



PRACTICE
Greenhealth®



The value of sustainability initiatives in surgical suites

An analysis of environmental stewardship programs, trends, and emerging issues

SEPTEMBER 2018



Greening the OR

Executive summary

Health care leaders understand the mandate: Cut costs. Improve patient and community health outcomes. Attract, engage, and retain qualified clinicians and staff.

What if your hospital could check these boxes while also reducing the environmental impact of the organization? Leading hospitals are zeroing in on the operating room (OR) as a key area of opportunity for reducing waste, energy use, and supply costs while maintaining or improving patient and caregiver safety. Practice Greenhealth award-winning hospitals pursuing sustainable initiatives in the OR saved more than \$58 million in 2017. A typical hospital with an 11-OR surgical suite could potentially garner average annual savings of \$616,000 for implementing a range of sustainable initiatives in the operating room, with individual programmatic cost reductions ranging from \$600 to \$15,000 per OR annually.

With over 52,000 operating rooms in the United States, the strategies highlighted in this report have the potential to save the health care sector \$2.95 billion annually.

Cleveland Clinic's main campus saved more than \$4 million with its Greening the OR efforts in 2017. The Valley Hospital in Ridgewood, N.J., saved \$47,000 in 2017 by instituting a reusable canister fluid management system across its 26 operating rooms. The University of Wisconsin's University Hospital and American Family Children's Hospital in Madison, Wis., saved around \$20,000 per month – or nearly \$240,000 in 2017 – with its 47 ORs by educating its anesthesia clinicians about the environmental impact of certain anesthetic gases.

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These hospitals are also substantially reducing their environmental impact through their OR sustainability initiatives. Cleveland Clinic avoided more than 162 tons of waste, 3.8 million kWh of energy, and eliminated 2,848 metric tons of carbon dioxide equivalents (MTCO₂e) in 2017. The Valley Hospital avoided 14 tons of medical waste while improving safety for its caregivers. And UW Health eliminated 4,000 MTCO₂e to the atmosphere by moving away from the use of the anesthetic desflurane as a result of its education initiative on the global warming potential of anesthetic gases.

Practice Greenhealth is the leading source of information on environmental best practices in health care in the United States. This report – based on data collected through Practice Greenhealth’s 2018 Environmental Excellence Awards – highlights a range of different strategies hospitals can utilize within the surgical environment to drive down environmental impact and better protect health while achieving cost reductions. Recognizing that hospital size is a significant determinant of program scope and scale, the report showcases the financial and environmental benefits derived by a range of health care organizations.

Understanding the value proposition of these programs in leading hospitals can help you make the case within your organization to improve environmental performance in the surgical suite. By accessing the tools, resources, and peer-to-peer learning opportunities available through Practice Greenhealth’s network, your hospital can also discover how other health care organizations have overcome both real and perceived barriers to sustainable practices in their ORs, and stay abreast of emerging issues and trends. These programs can drive cost savings that can be reinvested in patient care while creating more engaged, resilient, sustainable, and responsible organizations.

Big wins

For health care administrators and OR managers facing increased pressure to lower costs and improve efficiency while providing safe and effective patient care and work environments, it is important to quickly zero in on opportunities for small changes that yield big results. Look no further than the OR.

Surgery departments can bring in [up to 60 percent](#) of a hospital’s revenue. Despite its relatively small spatial footprint within a hospital, the operating room also drives the majority of a facility’s supply and labor expenses and is a major source of hospital admissions. Both inpatient and ambulatory surgery are major drivers of costs for health care organizations. While 27 percent of hospital stays involved OR procedures in 2014, they accounted for nearly half – or \$187.1 billion – in aggregate hospital costs, according to the [Agency for Healthcare Research and Quality](#). In California, just one minute of [OR time costs a hospital](#) more than \$36.

Operating rooms also have a disproportionate environmental footprint compared to the rest of the organization, producing [20 to 33 percent of a facility’s waste](#) and as much as 60 percent of its regulated medical waste. A [2017 study in UCSF’s neurosurgery department](#) found \$968 of wasted supplies per OR case, resulting in almost \$2.9 million wasted in one hospital in one department annually.



OPERATING ROOMS PRODUCE

20-33%

of a facility’s total waste

up to 60%

of a facility’s medical waste

5%

of a facility’s GHG emissions
(from inhaled anesthetics)

OPERATING ROOMS USE

3-6 times

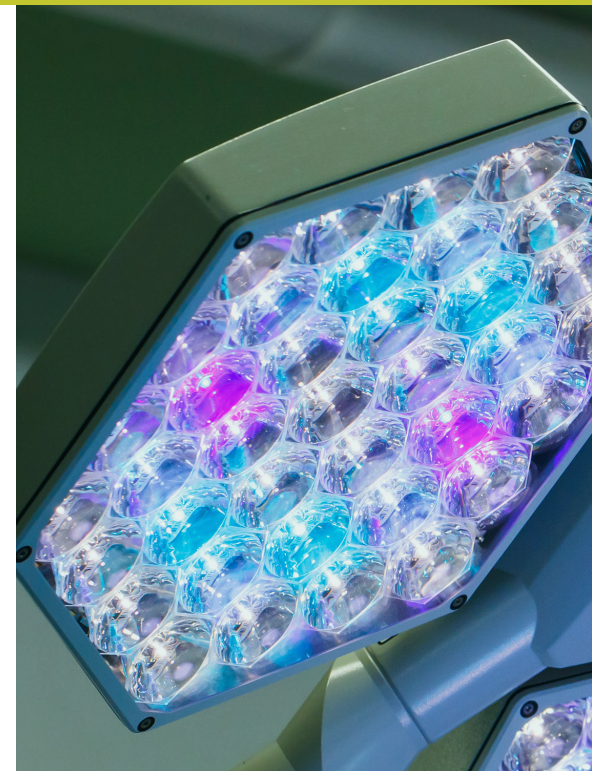
more energy (per square
foot) than rest of hospital

