Insights Series

Issue 45
siemens-healthineers.com/
insights

“Do no harm” to the planet

Making healthcare more environmentally sustainable

A thought leadership paper on “Achieving operational excellence” and “Transforming the system of care”

SIEMENS Healthineers

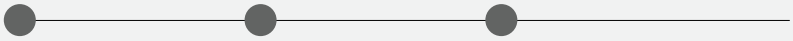
Preface

The Insights Series

The Siemens Healthineers **Insights Series** is our preeminent thought leadership platform, drawing on the knowledge and experience of some of the world's most respected healthcare leaders and innovators. The Series explores emerging issues and provides you with practical solutions to today's most pressing healthcare challenges.

At Siemens Healthineers, we pioneer breakthroughs in healthcare. For everyone. Everywhere. By constantly bringing breakthrough innovations to market, we enable healthcare professionals in:

Innovating	Achieving	Transforming
personalized care	operational excellence	the system of care



Our **Insights** portfolio is an integrated collection of events, speaking engagements, roundtable discussions, and an expanding array of print and digital platforms and products all carefully curated to share ideas, encourage discussion, disseminate original research and reinforce our position as a healthcare thought leader.

Please visit siemens-healthineers.com/insights-series

Executive summary

As the climate crisis facing the world continues to unfold, there is growing evidence that one of its impacts is on our physical health. Research indicates that half of all infectious diseases, from common waterborne viruses to deadlier diseases, are being made worse by our changing climate. The bottom line is that our mortality risk increases by up to 5.5% with every 1°C increase in global temperature.

The healthcare sector finds itself facing a curious paradox as the result of the climate crisis. First and foremost, the health effects of climate change must be dealt with. But second, healthcare leaders and organizations must come to terms with, and deal with, the fact that they are contributing to the problem. It has been estimated that healthcare contributes 4.4% of global net emissions. If it were its own country, healthcare would rank fifth in the world for greenhouse gas emissions, more than Japan or Germany.

This paper looks at ways to reconcile these two challenges, providing recommendations on steps that can be taken to make healthcare more environmentally sustainable while at the same time ensuring that we deliver high quality care to everyone who needs it.

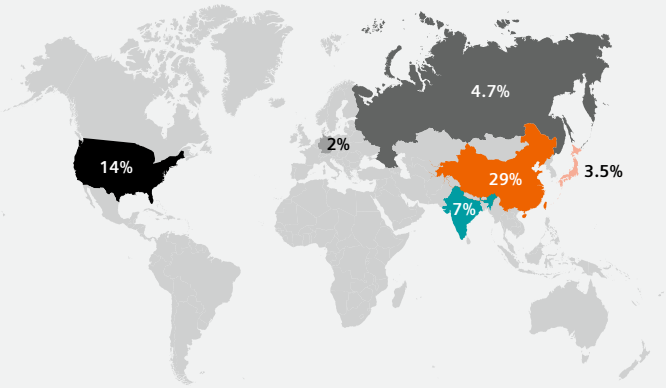
Many in the environmental community embrace the phrase "Think globally, act locally," suggesting that global efforts are no substitute for determined and creative local action. This paper proposes several actionable steps that healthcare facilities, notably hospitals, can take in order to meet the twin challenges of environmental sustainability and quality care.

While specific strategies will need to be adapted to specific circumstances, organizations will need to make significant progress on two general fronts. The first of these is decarbonization—reducing direct emissions from healthcare facilities as well as reducing indirect emissions from purchases of energy. The five steps outlined in this paper for achieving this are as follows: reduce consumption, produce energy on-site, transition to electrification, procure clean energy, and address any gaps that may remain through the purchase of carbon credits.

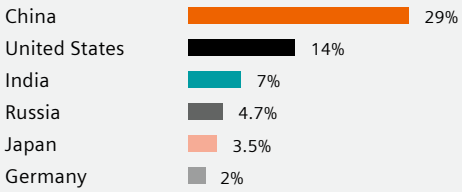
The second is reducing all other indirect emissions, many of which are supply-chain related. This means changing patterns and behavior in areas including the production, transport, use, and disposal of goods that the sector consumes such as medicines, chemicals, and medical and non-medical equipment.

Introduction

If the health sector were a country, it would be the fifth-largest emitter on the planet.



CO_2 Emissions:



4.4%

Healthcare sector

Our health as humans and the health of our environment are closely linked. In fact, there is clear evidence that the worsening climate crisis is having a direct impact on our physical well-being. With every 1°C increase in global temperature, mortality risk increases by up to 5.5 %.[1] Researchers estimate that the climate crisis could worsen more than half of all human infectious diseases, everything from those caused by common waterborne viruses to deadly diseases like plague.[2] Researchers have also made it clear that we do not have the luxury of time. The UN has emphasized that it is now or never—that we must find a way, this decade, to limit global warming to 1.5°C. Anything less, they warn, is not sustainable.

