Resources to Support Local Healthcare Decarbonization

APRIL 2024

Public Health
Seattle & King County

OVERVIEW

PURPOSE:

To summarize local health system sustainability efforts, provide sustainability examples from leading health systems, highlight recommendations for initiating and expanding sustainability action and make the public health case for decarbonization.

SUMMARY OF RESOURCES:

- **Brief:** Provides a broad picture of healthcare sustainability.

- **Resources to Initiate or Expand Sustainability:** Recommendations for achieving outcomes; benefits from action for communicating to leadership

- **Primer on Climate Change, Health and Equity:** Provides public health case for sustainability action.

- **Appendices:** Research, tools, resources and examples to get started.

SUGGESTED USE:

- Strategic planning
- Support conversations with organization leadership and board to achieve buy-in for sustainability action
- Sustainability initiative development and implementation
- Build awareness of connections between climate change, health and drivers of elevated risk

DEFINITIONS

TERM	DEFINITION
Sustainability	The integration of environmental stewardship, social equity and fiduciary responsibility to support healthy, equitable and resilient environments and communities over time
Decarbonization	To reduce greenhouse gas emissions and emissions intensity resulting from healthcare delivery
Implementer	Internal sustainability champions; dedicated staff with primary responsibility for moving work forward day-to-day
Leadership	C-suite, board members, and senior department leaders whose buy-in is necessary to initiate sustainability projects
Greenhouse gas emission protocol	Widely accepted metric for accounting for or reporting healthcare emissions, classified as scope 1 (*direct emissions - facilities and vehicles*), scope 2 (*indirect emissions - purchased energy*) or scope 3 (*supply chain - product, transport, disposal of goods and services*)
Health equity	Everyone has a fair and just opportunity to attain their highest level of health
Disability-adjusted life years (DALYs)	One DALY represents the loss of equivalent to one year of full health

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EXECUTIVE SUMMARY

Making the case
for sustainability

WHO: climate change is the number one threat to human health

▶▶ 250,000 additional deaths projected per year between 2030 and 2050

Healthcare emissions contribute to climate change and health impacts

▶▶ Comprise 8.5% of total U.S. emissions and increased 6% between 2010-2018

▶▶ Emit 9% of harmful air pollutants that contribute to more than 100,000 deaths related to air pollution each year in the U.S.

Climate change is already impacting health in the Pacific Northwest

▶▶ Record-breaking temperatures in June 2021 contributed to over 100 deaths, a 69-fold increase in ER visits and the highest volume of 911 calls in King County since the system was launched in 1969

Health facilities and infrastructure are threatened by climate change

▶▶ Events such as flooding and wildfires are increasingly disrupting operations

▶▶ Legacy Health Systems was forced to close facilities and evacuate patients and staff in northwestern Oregon due to wildfires in 2020

Taking action on sustainability is an opportunity to reduce contribution to climate change, build resilience and realize diverse benefits

▶▶ Benefits include cost savings via reduced energy, waste management and procurement expenses, reduced carbon footprint, improved collaboration between interdepartmental teams, and industry and public recognition for commitment to sustainability

▶▶ Reducing emissions could avoid thousands of premature deaths, respiratory illnesses such as asthma attacks and lost workdays per year

Historic support available for healthcare decarbonization initiatives via the Inflation Reduction Act

▶▶ The IRA contains incentives, tax credits and grants for initiatives such as improving building energy efficiency, installing renewable energy systems, shifting to electric vehicles and reducing supply chain emissions

National healthcare sector collaboration to achieve decarbonization

▶▶ The National Academy of Medicine Action Collaborative on Decarbonizing the U.S. Healthcare Sector is a public-private partnership of healthcare stakeholders committed to addressing the sector's environmental impact while strengthening sustainability and resilience. Membership comes from healthcare, government, trade associations, pharmaceutical/medical device manufacturers and academia.

SNAPSHOTS OF DIVERSE BENEFITS

Local healthcare systems and facilities are realizing cost savings and other benefits from diverse sustainability initiatives across energy infrastructure, operations, and clinical delivery. Several projects were implemented with limited up-front investment, utilizing existing staff capacity and expertise without complex infrastructure upgrades.

Examples:

KAISER PERMANENTE

▶▶ Strategies: installed solar at 100 facilities including 31 hospitals, installed renewable microgrid with 1 megawatt-hour storage capacity, achieved Energy Star or LEED certification for 87 facilities

▶▶ Outcomes: reduced energy use intensity by 6% compared to 2015

▶▶ Cost savings: **$21.4 million per year**

PROVIDENCE

▶▶ Strategies: transitioned from centralized to canister-based nitrous oxide at Providence St. Vincent Medical Center in Portland, Oregon.

▶▶ Project team: anesthesiologist, OR leadership, facilities leadership and senior hospital leadership

▶▶ Outcomes: **achieved 99% reduction in nitrous oxide waste**, reduced health risks to patients, visitors and staff from leaked NO2 and realized modest cost savings.

SEATTLE CHILDREN'S

▶▶ Strategies: committed to diverting 50% of main campus waste from landfills by 2025 through a comprehensive recycling program for paper, plastics, lighting, electronic devices, metals and composting of food and landscaping waste.

