse MedTech sector. It includes, for example, design optimisation, material substitution, reuse, recycling, refurbishment, remanufacturing, repair, reprocessing, or exploring chemical recycling and modular medical technologies, depending on the concrete application in question. The exact opportunities for circularity depend on the type of product, business models, and criteria, such as the value of the material used. Besides, circular practices need to meet the stringent patient safety requirements, the needs of customers, users (patients and healthcare professionals), and healthcare systems and be supported by regulations on waste management.

Exhibit 8 | Key levers for decarbonisation

	Type	Key lever	Who implements	% reductions	Cost
40%	Economically viable, no regulatory hurdles	Green power and heat	MedTech	5%	Low-Mid (<100 EUR/tCO2e)
		Green power and heat	Suppliers	20%	
		Material and process efficiency	MedTech and Suppliers	5%	
		Green power	Customers	10%	
25-30%	Economically viable but regulatory blockers	Dematerialisation	MedTech and suppliers	5%	Low-Mid (<100 EUR/tCO2e)
		Reprocessing	MedTech	5%	
		Design for recycling, efficiency, and longevity	MedTech	10%	
		Upstream recycled inputs	Suppliers	5%	
15-20%	Not economically viable, no regulatory hurdles	Clean transport fuels for freight (e.g., SAF, marine)	Suppliers	6%	High/very high (>150EUR/tCO2e)
		New processes for raw materials (e.g., H2-based steel)	Suppliers	7%	
		Carbon capture in industrial processes (e.g., in chems)	Suppliers	4%	
10%	Not economically viable, reg. blockers	Upstream new materials (e.g., new feedstocks)	Suppliers	5%	High/very high (>150EUR/tCO2e)
		Design for alt. materials (e.g., use of recycled materials)	MedTech	5%	
				Total (Net Zero) = >90%	

Note: Changes may require costly and resource-intensive refiling processes (with guidance on whether refiling in a particular instance is required often difficult to interpret), reprocessing regulations are highly fragmented at a national level, and regulations around quality standards for recycled materials are unclear.

Category 1: 40% end-to-end value chain emissions reductions are possible cost-effectively without regulatory hurdles, though implementation considerations remain.[47]

Several cost-effective technical solutions are readily available to switch out energy sources in MedTech supply chains and drive almost half of the net-zero journey. While it is complex to ensure a fragmented landscape of suppliers pulls these levers, these actions are generally attractive from an economic perspective and actionable from a regulatory perspective. These are the key levers that MedTech companies, their suppliers, and customers should be implementing as a priority by 2030:

- Switching to green power can, in many regions, be cost-competitive or even reduce cost. This is particularly true if sufficient scale is achieved in power purchase agreements, or if on-site renewables and batteries are installed. While harder in parts of Asia and Latin America than in Europe and the U.S., many companies are already procuring virtual power purchase agreements.

  "Through installing rooftop PV panels at our facility in Brisbane, we achieved 30% cost savings in our electricity bills." —Cook Medical

- Process efficiency in manufacturing involves optimising production methods, adopting lean manufacturing techniques, and recycling in production to reduce energy consumption, waste, and raw material use. These practices often result in material cost savings, alongside a significant reduction in GHG emissions. Outside manufacturing, cost and carbon can be reduced through optimisation of transportation logistics and switching from air freight to shipping or rail.

  "Alcon has focused on reducing energy use, water consumption, and waste generation at manufacturing sites, realizing savings of 212,913 gigajoules, 628 megalitres, and 5,233 metric tons, respectively, in the last three years. We have site-specific energy, water, and waste-reduction targets which have driven significant efficiency." —Alcon

- Switching to green heat. When properly installed to take advantage of waste heat sources, heat pumps can be materially cheaper than natural gas. That's particularly true for temperatures below 100°C, which

47. *As in other industries, the majority of MedTech emissions are driven by Scope 3, i.e., emissions that are beyond the operational control of MedTech companies, with Scope 1 and 2 emissions representing only 5–10% (please see Part IV of this report regarding "Collaboration as Key Catalyst for Accelerating Action").*

constitute half of MedTech's heat demand in their own operations[48]; upstream suppliers tend to require higher temperatures so may require biomethane from waste or more novel solutions (e.g., green H2).

- "Heat was a material part of our Scope 1+2 emissions but is no longer so thanks to a series of waste heat recovery projects that we introduced in our facilities across France, leveraging government funding. We are now looking at district heating networks and electrification (e.g., industrial heat pumps) to decarbonise our remaining heat needs." —BioMérieux

Key enablers to unlock these priority decarbonisation levers in the medical technology industry include:

- Speeding up and scaling the clean energy transition through the rollout of clean energies combined with investment in modernising infrastructure for clean energy, digitisation, and transport. Continuous access to clean energy capacity is a prerequisite for decarbonisation.

- A rapid implementation of the global commitment to triple renewable energies and energy efficiency.

- Reliable, standardised, workable supply chain communication tools that MedTech companies and the whole value chain can use to exchange data.

- A regulatory environment in which MedTech companies (and other corporates) are able to access green power purchase agreements (PPAs).

Category 2: 25–30% emissions reductions are economically viable but face some regulatory challenges and/or other hurdles.

- MedTech companies can achieve about a quarter of their abatement pathway through designing their products and packaging with sustainability in mind. Many of these levers could be economically viable today, but regulatory blockers impede some positive business cases and create implementation hurdles to a greater or lesser degree. Most changes to packaging are easier to implement from a regulatory perspective than changes to product.

- Dematerialisation involves reducing the material used in MedTech products and/or packaging. Implementing this lever saves money by reducing the volume of raw materials required and waste at end of life. Several examples already exist of mature MedTech companies taking this step in their products and particularly in their packaging.

  "In 2023, we launched new Ethicon procedure kits in Europe, the Middle East, and Africa. This reduced packing weight by 38%, packaging components by 50%, and integrated 20% post-consumer recycled (PCR) materials into the carton on average, as compared to previous kits." —J&J

  "Alcon partners with our suppliers to continually improve our products and processes. For example, Alcon modified the exterior packaging that goes into batches for sterilisation to reduce time spent in the sterilisation chamber, thereby lowering costs and the overall use of the sterilisation agent." —Alcon

- Increasing the upstream raw material recycled inputs involves engaging suppliers to ensure they adopt closed-loop systems to collect and reuse waste materials such as glass cullets, aluminium metal scraps, and plastic offcuts. Closed-loop material recovery to increase recycling can save suppliers money, whilst lowering the GHG emissions of the materials they are producing. Post-consumer recycled content is a further option, which, while it is not permitted in more safety-critical applications, can be implemented in more peripheral areas such as secondary and tertiary packaging.[49]

  "Every tonne of cullet that is remelted to make new glass products saves 1.2 tonnes of raw materials and reduces emissions of process CO2 by approximately 200kg. Substituting one

48. *Based on benchmarking conducted in Biopharma industry.*

49. *Currently the quality of recycled materials is inconsistent across geographies. Harmonisation between waste management practices and robust quality standards are required before MedTech can make widespread use of post-consumer recycled content in its products and primary packaging.*

tonne of cullet for raw materials also saves 322 kWh–approximately 67 kg CO2e [of energy]."[50] —British Glass[51]

- Designing for longevity involves designing devices with robust, easy-to-disassemble components.

  They enable repair and part replacement, reducing waste over the lifetime of the device. These actions may result in lower sales volumes (since products require less frequent replacement), but companies have seen more revenue through refurbishment services, maintenance, and upselling opportunities.