The operating room also consumes vast amounts of energy. A [study in The Lancet](#) found operating rooms to be three to six times more energy intensive per square foot than the hospital as a whole due to strict heating, ventilation, and air conditioning (HVAC) requirements, as well as lighting, patient monitoring and diagnostic equipment, and devices. And waste anesthetic gases from surgery represent around 5 percent of a facility's greenhouse gas emissions.

At the same time, hospital administrators face a looming OR nursing shortage of critical proportions. Sixty-five percent of [OR nurses say they plan to retire](#) by 2022. As hospitals consider how to attract the OR workforce of the future, a visible commitment to sustainability and corporate responsibility can be both a recruitment and a retention aid. A 2016 PwC survey found that 59 percent of millennials seek out employers with [corporate social responsibility values](#) matching their own, and a 2016 study by Cone Communications found that 79 percent of millennials consider a company's [social and environmental commitments](#) when deciding where to work. The same study notes that 74 percent of employees say their job is more fulfilling when they are provided with opportunities to make a positive impact on social and environmental issues, and 89 percent want hands-on activities around environmental responsibility in the workplace. The [position statement on environmental responsibility](#) for the Association of Perioperative Registered Nurses (AORN) concurs:

“Perioperative RNs should actively promote and participate in sustainability practices that preserve natural resources, reduce waste, and minimize exposure to hazardous materials.”

Operating rooms are an ideal place to start for hospitals seeking opportunities to save money while protecting patient and environmental health. The range of strategies highlighted in this report have been tested and vetted by hundreds of hospitals nationwide – with proven results. And many of the best ideas come directly from OR staff who observe wasteful and inefficient practices. Practice Greenhealth is working alongside hospitals to pilot, perfect, and measure the impact of these programs on health, the environment, and the bottom line.



A unified and consistent approach to implementing these best practices across the health care sector could save U.S. hospitals and ambulatory surgery centers nearly **\$2.95 billion annually** and reduce waste to landfill by more than **265,000 tons each year**.

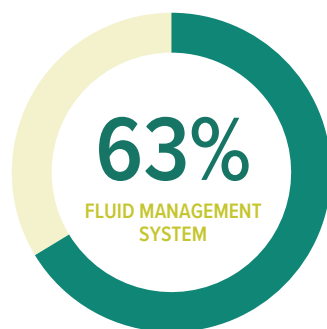
Cutting costs

Environmental stewardship in the operating room has consistently demonstrated a strong return on investment since Practice Greenhealth began tracking financial savings for these programs in 2014. Hospitals participating in the Environmental Excellence Awards reported combined savings of more than \$58.6 million in the operating room in 2017. These strategies also helped prevent nearly 13,000 tons of waste from going to the landfill in 2017. The average hospital could save around \$56,000 per operating room by implementing a range of different sustainable programs in their operating rooms – more than half a million dollars for a hospital with an 11-OR surgical suite. A unified and consistent approach to implementing these best practices across the health care sector could save U.S. hospitals and ambulatory surgery centers nearly \$2.95 billion annually and reduce waste to landfill by more than 265,000 tons each year.

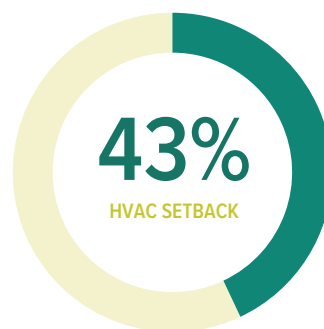
Leading hospitals continue to find new and creative ways to reduce environmental impact in operating rooms. The proven initiatives listed below should be the starting point for hospitals beginning to target their ORs. While the aggregate potential savings to the sector are eye-catching, many administrators and perioperative leaders want to understand the benefits of an environmental focus at a program-by-program level before they invest staff time or resources in tackling new initiatives.



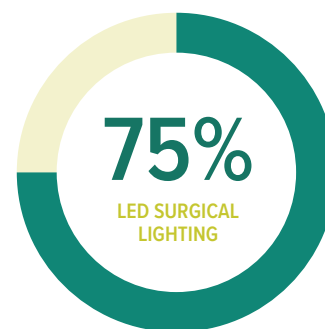
Recycling clinical plastics such as saline bottles, trays, bluewrap, overwraps, and other rigid plastics



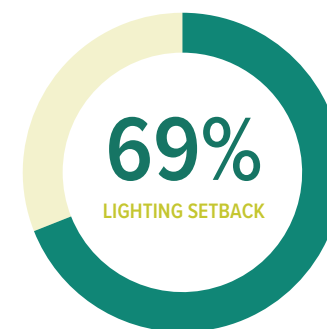
Utilizing a reusable canister fluid management system for suction canisters that automatically empties to the sanitary sewer



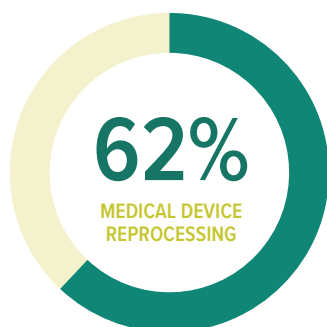
Programming the HVAC system to reduce air changes per hour when ORs are unoccupied to reduce energy consumption