▶▶ Outcomes: achieved **47% waste diversion rate** in 2022

SUPPORT AND MOTIVATION FOR ACTION

INFLATION REDUCTION ACT

The IRA contains incentives, tax credits and grants for sustainability initiatives such as improving building energy efficiency, installing renewable energy systems, shifting to electric vehicles and reducing supply chain emissions.

⏵⏵ *Solar installation:* Centro Diagnostico y Tratamiento San Sebastian Inc., a health clinic located in Puerto Rico, **received a $113,958 grant** to purchase a 96.76 kW photovoltaic solar system connected to a battery backup energy storage system.

⏵⏵ *HVAC infrastructure:* Oaks Healthcare LLC **received a $204,358 grant** to purchase a 350-ton chiller system for the nursing home/long-term care campus of buildings.

🌐 *Jump to Appendix A for more information on leveraging the IRA*

INCENTIVES/REBATES

Local public energy utilities including Puget Sound Energy, Seattle City Light and WA State offer incentive programs that may lower the cost of energy efficiency projects such as LED transition, HVAC efficiency and tracking, infrastructure upgrades and more.

⏵⏵ *Puget Sound Energy - Existing Building Commissioning*: Overlake Medical Center utilized a PSE incentive covering 75% of commissioning providers fees to identify opportunities for energy efficiency improvements and savings, such as adjusting HVAC settings and sequencing that resulted in a **10% electricity reduction** and **$150,000 per year savings in energy costs**.

🌐 *Jump to Appendix A for more information on local incentive programs*

MANDATES

Several decarbonization policy measures enacted by WA State and City of Seattle apply to the healthcare sector, requiring significant sustainability actions to achieve compliance.

⏵⏵ *Clean Buildings Standards:* WA State and City of Seattle require applicable buildings over 50k sq. ft., **including hospitals**, to meet declining carbon emission targets starting in 2026, 20k-50k sq. ft. buildings starting in 2031, reaching net-zero by 2050.

⏵⏵ *WA State Organics Management Law:* Requires governments, businesses and other organizations **including hospitals** to reduce the amount of organic material disposed in landfills and increase food waste diversion starting in 2024.

🌐 *Jump to Appendix B for more information on state and local mandates*
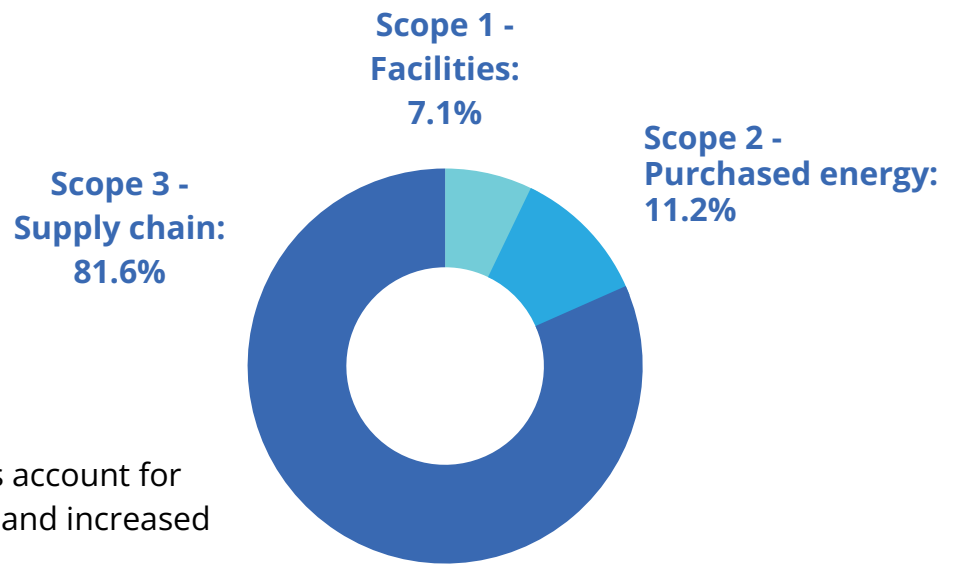
Climate change and the healthcare sector

Understanding how healthcare emissions contribute to climate change, impact health, and projections for the future

EMISSIONS CONTRIBUTE TO HEALTH IMPACTS

U.S. healthcare emission sources:

Scope 1 - Facilities: 7.1%

Scope 2 - Purchased energy: 11.2%

Scope 3 - Supply chain: 81.6%

Healthcare sector emissions account for 8.5% of total U.S. emissions and increased 6% between 2010 and 2018.

- The U.S. healthcare sector is the number one absolute and per capita health system emitter in the world.

- Climate change impacts health through extreme heat, wildfire smoke, flooding, vector-borne diseases and extreme weather events.

- Exposure to toxic air pollutants from U.S. healthcare emissions are projected to result in preventable future health damages of 388k lost life years from respiratory illnesses, cancer, stroke and other chronic diseases.

- Climate change events are impacting healthcare in increased emergency room admissions, patient mortality, risk to buildings, operations and infrastructure.

- The healthcare sector can improve efficiency, reduce waste, save money, demonstrate prioritization of patient health, and lower its contribution to climate change through commitments to decarbonize along with sustainability actions and initiatives.