- Designing energy-efficient products not only reduces Scope 3 emissions but also delivers long-term cost savings for customers. While innovation for efficiency may involve an initial investment, many companies have successfully demonstrated the value of these products by showing customers the significant energy savings they can achieve over time, such as through features like "stand-by modes."

  See Philips and Siemens Healthineers in the sidebar "Examples of Competitive Advantage from Sustainability Leaders".

- Recycling, refurbishing, and reprocessing can have a positive business case whilst contributing to the circular economy. Collecting, sorting, cleaning, and reusing materials is frequently cheaper than sourcing virgin materials, especially for high-value components. This lever is extremely challenging for contaminated products, but feasible for others. Take-back schemes also require significant scale to be cost-effective, though, and not all single-use devices are suitable for reprocessing, nor do all countries allow reprocessing of single-use devices.[52]

  "In FY 24, Medtronic collected 7.2 million products through take-back programs, and 335 million tons of materials were diverted from landfill. Since FY17, patient monitors and accessories that are no longer needed are returned to our distribution centres to be recycled or refurbished, and in the past five years, almost one million monitors have been refurbished." —Medtronic

- MedTech companies can already begin to implement design principles for new products, but changes for existing products are more challenging, as regulatory recertification is often required, which is a time- and cost-intensive effort (please see Part IV of this report).

Key enablers to unlock these decarbonisation levers include, among others:

- Developing a standardised product life-cycle assessment methodology targeted to the specificities of the medical technology sector by industry and standardisation organisations; governments should support and promote such standards.

- An effective internal market for waste in the EU in support of the circular economy.

- Support for the development of circularity indicators.[53]

- Adoption of value-based procurement methods by health systems, and government support for hospitals and healthcare delivery organisations to ensure they are financially resilient and able to invest in innovation.

- Capacity building for purchasers of medical equipment, including training to support the development and application of Green Public Procurement criteria.

- The use of digital solutions to reduce carbon footprint by industry and other healthcare system actors, including generating evidence about the potential of digital solutions for this purpose. Governments can also promote the development of standards to harmonise quantification of emissions, e.g., accounting for avoided emissions vs. non-digital solutions.

- Collaboration and partnerships among health systems, providers, MedTech companies, and waste managers to drive system change, especially with regard to end-of-life management.

50. *Emissions factor for energy intensity based on UK grid intensity, 2023 (Dept. Energy Security & Net Zero).*
51. *Recycled content in glass packaging, and Glass Sector Net Zero Strategy 2050, British Glass, 2019.*
52. *Study on the implementation of Article 17 of Regulation (EU) 2017/745 on medical devices on the EU market - Publications Office of the EU*
53. *Material Circularity Indicator | Ellen MacArthur Foundation.*

Category 3: 15–20% of the decarbonisation pathway is expensive and at low technological maturity, despite being generally feasible within the existing regulatory framework.

Some critical decarbonisation levers for suppliers to MedTech companies are expensive today, and MedTech companies will struggle to push their suppliers to act, given their low share of total global buying power. These include:

- Clean fuels to power the transportation and logistics throughout the MedTech supply chain, including sustainable aviation fuel (SAF), ammonia, e-methanol and green hydrogen for net-zero shipping, and electric or hydrogen-powered vehicles.
- Carbon capture in the production facilities of certain upstream MedTech suppliers who produce hard-to-abate raw materials, such as steel. For those input materials, carbon capture is a critical technology to decarbonise production, due to a lack of alternative technology options.
- Low-maturity green heat technologies such as green hydrogen will be needed in the upstream extraction and processing of raw materials to reach high temperatures, especially to produce some metals, e.g., green steel.
- Despite the costs, some steps are being taken to scale the vital technologies and drive costs down the learning curve. Logistics players are investing heavily in alternative fuels to decarbonise their own operations, and many steel and glass producers are also already taking independent action to decarbonise their high-temperature heat needs or explore carbon capture solutions. MedTech companies can help by sending a demand signal to these upstream materials producers via localised pilots.

Key enablers for unlocking this lever mid-to-longer term include:

- Government support for the acceleration and scale-up of clean energy technologies, including clean hydrogen and related infrastructure.
- Partnerships between industry, academia, and public sector bodies to invest in innovation and R&D.
- Alignment between states on policies to boost carbon capture and agreement on how carbon capture is accounted for.

Category 4: 10% of the sector's carbon emissions remains both prohibitively expensive and blocked from a regulatory perspective.

There are major regulatory blockers to implementing changes in key input materials, and these changes involve substantial costs:

- New processes will be needed in the production of some critical materials that, under existing regulation, could be seen as altering the physical properties of the MedTech device – and hence would trigger regulatory refiling processes. Examples include inert anodes in aluminium production and e-cracking in plastic production.
- Redesigning with alternative, low-CO2 materials involves replacing virgin materials currently used in MedTech devices or their primary packaging with alternatives. This could encompass replacing virgin plastics with alternatives such as bioplastics and post-consumer recycled content.

The costs of these technologies are likely to decrease considerably over time by 2040 as investments from other sectors scale and mature the key underlying green energy technologies.[54] MedTech is far from the only sector with a need to decarbonise upstream plastic production, or to employ alternative materials, such as bioplastics, to reach their net-zero targets.

- Whilst not an immediate priority for the sector's decarbonisation pathway, MedTech companies can actively contribute by co-investing with peers to share the costs and risk of funding and scaling pilots for these technologies with suppliers. Other sectors, such as BioPharma, Consumer Goods, and Food, have similar needs to develop medical/food-grade sterile bioplastics that can replace existing plastics.

54. *2025 Progress Report on Competitiveness of Clean Energy Technologies - European Commission;*

The cost of clean energy technologies worldwide, such as wind, solar and battery storage, are expected to fall further this year, a report by Bloomberg NEF in Feb 2025, despite rising protectionism in the form of tariffs on green energy imports. BNEF expects the levelised cost of electricity for clean technologies to fall by 22-49% by 2035;

Energy Technology Perspectives 2024 – Analysis – International Energy Agency (IEA, 2024)

Global market for key clean technologies set to triple to more than $2 trillion over the coming decade as energy transitions advance - IEA (2024)

Investigations and collaborations in this area could drive longer-term decarbonisation changes in the MedTech sector, with rigorous testing to ensure quality and patient safety are prioritized at all times.

- It is important that whilst these technologies are being refined and scaled, the sector engages in the necessary discussions to ensure that regulations can support the adoption of the technologies, ensuring that they can be used to decarbonise MedTech at the earliest possible opportunity.

Hence, key enablers for these long-term levers, include:

- Collaboration and partnerships among MedTech companies, their suppliers, as well as the broader ecosystem.
- Government incentives for clean technology R&D and support to industry pilots.

Roadmap for the sector to 2050

MedTech companies will need to pull all levers to deliver the full net-zero pathway by 2050 while continuing to maintain safety. The prioritisation and sequencing of levers is critical to ensure the sector gets going short-term, takes feasible and impactful actions in their own operations and with suppliers—and ultimately unlocks the route to full decarbonisation while aiming to stay competitive as a global technology innovation leader.

The below roadmap presents a pathway for the sector to 2050:

- Collaborate with inter- and intra-sector peers in localised pilots of immature green technologies to contribute to scaling these solutions.
- Embrace digitalisation to boost efficiency in own operations and the broader healthcare system (e.g., shift from paper to electronic instructions for use; improve efficiencies in distribution of MedTech devices or in prevention to avoid hospital admissions, etc.).

