Decarbonizing Health Care:

New Policies Can Build Markets for Low-Carbon Supply Chains

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About This Report

Decarbonizing Health Care: New Policies Can Build Markets for Low-Carbon Supply Chains

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Notes

This report is the third installment in a series exploring ways to reduce greenhouse gas emissions from the health care sector. The other reports in this series are: Decarbonizing Health Care: Clean Energy Policy Options; and Decarbonizing Health Care: Low-Carbon Transportation Policies Can Reduce Health Care Emissions and Benefit Local Communities.

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Cover images: (Left) Reprocessed medical metal implements in sterile packaging are sorted by gloved hands; (Center) Two health care professionals wearing surgical gloves and lab coats carry a box labeled "Medical Supplies. Attention is sterile! Medical masks - 1000 pcs" with a recycle symbol; (Right) A health care worker in scrubs sorts through shelves organized with boxes of medical supplies. Image rights purchased from Shutterstock.

Table of Contents

Decarbonizing Health Care: New Policies Can Build Markets for Low-Carbon Supply Chains

Executive Summary

As health care delivery organizations (HDOs) increasingly adopt and implement ambitious greenhouse gas (GHG) emissions targets, one of their biggest challenges will be reducing emissions that originate in their supply chains. Roughly 80 percent of health care emissions are indirect Scope 3 emissions,[1] much of which are embedded in the tens of thousands of medical and other products used by hospitals and other health care facilities. This includes diverse medical devices—ranging from single-use syringes to complex medical imaging equipment—each with potentially different materials, safety issues, and regulatory constraints.

The U.S. health care sector's increasing dependency on single-use disposable medical devices has created significant environmental and public health concerns. These include increased toxicity from harmful chemicals used in producing plastics, ingestion of microplastics, solid waste disposal impacts including toxic emissions from incineration of single-use plastic waste, air pollution from energy use, and embedded emissions of CO_2 in the fossil-fuel feedstock and manufacturing processes used for plastic medical devices.[2] To reduce these indirect supply chain emissions, leading health care systems are adopting a variety of internal practices and initiatives, including procuring low-carbon medical devices and pursuing strategies that reduce, reuse, and reprocess GHG-intensive medical supplies and other products. However, new and innovative materials and products may be scarce and costly and may require significant investment by manufacturers. Building the market for low- or zero-carbon medical supplies requires sending a signal to manufacturers and suppliers that "if you build it, they will come." The confidence to provide new product lines at existing companies or to start up entirely new companies dedicated to low-carbon materials and medical supplies will be based on an assessment of the existence and size of potential markets. It will also require a supportive and science-based regulatory

[1] The U.S. EPA defines Scope 3 emissions as "the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly impacts in its value chain." See U.S. EPA, Center for Corporate Climate Leadership, Scope 3 Inventory Guidance.

[2] Jain, N., and LaBeaud, D., How Should US Health Care Lead Global Change in Plastic Waste Disposal?, *AMA Journal of Ethics* 24, no. 10 (Oct. 2022): 986–93.

environment, including transparent information and clear standards about the required carbon content and footprint of products.

This paper will assess how health care supply chain decarbonization initiatives and strategies can achieve a broader scale and scope through additional complementary state and federal government policies. In some cases, health care sector initiatives can be a stepping stone to broader, economy-wide policies. In other cases, federal and state policies and initiatives can provide technical assistance and market signals that work in tandem with health care supply chain initiatives to spread good practices to a wider group of HDOs beyond the leading health care systems.

Summary of Policy Recommendations

Similar to our recommendations in our previous papers on energy use[3] and transportation,[4] we find that HDOs can take a two-tiered approach to shrinking their greenhouse gas emissions and other environmental impacts from their supply chains; first by adopting internal or industry-wide initiatives to reduce their own emissions associated with their supply chains, and second by engaging with broader policy solutions that will transform the markets for low-carbon medical technology and supplies by spurring demand for low-carbon products while stimulating investment in innovative products and materials.

The recommendations in this paper are based in part on the experience of non-health care companies and sectors that have built demand for green or low-carbon products through procurement and other methods. There is growing experience in the health care sector using these approaches and there have been important new initiatives launched in the last few years to facilitate low-carbon procurement. These include individual efforts by health care systems as well as collaborative health care sector efforts. These initiatives are critical and could be supplemented and expanded by the following recommendations.

[3] Georgetown Climate Center (GCC), Decarbonizing Health Care: Clean Energy Policy Options, April 2023.

[4] Georgetown Climate Center (GCC), Decarbonizing Health Care: Low-Carbon Transportation Policies Can Reduce Health Care Emissions and Benefit Local Communities, February 2024.

Recommendation 1: Policymakers could adopt a federal voluntary program focused on health care system supply chains

Any new program should be developed collaboratively with the health care sector based on data and best practices from HDO collaborative initiatives, including the new Climate Excellence Standard for Health Sector Suppliers, which aims to leverage the healthcare sector's purchasing power to mitigate the health impacts of climate change.[5] This standard provides a framework for health care organizations to enact substantial environmental improvements across their supply chains.

A national program could be based on some of the lessons learned and critical design elements used in the ENERGY STAR Program[6] and other successful voluntary initiatives. Lessons learned from ENERGY STAR could be adapted for a medical device program, which could contain some of the same components, including:

- Technical assistance on low-carbon procurement for manufacturers and suppliers,
- Development of voluntary standards for low-carbon products, and
- Certification and ecolabeling for qualified products. For medical devices, this could include low-carbon single-use products and reprocessed or recycled products.

Recommendation 2: The Veterans Health Administration could implement a pilot "Buy Clean" program for medical supplies

The Veterans Health Administration (VHA) is the largest integrated health care system in the United States, with commensurate influence over the market for lower-carbon alternatives to single-use and disposable medical devices. Although the VHA has implemented a number of policies to procure low-carbon energy and transportation products, it has yet to implement a program to procure low-carbon medical supplies. Recent revisions to the Federal Acquisition Regulations (FAR) in April 2024 could be an important opportunity to consider a pilot "Buy Clean" program for medical devices and supplies. Initially, the program could focus on a limited number of key supplies and could be expanded over time. In addition, the VHA could play a leadership role in designing and participating in the voluntary federal program for HDOs proposed above. VHA participation could be an important element in building the low-carbon medical supplies market.

[5] Practice Greenhealth, Climate Excellence Standard for Health Sector Suppliers.

[6] ENERGY STAR, ENERGY STAR.

Recommendation 3: Health care systems could consider expanding efforts to spur decarbonization of medical devices and could engage manufacturers of materials such as chemicals and plastics

New health care initiatives such as The Climate Excellence Standard for Health Sector Suppliers[7] and the Collective Healthcare Action to Reduce MedTech Emissions (CHARME) collaborative[8] represent a promising development in the effort to decarbonize supply chain emissions. Ultimately, these efforts could be expanded to engage primary materials producers (e.g., chemicals, steel, cement, etc.). This engagement could include discussing progress on new materials under development, specific low-carbon materials needs of the health care sector, and the developing market for low-carbon medical supplies. Collaboration on new low-carbon materials for medical supplies will benefit health care systems because these materials may initially be scarce and there may be competition for these or similar materials from non-health care sectors.

Recommendation 4: The Food and Drug Administration could expand research on the risks and potential benefits of reprocessed medical products

Concerns about contamination of medical devices have been a barrier to expanded use of reprocessed medical devices. To the extent that reprocessed devices can meet hospitals' safety requirements and reduce the carbon footprint of supplies, increased use of these devices could have a significant impact on reducing supply chain emissions. Additional funding of research on the safety of reprocessed devices could help validate the benefits of reprocessing and could facilitate the reduction of single-use products. It could also inform policies at the Veterans Administration and remove barriers to use of reprocessed medical supplies.

[7] This voluntary standard defines superior performance by medical device suppliers on emissions transparency and decarbonization. See Practice Greenhealth, Climate Excellence Standard for Health Sector Suppliers.

[8] This collaborative effort convenes health systems, medical device and equipment suppliers, distributors, GPOs, and other stakeholders "to define, implement, and champion best practices to reduce emissions from the MedTech supply chain. "Sustainable Purchasing Leadership Council, Collective Healthcare Action to Reduce MedTech Emissions (CHARME) Launch, April 10, 2024.

Recommendation 5: HDOs could support economy-wide policies that will lower the carbon footprint of supply chains

In addition to health care sector initiatives, broader economy-wide policies will be needed to fully decarbonize the supply chain and Scope 3 emissions. A previous paper in GCC's Decarbonizing Health Care series found that about 35 percent of emissions in the health care sector across all three scopes of the GHG Protocol originate with electricity generation and the decarbonization of the overall electric grid in the U.S. would significantly reduce the health care system's carbon footprint. A second paper in this series emphasized the importance of decarbonizing the nation's fleet of medium- and heavy-duty trucks, which make up a significant portion of the health care sector's Scope 3 emissions. Additional policies to decarbonize the industrial sector, particularly for chemicals and other primary materials used in the health care supply chain, could have a similar effect for HDOs. It is critical for HDOs to provide leadership on the development of these broader policies while simultaneously taking robust actions to reduce their supply chain emissions and build markets for low-carbon medical supplies.