The state of healthcare decarbonization

How health systems are taking action on sustainability and achieving diverse benefits

LOCAL HEALTH SYSTEMS AND FACILITIES ARE TAKING ACTION TO REDUCE THEIR CARBON FOOTPRINT

Healthcare accounts for around 11% of greenhouse gas emissions in King County. Local healthcare organizations are taking action to address climate change, reduce their carbon footprint, waste, improve energy efficiency and resilience to climate change effects:

Providence – anesthetic gas: transitioned from desflurane to sevoflurane which yielded an 83 percent reduction in emissions. Desflurane has a global warming potential 25 times greater than sevoflurane and is also more expensive to administer.

Kaiser Permanente – micro grid: stores up to 1 kw/h of energy from 250kw solar installation for use in the event of a power outage.

**Seattle Children's – commitment**: aim to achieve carbon neutrality by 2025 through a suite of energy efficiency, waste/water reduction, green procurement and building strategies.

Virginia Mason – waste reduction: achieved waste diversion rate of more than 50 percent through packaging reduction, pharmaceutical waste reduction, recycling clinical/consumer waste and donating unneeded medical supplies.
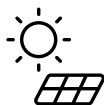
Harborview Medical Center - solar: installed 100 kw rooftop solar array. 2023 Practice Greenhealth Environmental Excellence Award Winner.
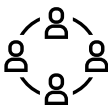
Washington Health Care Climate Alliance: "leadership body of Washington health systems committed to protecting the public from the health impacts of climate change, becoming anchors for resilient communities and contributing to meeting the state's climate goals."

BENEFITS ACHIEVED BY NATIONAL LEADERS

Cost savings: Gundersen Health System saves an estimated $3 million per year from energy efficiency improvements including turning off lighting, computing, heating/cooling systems in off-peak hours and weekends and upgrading lighting and building infrastructure.
- *Sites of care:* 40
- *Hospitals:* 7
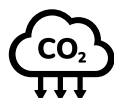
Reduced GHGE: The Cleveland Clinic reduced emissions by 24% between 2010-2020 through renewable energy, waste diversion, LEED building construction and sustainable procurement.
- *Sites of care:* 242
- *Hospitals:* 22

Reduced waste: NYU Langone Health recycles over 50 tons of electronic waste and diverts 150k pounds of plastic waste from medical device reprocessing and reusable sharps programs.
- *Sites of care:* 300
- *Hospitals:* 5

Energy efficiency: University of Vermont Medical Center improved its Energy Star score from 16 to 67 between 2015-2017, reduced overall energy use by 2.3 kilowatt hours through green transportation initiatives and LEED certified buildings.
- *Sites of care:* 6
- *Hospitals:* 1

Collaboration: HealthPartners established 23 Green Teams and workgroups with representation from across the organization to implement projects such as telemedicine, organic waste diversion, solar installation and unused medical supply donation.
- *Sites of care:* 90
- *Hospitals:* 9

Resources to initiate or expand sustainability

Information and examples to achieve leadership buy-in and key resources for getting started through implementation

MAKING THE CASE FOR SUSTAINABILITY

A critical step for sustainability implementation is achieving buy-in, resources and support from organizational leadership. Below are specific benefits from decarbonization, examples of health systems who have achieved these benefits and supporting resources.

BENEFIT	DESCRIPTION	EXAMPLE
Cost savings	Initiatives can yield savings via reduced energy, waste management, and procurement costs.	Rochester Regional Health saves $2.4 million annually through energy efficiency improvements.
Emission reduction	Greening building operations, purchasing renewable energy, expanding telehealth services, and waste diversion can all contribute to reduced health system emissions.	Kaiser Permanente became the first carbon neutral U.S. health system in 2020 through strategies including solar-powered microgrid installation, purchasing renewable energy, energy efficiency improvements and carbon offsets.
Energy efficiency	Actions such as transitioning to LED lighting are simple, relatively low-cost and net tangible energy reductions.	Cleveland Clinic reduced energy use by 25% per square foot and constructs all new buildings to LEED Green Building standards.
Collaboration	Sustainability projects commonly require diverse expertise and collaboration between teams, creating new connections, awareness and partnerships.	HealthPartners implemented 23 interdepartmental green teams and sustainability work groups across their headquarters, individual hospitals and clinics.

MAKING THE CASE FOR SUSTAINABILITY (CONT'D)

BENEFIT	DESCRIPTION	EXAMPLE
Risk management	Extreme weather events such as flooding, hurricanes and wildfires are disrupting healthcare operations.	Legacy Health Systems was forced to close facilities in northwestern Oregon due to wildfires in 2020.
Reduced disease	Reducing air pollutants co-emitted with greenhouse gases could avoid thousands of premature deaths in the coming decades.	Reduced GHGE via the IRA is projected to avoid up to 3900 premature deaths, 100k asthma attacks and 417k lost work days per year.

BENEFIT	EXAMPLE
Recognition	Practice Greenhealth awards the top 25 hospitals in the United States each year for environmental excellence. This recognition is a powerful demonstration of commitment to sustainability and a promotional resource.
Strong public support	Yale Climate Change in the American Mind: a majority of Washington State residents believe climate change is happening (75%), is human caused (60%), is impacting human health (63%) and that businesses should do more to address it (73%).
Resources	How the Inflation Reduction Act Can Help the Health Care Sector Reduce Greenhouse Gas Emissions: tax credits for renewable energy, energy suppliers, electric commercial vehicles and a variety of incentives intended to reduce emissions.