Short-term decarbonisation levers (by 2030):

- Implement economically viable levers with no regulatory hurdles across MedTech's own operations and the supply chain to achieve ~40% emissions abatement.
- Embed sustainable product design levers in new product development processes.
- Conduct proactive engagement with regulators to unlock regulatory blockers preventing:
  - The implementation of sustainable product design levers in existing products
  - The use of alternative, low-CO2 materials in MedTech products and packaging.
  - The use of new sustainable processes in the upstream supply chain.

Medium-term decarbonisation levers (2030–2040):

- Redesign existing MedTech products to implement sustainable product design levers.
- Begin to integrate low-CO2 alternative materials into MedTech devices and packaging.
- Engage suppliers to adopt new sustainable processes in the upstream supply chain.
- Transition to sustainable aviation fuel (SAF) and EVs/hydrogen trucks to decarbonise air and road freight.

Long-term decarbonisation levers (2040+):

- Transition to ammonia, green hydrogen, and other low-carbon alternative fuels to decarbonise sea freight.
- Engage suppliers of key commodities (e.g., steel, glass) with high temperature requirements to employ high-temperature green heat technologies.
- Engage suppliers of hard-to-abate commodities to employ carbon-capture technologies that will enable zero upstream emissions where these technologies are not already in place (e.g., green hydrogen/power-to-gas).

Implementation requires case-by-case assessment due to the heterogeneity of the sector

MedTech is very heterogenous. This sector-level roadmap is directionally representative; however, the specific detail and sequencing will differ based on the individual MedTech company context and product portfolio.

This is because a company's specific emissions hotspots vary depending on their product portfolio but also geographical location or customer profiles – all products have material upstream emissions, but the split between product use and end-of-life varies, as the exhibit below makes clear.

Specific levers will therefore be more or less applicable. For example, designing for efficiency and longevity will be crucial for large equipment (e.g., MRI scanners), but less so for consumables, where recycling, refurbishing, or possibly reprocessing besides incineration with energy recovery would be more impactful.

Exhibit 9 | Roadmap to NZ 2050| Immediate focus is to rapidly scale economically viable, high-impact levers across own operations and suppliers; patient safety remains key

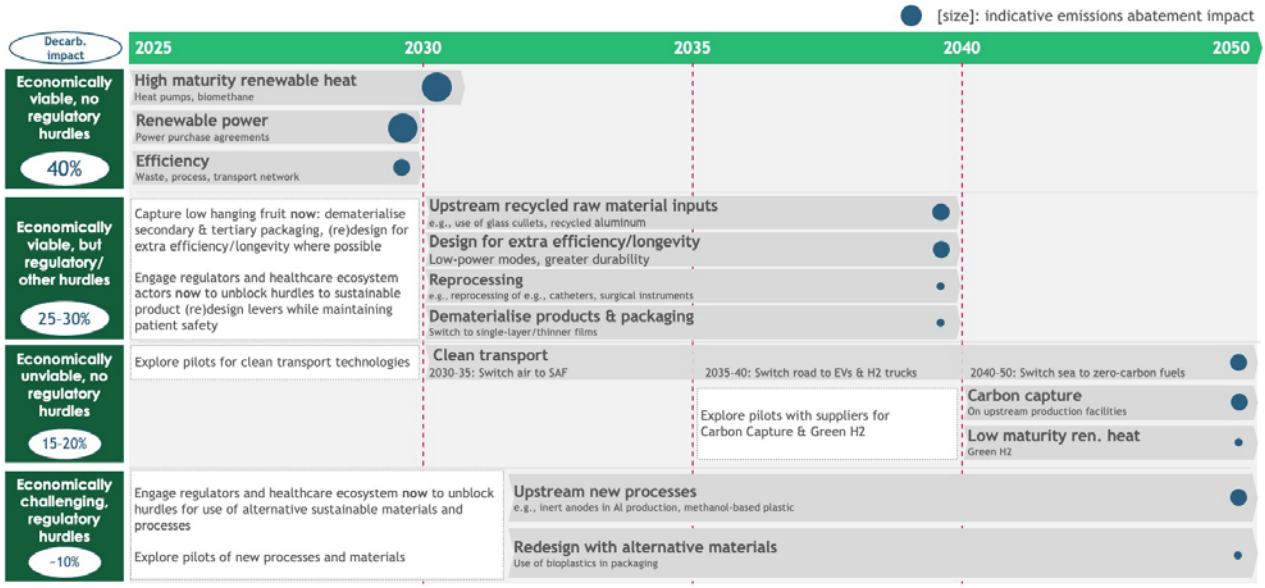
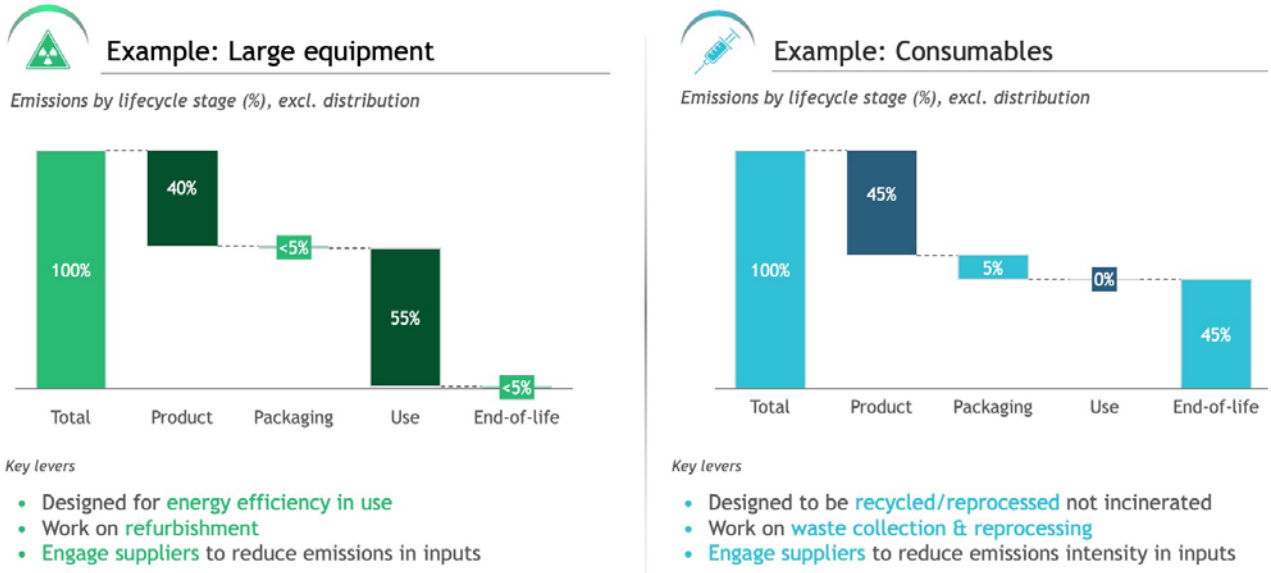


Exhibit 10 | Clear differences in emissions footprint by product type



Source: BCG analysis.

What Gets Measured Gets Reduced

Unless MedTech companies have a good understanding of their emissions, they will be unable to address their specific hotspots depending on their product portfolios. MedTech companies can already draw on a suite of standards and tools to build a clear view of their emissions, set robust targets, and show progress.