I. Introduction and Background

Roadmap

This paper, which is the third in our series on policies to decarbonize the health care sector, focuses on reducing the embedded emissions in health care supplies and medical devices. Section I provides background on the emissions profile of HDO supply chains. Section II discusses several types of procurement to reduce supply chain emissions, including durable supplies intended for extended reuse, reprocessing of single-use devices, supplies made of recycled content, and products with lower-carbon composition. The section also examines regulatory and institutional barriers to reprocessed and recycled supplies. Section III explores policies and programs to build new markets for low-carbon products, including "Buy Clean" procurement initiatives, environmental product declarations and ecolabeling, and low-carbon product standards. Section IV examines existing healthcare sector and government agency initiatives on medical supply procurement and proposes a broader federal government program to expand the scope of these programs. Section V explores longer-term economy-wide policies to develop innovative new low-carbon materials that could be used for health care medical supplies. Section VI provides conclusions and recommendations.

Emissions from Health Care Supply Chains

Scope 3 emissions are simultaneously the largest source of a hospital's lifecycle emissions and the most difficult component to address because they are largely sources of emissions not controlled directly by health care organizations. Figure 1 depicts the breakdown of emissions by scope for a typical non-profit healthcare system. Purchased goods/services and supply chains represent nearly half of emissions for a typical hospital. Medical supplies—many of which are disposable and incorporate fossil-fuel-derived plastics—also are a significant portion of health care system costs. At the facility level, supply expenses make up around 15 percent of total hospital expenses on average but can be as high as 40 percent in surgery-intensive hospitals.[9]

[9] Abdulsalam, Y., and Schneller, E., Hospital Supply Expenses: An Important Ingredient in Health Services Research, *Medical Care Research and Review: MCRR* 76, no. 2 (Apr. 2019): 240–52.

Figure 1: Healthcare Emissions by GHG Protocol Scope[10]

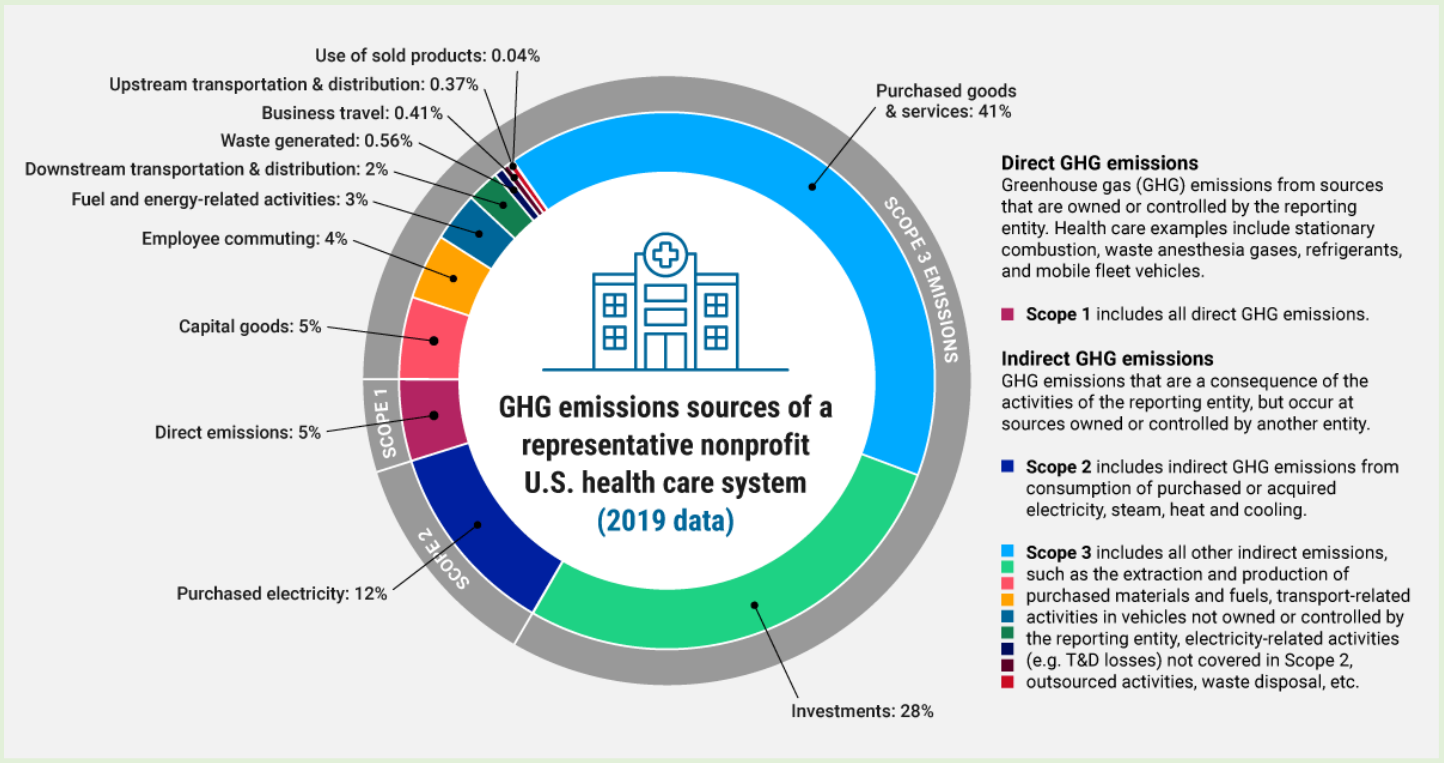


Figure 2 presents a different way to depict health care emissions, ranking emissions by their original sources rather than by GHG protocol category. In other words, to the extent that "every entity's indirect Scope 2 and 3 emissions are other entities' Scope 1 emissions", this depicts the sectors where direct Scope 1 emissions are contributing to the health care sector's indirect emissions (Scopes 2 & 3). This type of direct sector emission inventory also is relevant because federal and state policymakers use sectoral inventories to inform the design of policies that focus on direct emissions sources within their jurisdictions.

Figure 2 shows that direct emissions from industrial sources such as organic chemicals manufacturing, and plastics and resin manufacturing make up 5.6 percent and 2.6 percent respectively of the overall health care GHG footprint. In the health care industry, resins are frequently inputs into plastics used in a broader array of medical devices and products. Beyond the traditional items like surgical gloves, syringes, prosthetics, insulin pens, IV tubes, catheters,

[10] Graphic is from Practice Greenhealth, Scope 3 GHG Emissions Accounting Tool. Note that the percentages for the three scopes are estimates based on a typical non-profit health care system.

and inflatable splints, resins may be used for advanced medical devices including heart valves and components of MRI machines.[11]

As noted in previous papers in this series, this breakdown also shows that economy-wide policies that target the electric power sector are particularly important.[12] Emissions that originate from the generation of electricity contribute to 35 percent of the health care sector's emissions across all scopes. Broader decarbonization of the grid is critical because emissions that originate from electricity generation are by far the largest component of health care greenhouse gas emissions, approximately 7 times larger than the next largest category (see Figure 1), and roughly 35 percent of overall health care sector emissions.[13]

Finally, as described in GCC's paper on transportation and health care[14]emissions from freight, including the transport of medical supplies, are a significant part of HDOs' Scope 3 emissions. Truck transportation is responsible for 4.8 percent of healthcare sector emissions. Federal and state policies can reduce the carbon footprints of trucks that deliver thousands of different types of supplies and products to hospitals and other health care facilities.

