Institute for Healthcare Improvement

Getting Started with Clinical Decarbonization

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Institute for Healthcare Improvement

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Contents

Introduction

The health care sector is a major contributor to greenhouse gas (GHG) emissions, accounting for 8.5 percent of total GHG emissions in the US.[1] As anchors in their communities, hospitals and health systems can model sustainability best practices and affect broader change in their supply chains, local economies, and surrounding communities. For safety net hospitals that deliver care on tight margins and serve patient populations disproportionately impacted by the effects of climate change, investing in lowering carbon emissions holds the potential to advance their mission, strategy, and financial health.

To test strategies and measures to advance clinical decarbonization, between 2022 and 2025 the Institute for Healthcare Improvement (IHI) convened two initiatives — the Decarbonizing Care Learning Community and the Safety Net Decarbonization Collaborative — that used quality improvement methods to learn from small-scale tests of change and achieve reductions in carbon-emitting activities. The learning from health care teams participating in both initiatives is incorporated into this guidance document.

As part of this work, participating health systems were encouraged to use the Greenhouse Gas Protocol, a globally recognized framework for measuring, managing, and reducing greenhouse gas emissions.[2] The protocol provides a standardized approach for businesses, governments, and other organizations to track, report, and reduce their emissions across various activities and value chains.

Health care organizations participating in both the IHI Decarbonizing Care Learning Community and the IHI Safety Net Decarbonization Collaborative achieved a wide range of results in progressing toward their aims, and gained knowledge about success factors for clinical decarbonization efforts.

IHI Decarbonizing Care Learning Community (2022–2023)

- **Participants:** Teams from 14 health care organizations, ranging from those just starting decarbonization efforts to existing leaders in the field.
- **Learning Community Aim:** Test evidence-based changes to lower emissions from clinical care — focused on anesthetic gases and/or medical devices and supplies.
- **Example Aim Statements:** See Appendix A.

Key learning from the Decarbonizing Care Learning Community is summarized in the publication Accelerating Decarbonization in Clinical Care,[3] which presents strategies and specific change ideas for decarbonizing clinical care related to anesthetic gases, inhalers, and medical products.

IHI Safety Net Decarbonization Collaborative (2024–2025)

- **Participants:** Teams from 7 safety net hospitals (2 organizations also participated in the prior Learning Community).
- **Collaborative Aim:** Each participating team will design and launch a decarbonization improvement project and make progress toward creating the organizational conditions for broader climate and health leadership.
- **Example Aim Statements:** See Appendix A.

Prior to joining the Safety Net Decarbonization Collaborative, the participating hospitals — which all serve diverse populations adversely affected by climate change and unmet social needs — had already made significant commitments toward decarbonization within their organizations. For example, several hospitals are members of Practice Greenhealth and America's Essential Hospitals; established internal sustainability committees; created climate change action or resiliency plans; and are working to decrease supply chain emissions, and waste and emissions from food. During the Collaborative, these safety net organizations continued to build and expand on these commitments and accomplishments, working across a wide range of topic areas that were important to their organizations.

Structural Enablers to Support Clinical Decarbonization

A key learning from IHI's work with health systems on clinical decarbonization is that, for the work to be successful, certain structural elements must be in place to create an enabling environment for decarbonization efforts across the system. Some structural enablers are critical for getting started, such as developing a management system and establishing targets and timelines, while others are important for long-term progress, like building workforce capacity and managing carbon accounting and finance. In the Safety Net Decarbonization Collaborative, safety net hospital teams were more likely to lack key structural enablers at the organizational level, which created additional obstacles and, in some cases, slowed progress. In response to this learning, we adapted the structural enablers to reflect a more realistic set that could apply at the unit, department, or project level.

Structural enablers manifest in different ways depending on where in the system clinical decarbonization work is happening and who is leading the efforts. For example, a decarbonization improvement project led by a C-suite leader will look different than a project led by a clinician or a service line leader. In particular, the structural enablers needed to effectively do this work at the unit, department, or project levels may be different (see Table 1).