GUIDANCE, RESEARCH AND RESOURCES

There are a growing number of resources to help start and expand healthcare sustainability initiatives. Selected publications are highlighted below with additional ones available in the 'resources' section:

FOCUS AREA	RESOURCE
Building a foundation	[Reducing Healthcare Carbon Emissions: A Primer on Measures and Actions for Healthcare Organizations to Mitigate Climate Change](#): comprehensive overview of healthcare GHGE, guidance and action steps for getting started, emission reduction strategies, measures and implementation examples.
Starting a sustainability team or initiative	[Development of a center for the environment and health at a large academic medical center](#): outlines development of the Center for the Environment and Health at Mass General Hospital in Boston, MA. The 10-point Environmental Stewardship Plan is applicable to other health systems and hospitals.
Emission assessment and tracking	[Reducing Healthcare Carbon Emissions: A Primer on Measures and Actions for Healthcare Organizations to Mitigate Climate Change](#): pages 11-26 provide an overview of calculating healthcare emissions, sample measures within each category and applicable strategies.

FOCUS AREA	RESOURCE
Building operations	[Charting a course toward zero emissions healthcare](#): presents three broad pathways and 7 actions with multiple example interventions for each action to achieve decarbonization
Patient education and staff training	[Americares – Climate Resilience for Frontline Clinics Toolkit](#): Includes free, downloadable information sheets, guidance documents, and checklists for provider, patient and administrator audiences for heat, wildfires and hurricanes/flooding.
Clinical sustainability initiatives	[Inhaled anaesthesia and analgesia contribute to climate change](#): anesthesiology is one of the most promising opportunities for reducing clinical GHGE. This article outlines emission reduction strategies and is co-authored by a physician at Providence Health and Services that have achieved dramatic emission reduction and cost savings through transition from desflurane to sevoflurane.
Waste reduction	[Hospital food waste: reducing waste and cost to our healthcare system and environment: 10-15% of total healthcare carbon footprint is from food waste](#) with studies indicating only around a third of patient meals are fully eaten. Food waste can be difficult to quantify, donation is a priority but often not pursued due to legal considerations and there may be additional opportunities to repurpose unused food.

Climate change, health, and equity

Understanding how climate change impacts health, local hazards and why specific groups are at elevated risk

Climate change is the greatest health threat facing humanity, according to the World Health Organization, with a projected 250,000 additional deaths per year between 2030 and 2050. Effects including rising temperatures, sea levels, CO2 levels and more extreme weather events are impacting health through heat stress, respiratory illness, exacerbation of chronic disease, injuries, anxiety, depression, PTSD, vector-borne disease and more.

Emerging climate change and health impacts in Washington State:

Extreme heat: record-breaking temperatures in June 2021 contributed to over 100 deaths and increased ER visits for heat-related illness. A study of heat-morbidity data for King County between 1990-2010 found an association between heat expressed as humidex (temperature combined with humidity) and increased hospital admissions.

Wildfire smoke: wildfires are starting earlier in the year and happening with greater frequency. Smoke contains benzene, nitrogen oxide and particulate matter 2.5 that are harmful to health. Research has found increased odds of mortality in the first few days after wildfire smoke exposure.

Patient populations at elevated risk of health impacts:

- BIPOC: studies of heat, cold, hurricanes, flooding and wildfires find evidence that people of color are at higher risk.
- Older adults: are more likely to have a chronic health condition that is sensitive to extreme heat or poor air quality, have limited mobility to seek shelter, and depend on others to maintain daily health.
- Children: depend on adults for personal safety and access to protective measures. Are at higher risk from heat and air pollution, climate anxiety and PTSD.
- Outdoor workers: there are over 80,000 seasonal workers in WA State. They are exposed to high summer temperatures and/or wildfire smoke and are more likely to be uninsured or lack access to healthcare with limited benefits and safety measures.
- Those with chronic illnesses: heart disease, asthma, mental health conditions and others can be worsened by climate change effects such as heat waves, wildfire smoke and extreme weather events.
- Low-income households: the same physical, social, and economic environments that are associated with poor health outcomes for low-income communities also increase exposure and vulnerability to the health impacts of climate change.

Key drivers of elevated risk:

- Environment: poor baseline air quality and limited greenspace
- Social inequities: historic redlining, displacement, limited access to healthcare, emergency messaging unavailable in spoken language(s), and underrepresentation in healthcare, government leadership positions and decision-making spaces
- Social determinants of health: low-income, substandard housing with poor ventilation/mold, limited access to fresh fruits/vegetables, limited public transportation options

illustrative example:

King County Heat Mapping Project: Over 110k temperature readings taken at three different intervals during an extreme heat event in July 2020 found temperatures differed by as much as 20 degrees between areas of King County.