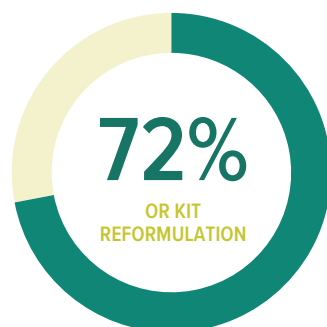
Utilizing LED surgical lighting in ORs to reduce energy use and maintenance, while concurrently reducing heat in the operating field and providing better color rendition



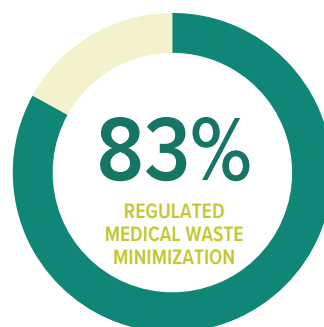
Using mechanism to turn down or setback ambient lighting when the OR is unoccupied to reduce energy consumption



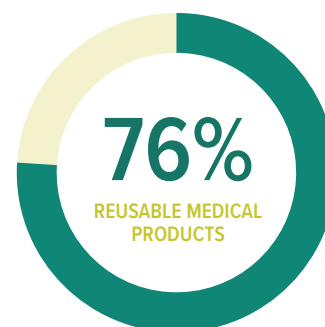
Reprocessing FDA-approved medical devices utilizing a third-party reprocessor and buying back reprocessed devices



Reformulating procedure packs to eliminate excess and unneeded supplies, reducing inventory and waste



Properly segregating infectious waste from non-infectious solid waste or recycling



Selecting medical devices, surgical textiles, and medical products that are reusable rather than disposable while maintaining infection prevention standards



Using reusable rigid sterilization containers to sterilize instrument kits, avoiding purchase and disposal of single-use blue sterile wrap

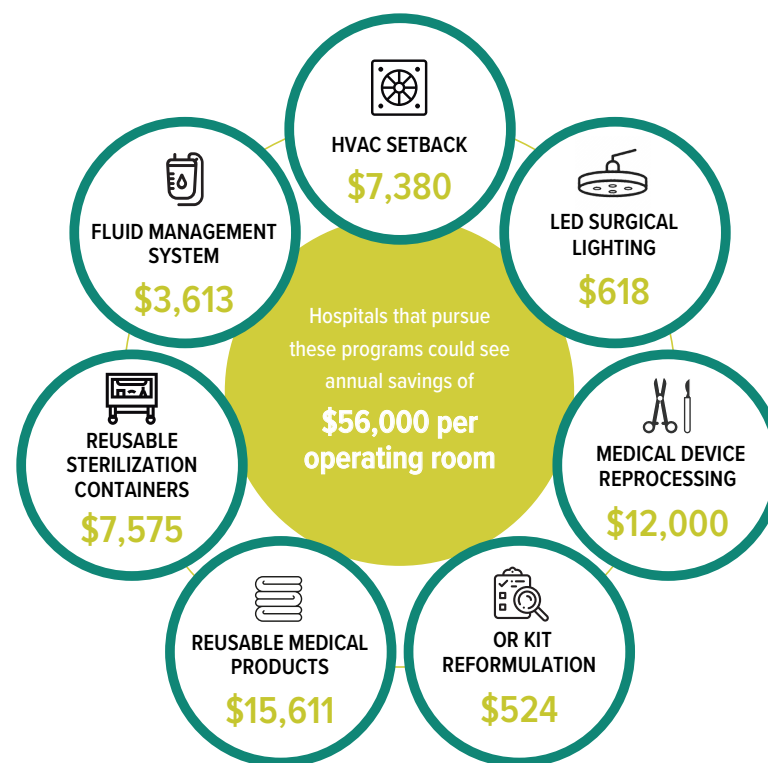
The data provides clear and compelling evidence of a strong financial return on investment for each programmatic area.

Average annual cost savings by programmatic area


Program	Average annual savings per hospital	Average annual savings per OR
Fluid management systems	\$51,107	\$3,613
HVAC setback in OR*	\$111,734	\$7,380
LED surgical lighting in OR*	\$12,985	\$618
Medical device reprocessing	\$215,240	\$12,000
OR kit reformulation	\$83,866	\$9,524
Reusable medical products	\$184,687	\$15,611
Reusable sterilization containers	\$105,512	\$7,575
Total projected theoretical cost savings per operating room for hospitals implementing all seven programs		\$56,321


*Figures for savings per OR for HVAC setback and LED lighting are only per operating room where this feature has been implemented.


According to the American Hospital Association, an average hospital has **11 operating rooms**. So an average hospital implementing seven of these programs could save approximately **\$616,000 annually** or about **\$56,000 per OR**.




While average cost savings help provide a glimpse of the kind of savings hospitals can achieve, the member summaries below highlight the impact of these initiatives in 2017 at hospitals of different size and scope.


 CLINICAL PLASTICS RECYCLING IN THE OR	Hudson Hospital	University of Vermont Medical Center	UCLA Health
	Small	Medium	Large
Number of ORs	3	19	42
Tons of avoided waste	2 tons	8 tons	42 tons
Avoided waste disposal fees	\$1,154	\$10,567	\$15,792
Other benefits	Proper waste segregation to reduce regulated medical waste and increase recycling yields environmental and financial savings for most health care facilities. Many facilities also partnered with local organizations, providing meaningful employment to various groups during material reclamation phases.		