Table 1. Structural Enablers of Clinical Decarbonization Efforts

Structural Enabler	Organizational Level (Senior Leaders)	Unit/Department/Project Level (Local Leaders)
Develop a Management System	• Assign executive leadership to take responsibility for sponsoring and supporting climate action • Appoint someone at the leadership level to lead environmental sustainability efforts • Build a system of organization-wide GHG (or proxy) accounting to inform strategic management and track progress • Establish a cross-functional team to build data collection and management infrastructure • Develop a climate action plan to strategically prioritize decarbonization activities • Develop a financing plan and resource commitment for implementing decarbonization interventions • Build a decarbonization governance structure for accountability and internal reporting	• Appoint a local climate champion or sustainability lead to coordinate unit-level actions and serve as the primary liaison with executive sponsors • Establish a regular meeting cadence with senior sponsor to discuss decarbonization progress, obstacles, and solutions • Establish tracking mechanisms (e.g., dashboards on single use vs. reusable items, use of desflurane/nitrous oxide) to monitor progress of decarbonization efforts against local benchmarks • Create a cross-functional team (e.g., clinical, operations, purchasing, quality improvement, project manager) within the unit to lead decarbonization projects, build data collection systems, and track progress
Establish Targets and Timelines	• Establish an organizational goal for reduction in emissions and associated timelines for decarbonization targets • Set a baseline year to assess decarbonization performance improvement • Establish interim annual decarbonization targets	• Develop unit-specific emission reduction or proxy targets that align with broader organizational decarbonization goals • Set a baseline measurement for the department's current performance and outline short-term milestones • Regularly review local progress against these targets to identify areas for improvement and adjust strategies as needed
Build Workforce Capability	• Institute education and training programs to promote climate literacy across the workforce • Embed sustainability in administrative and clinical roles and responsibilities • Promote a culture of sustainability and resource stewardship	• Provide targeted, departmental training and share best practices to enhance climate literacy • Create a space of psychological safety where team members can trust that they will be heard and not punished for speaking up • Incorporate sustainability into the daily roles and processes of the unit

		• Recognize and reward sustainable practices among staff, and encourage frontline teams to propose and test local decarbonization initiatives

While some health systems participating in the IHI decarbonization initiatives established organization-level improvement projects, most sites were set up to work most successfully at the unit or departmental level. For those just beginning their decarbonization work, starting at the microsystem level (i.e., individual, unit, service line) may be more feasible than launching an organization-wide project. Beginning in one unit or one department has some benefits and can allow teams to:

- Build capacity to improve performance (typically, reduce waste);
- Build team confidence;
- Quantify some financial impact relatively easily;
- Provide tangibility of the improvement project for local staff, who may be inspired to do more; and
- Replicate learning in other units.

Clinical decarbonization at the organizational level may not always be feasible, and safety net hospitals that participated in the IHI initiatives struggled with establishing a management system at the organizational level. However, most health systems can start at the individual, project, or unit level and still make an impact. Local projects are well-suited to building improvement capacity and can inspire people in other units to tackle similar projects.

Getting Started with Clinical Decarbonization

Regardless of the level of the system on which your improvement efforts focus, it is possible to launch successful projects to accelerate decarbonization in your organization using a quality improvement (QI) methodology. Building on the structural enablers described above, individuals and teams can get started by scoping the problem, organizing people and resources (including nurturing the will to change and aligning with leadership and organizational priorities), ensuring adequate feedback to allow adaptation and assessment of progress, and learning by doing.

The steps outlined below can help you get started and ensure that the necessary structural enablers are in place to support clinical decarbonization improvement efforts. The steps in this guide are based on the Model for Improvement,[4] the core improvement methodology in the two initiatives. Each step includes examples from health care teams that participated in the two IHI decarbonization initiatives. Appendix B includes QI tools and resources to support each step.

Step 1. Identify the Focus for Improvement

Individuals don't need to have "sustainability" in their job title to engage in clinical decarbonization efforts. Anyone within the organization can identify a problem and begin to identify ways to address it. Start by considering your role, where you work in the organization, and what you might be able to do without explicit sign-off or buy-in from your leadership.