To create an accurate emissions baseline, companies should follow the Global Greenhouse Gas Protocol. They can start by creating an easy spend-based baseline for their emissions, using emissions factors (e.g., kg CO2e/$ spent) against their spending by product category. An advanced approach is to use activity-based data (e.g., volume of input material used) with emissions factors, or ideally direct data from suppliers about their emissions footprint. Common platforms of rating providers will certify their base report.

To ensure comparability and granularity at the product level, companies can align on carbon footprint methods and standards for product lifecycle assessments that build on ISO standards 14040, 14044, and 14067; at EU level, the methodology for implementing the Sustainable Products Regulation (ESPR) would require adjustment to the specificities of the Medtech sector.

CSRD mandatory disclosures will show progress at the corporate level with year-on-year emissions reductions, alongside metrics on water, waste, and other environmental impacts, if reporting is done at the global level.

The Science-Based Targets Initiative will help them set a robust emissions target for assessing emissions reductions across all scopes.

Part IV– Collaboration as Key Catalyst for Accelerating Action

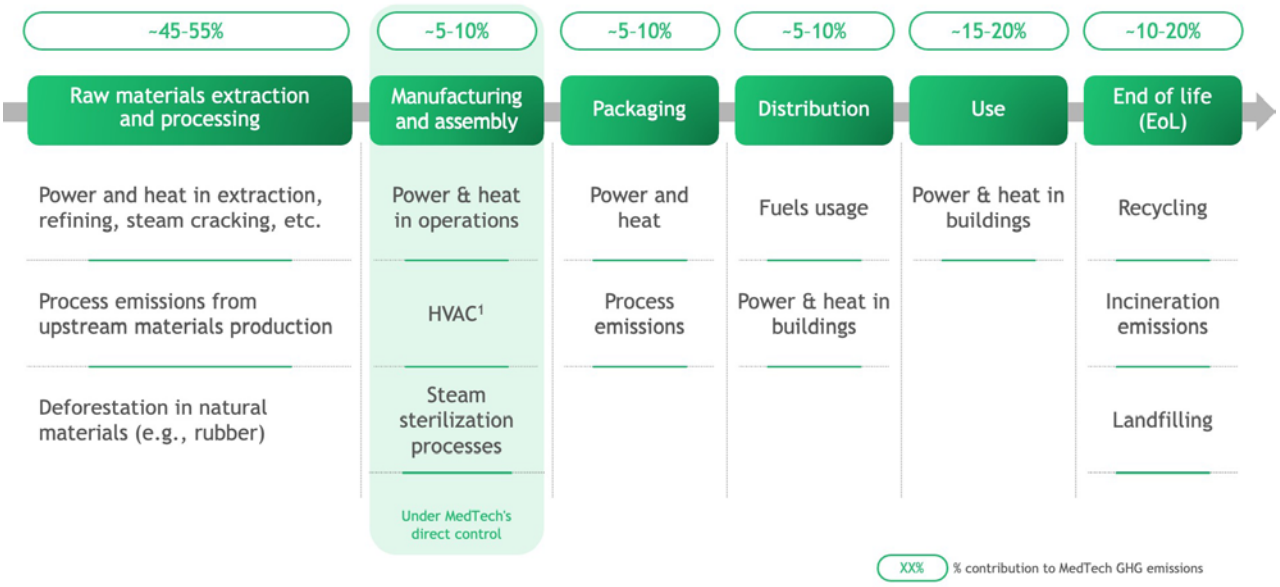
To decarbonise, MedTech companies need to engage with the entire value chain

As in other industries, the majority of MedTech emissions are driven by Scope 3, i.e., emissions that are beyond their operational control, with Scope 1 and 2 emissions representing only 5 to 10%: decarbonisation levers in their own operations. It is only through collaboration that they can contribute to driving system change within broader supply chains and that the necessary abatement potential can be realised.

Yet supply chains are international and involve layers of thousands of firms, many of which are in parts of the world where sustainable solutions are not prioritised and are difficult to implement. While actions in the EU influence decarbonisation in international supply chains, they will only go so far as nations around the world follow suit in implementing similar policies needed to reduce emissions domestically, thereby creating a global level playing field for lower-carbon products and processes. Cost drivers at an EU level alone may not justify the investment considering a larger impact, including impact on the ability to source input materials and components for manufacturing of medical technologies in the EU.

MedTech companies have started engaging with their supply chains—for example, through supplier education programs and codes of conduct. For example, Becton Dickinson hosted in 2024 a Supplier Climate Action summit to help support key suppliers in setting science-based greenhouse gas emissions reduction targets. The summit, a global, online event that was aimed at the top 1,200 emitting suppliers from around the world, marked a significant step forward towards achieving their short-term emissions reductions goals.

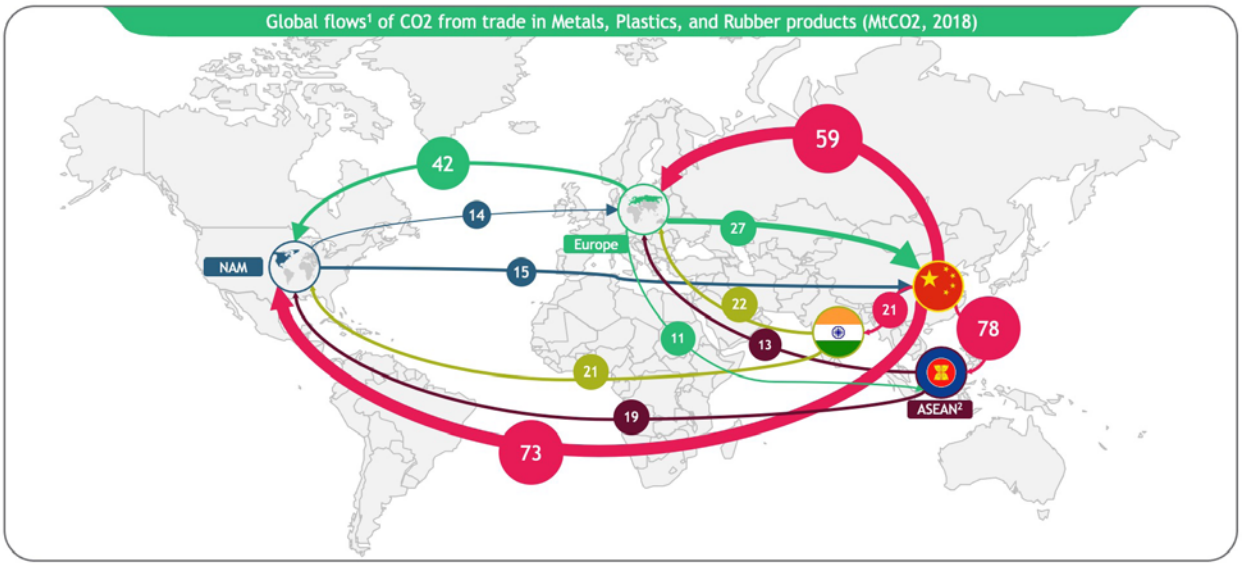
Exhibit 11 | Achieving net-zero requires action across the value chain



1. Heating, Ventilation, and Air Conditioning.

Source: BCG case experience.

Exhibit 12 | Tackling international supply chains will be critical



Notes: 1. Between selected countries/regions; smaller flows (<10 MtCO2) not shown; 2. Association of South East Asian Nations, consisting of Brunei, Burma, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand, and Vietnam. Source: OECD Trade in Embodied CO2. Database (TECO2).