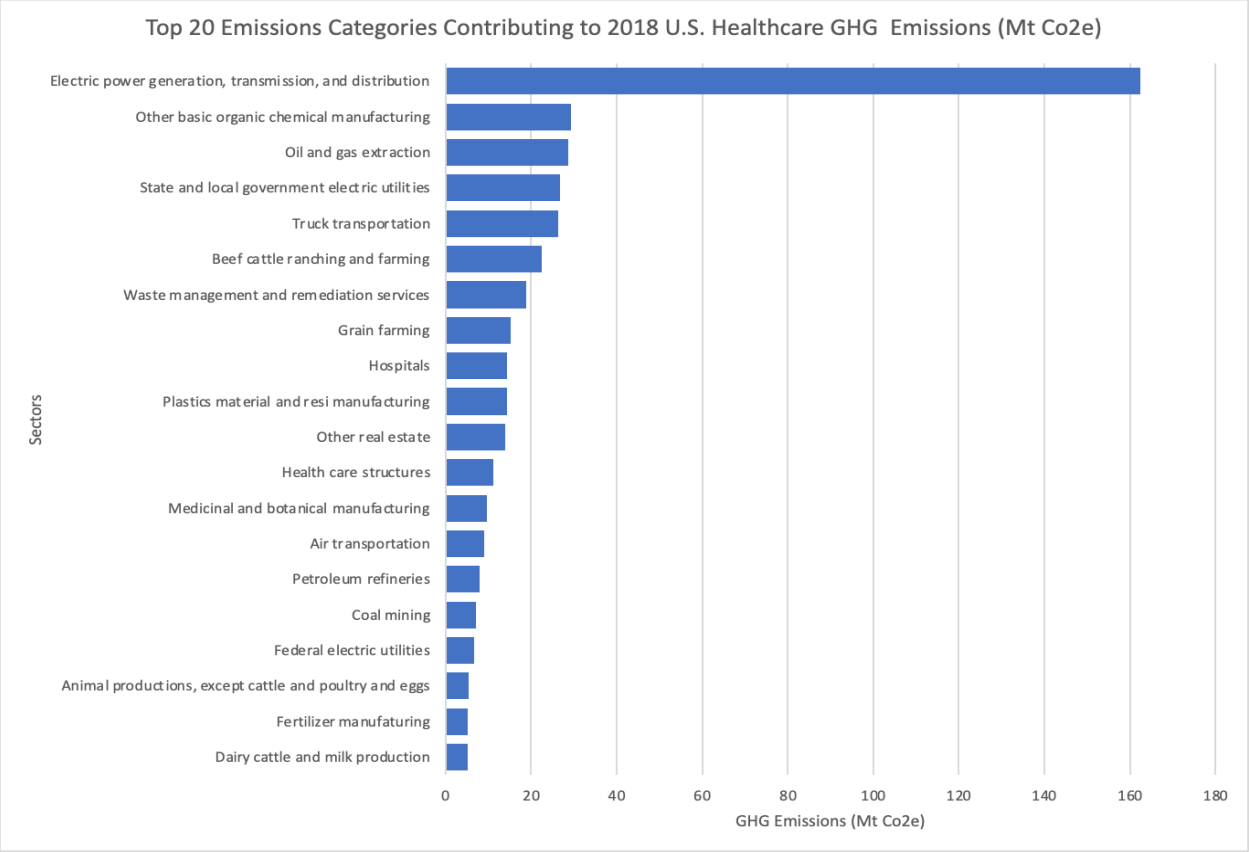
[11] See Nexeo Plastics, Healthcare, and Pradhan, S., Why Resins are Becoming Integral to Healthcare Industry, Industry Outlook.

[12] Georgetown Climate Center (GCC), Report: Energy Policies Are Key to Helping Health Care Delivery Organizations Meet Ambitious Emissions Commitments, April 12, 2023.

[13] Eckelman, Matthew J., et al., Health Care Pollution and Public Health Damage in the United States: An Update, *Health Affairs* 39, no. 12 (Dec. 2020): 2071–79. Note that this 35% statistic differs from the 29% figure that appears in the text of the article. This is because Exhibit 10 in the appendix of the article (available on the journal website) breaks out electricity into three categories, including a category called "electric power generation, transmission, and distribution" with 29.4% of emissions; a category called "state and local government electric utilities", with 4.8% of emissions; and a category called "federal electric utilities'', with 1.2% of emissions. For this paper, we've combined these three categories.

[14] Georgetown Climate Center (GCC), Report: Low-Carbon Transportation Policies Can Reduce Health Care Emissions and Benefit Local Communities, February 8, 2024.

Figure 2: Emissions Categories Contributing to U.S. Health Care GHG Emissions[15]



[15] Eckelman et al. op. cit. Data is from Appendix Exhibit A10.

II. Strategies to Reduce the Greenhouse Gas Footprint of Medical Supplies and Develop Low-Carbon Product Markets

A recent paper by Kaiser Permanente, Health Care Without Harm, and Accenture provides a detailed roadmap to decarbonization of the MedTech supply chain and presents several levers that are intended to lead to new markets for lower carbon medical supplies.[16] This section addresses two important categories: 1) circular economy measures, which increase the durability and reduce waste and energy use through the reuse, recycling, repurposing of medical devices; and (2) efforts to reformulate medical products.[17] A third critical lever, procurement of clean electricity, was addressed in our earlier paper on energy policies and health care.[18]

Circular Economy: Increasing Durability, Reprocessing, and Recycling of Medical Supplies

The U.S. health care sector's increasing dependency on single-use disposable medical devices has created significant environmental and public health concerns, including increased solid waste, energy use, and emissions. An alternative to some single-use devices is a circular economy approach, which EPA defines as "…a systems-focused approach [that] involves industrial processes and economic activities that are restorative or regenerative by design, enables resources used in such processes and activities to maintain their highest value for as long as possible, and aims for the elimination of waste through the superior design of materials, products, and systems (including business models)."[19]

Health care systems and medical device companies have implemented several "circular solutions", including increasing procurement of more durable devices intended for extended reuse, 3rd party reprocessing of single-use devices, and purchasing supplies that have recycled content. Additional circular strategies include reducing packaging and substituting for necessary

[16] Kaiser Permanente, Accenture, Practice Greenhealth, & Health Care Without Harm. Catalyzing Collective Action to Decarbonize Healthcare: Roadmap for Health Systems and MedTech Suppliers, May 2023.

[17] Ibid. Note that we have combined two "Collective Actions'' described in the paper cited above — Takeback Programs and Increased Product Durability — under the umbrella of "circular economy measures."

[18] Georgetown Climate Center (GCC), Report: Energy Policies Are Key to Helping Health Care Delivery Organizations Meet Ambitious Emissions Commitments, April 12, 2023.

[19] US Environmental Protection Agency, What Is a Circular Economy? Overviews and Factsheets, November 3, 2021.

packaging with more sustainable materials, and "take back programs" under which medical device suppliers collect used products for reprocessing or recycling.[20] The following sections explore the two general strategies of reprocessing and recycling medical devices.

Reprocessing Single-Use Medical Devices

Although some durable medical supplies such as surgical tools are routinely sterilized and reprocessed on-site at hospitals, it is also possible to reprocess certain single-use devices (SUDs) through commercial third-party reprocessors. These types of SUDs must be cleared for reprocessing by the Food and Drug Administration (FDA), which provides oversight and regulation of commercial reprocessors.

Reprocessing medical devices provides multiple environmental benefits, including lower GHG emissions and reduced plastics in landfills. Regarding GHG emissions, studies have shown that single-use medical devices use significantly more petrochemicals and have higher greenhouse gas emissions on a lifecycle basis compared to reusable medical devices.[21] Both the National Academy of Medicine's Collaborative on Decarbonizing the U.S. Health Sector[22] and the U.S. Agency for Healthcare Research and Quality (AHRQ) have recommended the expanded use of reprocessing to reduce single-use medical supplies. [23]

Reprocessing often provides potential cost-savings for hospitals. For example, one analysis showed that switching to reusable oximeters—instruments that measure the proportion of oxygenated hemoglobin in the blood—lowered costs by 56 percent.[24] Another study found that reprocessing can save between $600,000 and $1 million annually for a 200-bed hospital and generate even greater savings for larger health systems.[25]

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[20] Kaiser Permanente, Accenture, Practice Greenhealth, & Health Care Without Harm, op. cit.

[21] MacNeill, Andrea J, et al., Transforming The Medical Device Industry: Road Map To A Circular Economy. *Health Affairs* 39, no. 12 (December 2020): 2088–97.

[22] National Academy of Medicine, Key Actions to Reduce Greenhouse Gas Emissions by U.S. Hospitals and Health Systems.

[23] Sampath, B., et al., Reducing Healthcare Carbon Emissions: A Primer on Measures and Actions for Healthcare Organizations to Mitigate Climate Change. (Prepared by Institute for Healthcare Improvement under Contract No. 75Q80122P00007.) AHRQ Publication No. 22-M011. Rockville, MD: Agency for Healthcare Research and Quality; September 2022.

[24] Arciaga, Z., Ackerman, A., Justice, P., et al. Reusable pulse oximetry sensors: A cost-saving quality improvement project, *Quality Management in Health Care* 29, no. 1 (2020): 35–39. Cited in Duffy, J., Slutzman, J. E., Thiel, C. L., & Landes, M., Sustainable purchasing practices: A comparison of single-use and reusable pulse oximeters in the emergency department, *Western Journal of Emergency Medicine* 24, no. 6 (Nov.. 2023): 1034–42.

[25] Becker's ASC Review, How Reprocessing Can Benefit the Environment and Your Surgery Center: Sustainable TechnologiesTM Specialist Shares Strategies, July 11, 2022. Cited in Kaiser Permanente, Accenture, Practice

Institutional, Organizational, and Regulatory Barriers to Reprocessing

There are several organizational, regulatory, and institutional barriers to the expansion of reprocessed medical devices. Many of these barriers stem from the assumption that reprocessed medical supplies are less safe than single use devices, even though some experts believe "there is no compelling evidence that [single-use] devices reduce health care-acquired infections."[26] As discussed below, concerns about reprocessed devices have led the Veterans Health Administration to limit their use. In addition, accreditation and certification bodies for hospitals, such as the Joint Commission, are driven by the assumption that single-use disposables are safer than reprocessed products. To avoid unfavorable accreditor reports, hospitals prefer single-use disposables over reprocessed products.[27] The case for an increase in reprocessing could therefore benefit from additional research to assuage these concerns, which could subsequently lead to cultural and behavioral changes for medical personnel and administrators who are accustomed to single-use devices.