Structural Enablers Supporting This Step

- Develop unit-specific targets for clinical decarbonization that align with the broader organizational goals.

Questions to Consider

- Where do you work within the organization? What is within your sphere of control?
- What existing relationships can help move your work forward?
- Is there existing clinical decarbonization work that you can become part of?

Possible Obstacles

- Getting started can feel overwhelming. Consider beginning with a stakeholder analysis to determine the improvement team's sphere of control and who else needs to be involved in the work. For individuals seeking to change practices who do not have operational authority and responsibility, a stakeholder analysis is a useful tool to understand the social network by presenting key stakeholders' Interest (low, high) and Influence (low, high) in a 2x2 grid.

Examples from Participants in IHI Initiatives

- The **Harbor-UCLA Medical Center** team demonstrated how one dedicated clinician could investigate an area of concern and develop an improvement project without having specific positional authority. Waste handling is an example of an improvement topic that can be addressed locally within units, within the scope of local operations control. One team member, a physician, knew prior to participating in the IHI Collaborative that red bag waste (i.e., regulated medical waste[5]) was a significant problem in health care sustainability. She also recognized that her organization had a physician champion in the interventional radiology (IR) suite who was eager to improve sustainability but had many clinical duties that interfered with his ability to develop and implement projects. So, she began by approaching the IR physician champion, asked for his permission to look at the IR suites, and then did a walkthrough with the IR staff to identify quick wins

for improvement. The improvement team immediately identified deficits in the red bag waste sorting practices, which quickly became their focus. She conducted an audit to analyze the percentage of inappropriate waste being processed as medical waste (92 percent) to establish a baseline and build a rationale for improvement.

- The **Parkland Health** team conducted a stakeholder analysis to identify the key individuals and departments essential to advancing sustainability efforts across Parkland. The stakeholder mapping process began with a review of potential decarbonization projects, followed by identifying who would be directly impacted by or influential in those efforts. The team evaluated each stakeholder's level of influence, interest, and readiness to engage, which enabled them to map the individuals along an interest-influence matrix. This helped the team prioritize engagement strategies, anticipate barriers, and ensure cross-functional alignment early in the process. The analysis revealed opportunities to clarify ownership, improve communication channels, and integrate sustainability more deeply into operational roles. Asking "Who is missing?" also flagged individuals who were not engaged in the sustainability efforts but needed to be included, such as the director of facilities. The team then defined measurable key performance indicators (KPIs) for each department and used this insight to shape a strategy focused on monitoring behavior change before setting formal reduction targets. This approach laid the groundwork for a collaborative framework to implement three to five targeted sustainability initiatives annually, supporting long-term decarbonization goals.

Step 2. Establish the Improvement Team

Individuals involved in parts of the process or system that you are trying to improve will bring diverse perspectives and expertise to fuel more effective ideas for change that are more likely to be sustained while building will to make improvements. Once your topic of focus for clinical decarbonization is identified, you will need to establish the improvement team. Having a champion for the work is a great way to start. Teams participating in the IHI initiatives underscored that working together with peers was key to creating change. Relationships and soft skills are important to advancing this type of work. Learning what matters to people can help determine how to get them on board.

Decarbonization work is often considered outside the scope of quality priorities, especially at safety net hospitals. For teams participating in the IHI Safety Net Decarbonization Collaborative, the work often had to be done on their own time with little support or recognition. Teams that had supportive, enthusiastic senior sponsors were able to make more progress and had fewer obstacles and organizational challenges to navigate. Teams that lacked leadership support struggled to implement broader system changes such as changes to clinical workflows and processes. Some teams with robust system-level initiatives lost momentum when there was leadership turnover.

Structural Enablers Supporting This Step

- Appoint someone at the leadership level to lead environmental sustainability efforts.
- Appoint a local climate decarbonization champion or sustainability lead to coordinate unit-level actions and serve as the primary liaison with executive sponsors.
- Create a cross-functional team (e.g., clinical, operations, purchasing, QI, project manager) within the unit to lead decarbonization projects, build data collection systems, and track progress.
- Provide targeted, departmental training and share best practices to enhance climate literacy.