Source: BCG case experience.

Such initiatives could be replicated and advanced at much larger scale. Beyond this, companies can go further in embedding strict sustainability criteria in their procurement tenders, directing business to suppliers with better performance along sustainability metrics and working with suppliers to collect primary data on their emissions footprints. Through these means, companies can encourage change in supplier behaviour.

Collaboration could also include co-investment with key suppliers on specific initiatives to accelerate upstream Scope 3 emissions reductions.

Collaboration among industry peers is a key enabler of the broader decarbonisation of the MedTech sector. Subject to strict compliance with competition law, there are five key areas for MedTech companies to collaborate:

1. Common requests to suppliers. Whilst engaging suppliers individually can be challenging given MedTech companies' small buying power, coordinating asks where in line with competition rules across the sector can simplify or streamline these requests and boost demand in order to spur action. Sector commitments to sourcing specific new materials, such as bioplastics, via mechanisms such as buyers' alliances can also encourage suppliers to invest and scale up production of these materials.

2. Co-investing in green solutions. Driving scale for green solutions via buying groups can enable access to vital solutions (such as green power and heat) at favourable prices and increase access in regions with limited supply. Compliant group procurement initiatives are especially beneficial for SMEs that lack the scale to sign deals alone. The setup of such buying groups must comply fully with competition law (see "Managing the Risks of Industry Collaboration" sidebar).

   "Procuring green power is easiest in Europe, improving in North America but a challenge in Asia, and very difficult in South America." —Becton Dickinson

3. Co-investing in R&D and elevating collaborative research. Companies can also collaborate with peers and suppliers, as competition law allows, to share the investment costs and risks of piloting nascent technologies, such as carbon capture, utilisation, and storage (CCUS) and green hydrogen (green H2). This sends a broad demand signal and can accelerate the scale-up of solutions. R&D for like-for-like material replacements that meet stringent performance and safety requirements in medical applications can distribute risk and cost among stakeholders, fostering innovation within the sector.

4. Creating global sector standards for measurement. Aligning on standardised emissions accounting, reporting standards, and data requirements enables transparency and increases the efficiency of reporting teams who today lose significant amounts of time answering non-standard questionnaires. Standardisation of reporting also enables like-for-like comparisons between companies and products, ensuring sustainability leaders are properly recognised, appreciated, and rewarded. This is especially important for life-cycle assessments (LCA).

- "Very few LCAs meet recognised standards. It is crucial to align these analyses to ISO14040/14044 standards to ensure robustness and comparability." —Ambu

- "If LCAs do not follow standards, you allow the possibility for greenwashing." —Mölnlycke

- "Full LCAs—not just on carbon emissions—are key. We could use a bio-based agricultural product to replace plastics, reducing CO2, but this would drive eutrophication (or water pollution) and other environmental impact categories. And that requires time and R&D resources to ensure quality and patient safety, which are highest priority." —Paul Hartmann

Customers also need to be educated on what LCAs and PCFs are to understand the limitations and how to correctly interpret and compare data. Even if a standard is followed, there are plenty of variables that could limit comparability.

5. Coordinating approaches to regulators. Aligning on a concise, unified set of industry requests to regulatory bodies can also help the companies to resolve regulatory challenges that currently inhibit sustainability efforts.

A Role for Payers and Providers

Payers and providers can do a great deal operationally to support MedTech decarbonisation. They can decarbonise their facilities to reduce emissions from using devices. They can also reduce unnecessary clinical activity or change care models to improve patient outcomes, lower cost, and reduce carbon emissions.

In dealing with suppliers, they can make sustainability a tangible factor in purchasing and coverage decisions. Green supplier standards can drive change, and incentives from payers will be important.

Green supplier standards offer a prioritised set of sustainability criteria, ideally broadly consistent across health systems and countries both on content (to help tackle trade-offs between dimensions) and on data requirements (to reduce the administrative burden on sustainability teams, freeing their resources to drive impactful change). For example, value-based procurement (following MEAT principles[55]) can support the business case for MedTech companies to implement sustainable products—a more energy-efficient, durable product with a longer lifespan may cost more upfront but may enable significant cost-savings over its lifetime (via energy efficiencies and repair rather than replacement).

A big opportunity will be in waste disposal, especially for products that are limited to single or a few uses. These products generate minimal GHG emissions in actual use, but at the stage of disposal, including during incineration. Providers can coordinate with waste management organisations to promote recycling and set up takeback schemes that may also help to reduce waste and emissions. Where the recycling of medical products is currently banned by regulation, such as in Italy, policymakers need to update regulatory frameworks to allow this opportunity while maintaining patient and user safety.

55. The Value Based Procurement Journey in Europe, A MedTech Europe reflection, 2020.

"Takeback schemes are currently seen as a source of competitive advantage limiting collaboration between peers. However, cost, logistics, and low volumes may limit the applicability of takeback programs initiated supplier-by-supplier, reducing any advantage.

MedTech Europe helps to facilitate discussions between members and waste management players, enabling collaboration that will lead to wider adoption and bigger results."
—Roche Diagnostics

A Role for Policymakers

Governments and the EU can help MedTech companies decarbonise in multiple ways, both by incentivising the scale-up of affordable green technologies and in reviewing regulations for MedTech product changes, where justified. They also have a key role to play in fostering a common understanding of decarbonisation roadmaps, supported by adequate budgets, and ensuring that funding is not rediverted to other priorities.

Incentives for decarbonisation

Ensuring that there are incentives in place to drive the pace and scale of decarbonisation required across healthcare and MedTech value chains will be critical to achieving net-zero healthcare systems. Governments have a role in providing the enabling framework for decarbonisation across the economy, including by, for example, allocating necessary resources for healthcare system innovation and rollout of new technologies and infrastructure. They can also further improve and enforce ETS by seeking alignment on global carbon pricing as well as enacting value-based procurement.

Such moves can support MedTech companies to move faster to decarbonise, partly by raising the carbon cost of inaction and the pooling of public and private investments. Through CBAM and ETS, governments aim at pricing carbon at levels that strengthen the business case for decarbonisation short term. Reporting burden should be kept at the minimum level necessary, and CBAM circumvention needs to be addressed. Besides, extending CBAM to articles would risk manufacturing leakage as sourcing global components would become more expensive for manufacturing operations in Europe, as long as other regions do not enact similar carbon pricing and global markets do not compensate for higher manufacturing costs in Europe.

Governments have an even stronger part to play in supporting companies through the energy transition process, both through direct and indirect means. Incentivising a switch to renewables through tax breaks and subsidies will move the MedTech sector further towards using these low-carbon energy sources. Incentives are particularly important in the SME sector and to

reduce Scope 3 emissions with suppliers or customers whose fuel use in electricity and heat drive significant volumes of emissions along the value chain. As governments enact subsidies and other incentives to build up low-carbon renewable sources to replace fossil fuels, the MedTech sector as a whole will generate fewer GHG emissions, as will other sectors.

Governments in and beyond Europe can also invest in modern energy infrastructure; e.g., in energy grids to minimise intermittency in the transition to renewable power. As more renewables are added to energy grids, the need for digitalisation, storage, and reinforcement will increase to offset intermittency challenges and support decarbonisation.

Regulations

Governments have a legitimate interest in overseeing and restricting changes in healthcare products, but some of these rules are limiting innovation that would support decarbonisation. Some modifications to existing regulatory frameworks could support CO2-reducing design changes while preserving patient safety, health, and no-harm principles.