The healthcare sector must rise to the sustainability challenge because, paradoxically, the practice of healthcare has itself been a significant cause of the pollution and carbon emissions that threaten our health. Medical procedures generate a great deal of waste, much of it hazardous, and today's sophisticated medical technology consumes a significant amount of energy. It has been estimated that healthcare contributes 4.4% of global net emissions.[3] If it were its own country, healthcare would rank fifth in the world for greenhouse gas emissions, more than Japan or Germany. The problems that health leaders need to address extend beyond onsite waste generation and energy consumption, and include such matters as patient and staff travel and broader questions about shifting the focus of healthcare more sharply onto prevention.

"This is our company's inherent purpose: We improve access to care and quality of life in accordance with the United Nations Sustainable Development Goals."

Dr. Bernd Montag
CEO of Siemens Healthineers

How can these two challenges be reconciled? How can we provide more people around the world with high-quality healthcare, without at the same time contributing to a problem that damages their health?

On one level, this is a public policy issue to which world leaders are already turning their attention. As part of the COP26 Health Program, more than 50 countries have committed to building climate-resilient and low carbon health systems. Fourteen countries have also set a target date to reach net zero carbon emissions in their health systems before 2050.[4] In the U.S., the Department of Health and Human Services (HHS) is taking a more active role in addressing the challenges that climate change poses to health, starting with the establishment of the Office of Climate Change and Health Equity (OCCHE) in August of 2021. This was followed by the Administration's commitment at last November's United Nations Climate Conference[5] to creating a low-carbon health system.

Yet this is a challenge that must also be tackled by individual hospitals and healthcare organizations through independent action. Many in the environmental community embrace the phrase "Think globally, act locally," suggesting that global efforts are no substitute for determined and creative action at the local and national level.

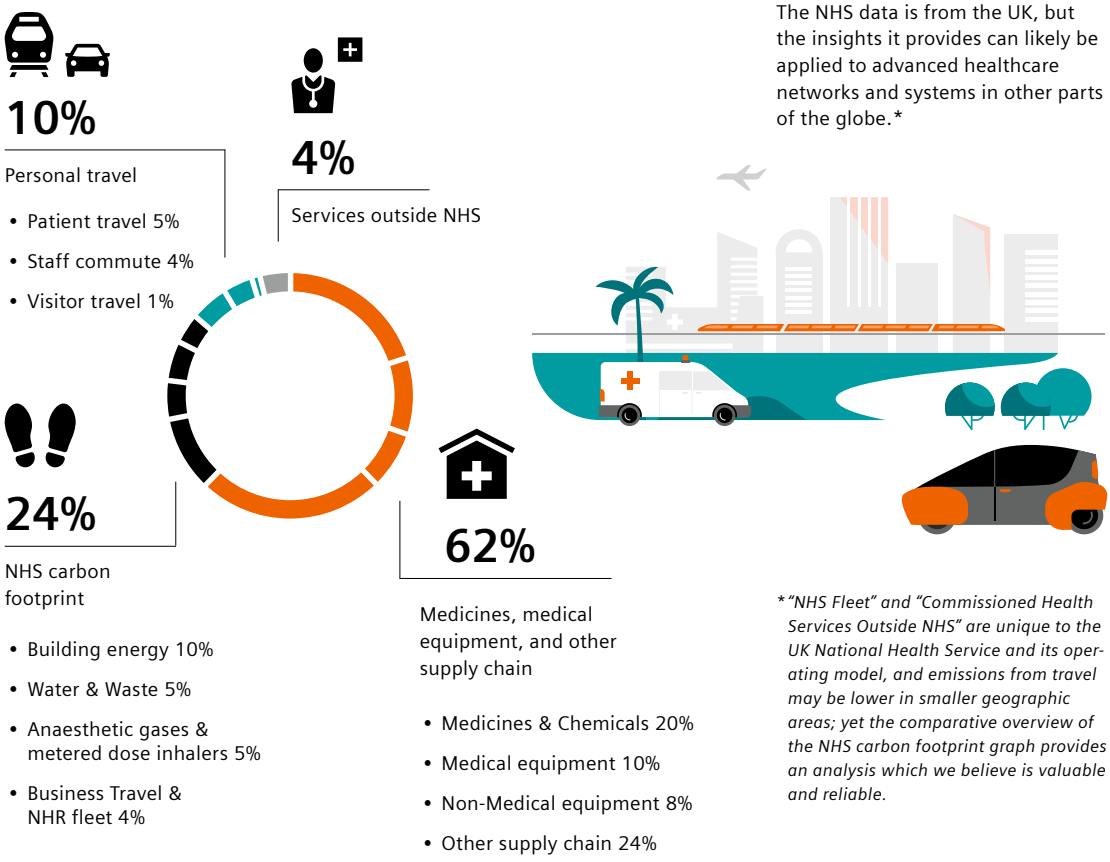
In the UK, the National Health Service (NHS) has an ambitious goal: to be the world's first net zero national health service. This means emissions are not just compensated for by offset, but eliminated altogether through enhanced efficiency, electrification, renewables, and other means. The NHS target is to reach net zero by 2040 for emissions they control directly (Scope 1 and 2), and by 2045 for those indirect emissions they can influence (Scope 3).[7] This division into "direct" and "indirect scope" serves as a useful perspective with which to evaluate emission reduction efforts.