Questions to Consider

- Where in your system is there already will to make changes and/or where can will be built?
- Who needs to participate in clinical decarbonization efforts? Who has influence in this space? What do these individuals care most about?
- Have you involved the people upstream and downstream to the issue you are trying to improve?
- Who is taking on the project management role?
- How will the work continue if the senior sponsor or the local climate champion moves on? Sustainability planning needs to start during project set up.

Possible Obstacles

- Outdated or overly cautious practices or policies can stand in the way of common-sense sustainability initiatives.
- Sustainability may not be in anyone’s specific title, which can create a lack of clarity. Consider creating a Responsibility Assignment Matrix (or RACI: Responsible, Accountable, Consulted, Informed) to have clear roles and responsibilities.

Examples from Participants in IHI Initiatives

- The **Lawrence General Hospital** team chose to focus one of their improvement efforts on reducing the use of disposable drinkware. They learned from prior efforts that it was important to get input and buy-in from a diverse group of stakeholders at the outset. For this project, that group included Infection Control, as well as non-clinical staff from Facilities Management and Quality and Compliance. Getting key stakeholders on board at the outset of the project helped to remove barriers later on. The core team asked a lot of questions up front about the process to ensure that the right people were consulted. For example, by including the director of nutritional services from the beginning, the team was able to more easily understand how filling the reusable cups with water fit into the current standard work and identify cups that were industrial dishwasher safe. Including frontline staff in the decision-making process reduced the perceived burden of these changes. The care team also needed to be involved in deciding whether a straw needed to be integrated into the reusable cup. Finally, having a QI expert and compliance person on the team helped them create tools to keep track of data, which is especially useful when presenting to leaders or for organizations like The Joint Commission.
- The **Jackson Health System** team had strong clinical champions who worked together to eliminate centrally piped nitrous oxide. They learned early on that this change would need to be clinician led and worked to get the right champions engaged. They focused on finding clinicians within Anesthesia, OB/GYN, and OR teams who had influence in their departments and who were open to sustainability initiatives. These champions helped communicate the project's significance to peers and served as advocates within their network. Using peer-reviewed articles, medical society directives, and clinician-authored how-to guides, these champions provided a strong evidence-based case that demonstrated the project's alignment with best practices. Rather than presenting a fully formed plan right away, the project leads also sought input from leadership early on, making them feel like stakeholders in the process. To gain leadership approval, they framed the initiative around key institutional priorities such as cost savings, environmental impact, patient safety, and operational efficiency. A key learning for them was that project management skills, not usually part of a physician's training, are essential for leading interdisciplinary projects with administrative and operational stakeholders. The project required structured planning, coordination, and accountability. Once the team was able to add in this project management element, they could establish clear timelines and assign roles and responsibilities.

Step 3. Create the Improvement Project Charter

Once the improvement team is established, the next step is to create a project charter for your improvement project. The charter outlines the improvement topic and aim statement, who is on the team, what changes you might test, and how you will measure progress toward your aim.

This information can also be represented through a driver diagram. (See Appendix B for more information on these tools.)

Each team participating in IHI's decarbonization initiatives selected different measures to track based on their project focus and their organization's goals. Below are some examples of measures that teams used to track progress towards their decarbonization goals:

- Metric tons of carbon dioxide from anesthetic gases
- Red bag waste generated (in weight)
- Food waste generated (in weight)
- Nitrous oxide use in the OR
- Recycling as a percentage of total waste

The safety net hospital teams that achieved the most progress toward their aims had tightly scoped improvement projects focused on processes within their control: battery recycling, red bag waste, food waste, and reducing anesthetic gas emissions. These efforts are meaningful on multiple levels: first, achieving net zero carbon emissions goals requires emissions reduction across systems and emissions sources; second, it builds team capacity and organizational will to continue pursuing continuous improvement in decarbonization.