The highest temperatures were in south end areas which have higher racial/ethnic diversity, existing health disparities and vulnerability to climate change effects. Densely urbanized areas also retained heat far longer than those with more natural landscapes as reflected in persistent high temperatures in dark red between the afternoon and evening temperature readings in the maps below:
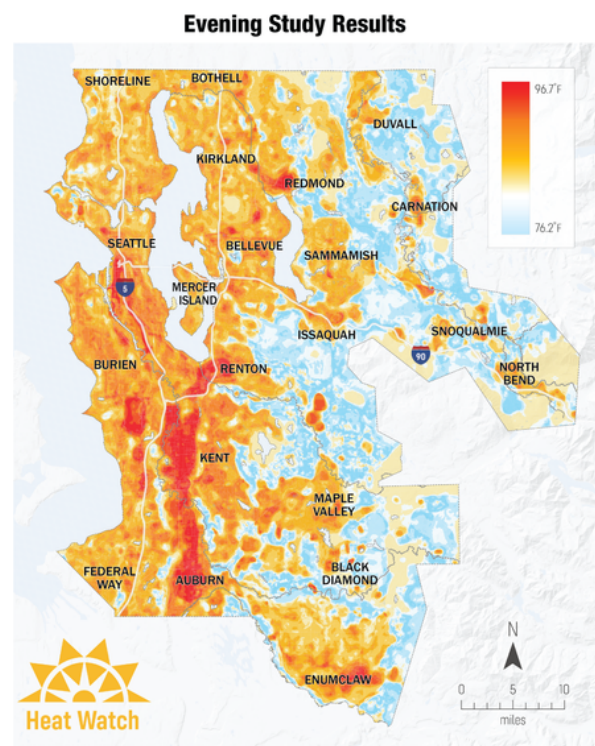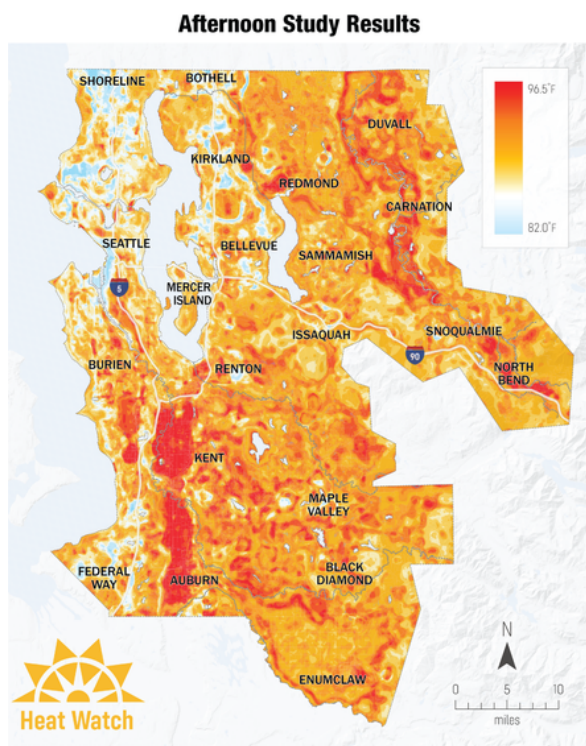
Healthcare GHGE contribute to health impacts:

- Accounts for 8.5% of total U.S. emissions and increased 6% between 2010-2018. U.S. healthcare emission sources: scope 1 - facilities (7%), scope 2 – purchased energy (11%) and scope 3 – procurement of healthcare goods and services (80%+). The U.S. healthcare sector is the number one absolute and per capita emitter in the world.
- U.S. healthcare sector contributes 9% of harmful air pollutants
- Air pollution is a major cause of mortality – associated with over 4 million deaths per year globally, more than 100,000 per year in the U.S and almost $900 billion per year in healthcare costs

Projected health benefits from U.S. decarbonization:

The Inflation Reduction Act – implications for climate change, air pollution, and health

- Projected to reduce U.S. GHGE by 42% by 2030 compared to 2005
- Reduced PM2.5 emissions are projected to avoid thousands of hospitalizations, reduce health care costs and increase economic productivity

Protecting the Public Health with the Inflation Reduction Act – Provisions Affecting Climate Change and Its Health Effects

- Reduced emission of air pollutants in methane and carbon dioxide are projected to avoid up to 3900 premature deaths, 100,000 asthma attacks and 417,000 lost workdays per year by 2030
- Support for wildfire smoke prevention measures may help reduce hazardous pollutants present in wildfire smoke and associated health impacts such as reduced lung function, bronchitis, exacerbation of asthma and immune system impairment

APPENDIX A

Funding procurement and incentives

Resources for leveraging the Inflaction Reduction Act and local/state utility programs to fund or subsidize sustainability projects

FUNDING PROCUREMENT

The Inflation Reduction Act is an historic opportunity to accelerate U.S. healthcare system decarbonization. The IRA contains several incentives, tax credits and grants for initiatives such as improving building energy efficiency, installing renewable energy systems, shifting to electric vehicles and reducing supply chain emissions. Below are several resources that offer a starting point for determining which opportunities are applicable to your health system/facility, requirements and implementation examples.

RESOURCE	DESCRIPTION
How the Inflation Reduction Act can help the health care sector reduce greenhouse gas emissions	Article outlining IRA provisions for the healthcare sector across building decarbonization, transportation, material production and financing
The Office of Climate Change and Health Equity quickfinder for leveraging the inflation reduction act for the health sector	Detailed summaries of IRA incentives, tax credit and funding opportunities applicable to the healthcare sector
Compendium of federal resources for health sector emissions reduction and resilience	Federal funding opportunities, tools, resources that can assist healthcare sector in emissions reduction/resilience
Webinar Series: Accelerating Healthcare Sector Action on Climate Change and Health Equity	Multi-part series with each session dedicated to an in-depth review of an IRA component/resource relevant for the healthcare sector. Features expert speakers and stakeholders.
The Inflation Reduction Act brings new opportunities for health care's climate action	Detailed review of IRA incentives/tax credits for clean electricity, transportation, buildings and resilience

LOCAL INCENTIVES

Puget Sound Energy, Seattle City Light and Washington State offer a range of incentive programs that can substantially lower the cost of many energy efficiency improvement projects such as LED transition, improving HVAC efficiency and tracking, infrastructure upgrades and more.