Kaiser Permanente, the largest integrated nonprofit health system in the U.S., has become the first American health care system to achieve carbon-neutral. By improving energy efficiency in its buildings, installing on-site solar power, purchasing new long-term renewable energy generation, and investing in carbon offsets to counter emissions from the natural gas power that heats and cools its hospitals.[6] Looking ahead, Kaiser Permanente and other healthcare providers will also expand their focus by reducing their carbon footprint through sustainable procurement. One example is its Environmentally Preferable Purchasing (EPP) Initiative, which purchases products and services confirmed to be less damaging to the environment and human health than competing products and services.

In order to bring decarbonization efforts into even sharper focus, it is essential to start with clear data on the carbon footprints of healthcare providers. Here too the NHS is a leader. As one of the largest single-payer healthcare systems in the world, the NHS has a unique ability to collect, aggregate and analyze data from an extensive and diverse nationwide network of locations. The recent NHS graph provides a remarkably precise breakdown of the sources of healthcare carbon emissions.

We believe there are opportunities to reduce emissions in key areas through a combination of leadership buy-in, incentives and programs at an organization level, technological innovations, and lasting operational changes with buy-in from employees. Using the NHS carbon footprint data as a framework, this paper identifies concrete actions that can be taken to make hospitals more sustainable and reduce those related activities that generate significant emissions.

Sources of carbon emissions in NHS[7]



The NHS data is from the UK, but the insights it provides can likely be applied to advanced healthcare networks and systems in other parts of the globe.*

**"NHS Fleet" and "Commissioned Health Services Outside NHS" are unique to the UK National Health Service and its operating model, and emissions from travel may be lower in smaller geographic areas; yet the comparative overview of the NHS carbon footprint graph provides an analysis which we believe is valuable and reliable.*

The solution

It all starts with a need for healthcare leaders to have clarity and alignment on their commitments. What are their specific carbon emission targets, and what are the timelines? Are they realistic for the organization? Can these targets be achieved without compromising care? What are the priorities for the organization and its stakeholders? How do they align environmental targets with other operational targets around cost, resiliency, and patient care?

The answers to these questions having been reached, the organization will have to make significant progress on two general fronts. The first of these is reducing direct emissions from healthcare facilities as well as reducing indirect emissions from purchases of energy. The second is reducing all other indirect emissions, many of which are supply-chain related.

1 Reducing direct emissions from healthcare facilities and indirect emissions from purchases of energy

Clearly, different institutions will need to develop their own unique decarbonization strategies, tailored to their specific objectives and requirements. However, most decarbonization roadmaps consist of five basic steps: reduce consumption, produce energy on-site, transition to electrification, procure clean energy, and address any gaps that may remain.

Reduce energy consumption

Of the five steps, the biggest and most important is reducing energy consumption through green building and medical technology. A 2022 Insights Series paper entitled Addressing the Energy Crisis in Healthcare made the sobering point that hospitals can consume up to 2% of a country's total energy consumption.[8]

The first step is to clearly assess the current situation. There must be full transparency about current energy consumption, so that risks and opportunities are properly understood, and everyone who needs to be involved in reducing that consumption can be brought on board. There are tools and services available to do a thorough energy and carbon analysis, which can determine the current energy demand and identify potential areas for carbon reduction.

The major sources of energy consumption within hospitals are heating, ventilation, air conditioning and lighting. These account for up to 69% of total energy consumption.[9] Some of the low hanging fruit in terms of energy savings therefore include installing smart and efficient lighting and newer technologies that can optimize air handling, chillers, and heating and cooling systems. While hospitals need to take care of patients and keep operations running around the clock, not every single room is occupied at any given time. So, for example, reducing clean air exchange in a surgery room that is not being used is a simple way to reduce energy consumption.