Structural Enablers Supporting This Step

- Establish a regular meeting cadence with the improvement project's senior sponsor to discuss progress, obstacles, and solutions.
- Establish tracking mechanisms (e.g., dashboards on single use vs. reusable items, use of desflurane/nitrous oxide) to monitor progress against local benchmarks.
- Establish a baseline measurement for the department's current performance and outline short-term milestones.

Questions to Consider

- What have other organizations done? What can your team learn from them?
- What is the team capacity both in terms of effort and skill level?
- What changes or improvement activities require permission and from whom?
- Who will this change affect in terms of workflow (perceived burden)?
- How will this change affect patient safety?
- What standard processes need to be modified?
- Is there already progress on making this change elsewhere in the organization (and if so, where)?

Possible Obstacles

- Determining measures can be complicated, especially when there are no existing data collection methods. Don't get bogged down trying to find the perfect measure; use data that are easily accessible. For example, if you can't determine the actual weight of all waste being removed, measure how many times per day or week waste is collected for removal.
- Look at what other organizations have done and collect data to back up your proposed improvement project. For example, you might point to the effect of nitrous oxide and desflurane leaks on the environment[6] and identify specific changes that other hospitals have implemented in this area to reduce their use.
- Ambitious goals are great but can become discouraging. Work with your team to set realistic, achievable targets.
- Each step will take longer than expected. Consider working with a project manager to help keep the project moving and to manage a risk tracker.

Examples from Participants in IHI Initiatives

- The **Los Angeles General Medical Center** team focused their improvement efforts on battery recycling. The team identified a problem with alkaline batteries that were essentially single use, being used to power scopes briefly during a procedure and then discarded. After conducting a process analysis, the team identified a way to separate the batteries from the scope housing for recycling and were able to set a clear goal for their improvement project. As the project got underway, clinician leaders attempting to remove the batteries and recycle them learned that they were required to tape one end of the battery, which slowed down the process for the clinical team. The team was able to develop a new process, enlisting anesthesia techs to collect used laryngoscopes, remove and tape the ends of the alkaline batteries, and place batteries in the appropriate recycling bin. This project provides a good example of a project with a clear, focused aim and the use of process improvement to identify and solve potential challenges.

- Another participating team chose to work on reducing food waste in the kitchen. The team engaged their director of dining services to lead the project and worked together to scope a project that had a clear, attainable aim statement: reduce kitchen breakfast preparation waste by 25 percent over the project period. They developed an action plan and a set of ideas to try that they believed would help them achieve their desired outcome and planned to carefully track waste over the course of the project. The team also engaged others involved in food purchasing and preparation, as well as those supervising and completing the food preparation work, to identify areas for improvement and develop new approaches and workflows. This engagement with staff at all levels enabled the team to be fully invested in the project and its outcomes. The team achieved their initial goal, and this project served as proof of concept for additional reductions on

an ongoing basis. This project highlights how much can be achieved when engaging the right people to design a project with a clear, feasible aim and action plan.

Step 4. Identify and Test Changes

Once the improvement team is established and has created a project charter, it is time to get to work on identifying and testing the key changes that you believe will help achieve your aim. Start small and build from there. Participants in IHI's decarbonization initiatives used Plan-Do-Study-Act (PDSA)[7] cycles to rapidly test small tests of change in their settings.

Structural Enablers Supporting This Step

- Establish a regular meeting cadence with the improvement project's senior sponsor to discuss progress, obstacles, and solutions.
- Establish tracking mechanisms (e.g., dashboards on single use vs. reusable items, use of desflurane/nitrous oxide) to monitor progress against local benchmarks.
- Regularly review local progress against targets to identify areas for improvement and adjust strategies as needed.
- Recognize and reward sustainable practices among staff and encourage frontline teams to propose and test local decarbonization initiatives.
- Create a safe space where team members can propose ideas for improvement without fear of being penalized.

Questions to Consider

- Is there one change that can be easily tested on a small scale (e.g., on one unit, with one team member)?
- How did the first test go? What went well, what didn't go as well? Did you get any feedback?
- What changes need to be made to standard work to ensure that the improvement is reliably implemented?