The business models and regulatory regimes faced by original equipment manufacturers (OEMs) also create disincentives to reprocessing devices. This is because OEMs have an incentive to sell a high-volume of disposable supplies to maximize their profits. There is also an asymmetry in the regulatory regimes for reusable vs single-use devices, which provides a cost advantage to marketing a device as disposable.[28]

Finally, the design of medical devices is also a constraint in some cases. Maintenance and reprocessing often are not considered in the design of medical devices. Consequently, many reusable medical devices are difficult to clean, disinfect and sterilize, resulting in them being excluded from the reprocessing chain.[29]

Greenhealth, & Health Care Without Harm. Catalyzing Collective Action to Decarbonize Healthcare: Roadmap for Health Systems and MedTech Suppliers, May 2023.

[26] MacNeill, Andrea J, et al. op. cit.

[27] Ibid.

[28] Ibid.

[29] Branaghan, Russell J., Joseph S. O'Brian, Emily A. Hildebrand, and L. Bryant Foster. 2021. Reusable Medical Devices, Reprocessing, and Design for Maintenance In *Humanizing Healthcare – Human Factors for Medical Device Design*, edited by Russell J. Branaghan, Joseph S. O'Brian, Emily A. Hildebrand, and L. Bryant Foster, 351–65. Cham: Springer International Publishing.

Reprocessing Single-Use Devices in the Veterans Health Administration (VHA)

As the largest integrated health care system in the United States, providing care to over 9 million veterans at 172 VA Medical Centers and 1,138 outpatient sites, the VHA's potential influence over the market for lower-carbon supplies and devices is significant. For this reason, existing policies that limit the adoption and expansion of reprocessing within VHA facilities are worth revisiting. In a memorandum dated February 6, 2015, the VHA determined that single-use devices (SUDs) are defined by the FDA as devices intended for one use or on a single patient during a single procedure and are not designed for reprocessing (cleaning and sterilization for reuse). Consequently, VHA facilities are prohibited from sending or returning used SUDs for reprocessing or reuse, and they cannot reprocess SUDs internally or use SUDs reprocessed by a third party due to patient safety concerns, including infection risks and device failure.

These policies have significantly constrained VHA facilities from adopting reprocessing of SUDs. This is true even though the FDA has reviewed the practice of SUD re-use and created a regulated pathway to ensure that reprocessed SUDs meet the same regulatory standards as original devices.[30] Nevertheless, the VHA prevents its hospitals from using reprocessed SUDs entirely, thereby not realizing the environmental and cost benefits associated with SUD reprocessing.[31]

The prospect of easing VHA's current prohibitive stance on the reprocessing of single-use devices (SUDs) presents a prime opportunity to embrace sustainable health care practices through policy revision. Advancements in reprocessing technologies and stringent FDA regulations offer a viable path for the safe and effective reuse of specific SUDs without compromising high standards for patient safety and device efficacy. To capitalize on the environmental and economic advantages of SUD reprocessing, the VHA could align its policies with those FDA regulations that have already established a comprehensive framework for the safe reprocessing of SUDs. This would require revising the 2015 memorandum to allow for the use of FDA-cleared reprocessed SUDs and developing clear guidelines for their selection, reprocessing, and use. Additionally, fostering collaboration with device manufacturers could reduce the economic incentives to label devices as single-use, ensuring the quality and safety of reprocessed devices in alignment with FDA standards.

[30] Food and Drug Administration (FDA), Final Guidance for Industry and FDA Staff: Reprocessing Medical Devices in Health Care Settings: Validation Methods and Labeling, March 2015.

[31] Association of Medical Device Reprocessors, The Reprocessing Solution: Reducing Greenhouse Gas Emissions and Lowering Healthcare Costs.

Recycling Medical Devices

Hospitals and medical device suppliers have also implemented recycling programs in which medical devices are broken into components and recycled instead of reprocessing and reusing the entire device.[32] The recycling of medical devices primarily involves the recycling of non-contaminated medical plastics and other components from used devices. Most medical instruments are made from plastics, as they are cost-effective, durable, and flexible compared with steel, ceramics, and glass. It is therefore beneficial to recycle plastic-based materials when it is feasible. Some non-plastic wastes also may be recyclable, such as stainless steel used in surgical instruments, medical implants and dental prosthetics collected from the cremation industry, mercury from dental amalgams, and aluminum from waste pharmaceutical blister packaging.[33]

Institutional and Regulatory Barriers to Recycling

Several regulatory and institutional barriers have limited recycling of medical devices. First, regulatory and safety standards may limit the scope of recycling activities for some single-use products. This is particularly true for infectious waste, which is subject to strict regulations for disposal.[34] Second, the inherent complexity of medical devices, which are often made from composites that are difficult to disassemble, poses a substantial challenge. Recycling these materials involves navigating through primary, secondary, tertiary, and quaternary recycling pathways, each with unique challenges. Primary recycling is generally infeasible due to the quality requirements of medical-grade plastics, while secondary recycling processes can degrade the polymers. Tertiary and quaternary recycling, involving chemical breakdown and energy recovery respectively, offer potential yet are constrained by technological and environmental limitations.[35]Third, there may be a lack of infrastructure to collect recyclable materials, such as packaging.[36] However, clinical plastics are typically high-grade and provide the opportunity to recover embedded materials.[37] Finally, cost concerns of the healthcare sector often overshadow the potential benefits of sustainable practices such as recycling. Investments in sustainability are

[32] Kaiser Permanente, Accenture, Practice Greenhealth, and Health Care Without Harm. op. cit.

[33] Kheirabadi, S., & Sheikhi, A., Recent Advances and Challenges in Recycling and Reusing Biomedical Materials. *Current Opinion in Green and Sustainable Chemistry* 38 (Dec. 2022): 100695.

[34] US Environmental Protection Agency, Medical Waste. On the other hand, there is some evidence that waste that is recyclable is sometimes included unnecessarily in the infectious waste stream. See Kane, G.M., C.A. Bakker, and A.R. Balkenende. Towards Design Strategies for Circular Medical Products. *Resources, Conservation and Recycling* 135 (Aug. 2018): 38–47.

[35] Kheirabadi, S., & Sheikhi, A. op. cit.

[36] MacNeill, Andrea J, et al. op. cit.

[37] Ibid.

viewed as costly, although they can be justified by long-term savings and environmental benefits.[38] Despite the challenges, many health care systems have successfully secured recycling vendors for clinical materials, demonstrating that these barriers can be overcome.[39]

Changing the Composition of Products

Developing and adopting lower-carbon products through changes in materials or manufacturing techniques could be one of the most effective strategies for reducing GHG emissions, but it may also have the longest timeline.[40] As noted in the Roadmap for Health Systems and MedTech Suppliers:

"Much of a product's carbon footprint comes from its raw materials and manufacturing, so addressing this directly is likely to have a major impact on emissions."[41] On the other hand, "New product composition takes significant time and investment and some products may be subject to regulatory approval."[42]

One possible way to address the significant emissions posed by single use plastic devices is procuring medical devices made from sustainable bioplastics, which may have lower embedded carbon emissions and may cause less environmental harm. Bioplastics are a diverse family of materials with differing properties whose carbon can be sourced from biological resources including starch, sugar, or cellulose. Different types of bioplastics vary in the extent and speed with which they break down into non-toxic components.[43]

Although they may displace fossil-fuel based plastics, some types of bioplastics may have drawbacks depending on how they are formulated. Bioplastics sourced from food crops are resource intensive, requiring large amounts of land, water, and energy to transform biomass into bioplastics. According to Dr. Neus Escobar from the Institute of Food and Resource Economics at the University of Bonn, "[t]he production of bioplastics in large amounts would change land use globally" which "could potentially lead to an increase in the conversion of forest areas to arable land" since "the increasing demand for the "'green" energy sources has brought massive

[38] FutureBridge. Sustainability in the medical device industry.

[39] Dixit, Varun, Praveen Kalra, Alexandra Ruan, and Brian B. Chesebro. Plastics in Health Care: Crisis or Opportunity?, *ASA Monitor* 84, no. 4 (April, 2020): 30–33., as cited in MacNeil A., et al., op. cit.

[40] Kaiser Permanente, Accenture, Practice Greenhealth, and Health Care Without Harm, op.cit.

[41] Ibid.

[42] Ibid.

[43] SAE Media Group, Disposables drive the rise of bioplastics in the healthcare industry, (May 19, 2021).

deforestation to some countries across the tropics.[44] Bioplastics also may rely on commercial or industrial level composters in order to break down fully.[45] Without adequate composting infrastructure, bioplastics may remain in landfills for a comparable time as traditional plastics.

On the other hand, there are new types of bioplastics under development that may address some of the traditional drawbacks. For example, the U.S. Department of Energy announced a grant in January 2024 to a Palo Alto based company — ReSource Chemical Corporation, which is scaling up a process for making plastic out of inedible biomass residues. This technology consumes CO_2, uses only water as a solvent, and simplifies process steps. The company believes its technology "could enable cost parity compared to the current state-of-the-art production process and reduce carbon intensity by 85 percent over fossil derived alternatives."[46]

III. Policies and Programs to Build Low-Carbon Product Markets

Reducing the indirect emissions from supply chains is challenging for most economic sectors and healthcare is no exception. Fortunately, there is an evolving body of experience building demand for green product markets in general, and health care in specific. This section will describe some of the key challenges and will discuss how procurement and other practices have been used in health care and in other sectors to build low-carbon product markets.