There are basic common sense behavior changes that can also help to reduce a hospital's energy consumption. One obvious example: as Addressing the Energy Crisis in

By reducing the number of air exchanges per hour during non-surgical periods, as part of their OR Setback Plan, Cleveland Clinic saves 25 million kWh/year in energy use and $2.5 million annually.[10]

Healthcare points out, two-thirds of energy consumption for CT scanners takes place while they are in a nonproductive, idle system state. Clearly, switching off a CT system overnight when it is not in use has the potential to greatly reduce that system's energy consumption. Similarly, activating low power modes in MRI systems can optimize cooling during non-productive states, which also reduces energy consumption. There are many solutions such as these to be found in hospitals. What is needed is for different departments to do the necessary research and analysis to identify what behavior changes are needed to bring down the consumption of energy, and educate their staff about them.

Transition to renewable energy

Another important step that must be taken to lower harmful emissions is to eliminate reliance on fossil fuel-based energy by incorporating renewable-based energy sources. These sources may be found off-site and accessed through a clean energy sourcing strategy, but many leading healthcare systems have also begun implementing on-site renewables—often solar photovoltaic systems which use energy from the sun, or wind turbines to generate electricity. Producing energy on-site has the advantage of securing availability of reliable energy and limiting vulnerability to unpredictable energy market prices, saving costs, and reducing the CO2 footprint.

Transition to electrification

Another decarbonization option that should be explored is shifting to electrification, which can be a completely zero-emission alternative. As the only energy source that can be sustainably generated, electricity can make a huge difference in shrinking a hospital's carbon footprint. The electrification of hospitals involves steps that include swapping existing technologies and systems that use fossil fuels, such as heating and cooling systems, with sustainable alternatives like heat pumps, and installing e-charging stations for electric vehicles. t the same time, as the demand for electricity in hospital increases, it is also important to have an accurate load prediction of hospital energy consumption as a part of successful energy management.

Procure clean energy

For organizations that are not ready to produce energy on-site, procuring renewable energy is an important step that hospitals must take if they want to reduce their carbon footprint. Starting with off-campus renewable procurement has the advantage of not interfering with existing infrastructure such as rooftops and parking facilities. It also avoids locational constraints such as utility connection limitations.

Address gaps through carbon credits

Finally, an organization can make up for its own carbon emissions by helping reduce them elsewhere. This can be done in the form of carbon credits, purchased to offset any remaining carbon emissions the hospital has not yet been able to eliminate. Carbon offsetting is the process of purchasing carbon credits on the carbon market generated by CO_2 absorption projects. The most direct way to purchase carbon credit is at the source: from the organization responsible for the project you want to support. In this case, your institution can either

invest in the development of the project with a promise of return in the form of future carbon credits, through Emission Reduction Purchase Agreements (ERPAs), or through a broker. The broker would find a project that suits you, then purchase carbon credits on your behalf and resell them to you with a mark-up.

2 Addressing indirect emissions in healthcare

As important as it is that hospitals take steps to reduce their own emissions and shrink their own carbon footsteps, it is critical that all healthcare organizations take part in a broader effort to address what is referred to as Scope 3 emissions in healthcare. The lion's share of these indirect emissions is generated along the health care supply chain. This includes the production, transport, use, and disposal of goods that the sector consumes such as medicines, chemicals, and medical and non-medical equipment.

Responsible production and use of medicines and chemicals

The production of medical products and pharmaceuticals is very carbon-intensive, and there is growing pressure on the pharmaceutical industry to adopt more sustainable strategies to reduce their carbon emissions and to clean up their production sites.

At the COP27 climate change conference, the U.S. Department of Health and Human Services (HHS) announced a joint plan with the NHS to align procurement requirements, highlighting the significant contribution of the supply chain to emissions in the healthcare sector. In the US, an estimated 8.5% of healthcare emissions can be attributed to the supply chain.[11]

However, it is not just the production of medicines and chemicals that causes emissions. These products contribute to this problem in many other ways, through inefficiencies in development, delivery, and ultimately when some are discarded. In the NHS, by way of example, the entire life cycle of medicines and chemicals accounts for 20% of total CO_2 emissions. Consequently, everyone in the biopharmaceutical supply chain—drug developers, manufacturers, clinicians, payers, and policymakers—should focus on reducing system inefficiencies.

One example of an inefficiency: Many patients requiring only a small drug dose are forced to purchase a full vial. Looking only at physician-administered Medicare drugs in the U.S., this waste leads to an estimated $2.8 billion of medication being thrown away each year.[12]

The healthcare sector can help resolve these problems by establishing sound prescription and drug management practices to minimize waste. Manufacturers could perform long-term storage tests to potentially extend the shelf-life of their drugs. Hospitals could regulate the amount of medication that is dispensed to a patient instead of dispensing medication for a period longer than three months.