RESOURCE	DESCRIPTION
[PSE Business Incentives program for medical facilities and clinics](#)	Incentives and training for existing building commissioning, lighting, HVAC upgrades, comprehensive pay for performance energy savings program and more
[SCL energy conservation initiatives](#)	Incentives for lighting, HVAC, data center, water heating and refrigeration projects
[SCL energy conservation incentives - commercial rebates](#)	Rebates for commercial HVAC, kitchen, ventilation systems and equipment with no pre-approval required
[Washington state early adopter incentive program](#)	The owner of a tier 1 (50,000+ sq. ft.) building can earn a $.85/sq. ft. incentive payment by demonstrating early compliance with the Clean Buildings Standard

APPENDIX B

Local mandates

*Understanding new state and local policies
requiring emission reduction*

LOCAL MANDATES

Washington State and the City of Seattle have enacted several policy measures requiring and/or incentivizing decarbonization that apply to the healthcare sector. These include City and State Clean Buildings Standards and Organics Management Law. Compliance with these mandates will likely require significant sustainability actions and may be an asset to achieving buy-in from leadership.

MANDATE	DESCRIPTION
WA State clean buildings performance standard	Requires applicable buildings including hospitals over 50k square feet to meet declining carbon emission targets starting in 2026, and those 20k - 50k to do so starting after the 2031 legislative session.
City of Seattle buildings emissions performance standard	Requires applicable buildings including hospitals over 20k square feet to meet declining carbon emission targets starting in 2031 and to reach net-zero by 2050
WA State organics management law	Requires state/local governments, businesses and other organizations including hospitals to reduce the amount organic materials disposed in landfills and increase food waste diversion starting in 2024
City of Seattle food service packaging	Requires food service businesses including hospital cafeterias to use food service packaging and service ware that is reusable, recyclable or compostable, provide disposal stations and sign-up for composting and recycling collection

Healthcare standards and accreditation

How national and state agencies are incorporating climate change and health into healthcare accreditation and quality incentive programs

HEALTHCARE ACCREDITATION AND STANDARDS

Climate change is starting to be integrated into accreditation, quality of care incentives and other healthcare evaluation processes. These in addition to local mandates may become effective incentives for action on sustainability and help achieve buy-in from leadership.

ORGANIZATION	DESCRIPTION
Joint Commission proposed standards on sustainability	*Optional* accreditation standards developed to accelerate healthcare carbon accounting and decarbonization
WSHA/HCA Medicaid quality incentive - added climate change and health survey	Hospitals seeking to earn the Medicaid Quality Incentive can now earn points by reporting their actions to address climate change/health impacts, emergency preparedness, sustainability and greenhouse gas emissions

APPENDIX D

Resources

From getting started through implementation

FEATURED RESOURCES

- **Comprehensive primer on healthcare sustainability:** with example initiatives, measures, case studies and recommendations for building a sustainability program: [Agency for Healthcare Research and Quality: Reducing Healthcare Carbon Emissions](#)

- **Guidance on starting a sustainability program:** [Development of a center for the environment and health at a large academic medical center Healthcare SOS – Sharing on Sustainability:](#) podcast series produced by Mass General Hospital Center for the Environment and Health covering topics such as 'creating a sustainability team', 'performing a waste audit', 'anesthesia and the environment'. Each episode features guests with expertise within the topic area and includes detailed action steps from real projects – many implemented within MGH.

- **Estimated health impact of healthcare sector greenhouse gas emissions:** [Health Care Pollution and Public Health Damage in the United States: An Update](#)

- **Health benefits from decarbonization initiatives:** Outlines the benefits of initiatives such as transition to renewable energy, active transportation, climate smart buildings, community environments and food systems: [The Health Promise of Climate Solutions](#)

- **GHGE inventory tool:** [Practice Greenhealth Health Care Emissions Calculator](#): free publicly available tool for developing a baseline GHGE inventory across scopes 1-3.

- **Resource for meeting with leadership:** [Accelerating Health Equity and Business Resilience through Decarbonization](#): comprehensive guide for senior leadership providing an orientation to climate change, connection with health/health equity, healthcare sector carbon footprint, rationale for decarbonization and specific roles/actions for senior leaders with applicable examples and case studies.

RESOURCES BY FOCUS AREA

Research, tools and resources to get started, form internal sustainability teams, track GHGE, develop sustainability programs, educate staff and patients, build awareness of climate change, health and equity connections and national healthcare sustainability collaboration and policy development opportunities.

▶ GETTING STARTED

RESOURCE	DESCRIPTION
Healthcare Without Harm Leading the way for a healthy climate	Portal to comprehensive resources, tools, guidance, case studies, and global healthcare emission reduction campaigns from Healthcare Without Harm.
Healthcare Without Harm Sustainable, climate-smart health care guidance	Outlines steps to gain commitment from leadership for action, assess emissions across scopes 1-3, develop a climate action plan and implement high-impact interventions.