Overcoming Barriers to Low-Carbon Product Markets

HDOs and other sectors looking to reduce the GHG impacts of the supply chain face many challenges. These include:

- A lack of transparent product-level emissions data and life cycle analyses;
- Insufficient support from suppliers;
- Low availability of low-carbon products and technologies; and
- Higher costs from a "green premium."[47]

[44] Science Daily, More bioplastics do not necessarily contribute to climate change mitigation, December 7, 2018.

[45] Waste Management World, Composting: Bioplastics and Composting: Not a Love Match, Mar 15, 2023.

[46] US Department of Energy, Funding Selections: FY23 Industrial Efficiency and Decarbonization Multi-Topic FOA.

[47] Dryden Group (Procurement & Purchasing Consulting Firm), 6 Challenges of Sustainable Procurement.

While these barriers can create delays in adoption of green technologies, over time, barriers can be addressed by a variety of policies and practices. The following section discusses approaches used in the health care and other sectors to create a market for new low-carbon products.

Drivers to Create Demand

Company or Organization Procurement of Low-Carbon Products

Changes in institutional systems and incentives for procurement of goods and services can be used to develop markets for low-carbon products by creating demand, driving innovation, and supporting low-carbon supply chains. These efforts can help companies or organizations reduce their supply chain emissions while also driving market transformation towards more sustainable products. These types of procurement programs may be pursued by individual companies, collectively by multiple companies, or through government procurement initiatives (as discussed below).[48] Typically, procurement programs set requirements or specifications for the purchase of goods and services. Standards are based on environmental criteria, such energy efficiency, recycled content, or embedded carbon content. In some cases, these programs require environmental product declarations (EPDs), which "transparently report objective, comparable and third-party verified data about products and services' environmental performances from a lifecycle perspective."[49]

For HDOs, the Sustainable Procurement in Health Care Guide developed by Practice Greenhealth, Health Care Without Harm, and Global Green and Healthy Hospitals offers step-by-step instructions on how to work through each step of this process, including how to engage with suppliers in the pre-purchasing, purchasing, and post-purchasing phases[50] and engage internal stakeholders including leadership, procurement and sustainability teams, clinicians, facility and administrative staff, and market departments.[51] The guide also discusses how to introduce or support sustainability practices within group purchasing organizations (GPOs), which are intermediaries "that help health care providers—such as hospitals, nursing homes and home health agencies—realize savings and efficiencies by aggregating purchasing volume and using that leverage to negotiate discounts with manufacturers, distributors and other vendors."[52] The

[48] EPA has compiled a compendium of "some of the leading sources of sustainable purchasing guidance around the globe." See EPA, Sustainable Purchasing Program Guidance: A Landscape Scan of Available Resources.

[49] The International EPD System, Environmental Product Declarations.

[50] Practice Greenhealth, Sustainable Procurement in Health Care Guide.

[51] Ibid.

[52] Ibid.

role of GPOs in procurement is critical as 72 percent of purchases made by hospitals are done through GPO contracts.[53]

Government Procurement Programs

Public sector sustainable procurement programs, sometimes called "Buy Clean" programs, may provide a framework or model for future public procurement efforts for medical devices in the health care sector. These initiatives, which are used by government agencies at the federal, state, and local levels, prioritize the procurement of goods and services that have lower environmental impacts, including reduced lifecycle carbon emissions. The goal is to leverage the significant purchasing power of government entities to drive market demand for sustainable products, thereby supporting the growth of green industries and technologies. Public procurement programs can have multiple benefits, including reducing the environmental footprint of government operations, helping decision-makers get used to sustainable purchasing, *and* stimulating the market for low-carbon products. In some cases, governments can create demand at a scale that will stimulate production and drive down the price of low-carbon products over the long-term.[54] These programs can also provide a reputational boost to a product, which can facilitate market penetration.[55]

The Inflation Reduction Act (IRA)[56] included provisions to boost federal and private procurement of low-carbon construction materials, including:

- $3.375 billion for GSA to invest in federal buildings to help reduce carbon emissions and catalyze innovation, primarily by acquiring and installing low embodied carbon (LEC) materials (e.g., asphalt, concrete, steel, and glass) for construction projects.
- $2.0 billion for the Federal Highway Administration (FHWA) to provide Low-Carbon Transportation Materials Grants to state and local governments for low-carbon construction materials.

[53] Healthcare Supply-Chain Association, A Primer on Group Purchasing Organizations, Questions and Answers.

[54] Tal, A., "Public Procurement (Chapter 7)", Making Climate Tech Work: Policies That Drive Innovation, Island Press, 2024.

[55] Baron,R. The Role of Public Procurement in Low-carbon Innovation, 33rd Round Table on Sustainable Development, 12-13 April 2016, OECD Headquarters, Paris.

[56] The IRA, which was signed into law on August 22, 2022, provides $370 billion in investments in clean energy and pollution reduction through a variety of tax credits, grants, and other mechanisms. See The White House, Inflation Reduction Act Guidebook.

- $350 million for grants, technical assistance and tools, including carbon labeling, to help manufacturers, institutional buyers, real estate developers, builders and others measure, report and lower embodied GHG emissions in construction materials and products.

Meanwhile, there are additional public procurement and related initiatives worth noting. For example, 13 states have committed to work with the federal government on "procurement of lower-carbon infrastructure materials in state-funded projects, and to collaborate with the Federal government and one another to send a harmonized demand signal to the marketplace."[57] In addition, the General Services Administration (GSA), which provides centralized procurement for the federal government, tracks climate change disclosures of large federal government contractors.[58]

Federal Procurement and the Health Care Supply Chain

While the public procurement initiatives cited above may provide useful models for future initiatives in the health care sector, there is an existing set of federal regulations–the Federal Acquisition Regulation (FAR) Part 23—which could be used to spur additional low-carbon procurement at the Veterans Health Administration. This directive, which applies broadly across most federal acquisitions, took effect in May 2024. It incorporates additional sustainability provisions, including:

- **Life-cycle Cost Considerations**: The rules were revised to clarify that agencies should "consider the life-cycle cost of any sustainable product or service, when considering whether the sustainable product or service can be procured at a reasonable price." This may encourage the VHA to consider procurement of more durable and efficient medical devices that could reduce long-term costs and environmental impact.
- **Applicability to Subcontractors:** Although the rule doesn't apply directly to subcontractors, it does hold the prime contractors working with government agencies responsible for meeting sustainability requirements in a contract, regardless of whether the product or service is provided by a subcontractor or a prime contractor.[59] This could lead to stricter oversight and modifications in subcontractor agreements to ensure all parties meet the sustainability standards mandated by VHA contracts.
- **Standards and Ecolabels:** The revised rule requires agencies to identify the standards and ecolabels that are applicable to the acquisitions and provides a process for agencies to

[57] Office of the Federal Chief Sustainability Officer, Federal Buy Clean Initiative.

[58] Government Services Administration, GSA Federal Contractor Climate Change Risk Management Scorecard, updated April 12, 2024.

[59] Sardo, M., Enhanced Sustainability Requirements for Federal Contractors, Insights, Jones Day.

document when the EPA recommendations do not meet reasonable performance requirements. As a result, VHA's procurement processes must be aligned with the most relevant eco-labels or environmental standards, which could include any future ecolabels developed for medical supplies.

Although the Department of Veterans Affairs (VA) currently does not have a low-carbon medical device procurement program, it has been very active on sustainable procurement in other categories, aligning its purchasing strategies with environmental and energy efficiency standards.[60] As of Fiscal Year 2022, the VA had undertaken several priority actions to enhance its sustainable procurement practices[61]:

1. **EPEAT Standard Compliance:** The VA successfully ensured that all personal computers, displays, imaging equipment, and televisions purchased in FY 2021 met the Electronic Product Environmental Assessment Tool (EPEAT) standard. This initiative underscores the VA's dedication to environmental sustainability by acquiring products that offer significant environmental, energy, and climate-related benefits.

2. **Sustainable Acquisition Training:** The VA conducted sustainable acquisition training for the staff within the Office of Small and Disadvantaged Business Utilization. This training is designed to equip purchasers with the knowledge necessary to fulfill the requirements of Executive Order (EO) 14057 and other statutory mandates for sustainable acquisition.

3. **Investment in Energy-Efficient Infrastructure:** In line with EO 14057 and relevant statutory requirements, the VA plans to purchase over 100 ENERGY STAR certified solar Electric Vehicle Supply Equipment (EVSE) units. This investment supports the deployment of Zero-Emission Vehicles (ZEVs) across the VA's fleet, contributing to energy conservation and emission reduction goals.

Extending these types of sustainability approaches to medical supplies has the potential to accelerate development and adoption of lower carbon alternatives across the entire HDO sector.

[60] US Department of Veterans Affairs, Energy, Environment, and Fleet Program.

[61] U.S. Department of Veterans Affairs, Sustainability Plan, Oct. 2022.