Upgrade to more energy-efficient medical equipment

While medical devices are not the top contributors to energy consumption in hospitals, medical emissions do contribute a significant 10% of the total healthcare carbon footprint. A Swiss study found that annual energy

"UCSF is a global leader in clinical care and imaging research, and we are proud to work alongside our industry partners in this nascent concept of Green Radiology."

Christopher P. Hess, MD, PHD
UCSF Department of Radiology & Biomedical Imaging

consumption of four MRIs and three CTs was equal to the energy consumption of a town of 850 people.[13]

The good news is that there is equipment available which requires less energy. For MRI systems, for example, one-third of energy consumption is attributed to helium cooling while the system is not in use.[11] Transitioning to newer green medical systems with technology that minimizes such operation, or upgrading to systems with better energy efficiency, can reduce overall energy consumption. This also applies to other equipment by establishing protocols to switch off when not in use, or taking advantage of sleep mode, saving energy when not in use.

Case study: World's first carbon-neutral radiology department[14]

Siemens Healthineers and University of California at San Francisco (UCSF) have formed a collaboration to make radiological imaging greener, while improving access to, and quality of, radiological imaging in Northern California. The agreement will also explore artificial intelligence in radiology, clinical data and image integration, and quantitative imaging. The first key area of innovation, Green Radiology, will include the creation of the world's first carbon-neutral radiology imaging service at UCSF. This collaboration will monitor power consumption of radiology equipment at UCSF using Siemens Smart Infrastructure solution, and leverage new Siemens' scanner technology that is greener, lighter, smaller, and has easier sitting requirements, so that more patients can access high-quality imaging without travelling long distances.

Digitalization can also play an important role in energy saving by making processes more efficient. In radiology, for example, using AI-powered image reconstruction can reduce scan time, and associated energy consumption, by up to 60%. AI technologies also help reduce errors and the resulting need for retesting, which also contributes to decreasing overall energy consumption.

Foster circular economy and reduce waste

As noted above, many of the materials and products used in healthcare cause emissions while being produced and while being used. And sadly, they also contribute to emissions when they are no longer useful, because they then become waste to be disposed of, often through incineration. The incineration of medical waste produces mainly gaseous emissions, including steam, carbon dioxide, nitrogen oxides, and a range of volatile substances that contribute to air pollution.[15]

Hospitals need to accelerate the transition towards a circular economy through more rigorous attention to practices such as recycling, composting, reusing, reducing waste. Hospitals can also extend the lifespan of equipment as long as possible through repairing and refurbishing. In the case of laboratory testing where high volumes of single-use items are normally used to prevent contamination, healthcare systems could instead procure products designed with less plastic or with alternative packaging material that are more environmentally friendly to avoid costly waste management and incineration.

Reduce travel and transport

Hospitals and other health facilities depend heavily on travel and transportation. Patients and their families

Over the past 10 years, since we pioneered the innovation field of Green Radiology in collaboration with Siemens Healthineers, we could show that significant energy savings can be achieved without compromising patient operations. And we haven't reached the end yet."

Prof. Elmar Merkle, MD
University Hospital Basel Department Chief Radiology and Nuclear Medicine

travel to and from the hospital. Staff travel to and from work, and to other sites within their network. Supplies need to be brought in, and waste needs to be shipped out. This presents healthcare organizations with a number of challenges, but an equal number of opportunities to reduce vehicle emissions.

An obvious step hospitals can take is to promote and if possible facilitate the use of public transport. Next, they need to conduct a careful evaluation and redesign of their transportation systems, ensuring that all new purchases and lease arrangements are for either ultra-low emission vehicles (ULEVs) or zero emissions vehicles (ZEVs). The transition to less polluting vehicle fleets can generate significant climate change mitigation benefits.[16]

Another approach is to reduce the size and number of commercial deliveries by focusing on inventory planning to avoid last-minute, high-speed deliveries that contribute to high carbon dioxide emissions. Consolidating orders and deliveries, procuring products with reduced packaging material and packaging size, and employing near-zero emission vehicles for delivery, are effective ways to tackle indirect carbon emissions.

The next frontier in sustainable healthcare can only be reached with new approaches to the delivery of healthcare itself. The fact is that it is possible to move to less environmentally-burdensome care. Indeed, digitalization, telehealth solutions and networked care can dramatically reduce the need for patient travel as well as visitor travel, staff commutes, and business travel—which combine for another 14% of total emissions.