RESOURCES BY FOCUS AREA

 COMMITMENTS

RESOURCE	DESCRIPTION
White House Health Sector Climate Pledge	Voluntary commitment to reduce greenhouse gas emissions 50 percent by 2030 and achieve net zero emissions by 2050. Over 100 healthcare organizations representing 872 hospitals have signed as of April 2023, including CommonSpirit/Virginia Mason, Kaiser Permanente, Providence Health and Seattle Children's Hospital.
National Academy of Medicine Action Collaborative on Decarbonizing the U.S. Health Sector	Public-private partnership of health system leaders committed to addressing the sector's environmental impact while strengthening its sustainability and resilience. Includes members from federal health agencies, major private health systems , trade associations pharmaceutical manufacturers, medical device manufacturers, academia, and local health jurisdictions working across five work groups/focus areas.
Healthcare Without Harm Climate Challenge	Global coalition of healthcare organizations that have pledged to reduce carbon footprint, build resilience and advocate for climate change action. 350 total members with 36 in the United States.
Healthcare Without Harm Race to Zero	United Nations sponsored global campaign with the goal of reducing emissions swiftly and fairly in line with the Paris Climate Agreement.

RESOURCES BY FOCUS AREA

ASSESSMENT AND TRACKING

RESOURCE	DESCRIPTION
Mandatory Reporting of Emissions to Achieve Net-Zero Healthcare	Call for the U.S. to follow countries such as the United Kingdom and require all health care delivery organizations to report emissions as a critical step towards reaching IPCC and U.S. decarbonization goals.
Practice Greenhealth Health Care Emissions Calculator	Free publicly available tool for developing a baseline GHGE inventory across scopes 1-3.
Practice Greenhealth Climate Impact Checkup ($)	Tool for healthcare facilities to calculate their scope 1, 2 and selected scope 3 emissions. *Note: requires Practice Greenhealth membership.*
EPA GHG Emission Factors Hub	Regularly updated emission factors for converting greenhouse gases to units of carbon dioxide equivalent (CO2e) in greenhouse gas inventories

RESOURCES BY FOCUS AREA

⊕ CLINICAL

RESOURCE	DESCRIPTION
Net Zero Healthcare: A Call for Clinician Action	Call for clinicians to organize and lead health system decarbonization with example opportunities for action such as reducing unnecessary services, educating staff on lower carbon footprint clinical techniques, and reducing patient demand for health services.
Environmental Impact and Cost Savings of Operating Room Quality Improvement Initiatives: A Scoping Review	Study to identify initiatives that reduced environmental impact and OR costs. 28 interventions were included and potential cost savings ranged from $873 to $694,141.
Using telemedicine for a lower carbon footprint in healthcare: A twofold tale of healing	Highlights telemedicine advances made during the COVID-19 pandemic and opportunities to achieve emission reduction and 'patient-friendly' visits through research, infrastructure improvement and patient education.
Nitrous oxide	CleanMed 2023 and Cascadia Nitrous Oxide Collaborative webinar presentation on nitrous oxide leakage, emissions associated with existing centralized NO2 systems and benefits of transition to portable canisters.
The plastic pandemic: quantification of waste on an inpatient medicine unit	Results from a 24-hour waste audit done on a 20-bed inpatient unit at Mass General Hospital. Over half was single-use plastic items and a waste reduction intervention utilizing reusable alternatives could reduce landfill waste by 47%, reduce GHGEs 56% and save money.

RESOURCES BY FOCUS AREA

✚ CLINICAL (CONT'D)

RESOURCE	DESCRIPTION
Effects of switching from a metered dose inhaler to a dry powder inhaler on climate emissions and asthma control	Study to compare effects of switching inhaler type on emissions and asthma control in a subset of 2236 patients from the Salford Lung study on Asthma. Participants switching to DPI had a more than 50% decrease in carbon footprint with no loss of asthma control.
Life Cycle Assessment and Costing Methods for Device Procurement: Comparing Reusable and Single-Use Disposable Laryngoscopes	Single-use laryngoscopes generate 16-18 times more carbon dioxide equivalents than reusable alternatives and are more expensive if the reusable lasts 4-5 uses.
Action guidance for addressing pollution from inhalational anaesthetics	Strategies for reducing emissions including avoidance of desflurane, nitrous oxide, intravenous anaesthesia, capture of anaesthetic gases and intervention examples.
Transition to reusable surgical gowns at a hospital system	Study evaluating feasibility, waste reduction and cost savings potential of transition from single-use to reusable gowns among operating room staff at a tertiary hospital system in California. Found transition to reusable gowns would yield 30k annual waste diversion, cost savings and was generally accepted by participating staff.