 FLUID MANAGEMENT SYSTEM	Providence Hood River Memorial Hospital	The Valley Hospital	Tampa General Hospital
	Small	Medium	Large
Number of ORs	5	26	47
Tons of avoided waste	7	14	135
Avoided waste disposal fees from disposable canisters	\$12,662	\$8,459	\$40,450
Avoided purchase cost of disposable canisters	\$7,134	\$29,172	\$93,933
Avoided purchase cost of chemical solidifiers (if applicable)	\$0	\$9,353	\$53,933
Total avoided waste	7 tons	14 tons	135 tons
Total savings	\$19,797	\$46,984	\$188,316
Other benefits	Reusable canister fluid management systems are directly connected to the sanitary sewer, helping facilities reduce regulated medical waste expenses and unnecessary supply expenses, as well as avoid exposure to bloodborne pathogens and chemical exposure for staff when emptying suction canisters. These machines also reduce OR turnover time, help monitor patient fluid loss, and are often equipped with smoke evacuators.		


 REPROCESSING OF MEDICAL DEVICES	Blanchfield Army Community Hospital	Regions Hospital	Advocate Christ Medical Center
	Small	Medium	Large
Number of ORs	4	27	44
Tons of devices collected	3	12	9
Avoided waste disposal costs	\$1,765	\$11,587	unknown
Pounds of reprocessed devices collected per OR procedure	1.6	1	0.7
Total spent on reprocessed devices in 2017	\$412,298	\$364,187	\$234,856
Total reprocessing purchase savings in 2017	\$412,298	\$349,088	\$301,642
Other benefits	Reprocessing of medical devices provides an opportunity to recycle and reuse valuable devices rather than using once and sending to landfill. At the end of their useful lives, these devices can be recycled by the reprocessor.		


 RIGID STERILIZATION CONTAINERS FOR SURGICAL INSTRUMENTATION	Iowa City VA Health Care System	Kaiser Permanente San Jose Medical Center	Mayo Clinic Rochester
	Small	Medium	Large
Number of ORs	8	14	128
Percent of instrument trays utilizing reusable sterilization containers	100%	81%	56%
Avoided purchase cost (\$ saved) of bluewrap	\$7,850	\$37,228	\$171,600
Tons of avoided waste	6	3	20
Avoided waste disposal fees	\$380	\$1,844	\$4,521
Total savings (\$)	\$8,230	\$37,228	\$176,121
Other benefits	Using rigid sterilization containers for surgical instrumentation reduces the need to purchase and dispose of bluewrap. Many health care facilities have also found reduced labor for staff in the sterile processing department associated with the purchasing, stocking, waste conveyance, storage, etc. if blue wrap or some other type of overwrap were used, as well as the need for flash sterilization when sterile wrap is torn.		

 CUSTOM OR KIT REVIEW	Seattle Children's Hospital	Hackensack University Medical Center	University of Chicago Medicine
	Small	Medium	Large
Number of ORs	14	34	44
Total number of custom OR procedure pack types	37	110	84
Number of pack types reviewed	37	110	84
Percent of OR custom pack types reviewed	100%	100%	100%
Avoided purchase cost of unnecessary supplies	\$49,844	\$21,496	\$91,000
Waste disposal savings	\$1,815	\$1,480	\$500
Total cost savings	\$51,659	\$22,976	\$91,500
Other benefits	OR kit review is an opportunity for health care organizations to streamline the number of individual kits used, which can dramatically increase efficiency, reduce inventory and the amount of expired and unnecessary products, yielding significant cost savings.		

 REUSABLE TEXTILES AND DEVICES	Dignity California Hospital Medical Center	Clement J. Zablocki VA Medical Center	Inova Fairfax Hospital
	Small	Medium	Large
Number of ORs	9	12	50
Tons of reusable items used	85	17	unknown
Cost savings from reusable items	\$48,427	\$13,899	\$229,279
Other benefits	Using reusable linens and equipment reduces waste of single-use plastic materials. Many facilities report significant savings when expensive instruments are returned that would otherwise have been thrown out. Clinicians typically report increased comfort with the reusable surgical gowns.		

 HVAC SETBACK IN THE OR	Providence VA Medical Center, Rhode Island	Memorial Sloan Kettering Cancer Center	NYU Langone Health
	Small	Medium	Large
Number of ORs	5	27	53
Number of ORs that have implemented an HVAC setback program	5	28	33
Operating Rooms (ORs):	5	28	53
Percentage of ORs that have implemented HVAC setback	100%	100%	62%
Rate of air exchanges per hour (ACH) during unoccupied/setback mode	10	6	6
Has the facility tracked associated energy reduction and cost savings from the HVAC setback program?	Yes	Yes	Yes
Energy savings (kWh)	523,699	1,775,350	1,273,904
Energy cost savings	\$68,081	\$271,645	\$920,295
MTCO ₂ e saved	390	1,321	948
Reduction in greenhouse gas emissions converted to passenger vehicles driven for one year	84	283	203
Other benefits	HVAC setback has been found to increase the lifespan and reduce the maintenance needs for the HVAC system. Many facilities also realize that with a setback program in place, they are more closely monitoring the HVAC system for consistency.		