Possible Obstacles

- Changes that might impact multiple units or departments will require communication with multiple individuals across the hospital and/or across shifts.
- Starting with a small test of a change that has a high likelihood of success can ensure small wins to keep team members motivated and morale high.

- The Plan phase of the PDSA cycle doesn't need to be perfect; repeating the Plan phase without testing the change won't lead to progress toward the aim.
- Measurement by itself is typically insufficient to change behavior. However, some degree of measurement is usually necessary to identify opportunities for improvement and monitor performance over time.

Examples from Participants in IHI Initiatives

- The **Lawrence General Hospital** team initially piloted the use of reusable cups for patients on just one floor. They chose to start on a floor with an open-minded nurse supervisor to test the new process and work out any initial challenges in a friendly environment. After a few weeks of successful testing, they were able to expand to additional floors. Based on feedback from the first few rounds of testing, they made an adjustment to purchase smaller-sized pitchers and they are now planning to implement the improvement on additional inpatient floors. By starting small, the team was able to identify and address initial challenges and then quickly expand the improvement. The team hoped the change to reusable cups and pitchers would be a seamless switch and quickly learned that they would need to change a lot of standard work related to distributing, cleaning, and filling the cups. One key learning for the team was that having a weekly meeting with all stakeholders involved (e.g., Green Team, food services, nurse supervisors) was incredibly helpful in getting workflow issues addressed quickly.

- The **Harbor-UCLA Medical Center** team chose to start their red bag waste project in one high-volume clinical area (interventional radiology, or IR) that generates a significant amount of waste from single-use devices and supplies. By starting in just one area, they were able to fine tune their measurement approach. Using direct observation, the team established a simple measurement system to collect baseline data on how much red bag waste was being generated. The team iterated on their method for measuring red bag waste through multiple PDSA cycles. Table 2 outlines the team's initial test to establish a weighing method for the IR suite's daily red bag waste. Their initial audit showed that 90 percent of the items in the red bag waste containers did not need to be there. The team used the information from the audit to orient and educate staff on items that could be classified as red bag waste. Working with an IHI Improvement Advisor, the team was also able to develop figures to visualize their data, which made it easier to share progress with colleagues and identify next steps.

Table 2. Harbor-UCLA Medical Center Interventional Radiology Initial Test of Measuring Daily Red Bag Waste

Plan			Do
Questions	**Prediction**	**Data Collection**	**What Happened?**
Can we weigh red bag waste today (get a number)?	Yes	Ask the team	We got numbers! There were 3 of us there but could be done by 1 person. Toughest part was figuring out where to store the scale.
Can we use a phone to take a photo of the scale readout to capture weights?	Yes	Ask the team	It is possible to take a photo of the scale readout if you always keep the hand that touches the phone clean.
Can we measure waste in less than 10 minutes?	Yes	Team leader uses timer to obtain start and stop times	It took 15 minutes, but that included putting batteries in the scale before use.

Step 5. Assess Progress and Plan for Spread

To sustain gains in clinical decarbonization, health systems must incorporate improvements into standard work and procedure protocols. Many teams participating in the IHI initiatives made small gains in their decarbonization improvements at the local level but struggled to spread or scale projects outside of their specific unit. Teams found that to achieve continued success in their decarbonization efforts, they needed to dedicate continuing attention to the work. One-time fixes don't persist unless they are integrated into standard work. In addition, continuing education is required for staff and must be incorporated into new staff onboarding.

Structural Enablers Supporting This Step

- Nominate executive leadership to take responsibility for sponsoring and supporting clinical decarbonization.
- Incorporate clinical decarbonization efforts into the daily roles and processes of the unit.