RESOURCES BY FOCUS AREA

💲 COST AND COST SAVINGS

RESOURCE	DESCRIPTION
Practice Greenhealth cost of ownership toolkit	Resource for calculating the energy, water, disposal and other costs in addition to the purchase price for a true cost of ownership.
Sustainable Procurement in Health Care Guide	Comprehensive guide outlining the business case, benefits, goals and steps for building a sustainable procurement program.
Viewing sustainability through the cost-savings lens	Interview with the Director of Member Engagement at Practice Greenhealth highlighting specific opportunities for cost savings through sustainability initiatives with real world examples.
Can Sustainable Hospitals Help Bend the Health Care Cost Curve?	Study of sustainability initiatives to reduce energy use, waste and improve operating room supply efficiencies at participating hospitals. The potential cost savings if these programs were adopted by all hospitals in the U.S. is $5.4 billion over five years and $15 billion over 10 years.

RESOURCES BY FOCUS AREA

EDUCATION

RESOURCE	DESCRIPTION
Healthcare SOS – Sharing on Sustainability	Podcast series produced by Mass General Hospital Center for the Environment and Health covering topics such as 'creating a sustainability team', 'performing a waste audit', 'anesthesia and the environment'. Each episode features guest(s) with expertise within the topic area and action steps from real projects
Americares – Climate Resilience for Frontline Clinics Toolkit	The toolkit includes free, downloadable information sheets, guidance documents, checklists for provider, patient and administrator audiences for heat, wildfires, hurricanes and flooding with case studies of how climate change is affecting frontline clinics in the U.S.
Climate MD	Developed by the Harvard T.H. Chan School of Public Health. Features provider-oriented guides, resources, webinars, and e-courses on climate change and health impacts, communicating risks to patients, improving clinic resilience to climate change etc.
A Physician's Guide to Climate Change, Health and Equity	Developed by the Public Health Institute. Guide for healthcare providers providing an understanding of climate science, health equity, physician role in addressing climate change health impacts and connections with equity.
The Health Effects of Climate Change	Virtual, self-paced, free course developed by Harvard University covering climate change and health research methods, impacts, strategies for mitigation/adaptation and addressing the health effects of climate change.

RESOURCES BY FOCUS AREA

POLICY

RESOURCE	DESCRIPTION
Health Professionals and the Climate Crisis: Trusted Voices, Essential Roles	Highlights that health benefits can be a powerful rationale to support climate change mitigation and adaptation policies and clinical healthcare professionals are among the most trusted messengers and advocates for individual, organizational and policy change.
Decarbonizing Health Care: Clean Energy Policy Options	Reviews federal, state and local policies with the greatest potential impact on healthcare sector emissions with special focus on provisions within the Inflation Reduction Act.
The Health Promise of Climate Solutions	Outlines potential health benefits from 'climate solutions' within five categories including electricity production, transportation, buildings and homes, community environments and food/food systems.

RESOURCES BY FOCUS AREA

CLIMATE CHANGE AND HEALTH

RESOURCE	DESCRIPTION
Mortality associated with wildfire smoke exposure in Washington State, 2006-2017: a case crossover study (Doubleday et al)	2020 study finding increased odds of mortality in first few days following wildfire smoke exposure in Washington State.
Increased hospital admissions associated with extreme-heat exposure in King County, Washington, 1990-2010 (Busch Isaksen et al)	2015 study of heat-morbidity data for King County, Washington between 1990-2010, found that heat, expressed as humidex is associated with increased hospital admissions.
Impacts of extreme heat on emergency medical service calls in King County, Washington, 2007-2012: relative risk and time series analyses of basic and advanced life support (Calkins et al)	2016 study finding that extreme heat increases risk of EMS calls in King County, Washington.
In the hot seat: saving lives from extreme heat in Washington State	2023 report on the 2021 heat dome event, health impacts, mapping, projections and recommendations to reduce risk from future heat events.

RESOURCES BY FOCUS AREA

CLIMATE CHANGE AND HEALTH (CONT'D)

RESOURCE	DESCRIPTION
Climate Changes Mental Health	Primer on how climate change effects can lead to mental health impacts, groups at elevated risk and a case study example from survivors of Hurricane Katrina.
Climate Change is Taking a Toll on Gen Z Mental Health	Findings from 2022 NextGen Climate Survey of youth ages 14-24 nationwide indicating 75% had experienced anxiety or stress related to climate change.
HHS Office of Climate Change and Health Equity	Hub for programs, services and actions focused on climate change and health equity.
Project ECHO Climate Change and Human Health Program	Links to webinar series and other resources.
Yale Climate Change in the American Mind	Nationally representative annual survey of Americans views on climate change.

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RESOURCES BY FOCUS AREA

CLIMATE CHANGE AND HEALTH EQUITY

RESOURCE	DESCRIPTION
Which populations experience greater risks of adverse health effects resulting from wildfire smoke exposure?	People of color and low-income individuals bear disproportionate burden of asthma and other respiratory diseases and may be at increased risk of health effects from wildfire smoke exposure.
Racial Disparities in Climate Change-Related Health Effects in the United States	Multiple studies of heat, extreme cold, hurricanes, flooding, and wildfires find evidence that people of color, including Black, Latinx, Native American, Pacific Islander, and Asian communities are at higher risk of climate-related health impacts.
Climate-related health risks among workers: who is at increased risk?	Kaiser Family Foundation analysis finding 65 million U.S. workers in occupations at increased risk for climate-related health impacts are disproportionately BIPOC, low-income and lacking health insurance.
Washington Environmental Health Disparities Map	Mapping tool that compares communities for environmental health disparities, exposures such as diesel emissions, ozone, and proximity to hazardous waste sites.