 LED SURGICAL LIGHTING	University Hospitals Geauga Medical Center	Cleveland Clinic
	Small	Large
Number of ORs	12	86
Number of ORs equipped with LED surgical lighting	11	86
Percentage of ORs equipped with LED surgical lighting	92%	100%
Energy savings (kWh)	4,493	215,874
Energy cost savings	\$449	\$15,985
MTCO ₂ e saved	3.3	161
Reduction in greenhouse gas emissions converted to passenger vehicles driven for one year	0.72	35
Other benefits	LED lighting has a longer lifespan, reducing the maintenance needs to switch out bulbs as frequently or during a case. Facilities report clinicians prefer LED lights for the better visual field, as well as no overhead heat. Eliminating overhead heat from the lights can increase clinician comfort, and reduce the need for OR room cooling, yielding another energy savings opportunity.	

 ANESTHESIA	Harborview Medical Center	UW Health, Madison	Cleveland Clinic
	Small	Medium	Large
Number of ORs	26	47	86
Provided education on environmental impacts of inhaled anesthetics and reduction strategies for clinicians	Yes	Yes	Yes
Education or strategies used	<p>The anesthesiologists and anesthesiologists are aware of the environmental impacts of anesthetic gases and use low gas flow to decrease impact. New anesthesia machines rolled out during 2015 and 2016 have a message that notifies staff if they have a high gas flow. The reminder message has decreased anesthetic gas use and subsequently helped decrease environmental impact. The scavenger system is checked daily to make sure it is operating correctly. CRNAs are required to complete a yearly machine check competency that includes the scavenger system.</p>	<p>Annual grand rounds, resident education, new staff orientation, clinical guide, and vaporizer labels</p>	<p>Anesthesia champion spoke about usage of anesthesia and flow rate management at Anesthesia Institute Grand Rounds. Eliminated desflurane from formulary, worked to reduce nitric and nitrous oxide.</p>
Removed desflurane from formulary	No	No	Yes, eliminated desflurane based on cost savings and clinical equivalence.
Removed desflurane vaporizers from ORs to minimize use	Yes	Yes	Yes
Total MTCO ₂ e from purchased inhaled anesthetics in 2017	1,137	1,216	4,020
MTCO ₂ e saved	835	4140	<i>unknown</i>
Reduction in greenhouse gas emissions converted to passenger vehicles driven for one year	179	190	<i>unknown</i>
Cost savings	\$50,000	\$24,000	\$185,666

Measuring and reducing environmental impact in the OR

While these programmatic initiatives reduce costs, they also reduce a hospital's environmental impact while providing other co-benefits. Practice Greenhealth tracks both avoided waste and avoided energy use in operating rooms. It is important to note, however, that these numbers are significantly underreported due in part to the challenges of accurately capturing energy savings or waste reduction for a single department.

Together, 211 reporting hospitals avoided sending 12,781 tons of waste to landfills in 2017, an average of 14.8 tons per facility annually as a result of sustainability programs in the operating suite. Likewise, the limited number of hospitals reporting energy reduction data (20) avoided more than 11.3 million kWh in aggregate, avoiding 8,415 MTCO₂e, which is equivalent to taking 1,802 passenger vehicle off the road for a year. Hospitals reduced energy use in the OR by an average of 565,339 kWh annually, equivalent to approximately 421 MTCO₂e.