Examples from Participants in IHI Initiatives

- The **NYC Health + Hospitals** team was led by the chief quality officer. Because of her leadership role in the organization, she was able to integrate clinical decarbonization work with the organization's broader quality agenda. One of their hospitals, NYC H+H/Jacobi/North Central Bronx — which includes a Level-I trauma center and community-based campus in the Bronx — has incorporated environmental sustainability into its Quality Assurance/Performance Improvement (QAPI) strategic planning. Across the health system, they have begun integrating concepts of climate action into their Quality Academy, a six-month performance improvement program for frontline staff, by sharing ecofriendly examples throughout the curriculum and delivering a presentation to provide practical tips to participants to advance high-quality, planet-friendly health care through quality improvement work. The health system has also established a one-hour training that outlines the impact of climate on health, practical tips to reduce the effects, and communication best practices. These activities have helped to embed decarbonization efforts into organization-wide priorities, ensuring a path forward and training new generations of clinicians and leaders.
- The **Los Angeles General Medical Center** team was able to expand the laryngoscope battery initiative to other areas of the hospital because the perioperative team was formally linked to a hospital-wide Green Committee, chaired by the chief quality officer. Other hospital areas (e.g., OB/GYN) that learned about the initial decarbonization project also became interested in implementing this improvement. The improvement project team leader leveraged her position as assistant director of perioperative services to engage clinical areas that share common procedures and battery-powered instruments.

Making the Business Case for Clinical Decarbonization

To gain necessary leadership buy-in and support for clinical decarbonization initiatives, individuals leading the work need to show return on investment to the organization. Leaders and team members can do this in different ways, depending on what is most important to the organization. Many decarbonization efforts will result in cost savings; others will improve staff morale, recruitment, and retention; some efforts may decrease disruptions in energy and product supply chains; and some may improve climate resilience (i.e., the ability of individuals, communities, ecosystems, and infrastructure to cope with and recover from climate change) or connect with public health or service parts of the organization's mission.

Health care organizations might not see these returns in the short term, however, so it's important to present a plan to describe how clinical decarbonization efforts fit into long-term organizational priorities and strategies. Often, there is a business case built into individual

decarbonization activities rather than a standalone business case for decarbonization in health care overall. For safety net hospitals, decarbonization efforts that focus attention on waste reduction and cost savings are key areas for improvement.

The easiest starting points are often those with the highest likelihood for demonstrating the quickest results such as energy waste, pharmaceutical waste, or food waste. Clinical changes that advance decarbonization efforts can also be a great place to start if your organization has identified a strong clinical champion to support these changes.

Questions to consider in making the business case for clinical decarbonization to leadership:

- Whose buy-in do you need to make changes in your area of focus?
- What exactly do you need from them (e.g., overcoming barriers, bringing visibility to the work, financial support, staff resources)?
- What are their interests and values (e.g., financial, reputational, connection to strategic priorities, population health, equity)?
- What is the best way to communicate with them (e.g., one-page document, financial model, presentation, one-to-one conversation, walk-around tour)?
- How will you measure progress and communicate success? What story do you want to be able to tell?
- What is the scale-up plan or plan for the next round of decarbonization work? Who might your partners be?

Conclusion

Getting started with clinical decarbonization can feel daunting since hospitals and health systems have multiple competing priorities and may have limited resources. The scope of clinical decarbonization work is extensive, with many critical improvement areas that need to be addressed. Clinicians, hospital staff, and teams can use this guide to help identify ways to get started with projects both small and large that can lead to more sustainable practices and, ultimately, a reduction in greenhouse gas emissions.

Appendix A: Example Clinical Decarbonization Improvement Aims

The tables below include improvement aims for health care organizations that participated in the IHI decarbonization initiatives.

Health Care Organizations Participating in the IHI Decarbonizing Care Learning Community