A 2021 study, *Does telemedicine reduce the carbon footprint of healthcare? A systematic review,* confirms what most of us would probably have assumed—that telemedicine reduces the carbon footprint of healthcare, primarily by reducing travel-associated emissions, with carbon footprint savings ranging from 0.70 kg to 372 kg CO_2 per consultation.[17]

While telemedicine and telemonitoring reduce unnecessary commuting, the climate-friendly potential of digitally-enabled care extends even further. First, better care delivery coordination can lead to better resource management. Second, healthcare services can be moved from hospitals to local, less resource-intensive facilities. Third, patient apps support disease management, which can reduce or optimize drug consumption and help patients to make beneficial health decisions.

Case study: Instituto Hermes Pardini SA reduces carbon footprint in laboratory significantly

Insituto Hermes Pardini SA is one of the world's largest private laboratories. It is strongly committed to sustainability and optimizing its environmental footprint.

After replacing its previous system configuration with an innovative solution from Siemens Healthineers, it has reduced water consumption by >32%, equivalent to more than 3 million liters of water savings per year. This has had a direct impact on energy saving and significantly reduced emissions. As a result, more than 1.6 tons of emissions are avoided per year, equivalent to the amount of carbon sequestered by 7284m^2 of forest in one year.

The path forward

Sustainability transformation is no longer an option to be debated; it is an imperative. And organizations, sectors and governments must choose between helping lead the charge or being left behind. Early healthcare movers who take advantage of the opportunities will have more time to mitigate the risks of non-compliance and be better positioned in the future.

The U.S. government, for example, has announced a series of new resources to support the healthcare sector in transitioning to clean energy, reducing emissions, and building climate resilience.[18] The inflation Reduction Act (IRA), the strongest single U.S. climate action ever signed into law, directs $369 billion in strategic investments over the next ten years to drive the growth of clean energy and cut the nation's carbon footprint. Incentives in the IRA can be used directly by American health systems to reduce their emissions through investments in clean renewable electricity, electrifying vehicle fleets, installing electric vehicle charging stations, increasing building energy efficiency, and additional clean energy project financing opportunities. The IRA should serve as a model to other nations that want to move towards a low-carbon economy and accelerate health care sector decarbonization and resilience.[19]

For healthcare leaders, reducing their organization's carbon footprint starts with a clear set of goals and commitments from top management, followed by stakeholder engagement and adequate resource allocation on sustainability efforts. As outlined above, those efforts will have to be focused on reducing direct emissions from within the facility, reducing emissions from purchases of energy, and reducing indirect emissions, many of which are supply-chain related.

The last point to be made about all of this hinges on one of the central tenets of healthcare, which is that the very best care is that which helps people avoid becoming sick in the first place. This is true for patients, but it is equally true in the context of this paper. Healthcare is a resource-intensive field, and the sicker patients are, the more resources they require. And whether it is through the travel they have to do, the medicine they have to consume, the equipment their diagnosis and treatments require, the care these patients receive can only contribute to the carbon footprint of the facility caring for them. Which is why in addition to reducing the environmental footprint of delivering healthcare, it is vital to invest in the kind of prevention and precision diagnosis that will help lower demands on healthcare organizations, and reduce their environmental impact in the process.

The phrase "Do no harm" is often associated with healthcare, and for good reason. It is one of the principles by which healthcare providers define what they do. Healthcare leaders today must contend with an expanded challenge to do no harm, extending beyond patients to the planet itself. This is no easy feat, but as this paper has outlined, it is possible. It remains only for visionary leaders to start the process.

Suggested follow-up on

- For more information on Siemens end-to-end decarbonization solution including consulting service, please visit: **siemens.com/global/en/company/topic-areas/smart-infrastructure**

siemens-healthineers.com/insights

- Siemens Healthineers Insights Brief issue 1: Addressing the energy crisis in healthcar. Available at: **siemens-healthineers.com/insights/news/energy-consumption**
- Siemens Healthineers Sustainability Report Available at: **siemens-healthineers.com/company/sustainability**

Information:

The Siemens Healthineers Insights Series is our preeminent thought leadership platform, drawing on the knowledge and experience of some of the world's most respected healthcare leaders and innovators. It explores emerging issues and provides practical solutions to today's most pressing healthcare challenges.

All issues of the Insights Series can be found here: **siemens-healthineers.com/insights-series**

Contact:

For further information on this topic, or to contact the authors directly:

André Steinbuss
Global head of Achieving Operational Excellence
Siemens Healthineers

andre.steinbuss@siemens-healthineers.com

About the authors

Joanne Grau
Thought Leadership Manager for
Achieving Operational Excellence
Siemens Healthineers

Joanne has had fifteen years of marketing experience in Siemens Healthineers as marketing director for the diagnostics division based in New York and as Head of Marketing for ASEAN countries based in Singapore. Joanne graduated from UCLA with a degree in molecular biology. Before joining Siemens Healthineers, Joanne was a research scientist in Quest Diagnostics (formerly Celera) and has authored multiple publications.