Today there are significant hurdles in place for MedTech companies to decarbonise their products and packaging. For example:

- **No clear guidance on what requires regulatory recertification.** Clear guidelines from regulators are lacking on which sustainable product design changes require extensive testing and regulatory involvement and which have fast, simple implementation. This creates uncertainty and inertia, given the costs, effort, and time associated with undergoing a complete regulatory refiling.

- **No clear quality standards for recycled materials.** Companies also lack quality standards for recycled materials that would pass the stringent sector regulation of the MDR/IVDR. There is reluctance on engaging suppliers to increase the content of upstream recycled raw material due to concerns products may not meet MDR/IVDR standards, even with high-quality materials being available.

- **Slow, cost- and resource-intensive process to use alternative, like-for-like materials.** The high cost and resource requirements as well as the length of the regulatory recertification process deter companies from substituting materials in devices with low CO2 equivalents, even when like-for-like safe alternatives exist (e.g., certain bioplastics).

  "Regulation prevents us from adopting some alternative materials because the refiling process is so onerous for many alternative materials." —Cook Medical

- **Lack of clarity on what single-use devices are suitable for reprocessing.** While EU MDR provides guidelines on reprocessing of single-use devices in the EU, fragmented national legislation on the topic means that there is a lack of clarity on which types of single-use devices are suitable for reprocessing. This is in stark contrast to the medical device reprocessing industry in the U.S., which has operated under unified oversight of the FDA for over 20 years and is now worth over $1 billion across all areas of reprocessing (beyond single-use devices), more than 46% of the global market.[56]

Regulators can do more to promote circularity, including by a streamlined refiling process for changes in input materials (e.g., enabling the use of recycled inputs that meet the necessary quality levels). Enabling greater digitalisation would complement such a push for circularity by reducing the amount of input materials needed in the first place. The adoption of electronic Instructions for Use (Seifus), as is currently already possible in many jurisdictions, e.g., the U.S., Japan, and Australia, and being piloted for BioPharma products in the EU, is an oft-cited example of a valuable regulatory unlock for sustainability.

Cross-border standardisation is crucial to promote, for example, reprocessing of MedTech equipment, which can reduce the GHG burden of a product in certain circumstances. The study of the European Commission contracted to the Austrian Health Institute[57] on the topic makes 15 recommendations for the future of reprocessing in Europe, including calling for additional research to allow harmonised, product category-

56. *SNS Insider, 2023 report on total reprocessing market.*
57. *Study on the implementation of Article 17 of Regulation (EU) 2017/745 on medical devices on the EU market.*

specific requirements across the EU. This way, regulators can enable a strong single market for European reprocessing that would provide the scale needed for expanding this program.

At the same time, the reprocessing potential will depend on the type of product and cannot always be scaled to other similar-type devices, since it's not technically feasible. This lack of expansion and low process yields in reprocessing activities are a limiting factor besides the regulatory landscape for reprocessing in the EU.

A comparison to the U.S. market should also be put in context where devices that are reprocessed are quite often not single-use in the EU market, e.g., Pulse Ox leads.

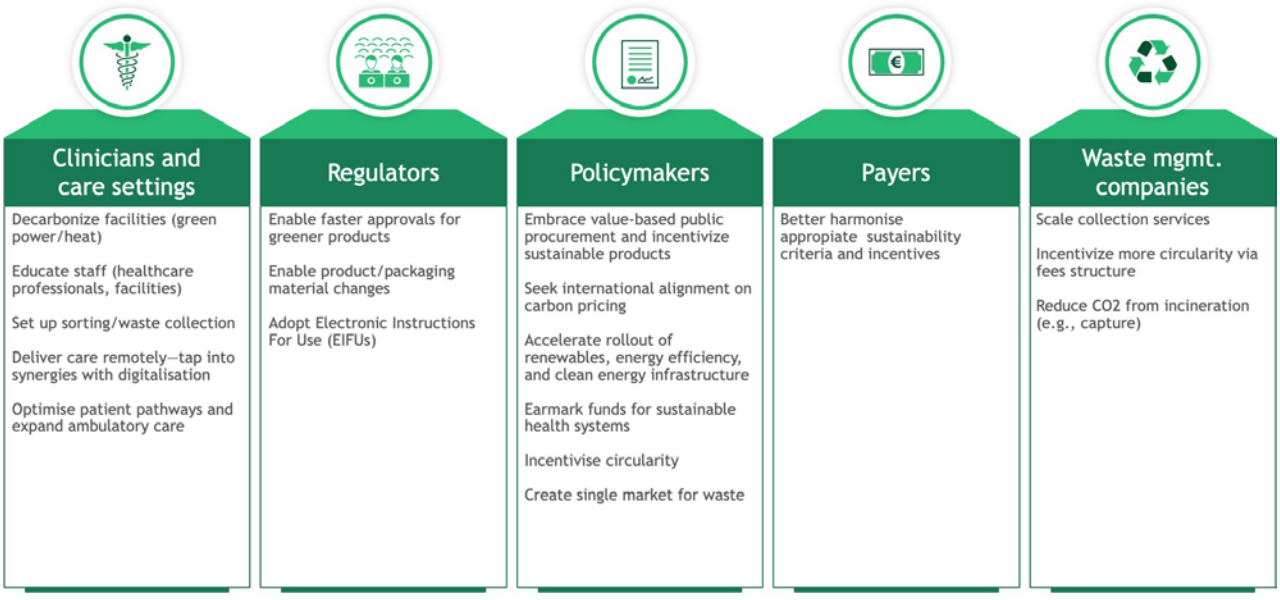
Regulators can also support MedTech companies in their journey towards net zero through early evaluation of and judgment on the viability and safety of:

- Nascent alternative materials, such as bioplastics.
- New upstream processes, such as e-cracking or inert anodes, which enable the green production of materials already commonly used by the MedTech sector (plastics and aluminium respectively).

Significant financial and resource investments are required of MedTech companies and their suppliers to develop and employ these alternative materials or production processes. Regulators can help to derisk such investments by providing clear, early guidance on whether alternative materials and processes will be permitted and, in support of innovation, allocating strategic investments in healthcare infrastructure within national and EU budgets.

It's time to start a dialogue on these rules and required changes now, so the rules are in place by the time MedTech companies shift towards design and other adjustments for decarbonisation beyond the no-regret changes.

Exhibit 13 | Delivering net-zero requires the whole system to act



Regulators can also mandate the reporting on GHG emissions. They can offer standardised categories to facilitate comparison and show improvement over time – for example, promoting a robust standard for life-cycle assessments (LCA).

By engaging and collaborating with ecosystem actors, companies can not only move further and faster in their own decarbonisation, but also simultaneously propel the broader Healthcare sector. All stakeholders need to play their part in enabling the net-zero transition for MedTech, including clinicians who use medical devices, regulators who approve filings, policymakers who create the incentives, regulations, and enabling framework for decarbonisation, payers who influence product selection, and waste management companies, which handle products at end of life.

Managing the Risks of Industry Collaboration

The European Commission revised its Horizontal Guidelines on Competition Law in June 2023, specifically including a chapter dedicated to sustainability agreements. The revised guidelines aim to ensure leeway for competitors to enter, under certain conditions, into agreements to jointly pursue the goals of sustainable development. This leeway includes the provision of clearly defined regulatory "safe harbours."