Organization Name	Aim
Atrium Health	• Implement low fresh gas flow anesthesia by 1L/min by end of 2023. • Reduce nitrous oxide usage by 25% by end of 2023. • Reduce desflurane usage by 50% by end of 2023 and potentially phase out usage in Atrium Health Greater Charlotte Market area.
Jackson Health	Reduce red bag waste (i.e., regulated medical waste) by 20% on a monthly basis in the IRs post-implementation, and 50% on a monthly basis in the acute care areas by December 2023, with even larger reductions expected in other procedural areas.
John Muir Health	Develop baseline carbon footprint of John Muir Health (water, energy, chemicals, food, and waste [hazardous, recycle, landfill]) by October 31, 2023, and define reduction targets and strategies by December 31, 2023.
Memorial Sloan Kettering Cancer Center	Reduce Scope 1 GHG emissions from anesthetic gases by 25% by 2025 from 2019 baseline.
M Health Fairview	Reduce the monthly average of desflurane used at Princeton Hospital by 50% from 363L to 181L by December 31, 2023, with the overarching goal to eliminate desflurane as an anesthetic agent at this site and across the system.
Northern Light Health	Achieve an 80% reduction in the use of desflurane in FY24 (October 1, 2023 to September 30, 2024) over 2021 baseline year usage, with a stretch goal of complete elimination of desflurane by fiscal year end.
Parkland Health	Cut the desflurane use by at least half by December 31, 2023 at the main hospital. Decrease is measured relative to 2022 baseline.
Stanford Health	• Purchase a minimum of 20% reprocessed versions of 3 different Ligasure of Harmonic devices by November 30, 2023. • Reduce yellow foam use by 50% by July 2024. • Decommission the centrally piped N2O system and transition to an E-cylinder delivery system by end of 2023 at all facilities.

Health Care Organizations Participating in the IHI Safety Net Decarbonization Collaborative

Organization Name	Aim
Harbor-UCLA Medical Center	Reduce unused item disposal from interventional radiology (IR) kits by 25 percent and reduce red bag waste (i.e., regulated medical waste) volume by 50 percent.
Jackson Health System	Lower emissions from nitrous oxide (N20) by more than 90%, decommission the centrally piped N2O system, and transition to an E-cylinder delivery system by end of 2025 at a pilot facility, with plans to scale up efforts to other facilities in the future.
Lawrence General Hospital	• Decommission central nitrous oxide piping at the hospital by August 30, 2024, in order to reduce nitrous oxide emissions by 90% from the Main/C-section OR and transition to portable E-cylinders attached to the anesthesia machines, which will help us to achieve emissions reductions in line with our Health and Human Services (HHS) Pledge and The Joint Commission Healthcare Sustainability certification. • Reduce use of disposable drinkware (cups and pitchers) by 50% by October 25, 2024, at the main hospital campus by substituting reusable products.
Los Angeles General Medical Center	• Increase the number of batteries recycled from used laryngoscope handles within Los Angeles General Medical Center to 100% by March 2025. • Reduce the amount of excess waste, such as laparoscopic irrigator tubing, within the recycling bin to decrease the number of pick-ups by our hazardous waste team.
NYC Health + Hospitals	• Global Aim: Develop structures and tools to promote climate action. • Smart Aim: Promote the integration of a climate lens in 10 Quality Academy Cohort #4 projects (a six-month program for frontline staff to complete a performance improvement project by sharing ecofriendly examples throughout the curriculum).
Parkland Health	Create a sustainability committee, with goals for each leader involved in the committee that will be reported on a quarterly basis.

Appendix B: Additional Resources and Further Reading

IHI Quality Improvement Resources and Tools

- Model for Improvement and PDSA Cycles
- Forming a Team
- Aim Statement Worksheet
- Project Charter Tool
- Driver Diagram
- PDSA Worksheet
- Establishing Measures

IHI Climate and Health Resources

- Decarbonizing Care Delivery Organizational Readiness Assessment
- Decarbonizing Care Delivery Quality Improvement Workbook: Lowering Emissions from Anesthetic Gases
- Accelerating Decarbonization in Clinical Care
- Natural Disasters' Impact on Supply Chain Spurs Reckoning with Health Care's Role in Climate Change
- IHI Open School Course: Decarbonizing Care 101: Climate and Health

Additional Resources

- Providence Toolkits and Resources for nitrous oxide, waste optimization, Green Teams, and environmental stewardship strategy and planning
- NYC Health + Hospitals Climate Health Champions Toolkit
- The Joint Commission Sustainable Healthcare Resource Center
- Georgetown Climate Center's Decarbonizing Health Care: Clean Energy Policy Options
- CASCADE's Greenhouse Gas Emissions Estimation in Canadian Healthcare
- American Society of Anesthesiologists The Environmental Impact of Inhaled Anesthetics

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