Isabel Nieto Alvarez, PhD
Thought Leadership Manager for Transforming the System of Care and Global Senior Innovation Key Expert on patient experience
Siemens Healthineers

Isabel has served as a marketing manager and business developer for the company, and as Professor at the Universidad Anáhuac, México focused on sustainability in healthcare for medical students and psychology. She is a biomedical engineer from Universidad Iberoamericana in Mexico, holds a Master in Science on Mind and Body Medicine from Saybrook University in California, U.S. and certifications on Leadership in Healthcare without Harm and Design Thinking.

André Steinbuss
Global head of Achieving
Operational Excellence
Siemens Healthineers

André Steinbuss has spent almost ten years in various positions in marketing with a focus on diagnostic imaging at Siemens Healthineers. Andre graduated in medical technology engineering at the University of Applied Sciences in Luebeck. Before joining marketing, he spent ten years in research and development in the hearing instrument business of Siemens. During this time, he has authored multiple patents and publications.

Christina Triantafyllou, PhD
Vice President and Global Head
of Transforming the System of Care
Siemens Healthineers

Christina began her healthcare career at Harvard Medical School, Boston, where she worked as a medical physicist developing imaging technology for the study of brain anatomy and function in disease. At Siemens Healthineers, she served as the Director of Global Ultra High Field MR Solutions, focusing on business strategy, KOL-based collaborations in innovation/clinical translation, and product management for the first worldwide clinical 7T MR system. Christina holds a Ph.D. in Medical Physics from Kings College, University of London, UK. Prior to joining Siemens Healthineers, she held appointments at Harvard Medical School, and at Massachusetts Institute of echnology in Boston.

Vibhas Deshpande, PhD
Vice President of Sustainability
Innovation and Strategic Research at
Siemens Healthineers

Vibhas' research interests include environmental sustainability in healthcare, early disease detection and risk stratification using multi-modal tools, and addressing inequity in healthcare. Vibhas is working towards building Green Radiology and Green Hospital solutions through technological innovation and collaborations with leading Universities and hospitals in North America. To further his research in chronic liver disease biomarker development and risk stratification in extracranial carotid disease for stroke prevention, Vibhas built academic-industrial consortia that were awarded NIH grants to pursue these goals. With innovation and clinical translation, Vibhas is looking forward to making an impact on improving health outcomes for patients everywhere, while lowering the environmental footprint.

References

Acknowledgements

We are deeply grateful for the extensive expertise and insights from our customers and colleagues. Special thanks to our colleagues from Siemens Smart Infrastructure Ayana Nathan, Stacy Mahler, and Katharina Nowak-Strohmeier for their contribution.

1. O. A. Net zero healthcare [Internet]. about Digital Health. 2022 [cited 2023Feb8]. Available from: **aboutdigitalhealth.com/2022/09/20/net-zero-healthcare-pharma**

2. Mora C, McKenzie T, Gaw IM, Dean JM, von Hammerstein H, Knudson TA, et al. Over half of known human pathogenic diseases can be aggravated by climate change. Nature Climate Change. 2022;12(9):869–75.

3. Karliner J, Slotterback S, Boyd R, Ashby B, Steele K, Wang J. Health Care's climate footprint: The Health Sector Contribution and opportunities for action. European Journal of Public Health. 2020;30(Supplement_5).

4. Countries commit to develop climate-smart health care at COP26 UN climate conference [Internet]. World Health Organization. World Health Organization; [cited 2023Feb8]. Available from: **who.int/news/item/09-11-2021-countries-commit-to-develop-climate-smart-health-care-at-cop26-un-climate-conference**

5. Balbus JM, McCannon CJ, Mataka A, Levine RL. After COP26 — putting health and equity at the center of the Climate Movement. New England Journal of Medicine. 2022;386(14):1295–7.

6. Permanente K. Kaiser Permanente becomes first carbon-neutral health system in the U.S. [Internet]. Kaiser Permanente Becomes First Carbon-Neutral Health System in the U.S. 2020 [cited 2023Feb8]. Available from: **prnewswire.com/news-releases/kaiser-permanente-becomes-first-carbon-neutral-health-system-in-the-us-301130245**

7. NHS choices. NHS; [cited 2023Feb8]. Available from: **england.nhs.uk/greenernhs/a-net-zero-nhs**

8. Grau J, Nieto Alvarez I, Deshpande V. Addressing the energy crisis in healthcare. Insight Series [Internet]. Siemens Healthineers; 2023Jan; Available from: **siemens-healthineers.com/insights/news/energy-consumption**

9. Bawaneh K, Ghazi Nezami F, Rasheduzzaman M, Deken B. Energy consumption analysis and characterization of healthcare facilities in the United States. Energies. 2019;12(19):3775.