Like the UK CMA's Green Agreements Guidance released in October 2023, the EU revised its Horizontal Guidelines on sustainability to enable, rather than inhibit, joint collaborations on sustainability.

The healthcare sector already has some examples of collaborations that have been running for several years, including the SMI Health Systems Task Force, a group of biopharma companies who have had success with developing joint, minimum supplier targets and sourcing green power together in Asia.

Disclaimer: This is not legal advice or guidance, and companies collaborating on sustainability should always seek formal legal advice from competition lawyers.

Conclusion – Driving Progress in Healthcare for the Industry, the Planet, and the People

The climate crisis affects all sectors, including healthcare, as rising temperatures bring hardships worldwide. As pressure mounts to decarbonise, the MedTech industry overall, like many others, has work to do, and while there are standout examples of leading action on a 1.5-degree pathway, the sector as a whole has to step up efforts to get on track with a 1.5-degree pathway.

In particular, action on Scope 3 emissions needs to be taken—companies need a concerted effort to understand product emissions, engage suppliers in decarbonisation efforts, and coordinate with customers on product use and end-of-life emissions. The majority of MedTech emissions are driven by Scope 3, i.e., emissions that are beyond the operational control of MedTech companies that market products. Scope 1 and 2 emissions represent only 5–10% of the MedTech sector's end-to-end emissions. 45–55% of emission potentials lie with raw material extraction and reprocessing in the supply chain, 15–20% in the use phase, 10–20% in the end of life stage, and 5–10% in packaging.

MedTech companies can take action to reduce emissions across the value chain with only limited additional carbon costs, and taking action can build a competitive advantage. The complexity of the supply chain of up to 30+ tiers and overall limited market power of the sector have to be

taken into account, though.
To get started, MedTech companies could:

1. Comprehensively assess their emissions baseline, collecting granular activity level and supplier data wherever possible and aligning on a common method for reporting.

2. Set science-based targets for the near term and longer term, aligned to a 1.5-degree pathway.

3. Implement "no regret moves" in their own operations (switching to green power and heat, investing in efficiency, including through digitalisation) and design products and packaging to reduce waste, improve recyclability, and minimise energy use.

4. Work with suppliers to encourage them to decarbonise their operations and engage further upstream to implement the process changes that will be needed for net-zero. MedTech companies can co-invest with some suppliers if they wish to drive the change.

5. Work with peers and the broader healthcare ecosystem to create common emissions measurement frameworks and (competition law-compliant) green tech buying groups to reduce costs through scale.

6. Implement changes internally to prioritise sustainability, and incentivise operational teams to optimise for lower environmental impacts alongside quality and costs.

7. Cooperate, including at association level where appropriate. Work on collective solutions, including through setting up, in respect of competition rules, buying groups for power and heat technologies, aligning on common reporting frameworks for product lifecycle assessments, and building scale across players for take-back and circularity schemes.

The MedTech sector also needs other parts of the healthcare ecosystem to support them in the decarbonisation journey—including clinicians, patients, regulators, policymakers, payers and providers, and waste management companies.

Each actor has a role to play in enabling the net-zero pathway for the sector, from supporting the transition through multiple actions, including the right regulatory conditions and government incentives to enabling lower carbon treatment options, such as with telehealth offerings. Joint decarbonisation and competitiveness planning are key for managing the transition in the sector to retain its global innovation leadership and ensure access to medical technologies for patients.

This report has sought to highlight opportunities, pitfalls, and collaboration needs required to make optimum progress on decarbonising healthcare and how a competitive medical technology industry can contribute. It seeks to inspire conversations within MedTech companies and with regulators and different stakeholders across the healthcare ecosystem that share the vision of a future where our healthcare systems are environmentally and financially sustainable, equitable, and resilient to future crises. People and planetary health are two sides of the same coin, and building resilient and sustainable health systems requires a robust, competitive, innovation-driven medical technology industry. Patients have no time to lose.

Appendix – Policies for Decarbonisation Today

Pressure is building up for the MedTech sector. This includes increased reporting requirements and regulations that put a price on GHG emissions.

Mandatory reporting

The EU Corporate Sustainability Reporting Directive (CSRD) requires large companies to start reporting carbon emissions and broader environmental impacts. Its Corporate Sustainability Due Diligence Directive (CSDDD) rule requires companies to conduct due diligence on their operations and supply chains to ensure respect for the environment and human rights.

Taxes and incentives

The EU Carbon Border Adjustment Mechanism (CBAM) and Emissions Trading System (ETS) aim to support achieving the EU's target for carbon neutrality by 2050. These mechanisms encourage global companies to adopt greener practices and limit emissions from highly emitting sectors.

Such policies are already touching MedTech companies and will affect the cost of input materials in commodities, such as steel, glass, and aluminium, as suppliers transfer the added costs to MedTech as a customer. In 2027, these regulations will expand to fuels used in building heating and in road transport and will eventually cover other industries that supply raw materials to MedTech, such as plastics.

The cost of these regulations may increase over time, with full charging gradually phased in by 2034. The price per ton of carbon charged on emissions from heavy industry may double between 2024 and 2040. Striving for global carbon pricing would help to provide a level playing field for MedTech.

- There are also several incentive mechanisms aiming to promote innovation and resilience of the healthcare system in the EU, and which therefore impact how companies decarbonise product supply chains and healthcare delivery. These include streamlining state-aid processes and reducing the administrative resources required for Important Projects of Common European Interest (IPCEIs).
- Promoting research and innovation for more sustainable medical technology development. This includes the development and use of alternative materials, circular products, or business models.
- Investing in hospitals and other healthcare delivery organisations to support them in greening their infrastructure and operations. This could include portfolio analysis and investment in sustainable, circular, and more energy-efficient equipment, recycling, and waste management infrastructure, and safe, scalable, and sustainable waste disposal technologies.
- Rolling out digital solutions to reduce carbon footprint. This could entail more research into the benefits and decarbonisation potentials of digital solutions from an environmental perspective. Governments could do more to promote the development of standards to harmonise the ways in which organisations quantify, e.g., avoided emissions as a result of digital solutions to compare outcomes from non-digital solutions.
- Capacity building for purchasers of medical equipment, including training to support the application of Green Public Procurement criteria.
- Road-mapping and the harmonised implementation of environmental policies and regulations at member state level, and where possible, alignment with countries outside Europe.

Circularity and restrictions on materials

- These policies limit some chemicals and other materials, promote recycling, and reduce waste.
- The Packaging & Packaging Waste Regulation (PPWR) sets binding rules and obligations on packaging design and waste management from 2025 on. It discourages unnecessary packaging and mandates volume and weight reductions, as well as promotes sustainability requirements for packaging and recycling.

- The EU Batteries Regulation aims to make batteries sustainable across their entire lifecycle, through design requirements, such as responsible sourcing of raw materials, minimum performance, and durability standards, and recycling targets.
- The Regulation on Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH), to be revised in 2025, requires European companies to manage the risks associated with chemical substances. This includes restrictions on the use of certain substances.
- The Ecodesign for Sustainable Products Regulation is the cornerstone of the European Commission's approach to more environmentally sustainable and circular products. It aims to significantly improve the sustainability of products placed on the EU market by improving the environmental performance of products from a life-cycle perspective, including their circularity, energy performance, recyclability, or durability.

To comply with these requirements, MedTech companies will, among other actions, need to increase their operational sustainability and invest in robust data governance and reporting. Part of that effort involves acquiring the tools to provide transparency on their environmental impact across the value chain. They will also need to invest heavily in R&D to develop better performing, alternative materials for products and packaging. To avoid many of these taxes and fines, MedTech companies can work on decarbonising their end-to-end supply chain together with suppliers, reducing the carbon intensity of their materials.