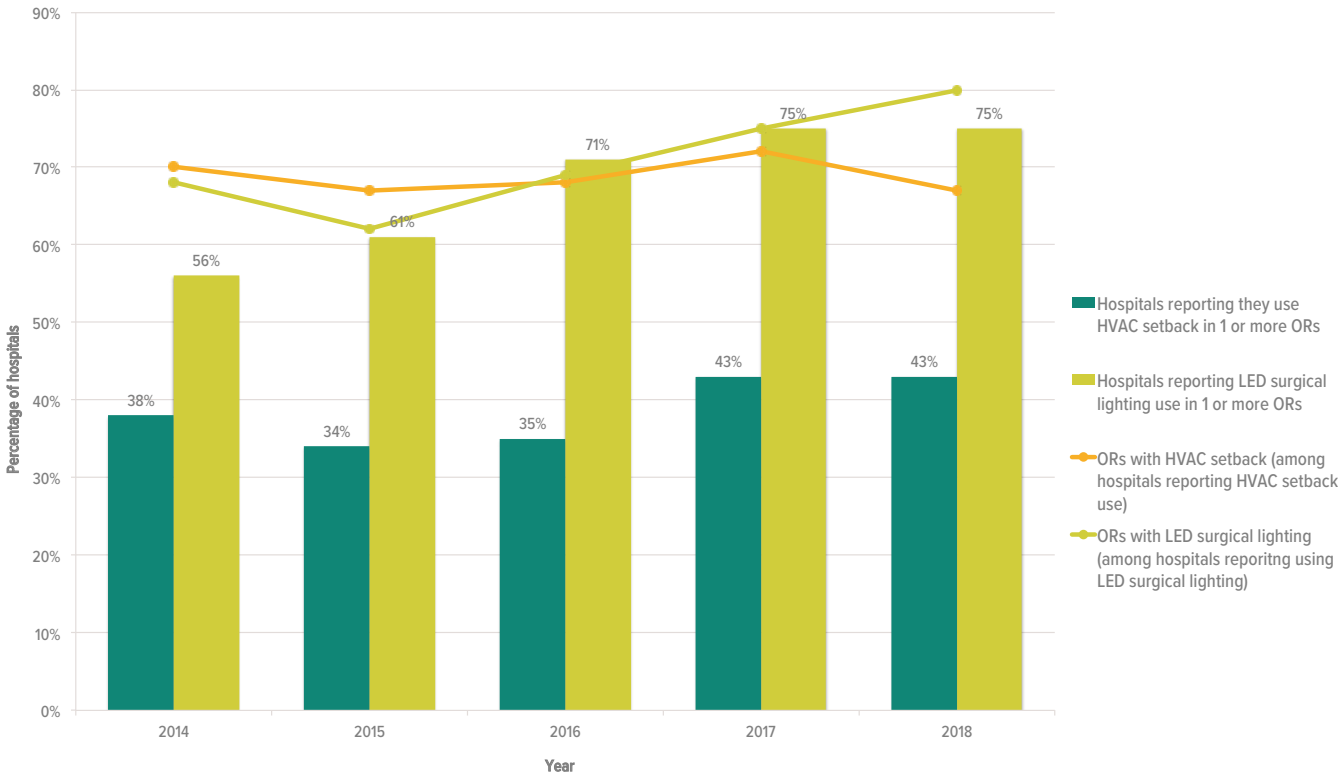
Attention on energy

In [one study](#), energy use in ORs was found to be three to six times higher than the hospital as a whole. Within the OR, the HVAC system accounted for 90 to 99 percent of the OR's energy use per square foot and 36 percent of its greenhouse gas (GHG) emissions. The study demonstrated that implementing an HVAC setback program when ORs were unoccupied at night and on weekends cut the energy use and GHG emissions in half. While many hospitals are tackling energy reduction in the operating room, there is still considerable opportunity for improvement, especially for a department that runs at such a high energy intensity.

The percent of hospitals utilizing energy-savings techniques such as HVAC setback and LED surgical lighting has increased slowly and steadily with the percent of hospitals utilizing HVAC setback in one or more ORs up 13 percent and the percent of hospitals utilizing LED surgical lighting in one or more ORs up 34 percent over the past five years. In examining the trend data, Practice Greenhealth looks not only at the percent of hospitals that report they utilize these strategies, but also at what percent of all ORs within those facilities are utilizing these technologies.

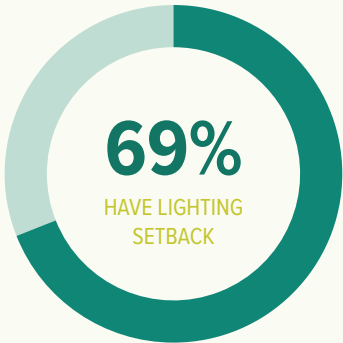
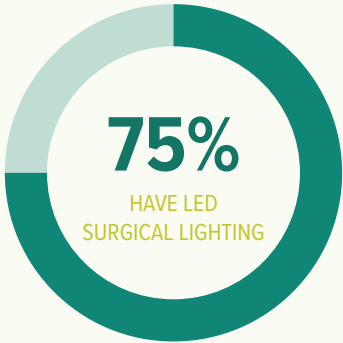
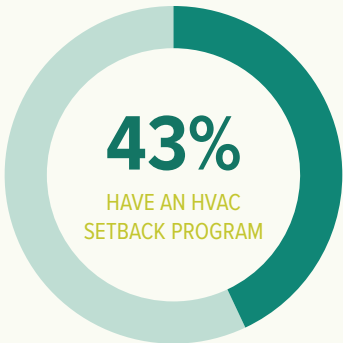


Hospitals with HVAC setback and LED surgical lighting



For example, while 43 percent of hospitals indicated they were utilizing HVAC setback as a strategy in 2017, a deeper analysis reveals that only 67 percent of the ORs in these facilities are using an HVAC setback mechanism. And while a hospital typically won't have 100 percent of its ORs set back because a handful will be left in full ventilation mode to support emergency surgery or procedures, there is still room for improvement in those hospitals already utilizing this strategy. Aging building infrastructure can be a contributing factor, as some hospitals require infrastructure upgrades in order to take advantage of the HVAC setback strategy. Additionally, many hospitals do not submeter energy use for their ORs, which can sometimes limit the ability to accurately track energy savings from OR-specific initiatives. Showcasing the significant cost savings these energy reduction strategies can achieve can be an important first step in gaining support from leadership to invest in the technologies.

Among reporting hospitals



Emerging strategies for environmentally responsible anesthesia

Over the last five years, there has been an increased focus on the opportunity to provide environmentally responsible anesthesia care within the bounds of clinical guidelines. Led and supported by anesthesia providers, including the [Task Force on Environmental Sustainability Committee of the American Society of Anesthesiologists](#) as well as global partners in Australia, Brazil, Canada, and the United Kingdom, a body of peer-reviewed literature has established that waste anesthetic gases are a significant contribution to health care greenhouse gas emissions. In most U.S. health care settings, waste anesthetic gases (WAGs) – inhaled anesthetic gases that are not metabolized by the patient and are subsequently exhaled – are scavenged from the immediate clinical setting and vented off the roof into the atmosphere, where they are significant contributors to climate change, due to their high global warming potential (GWP).