10. Climate action playbook for hospitals [Internet]. Climate Action Playbook for Hospitals. [cited 2023Feb8]. Available from: **climatecouncil.noharm.org**

11. (ASH) ASfor H. HHS shares health sector emissions reduction and climate resilience announcements at cop27 [Internet]. HHS.gov. 2022 [cited 2023Feb8]. Available from: **hhs.gov/about/news/2022/11/10/hhs-shares-health-sector-emissions-reduction-climate-resilience-announcements-at-cop27**

12. Skerrett P. Discarded drugs: A wasteful and costly problem that requires whole-of-government approaches [Internet]. STAT. 2021 [cited 2023Feb8]. Available from: **statnews.com/2021/02/25/discarded-drugs-wasteful-costly-problem**

13. Heye T, Knoerl R, Wehrle T, Mangold D, Cerminara A, Loser M, et al. The energy consumption of radiology: Energy- and cost-saving opportunities for CT and MRI operation. Radiology. 2020;295(3):593–605.

14. Siemens Healthineers and UCSF Create First Carbon-Neutral Radiology Imaging Service [Internet]. 2021. Available from: **ucsf.edu/news/2021/11/421756/siemens-healthineers-and-ucsf-create-first-carbon-neutral-radiology-imaging**

15. Hernández A-CG. [Internet]. Reducing Healthcare's Climate Footprint - Opportunities for European Hospitals & Health Systems. Healthcare without harm; 2016 Dec. Available from: **noharm-europe.org/sites/default/files/documents-files/4746/HCWHEurope_Climate_Report_Dec2016.pdf**

16. Addressing Climate Change in the Health Care Setting Opportunities for Action. Practice Greenhealth; Available from: **practicegreenhealth.org/sites/default/files/pubs/epp/ClimateChange.pdf**

17. Purohit, A., Smith, J. and Hibble, A. (2021) "Does telemedicine reduce the carbon footprint of healthcare? A systematic review," Future Healthcare Journal, 8(1). Available at: **doi.org/10.7861/fhj.2020-0080**

18. Health Sector Leaders Join Biden Administration's Pledge to Reduce Greenhouse Gas Emissions 50% by 2030. 2022. Available from: **whitehouse.gov/briefing-room/statements-releases/2022/06/30/fact-sheet-health-sector-leaders-join-biden-administrations-pledge-to-reduce-greenhouse-gas-emissions-50-by-2030**

19. Harm HCW. The inflation reduction act brings new opportunities for Health Care's Climate Action [Internet]. Medium. Medium; 2022 [cited 2023Feb8]. Available from: **noharm.medium.com/the-inflation-reduction-act-brings-new-opportunities-for-health-cares-climate-action-f47a14202c5**

At Siemens Healthineers, we pioneer breakthroughs in healthcare. For everyone. Everywhere. By constantly bringing breakthrough innovations to market, we enable healthcare professionals in innovating personalized care, achieving operational excellence, and transforming the system of care. Our portfolio, spanning from in-vitro and in-vivo diagnostics to image-guided therapy and innovative cancer care, is crucial for clinical decision-making and treatment pathways.

Built on a history of innovation going back more than 125 years and with unique strengths in patient twinning, precision therapy, as well as digital, data, and artificial intelligence (AI), we are well positioned to take on the biggest challenges in healthcare. We will continue to build on these strengths to help fight the world's most threatening diseases, improving the quality of outcomes, and enabling access to care.

As a leader in the industry, we aspire to create better outcomes and experiences for patients no matter where they live or what health issues they are facing. We innovate sustainably to develop scalable solutions that can be tailored to the needs of healthcare providers, and the local health infrastructures.

Motivated by our purpose and guided by our values, we are building an inclusive culture, where we embrace diversity in all its forms. We are a team of 66,000 highly dedicated employees across more than 70 countries passionately pushing the boundaries of what's possible in healthcare to help improve lives of people around the world.

siemens-healthineers.com/
insights-series

Did you enjoy the read? Make sure to subscribe to our newsletter to always receive the latest thought leadership insights.

All issues of the Insights Series can be found here:
siemens-healthineers.com/insights-series

Siemens Healthineers Headquarters
Siemens Healthcare GmbH
Henkestr. 127
91052 Erlangen, Germany
Phone: +49 9131 84-0
siemens-healthineers.com

Published by Siemens Healthcare GmbH · HOOD05162003337044 · online · 0323 ·