Offtake Agreements and Advanced Market Commitments

Governments or private entities can also create demand in new markets through offtake agreements and advance market commitments. Under an offtake agreement, the buyer agrees to buy a specific quantity of an existing product at an agreed-upon price over some period of time.[62] For example, in 2021, British Airways signed a deal with LanzaJet, a low-carbon jet fuel company, for 7500 tons per year of a fuel additive that will reduce GHG emissions by 70 percent compared to traditional jet fuel. [63]

Advance market commitments are "contractual agreements for the future purchase of products that are still under development." These agreements guarantee a buyer for new and innovative products when they are ready to be sold.[64] This strategy has been used by Frontier, a group of companies that have committed to purchasing just over $1 billion worth of permanent carbon removal between 2022 and 2030.[65] Governments can also pursue AMC agreements. For example, the U.S. and other governments agreed to buy billions of doses of COVID-19 vaccines at specific prices during the recent worldwide pandemic.[66]

Collaboration with Suppliers

The structure of the healthcare supply chain itself is complex, and there may be multiple suppliers for a single product. Broadly speaking, raw materials are extracted and sent to a manufacturer.[67] Within the category of "manufacturers," there may be several layers of suppliers. Generally, Tier 3 suppliers turn raw materials into parts, Tier 2 suppliers turn those parts into components, Tier 1 suppliers turn these components into a module or system, and the original equipment manufacturer (OEM) turns these modules/systems into a manufactured product.[68]

The literature on reducing Scope 3 emissions stresses the need for companies to collaborate with key suppliers and OEMs on emissions tracking and data sharing for specific products. Often this requires partnering with multiple companies within the supply chain and "building a community

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[62] Bipartisan Policy Center, Kickstart Markets for Clean Energy Technologies | A Newbie's Guide to Demand-Side Support, Jan. 2024.

[63] Ibid. Also see, TechCrunch, LanzaJet Inks Deal with British Airways for 7,500 Tons of Low-Emission Fuel Additive per Year, February 9, 2021.

[64] World Resources Institute, How Advance Market Commitments and Contracts for Difference Can Help Create a Market for Green Industrial Products, November 2, 2023.

[65] WRI, op cit. Also see Frontier.

[66] Rissman, J., op cit.

[67] Procurement Partners, Healthcare Supply Chain: Everything You Need to Know.

[68] Insight Solutions, What is a Tier 1 Company or Supplier?

of experts across companies."[69] This type of collaboration on emissions data is critical because access to emissions data from suppliers is not under a company's control. It can be very difficult for purchasers to influence lower-tier suppliers farther down the supply chain, and higher standards for higher-tier suppliers don't necessarily "cascade" down, particularly if procurers place demands on suppliers that are difficult or impossible to meet without compromising ethical or sustainable principles.[70] There also may be barriers to this type of collaboration, including contractual limits on suppliers for re-sharing data that is part of their own Scope 3 emissions to the next tier of the supply chain. In some cases, there may also be differences in emissions measurement methodologies along a supply chain or concerns that sharing data will reveal sensitive competitive data about a product.[71]

As will be discussed in the next section, breaking down these types of barriers in the health care supply chain is an important goal of the recently launched Collective Healthcare Action to Reduce MedTech Emissions (CHARME) initiative. The initiative convenes health systems, medical device and equipment suppliers, distributors, GPOs, and other stakeholders "to define, implement, and champion best practices to reduce emissions from the MedTech supply chain."

In addition to collaboration with key suppliers and medical device OEM's, it may be advantageous for health care systems and their suppliers to begin to engage with producers who are developing the next generation of low-carbon materials. An analysis by the World Economic Forum and Boston Consulting Group found that at least initially, the demand for low carbon materials, including chemicals and plastics, could be greater than the available supply. They note:

"Across most major value chains, the market share of downstream players with science-based decarbonization commitments far surpasses the share of upstream players who would need to supply green materials to achieve these commitments. […] Downstream companies will need to rethink procurement to strategically secure and develop supply."[72]

A McKinsey & Company analysis found that the scarcity applies to the market for high quality recycled plastics, which "is expected to remain undersupplied until 2030 and likely beyond because of rapidly growing demand and limitations in proper collection and sorting infrastructure, leading to significant premiums, depending on the plastic grade."[73]

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[69] Spiller, P., Making supply-chain decarbonization happen. McKinsey & Company, June 2021.

[70] Harvard Business Review, A More Sustainable Supply Chain.

[71] Stenzel, A., & Waichman, I. Supply-Chain Data Sharing for Scope 3 Emissions. *Npj Climate Action* 2, no. 1 (March 13, 2023): 1–7.

[72] World Economic Forum, Winning in Green Markets: Scaling Products for a Net Zero World.

[73] McKinsey, Capturing the green-premium value from sustainable materials.

Ecolabels

Environmental Protection Agency (EPA) defines ecolabels as "marks placed on product packaging or in e-catalogs that can help consumers and institutional purchasers quickly and easily identify those products that meet specific environmental performance criteria and are therefore deemed "environmentally preferable".[74] Ecolabels have several benefits for supply chain decarbonization efforts. First, they can increase transparency about the environmental impacts of products, which can provide consumers with better information to make informed purchasing decisions. Second, ecolabels can spur companies and manufacturers to reduce the emissions embedded in products through technological innovation and can give them the ability to differentiate their products through a certification by a third party.[75] Third, ecolabeling can foster collaboration and better environmental performance along a supply chain as manufacturers and suppliers share data and practices.[76]

Notable examples of ecolabels in the United States include:

- **ENERGY STAR** was launched in 1992 by the EPA as a performance-based standard and ecolabel to guide consumers towards more sustainable purchasing decisions for appliances and other electronic devices.[77] ENERGY STAR also sets energy efficiency standards for commercial buildings and industrial facilities. Many health care facilities participate in ENERGY STAR and use tools or programs to track energy performance, plan upgrades, and get recognition for meeting energy efficiency goals.[78] Although it is difficult to separate ENERGY STAR benefits from overlapping regulatory and electric grid developments, the EPA estimates that in 2020 alone, the ENERGY STAR program reduced GHG emissions by 400 million metric tons and reduced consumer energy costs by $42 billion. [79] About 90 percent of U.S. households recognize the ENERGY STAR label.[80]

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[74] US EPA, O. Introduction to Ecolabels and Standards for Greener Products, December 5, 2014.

[75] Iraldo, F., Griesshammer, R. and Kahlenborn, W. The Future of Ecolabels. The International Journal of Life Cycle Assessment 25, no. 5 (May 1, 2020): 833–39.

[76] Tachizawa, E.M., Gimenez, C. and Sierra, V., Green supply chain management approaches: drivers and performance implications, *International Journal of Operations & Production Management*, Vol. 35, no. 11, (Nov. 2015), pp. 1546-1566.

[77] ENERGY STAR, ENERGY STAR

[78] ENERGY STAR, Healthcare: An Overview of Energy Use and Energy Efficiency Opportunities

[79] U.S. EPA, ENERGY STAR Impacts.

[80] U.S., EPA, ENERGY STAR Awareness.

- **Leadership in Energy and Environmental Design (LEED)** provides third-party certification of a building's green design features and provides a global standard for eco-friendly construction.[81] LEED has certification provisions for healthcare projects that address special features of hospitals and other health care facilities, including round-the-clock operation, ventilation needs, and high electric load from equipment. Globally, there were nearly 4,000 LEED-certified health care projects as of March 2024.[82]
- **Electronic Product Environmental Assessment Tool (EPEAT)** is a global ecolabel for the IT sector, developed by using a grant from EPA and owned and managed by the Global Electronics Council (GEC). EPEAT helps purchasers, manufacturers, resellers, and others buy and sell environmentally preferable electronic products through setting environmental performance criteria, including materials selection, supply chain greenhouse gas emissions reduction, design for circularity and product longevity, and energy efficiency.[83] Healthcare facilities can use EPEAT to purchase electronic products from computers, displays, medical imaging equipment[84], printers and other equipment.

[81] U.S. Green Building Council, LEED data trends from the past five years., Oct 12, 2022.

[82] U.S. Green Building Council, Applying LEED to healthcare projects.

[83] US Environmental Protection Agency, Electronic Product Environmental Assessment Tool (EPEAT).

[84] In July 2022, the GEC published State of Sustainability Research for Medical Imaging Equipment, which provides a detailed life-cycle assessment and climate impact of medical imaging equipment.

IV. Voluntary Health Care Sector Initiatives to Reduce Supply Chain Emissions

Many HDOs are working to reduce their supply-chain GHG emissions through internal procurement processes and broader initiatives, including the National Academy of Medicine (NAM) Action Collaborative on Decarbonizing the U.S. Health Sector,[85] the Climate Excellence Standard for Health Sector Suppliers,[86] and The Collective Healthcare Action to Reduce MedTech Emissions (CHARME) collaborative.[87] While not the focus of this paper, there are also valuable international examples of initiatives to reduce supply chain emissions, including the United Kingdom's National Health Service Supplier Roadmap (see text box). This section will describe how the health care sector is using these approaches to develop transparent emission data and low-carbon procurement practices for medical technology and supplies. We will then propose a broader, voluntary federal government initiative that would expand the reach of these programs and provide ecolabeling for selected medical supplies.