It is conservatively estimated that these gases could comprise 5 percent or more of a health care organization’s carbon footprint, [based on studies of the United Kingdom’s National Health Service](#). This is an imperfect estimate and only represents the percentage from acute care inpatient hospitals in the U.K., suggesting the actual GHG footprint of anesthesia is greater. [A 2017 study in The Lancet](#) compared the greenhouse gas emissions from operating rooms at hospitals in three countries and found anesthetic gases make up 51 percent of a U.S. operating room’s greenhouse gas emissions, whereas at a hospital in the U.K., anesthetic gases represent 4 percent of the OR footprint, a variation accounted for by significant differences in providers’ anesthetic gas choices. The Practice Greenhealth data pool substantiates the claim of significant emissions from WAGs, with 101 hospitals conservatively reporting more than 204,753 MTCO₂e emissions in 2017, based on data from purchased inhaled anesthetic gases. That translates to an average 2,027 MTCO₂e per facility or 152 MTCO₂e per OR annually from purchased inhaled anesthetic agents.

Desflurane, sevoflurane, isoflurane, and nitrous oxide are the most common anesthetic gases used for patient care in the United States. Desflurane has the highest global warming potential – more than five times higher than isoflurane which ranks next. Nitrous oxide persists in the atmosphere for 114 years, magnifying its impact.

Global warming potential of inhaled anesthetic agents

Inhaled anesthetic agent	100-year global warming potential (per kg, in comparison with CO ₂ where CO ₂ = 1)	Atmospheric lifetime (years)
Desflurane	2,540	14
Isoflurane	510	3.2
Sevoflurane	130	1.1
Nitrous oxide	265	114

This table is a [subset of the data](#) provided in Table 1. Summary of Radiative Properties, Atmospheric Lifetimes, and Global Warming Potentials for Nitrous Oxide and the Halogenated Anesthetic Gases from Andersen, M., et al. Assessing the Impact on Global Climate from General Anesthetic Gases. Anesthesia & Analgesia 114(5):1081-1085, May 2012.

For nitrous oxide, Practice Greenhealth uses the GWP value in the IPCC 5th Assessment Report, in alignment with GHG Protocol.

8 hours
of desflurane



— is equivalent to: —

116 days
of driving



While anesthesia and analgesia are necessary components of patient care, there are a range of clinical strategies recommended by the American Society of Anesthesiologists that can minimize environmental impact and greenhouse gas emissions while supporting safe patient care standards. Anesthesia providers have the opportunity to directly contribute to their organization's overarching climate goals through behavior and practice modification.

For hospitals, a tangible starting point has been to provide education for clinicians on the environmental impact and expense of each inhaled anesthetic, supporting modifications in practice behavior. Forty eight percent of hospitals have taken the initial step of providing education to anesthesia providers on the environmental impacts of anesthesia practice, a 42 percent increase from three years ago. Assessing the annual volume of each anesthetic gas purchased and establishing a baseline is another critical step in effectively managing and reducing the carbon footprint of anesthesia. The number of facilities reporting on carbon emissions from anesthetic gases has increased by 78 percent over the past three years. The University of Wisconsin's University Hospital and American Family Children's Hospital [saved about \\$20,000 per month](#) – or nearly \$240,000 annually – by educating its anesthesia clinicians about the environmental impact of certain anesthetic gases.

To maximize strategic impact, it is important to focus on the areas where the largest wins can be readily realized. Within anesthesia practice, desflurane is an obvious target and also happens to be the most expensive inhaled anesthetic agent. Some hospitals have approached desflurane reduction from the perspective of cost containment, while also reaping the co-benefits of carbon mitigation and better protecting community health. A [study in the American Journal of Public Health](#) found that eliminating desflurane from laparoscopic hysterectomies reduced greenhouse gas emissions by 25 percent per case. Removing desflurane vaporizers from the OR – making them available only by clinician request but not easily accessible – is a strategy 22 percent of hospitals in the data set have used to decrease use of this gas. Taking it a step further, 27 percent have eliminated desflurane entirely from their formularies.

Other [practices recommended by the American Society of Anesthesiologists](#) to address the carbon footprint of anesthesia include:

- **Use low fresh gas flow rates:** Anesthesia providers can reduce the impact and amount of anesthetic gases used and vented by using less gas to begin with, while closely monitoring the patient. Many new anesthesia machines help to monitor fresh gas flow rates and support anesthesia providers using this strategy.
- **Select alternative anesthesia options:** Clinicians can review and consider on a case-by-case basis alternative anesthesia options such as regional, local anesthesia and IV sedation instead of or as a supplement to an inhaled anesthetic agent.
- **Reduce the use of nitrous oxide:** Nitrous oxide is typically used as a carrier gas and has the second highest GHG impact after desflurane. Nitrous oxide also happens to be used outside of the operating room, typically in dental, labor and delivery units, and emergency departments. These units are not equipped with the scavenging systems required in the OR, thus staff and visitors can be exposed to leaks and waste anesthetic gases, posing a potential health risk with repeated exposure.



48%

of hospitals are providing education to anesthesia providers on the environmental impacts of anesthesia practice.

22%

of hospitals have removed desflurane vaporizers from the OR, making them available only by clinician request.

27%

of hospitals have eliminated desflurane entirely from their formularies.

- **Evaluate new anesthesia equipment:** Work with anesthesia providers, supply chain, clinical engineering, and the value analysis team when new anesthesia machines and equipment are to be purchased. Some new models include features that increase energy efficiency, provide alerts for fresh gas flow rates, monitor anesthetic gas consumption, and scavenge and sequester waste anesthetic gases rather than venting outside.
- **Retrofit existing anesthesia equipment:** Facilities can retrofit existing anesthesia machines with supplemental anesthetic gas scavenging and capture systems. These systems capture the WAGs and contain them, rather than venting outside. Another retrofit option is to install valves on the equipment that increase energy efficiency, prolong lifespan of the medical gas vacuum pump, and reduce maintenance costs for these systems.