Analysis Methodology

National view of healthcare emissions

Two data sources were used to express each national healthcare footprint as a percentage of national emissions.

National GHG footprint using the EU Commission's EDGAR: The EU Commission's Emissions Database for Global Atmospheric Research provides a time-series of GHG emissions by country from 1990 to 2022. The footprint calculates national domestically produced emissions (occurring inside a nation's borders) and does not include emissions embodied in imports.

National healthcare footprint: Lancet's Countdown Report (2023) provides the GHG footprint of healthcare by country. It includes direct emissions by healthcare facilities, as well as emissions from the consumption of goods and services provided by other areas.

MedTech emissions baseline

The MedTech emissions baseline considers the value chain in three parts. Each value chain step's contribution to MedTech emissions was calculated using the available data and prior work, with both bottom-up and top-down approaches.

1. Supply chain emissions from cradle-to-customer: A low-side view derived bottom-up with selected MedTech companies' public Scope 3 emissions reporting[58] using a revenue intensity factor scaled to the full MedTech market. A high-side view used data from public reports[59,60,61] to understand the share of healthcare emissions in the supply chain and

58. *Carbon Disclosure Project database of company disclosures.*
59. *Arup & Healthcare Without Harm (2019), Healthcare's Climate Footprint—How the health sector contributes to the global climate crisis and opportunities for action.*
60. *BCG & Sustainable Markets Initiative (2022), Decarbonising Healthcare Supply Chains—Recommendations on how to drive emissions reductions across healthcare supply chains.*
61. *Ibid.*

how these are distributed between MedTech, pharma, and other supply chains. The split of emissions within the MedTech supply chain was calculated applying the methodology described in "Abatement Potential and Cost Methodology."

2. Emissions in use: This analysis likewise used both a bottom-up approach with selected MedTech companies' public Scope 3.11 emissions reporting and a top-down view using healthcare systems' reported emissions from electricity consumption[62] and estimates for the share driven by medical equipment.[63]

3. End-of-life emissions: The bottom-up approach used companies' reported end-of-life emissions with robust Scope 3.12 methodologies, weighted for product portfolio composition[64]—and a top-down view, using estimates of healthcare emissions from waste treatment in public reports. These two approaches together estimated the share driven by MedTech based on the waste share of MedTech and modes of disposal.

Financial risks of inaction

The financial risk of inaction considers a plausible worst-case scenario in 2030 for a large MedTech company. The potential cost is expressed as a percentage of annual operating profit; some costs may be recurring, others (e.g., fines) are less likely to be.

Legislative risks

- Risk of fines: fines for non-compliance with EU sustainability regulation.
- Price of carbon, e.g., CBAM and ETS, will add cost to raw materials and component inputs for MedTech manufacturing. These consist of the following:
    - ETS 1, expected to reach 150 EUR/ton CO2e by 2035, applicable to: EU-sourced carbon intensive inputs (steel, aluminium).
    - Air and maritime logistics (indirect cost passed through via airline/ship operator).
    - Fossil fuel power used in manufacturing (indirect carbon cost passed through by generator).
    - ETS 2, expected to reach 80 EUR/tonne CO2e by 2035, applicable to:
        - Heat produced in the manufacturing process (indirect carbon cost passed through by fuel supplier).
        - Road logistics (indirect cost passed through via fuel supplier).
- CBAM, expected to reach 150 EUR/tonne CO2e by 2035, applicable to:
    - Non-EU sourced carbon-intensive inputs (steel, aluminium, bulk chemicals).
    - Extended Producer Responsibility: Fees charged to companies to cover costs of processing packaging waste.

Physical risks

- Physical damage to production assets: increasing risk of extreme climate events across the world (e.g., floods, hurricanes), causing physical damage to sites.
- Supply chain disruptions: disruptions to production caused by unreliable supply chain due to increasingly common extreme climate events.

62. *NHS England (2020), Delivering a 'Net Zero' National Health Service.*
63. *The Danish Electricity Saving Trust (2009): Demonstration Project for Medical Equipment (internal report).*
64. *Evaluate (a Norstella company).*

Abatement Potential and Cost Methodology

These calculations work in three parts:

1. Allocating MedTech's emissions to the range of different emissions sources.

2. Defining levers for the abatement of each emissions source.

3. Calculating the cost of each lever to calculate the cost of abating emissions.

1) Allocating MedTech's emissions to the range of different sources

These emissions come from different material input types (e.g., plastics, metals) and activities (e.g., transport, MedTech product manufacturing, product use). BCG calculated them according to the material input types and activities using companies' public emissions reporting, expert research, and BCG experience.

2) Defining levers for the abatement of each emissions source

BCG has developed a database of abatement levers for various commodities and activities through case experience and public decarbonisation reports (e.g., Mission Possible, Material Economics, IAI). Each lever represents an action to abate emissions (e.g., switching to battery-powered trucks for transport emissions), reducing a certain percentage from that source. Emissions from each source can be reduced by applying specific abatement levers. Categorising emissions abated by each lever by type (e.g., power, heat) allows calculation of the share driven by different emissions types.

3) Calculating the cost of each lever to calculate the cost of abating emissions

BCG's abatement lever library likewise calculates the cost per tCO2e abated from company experience and public decarbonisation reports (e.g., Mission Possible, Material Economics, IAI). Some levers are cost-saving, like increasing industrial process efficiency. The cost and abatement potential of each lever allows calculation of the cost per ton of CO2e to abate an entire emissions source (e.g., plastics). Using these costs and the share of MedTech's emissions from each source, BCG calculated the cost per ton of CO2e to abate MedTech's emissions.

Abbreviations

ATACH	Transformative Action on Climate and Health
BCG	Boston Consulting Group
C	Celsius
CBAM	Carbon Border Adjustment Mechanism Regulation (EU) 2023/956
CEO	Chief executive officer
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
COGS	Cost of goods sold
COP	Conference of the Parties
CSRD	Corporate Sustainability Reporting Directive (EU) 2022/2464
CS3D	Corporate Sustainability Due Diligence Directive (EU) 2024/1760
EDGAR	The Emissions Database for Global Atmospheric Research
E.g./ e.g.	Exempli gratia/for example
Etc.	Et cetera
ETS	Emission Trading System Directive 2003/87/EC
EU	European Union
EUR	Euro
FY	Financial year
GHG	Greenhouse gas
Gt	Gigaton
H2	Hydrogen
I.e./i.e.	Id est/this means
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IPCEI	Important Project of Common European Interest
ISO	International Standardisation Organisation
IVDR	Regulation (EU) 2017/746 on *In-Vitro* Diagnostics Medical Devices
kWh	Kilowatt per hour
LCA	Life cycle assessment
MEAT	Most economically advantageous tender
MedTech	Medical Technology Industry
MDR	Regulation (EU) 2017/745 on Medical Devices
NDC	National Determined Contribution
NHS	National Health Service
NZ	Net zero
OECD	Organisation for Economic Cooperation and Development
PCR material	Post-consumer recycled material
PPA	Power Purchase Agreement
R&D	Research and development
SAF	Sustainable aviation fuel
SME	Small and medium sized enterprise
UN-FCC	United Nations Framework Convention on Climate Change
U.S.	United States of America
WEF	World Economic Forum

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