Health Care Sector Supply Chain Initiatives

National Academy of Medicine Action Collaborative on Decarbonizing the U.S. Health Sector (Climate Collaborative)

The Climate Collaborative, co-chaired by the National Academy of Medicine (NAM), the Department of Health and Human Services' Office of Climate Change and Health Equity, UnitedHealth Group, and Cardinal Health, operates as a public-private partnership. It engages over 60 leaders from various sectors, including the federal government, biomedical and pharmaceutical industries, hospital systems, private insurers, health professions, and civil society. These stakeholders work together to create and execute a unified action plan aimed at reducing the health sector's carbon footprint and enhancing its resilience.[88] The Climate

[85] National Academy of Medicine, Action Collaborative on Decarbonizing the U.S. Health Sector, accessed February 22, 2023.

[86] Health Care Without Harm.

[87] Sustainable Purchasing Leadership Council, Collective Healthcare Action to Reduce MedTech Emissions (CHARME) Launch, April 10, 2024.

[88] National Academy of Medicine. op. cit.

Collaborative has also done focus groups with patient advocacy groups and community-based organizations to understand perspectives from patients and communities.[89]

One of the Collaborative's four key areas of focus is healthcare supply chain and infrastructure, which is concentrating on identifying and leveraging opportunities to diminish the health care supply chain's carbon footprint and bolster its resilience. This includes fostering sustainable innovation across services, product manufacturing, packaging, and distribution. This working group has created the Sustainability Journey Map & Resource Repository. This tool is designed to support healthcare suppliers, regardless of their size, industry, or stage in meeting sustainability goals. It provides a roadmap and access to resources, best practices, and toolkits aimed at facilitating the decarbonization process.[90] It includes a focus on Scope 3 emissions, which is intended to help health care systems and suppliers focus on measuring, setting goals, and implementing strategies to address supply chain emissions beyond their direct control.

Climate Excellence Standard for Health Sector Suppliers[91]

The Climate Excellence Standard, set forth by the U.S. Health Care Climate Council through Practice Greenhealth, defines superior performance by medical device suppliers on emissions transparency and decarbonization. This standard provides a framework for health care suppliers, health care systems, and GPOs to enact substantial environmental improvements across their operations and supply chain. The standard can be used to showcase suppliers that are leaders on setting net-zero targets and measuring and disclosing their emissions. In addition, some or all of the elements of the standard can be incorporated into the procurement process by health systems or GPOs. Following are some of the highlights of the program requirements, which will be implemented in two phases:

- **Phase 1 (2023-2025)**
    - **Emissions Target:** Organizations must have submitted a science-based emissions reduction target to SBTi for approval, or have publicly committed to submit a target to the Science Based Targets Initiative (SBTi).
    - **Emissions Measurement Disclosure, and Verification:** If participants do not have and SBTi plan submitted or approved, they must (1) publicly commit to a science-based target (as defined by SBTi); (2) measure their Scope 1, 2, and 3 emissions with the

[89] National Academy of Medicine, Understanding Perspectives on Decarbonizing the Health Sector: Full Activity Overview, July 2023.

[90] National Academy of Medicine, Sustainability Journey Map.

[91] Practice Greenhealth, Climate Excellence Standard for Health Sector Suppliers.

Greenhouse Gas Protocol; (3) disclose their emissions through recognized and publicly accessible platforms; and (4) assure Scopes 1 and 2 emissions data through third-party verification.

- **Carbon Offsets:** Use of carbon offsets[92] is limited to emissions that "currently do not have a realistic, practical solution (applicable through 2025 only).
- **Reduce Operational Emissions:** Organizations must develop and publicly share a plan to cut operational emissions (Scope 1 & 2) and certain Scope 3 emissions categories (e.g., staff commuting, business travel).
- **Vendor Engagement:** Organizations incentivize major vendors and subcontractors (at least 20 percent of spend) to commit to science-based targets and meet other requirements described above.

- **Phase 2 (Starting 2026):** The existing elements of the standard will be evaluated and the standard may add the elements below and possibly other provisions:
  - Continuation of Phase I requirements;
  - Providing dates when suppliers will have a SBTi-aligned plan to limit the use of offsets to not more than 10 percent of emissions;
  - Providing emission factors for products representing 20 percent of revenue within each business unit (by 2028);
  - Reducing single-use plastics by promoting sustainable, non-toxic products that are part of a circular system;
  - Preparing, executing, and disclosing resilience plans with climate and environmental considerations; Plans should build in considerations to produce and deliver products with minimal disruption due to man-made or natural disasters. Incorporate climate resilience tactics into annual strategic decision-making, policies, pay bonuses, and the organization's mission statement.

[92] MIT's Climate Portal defines carbon offsets as follows: "Carbon offsets are tradable "rights" or certificates linked to activities that lower the amount of carbon dioxide (CO_2) in the atmosphere. By buying these certificates, a person or group can fund projects that fight climate change, instead of taking actions to lower their own carbon emissions. In this way, the certificates "offset" the buyer's CO_2 emissions with an equal amount of CO_2 reductions somewhere else." Carbon offsets have been controversial and the use of offsets to meet corporate net zero targets raise measurement, equity, and other issues. See Gurgel, A., Carbon Offsets, MIT Climate Portal for a general overview of the issues and Freedman, A., Emissions standards group roiled by carbon controversy, Axios, April 12, 2024 for a description of a recent controversy over using offsets to address Scope 3 emissions under the Science-Based Targets Initiative (SBTi).

- Reducing transportation emissions across supply chain through various methods; and
- Annual disclosure of the organization's major actions taken to create a sustainable, closed-looped, and resilient supply chain.

UK National Health Service (NHS) Supplier Roadmap[93]

The UK's National Health Service (NHS) has developed a Supplier Roadmap, which emphasizes the critical role of suppliers in achieving its' net-zero national emissions goals by 2045. This initiative includes a focus on sustainable procurement and requires the following features:

From April 2023/24: For all new contracts exceeding £5 million annually, suppliers are required to publish a Carbon Reduction Plan covering their UK Scope 1 and 2 emissions, and a subset of scope 3 emissions as a minimum. Starting April 2024, this requirement will extend proportionally to all new procurements.

From April 2027: All suppliers will be required to publicly report targets, emissions and publish a Carbon Reduction Plan for global emissions aligned to the NHS net zero target, for all their Scope 1, 2 and 3 emissions.

From April 2028: New requirements will be introduced overseeing the provision of carbon footprinting for individual products supplied to the NHS. The NHS will work with suppliers and regulators to determine the scope and methodology.

The Collective Health Care Action to Reduce MedTech Emissions (CHARME)

The Collective Healthcare Action to Reduce MedTech Emissions (CHARME) initiative, launched in April 2024, will implement a two-year plan to encourage collaborative efforts to take decarbonization actions on renewable energy, product innovation, product utilization and engagement with clinicians and clinical staff, and transportation and logistics.[94]

The initiative will implement the findings and recommendations of a paper published in 2023 by Kaiser Permanente, Health Care Without Harm, and Accenture, with input from over 30

[93] National Health Service, Greener NHS, Suppliers.

[94] Sustainable Purchasing Leadership Council, Collaborative for Healthcare Action to Reduce MedTech Emissions (CHARME).

organizations.[95] The participating health systems included hundreds of hospitals from across the country, and the suppliers included MedTech companies representing over $1 trillion in annual revenue.[96]

Proposed Federal Voluntary Program for Health Care

The health care initiatives discussed above are designed to expand the data sharing and collaboration necessary for low-carbon procurement in the health care sector. These initiatives could be further broadened through a new federal voluntary program that would provide the resources and scope to reach beyond the leading health care systems and medical device suppliers involved in the initiatives discussed above. This new program could be led by the Department of Health and Human Services through the Office of Climate Change and Health Equity (OCCHE) and possibly in conjunction with EPA. It should be developed collaboratively with health care organizations and medical suppliers and should build on data and best practices from the existing collaborative initiatives. For this type of federal initiative to be effective, policymakers would need to provide the funding and resources necessary to establish and sustain it. In addition, the participation and leadership of the VHA in this effort is critical and would further accelerate low-carbon procurement.

A national program could be modeled on some of the same design elements as the ENERGY STAR Program and other successful voluntary initiatives. For example, the new program should have the following components:

- Technical assistance on low-carbon medical supplies;
- Development of voluntary standards for low-carbon products;
- Ecolabeling for qualified supplies, including low-carbon single use products and reprocessed or recycled products; and
- Third-party certification requirements for medical devices to receive the ecolabel designation.

[95] Kaiser Permanente, Accenture, Practice Greenhealth, & Health Care Without Harm. Catalyzing Collective Action to Decarbonize Healthcare: Roadmap for Health Systems and MedTech Suppliers, May 2023.

[96] PR Newswire, Collective Healthcare Action to Reduce MedTech Emissions (CHARME) tackles emissions-intensive health care supply chain, April 9, 2024.

V. Supporting Low-Carbon Materials for Health Care Supply Chains

This section explores how broader efforts to decarbonize primary materials in the industrial sector will be critical for supply chain decarbonization in the health care sector. Specifically, we explore how technologies and policies aimed at reducing carbon emissions in industrial processes can help mitigate the carbon footprint of hospitals and health care systems. Although other primary materials are a part of the HDO supply chains (e.g., cement and steel for construction), this section will focus on chemicals, which are the most significant category of materials for medical supplies and technology. As noted in Figure 2, direct emissions from industrial sources such as organic chemicals manufacturing and plastics and resin manufacturing make up 5.6 percent and 2.6 percent respectively of the overall GHG footprint of the U.S. health care sector.