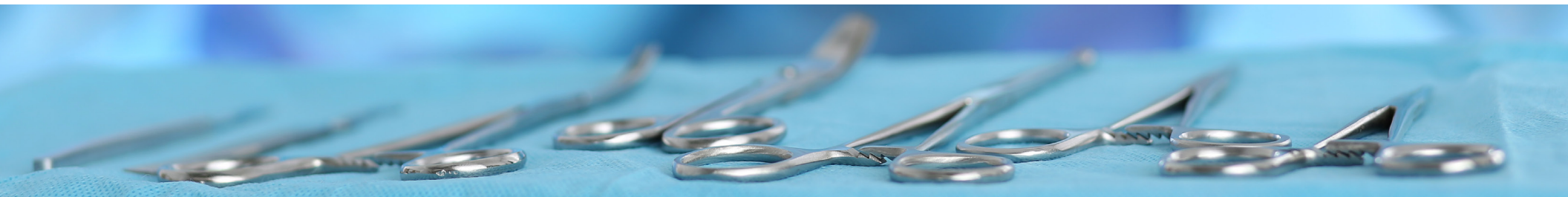
Re-examining reprocessing

Medical device reprocessing is one of the largest cost savings opportunities for the health care sector. A recent [Transparency Research report](#) estimated the global medical device reprocessing market will continue to grow annually by 15 percent, reaching \$3.35 billion by 2024 globally and more than \$848 million in North America. Single-use disposable medical devices can be diverted from the regulated medical waste stream, reprocessed by an FDA-approved third-party reprocessor and purchased back at almost half the original price while still maintaining patient safety. [Some studies](#) have even indicated that reprocessed devices may be more safe than virgin devices, as each individual device is function tested versus batch testing for virgin devices. Devices used in the OR and in general patient care that may be reprocessed range from non-invasive devices, such as blood pressure cuffs or DVT sleeves, to the more expensive, invasive devices, such as ultrasonic scalpels, according to the FDA. Practice Greenhealth member hospitals reprocessing medical devices reported an average savings of \$12,000 per operating room, or \$215,240 per facility in 2017.

Hospitals that have developed a thoughtful proactive framework for managing medical device reprocessing have achieved considerable savings while driving down environmental impact, with [Kaiser Permanente estimating nearly \\$11 million in savings annually](#), and HCA Healthcare estimating [\\$29 million in savings and 786 tons of avoided waste across its hospital portfolio](#) in 2017.

While Stryker Sustainability Solutions, a major medical device reprocessor, estimates that a hospital could save between \$250,000 and \$1 million annually from reprocessing and purchasing back reprocessed devices, depending on facility size and operations, a range of evidence indicates that there are other factors currently limiting the savings opportunities for hospitals that are already utilizing these programs.

Even with a top-notch safety record, the reprocessing industry has a long and challenging [history](#), as original equipment manufacturers (OEMs) vied to compete new products against reprocessed medical devices. Despite a strong market presence in hospitals – nearly 62 percent of the data set are reprocessing some medical devices (and nearly 98 percent are reprocessing if one health system that does not reprocess is removed from the data set) – there are emerging challenges within the reprocessing market that appear to be limiting the success some hospitals are achieving with this program. A focus group of Practice Greenhealth members identified a slew of challenges across the supply chain that may contribute to this decline.



Hospitals have begun to identify changes in contracting around reprocessing, including bundled pricing for new and reprocessed devices, minimum quotas of virgin devices for every reprocessed device purchased back, and other contracting changes that have reduced the financial savings hospitals can derive from these programs. Other issues cited include small, incremental changes in device design or software updates by the OEMs that limit the ability of hospitals to reprocess certain devices, preferred placement of new versus reprocessed devices in stockrooms, and misleading education about potential safety concerns to clinicians and supply chain professionals.

Hospital leadership, supply chain professionals, and OR professionals have navigated these issues through focused education and communication initiatives. An engaged supply chain is critical to avoid bundled contracts, blended pricing, or limitations/disincentives on purchasing reprocessed devices. Some facilities have developed and enforced stringent vendor-interaction policies clearly outlining their organizational sustainability goals and commitment, and limiting the ability of outside vendors to offer alternate viewpoints on the safety and efficacy of reprocessed devices or financial incentives to individual staff to avoid or impede reprocessing. Consistent opportunities for education and feedback with clinicians helps ensure appropriate collection and utilization of reprocessed devices, helps maximize the impact of the program, and heads off concerns before they become impediments.

Conclusion

It's no surprise, the operating room is a major revenue driver for a hospital, and the reputation of the surgical suite is closely tied to the hospital's overall reputation. In a time where every dollar counts, significant savings opportunities can be found in practices that increase efficiency, reduce waste, improve patient and staff care, and support environmental and community health.

The business case is sound. The wealth of peer-reviewed literature more closely examining these opportunities has established environmental stewardship in ORs as a critical element in reducing the carbon footprint of the health care sector. Resources include [Practice Greenhealth's Greening the OR initiative and guidance](#), the American Society of Anesthesiologists' [Greening the Operating Room and Perioperative Arena](#), the Association of Perioperative Registered Nurses [statement on environmental responsibility](#) as well as stories of sustainability success in operating rooms on hospital websites. Moving forward, the adoption of environmental best practices in the OR can be scaled by creating new opportunities to educate and engage clinician champions, by showcasing the business case for adopting these improvements, and by building supply chain engagement and support for these initiatives.





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