The chemical sector is energy-intensive and relies heavily on fossil fuels for feedstocks and energy, making decarbonization challenging but necessary. Globally, chemicals make up 10 percent of final energy consumption.[97] Plastics make up about 40 percent of chemical industry products by mass. Industrial decarbonization expert Rebecca Dell summarizes and breaks down industrial emissions as follows: "there are about 10 chemicals that are basically the precursors for two products—plastic and fertilizer—that dominate those emissions. You can think of this in four product categories: cement, steel, plastic, and fertilizer. Just making those materials is responsible for two-thirds of all the GHG emissions from the entire industrial sector."[98]

Decarbonizing the chemical sector is a critical step in achieving overall global GHG reduction goals, and efforts to decarbonize the health care supply chain can be an important component of national and international strategies for chemical industry decarbonization.

Chemicals have diverse production processes and a full discussion of technologies and strategies for decarbonizing the chemical industry is beyond the scope of this paper. Nevertheless, several recent analyses have put forward technology roadmaps to help the chemical industry reduce its

[97] IEA, World Energy Balances Data Service, updated April 2023, cited in Rissman, J., Zero Carbon Industry, Transformative Technologies and Policies to Achieve Sustainable Prosperity, Columbia University Press, 2024. Final energy consumption is the total energy consumed by end users, such as households, industry and agriculture. See Glossary: Final energy consumption.

[98] Roberts, D., Volts Podcast: Rebecca Dell on Decarbonizing Heavy Industry, February 11, 2022.

carbon footprint and transition to net zero emissions.[99] In general, these analyses have highlighted the following technology levers to reduce CO_2 emissions in the chemical sector:

- **Phase out fossil fuels for steam generation and ramp up carbon-free heat source technologies,** including on-site renewable energy and zero-carbon electrification
- **Decrease energy waste and increase energy efficiency**, including implementing heat integration, process optimization, and waste heat recovery systems
- **Increase materials efficiency or substitute new materials**, including optimizing material use and reducing waste generation through innovative design and production processes. This includes substituting traditional materials with lower-carbon alternatives like bio-based plastics, recycled plastics, or alternative chemicals with lower environmental impacts. For example, shifting to feedstocks such as agricultural residues can help reduce the sector's reliance on petroleum-based raw materials.
- **Use circular economy approaches**, which include—as discussed above—designing products and processes that minimize waste and enable the reuse, recycling, or repurposing of materials. For example, technologies for recycling can break down plastics and other materials into their basic building blocks for reuse in manufacturing.
- **Capture CO_2 emissions** during chemical production to store underground or use in additional products
- **Use "green hydrogen,"**[100] which, for some chemical industry processes, could be a cost-effective feedstock to reduce carbon dioxide emissions.

These strategies are not mutually exclusive—a combination of approaches will be necessary to achieve significant decarbonization in the chemical sector. That said, many of these strategies are promising but at the early stage of development. Significant investment and innovation will be necessary over the coming years to drive decarbonization in the chemical industry. This investment will only come if there are significant new markets for products made with low-carbon chemicals.

While economy-wide industrial decarbonization by definition would require action at a scale much larger than health care supply chain decarbonization, the two issues are linked. As a recent

[99] See Rissman, J., Zero Carbon Industry, Transformative Technologies and Policies to Achieve Sustainable Prosperity, Columbia University Press, 2024; and U.S. DOE, DOE Industrial Decarbonization Roadmap, DOE/EE-2635, September 2022.

[100] The overall GHG benefits of using "green" hydrogen will depend on whether and how renewable electricity is used to produce the fuel. See Jenkins, J.D., Biden admin's long-awaited hydrogen rules are here — and on the right track, Canary Media, December 22, 2023.

report on decarbonizing medical supplies used in the health care system noted "Much of a product's carbon footprint comes from its raw materials and manufacturing, so addressing this is directly is likely to have a major impact on emissions for both health systems and MedTechs."[101]

Policies to Drive Industrial Decarbonization

IRA Incentives to Promote Industrial Decarbonization

Although the industrial sector was not the primary focus of the Inflation Reduction Act (IRA),[102] several provisions could help reduce carbon dioxide emissions from the production of primary materials—such as plastic, paper, steel, and cement—used to manufacture medical supplies and in the construction of new or expanded health care facilities. As discussed previously, there are incentives to build demand and industrial capacity for lower-carbon cement and steel through government procurement, including funding for low-carbon materials in federally owned buildings and grants to states that use low-carbon cement and steel in highway projects. As markets and capacity for these products grow, these materials can be used for hospital and health care construction projects. Additional incentives relevant to industrial decarbonization include:

- **Tax credits for clean electricity:** As discussed in Section I, electricity is a significant component of supply chain emissions and is a key input to many industrial processes. The IRA has numerous clean energy tax credits and other provisions that will help decarbonize the electricity grid and reduce the carbon emissions embedded in the products and services purchased by HDOs.
- **Grants for the deployment of new manufacturing methods for low-carbon production of plastics, chemicals, paper, and other primary materials:** Although these grants will not have a short-term impact on industrial emissions, they could contribute to new and innovative low-carbon materials over the longer-term.
- **Tax credits for carbon capture and storage and green hydrogen**, both of which may have longer-term applications to decarbonizing industrial facilities.

[101] Kaiser Permanente, Accenture, Practice Greenhealth, & Health Care Without Harm. op. cit

[102] See The White House, Inflation Reduction Act Guidebook.

Potential Economy-wide Policies for Industrial Decarbonization

Although a full discussion of potential future economy-wide policies to decarbonize chemicals and other industrial sectors is beyond the scope of this paper, the following general categories of policies are relevant.

Research and Development Funding

Governments can allocate funding for research and development initiatives focused on developing innovative materials used in low-carbon medical supplies and technologies. Research grants, innovation funds, and public-private partnerships can support collaborative efforts between academia, industry, and government agencies to advance sustainable innovations. By investing in R&D, governments stimulate innovation, drive technological advancements, and create new opportunities for low-carbon products throughout the economy.[103]

Mandatory Standards

Energy efficiency standards can be set for industrial facilities and emissions standards can be adopted to reduce the emissions intensity of the most common commodity chemicals used in the manufacture of medical devices. Facility emissions standards, which can be set in CO_2e per unit of product produced, could consider factors such as the types of processes involved and the feasibility of emission reduction technologies.[104]

Carbon Pricing

Implementing carbon pricing mechanisms, such as carbon taxes or cap-and-trade systems, internalizes the cost of carbon pollution and makes innovative low-carbon alternatives at industrial facilities more cost-competitive compared to traditional high-emission practices. A price on carbon for the carbon content of primary materials such as chemicals, assuming it was set at the appropriate level, would encourage the adoption of lower-carbon technologies and materials across the health care supply chain.[105] An additional variant of carbon pricing is a carbon border adjustment mechanism (CBAD)—a fee on imported goods based on the carbon dioxide or other GHGs created in manufacturing them.[106] This type of policy—which is designed

[103] Tal, A., op cit.

[104] Rissman, J., op cit.

[105] Resources for the Future, Federal Climate Policy 105: The Industrial Sector.

[106] Wolfram, C. and Krol, A., Carbon Border Adjustments, MIT Climate Portal, December 11, 2023.

to put domestic and foreign goods on a level playing field—is about to be launched in Europe for certain carbon intensive and trade exposed products.[107] It also has been proposed in the U.S.[108]

Arguably, increased R&D and either or both mandatory standards and carbon pricing will be necessary to address industrial emissions. Of these three general approaches, R&D is the least controversial and funds for industrial decarbonization research and deployment were included in both the IIJA and the IRA. However, a recent DOE report concluded that much greater private and public investment will be necessary to meet the challenges posed by industrial carbon emissions—as much as $1.1 trillion across the industrial sector.[109]

VI. Conclusions

Leading HDOs have taken important steps to reduce emissions in their supply chains, including carbon embedded in medical supplies and products. Initiatives like the Climate Excellence Standard for Health Sector Suppliers include many of the pieces necessary to build markets for lower carbon products. This paper argues that these initiatives could lay the groundwork for even more expansive efforts, including a national voluntary program with low-carbon standards for medical supplies, ecolabeling, and technical assistance for HDOs at various stages of low-carbon procurement. We also recommend a pilot Medical Supplies Buy Clean Procurement Program for Veterans Administration facilities to help build the medical supplies market. In addition, HDOs could facilitate reformulation of key health care supply chain materials and assist larger efforts to decarbonize the industrial sector by collaborating with key industrial manufacturers. Finally, to meet ambitious GHG targets and address their Scope 3 emissions, it will be critical for HDOs to share ideas and insights with their peers and with policymakers, and to engage in policy development as the U.S. continues to decarbonize the electric, industrial, and transportation sectors.

[107] European Commission, Carbon Border Adjustment Mechanism.

[108] Gangotra, A., et. al, 4 US Congress bills related to carbon border adjustments in 2023, World Resources Institute, December 13, 2023.

[109] US Department of Energy, U.S. Department of Energy Reports Identify Transformative Opportunities for Widescale Clean Energy Deployment, September 18, 2023.

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