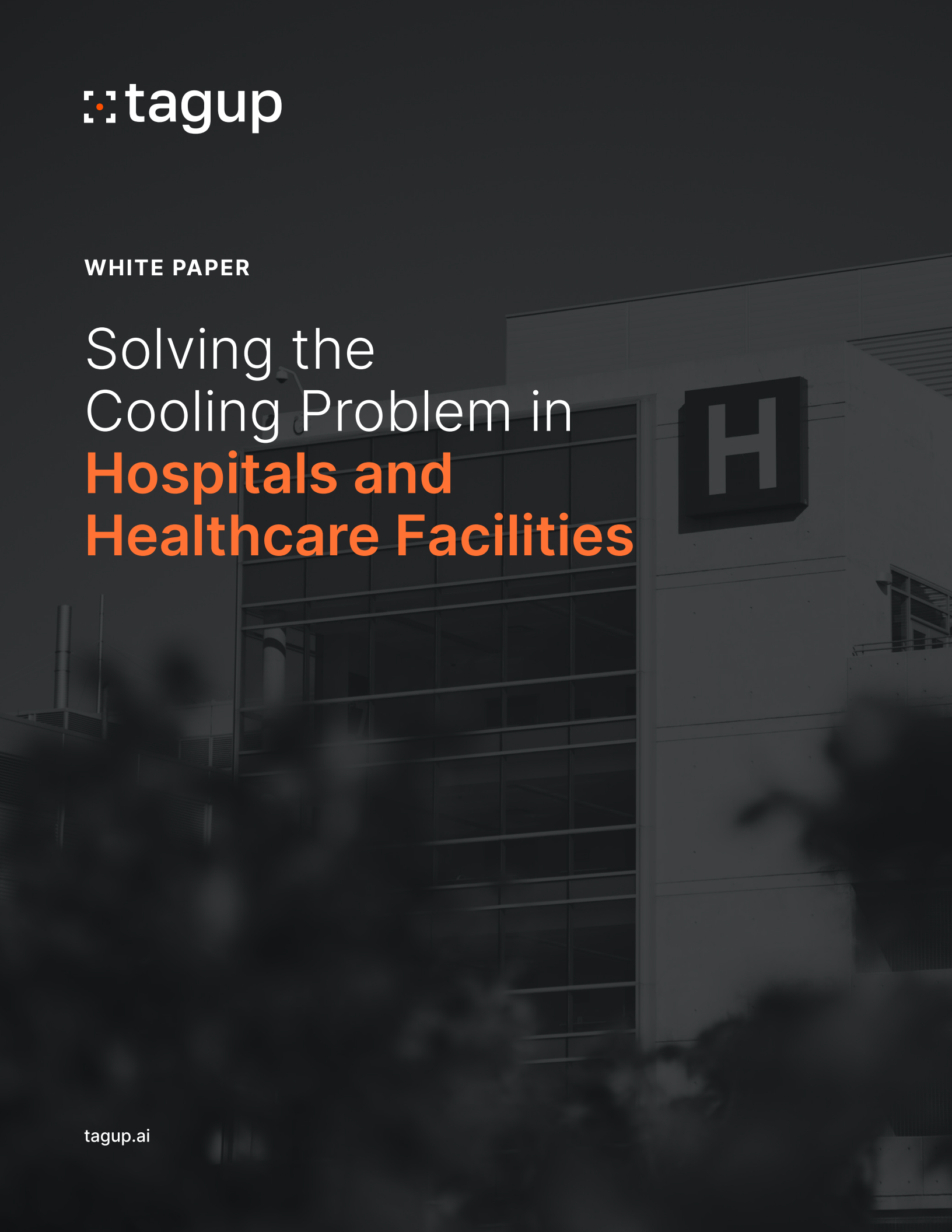
tagup

WHITE PAPER

Solving the Cooling Problem in **Hospitals and Healthcare Facilities**



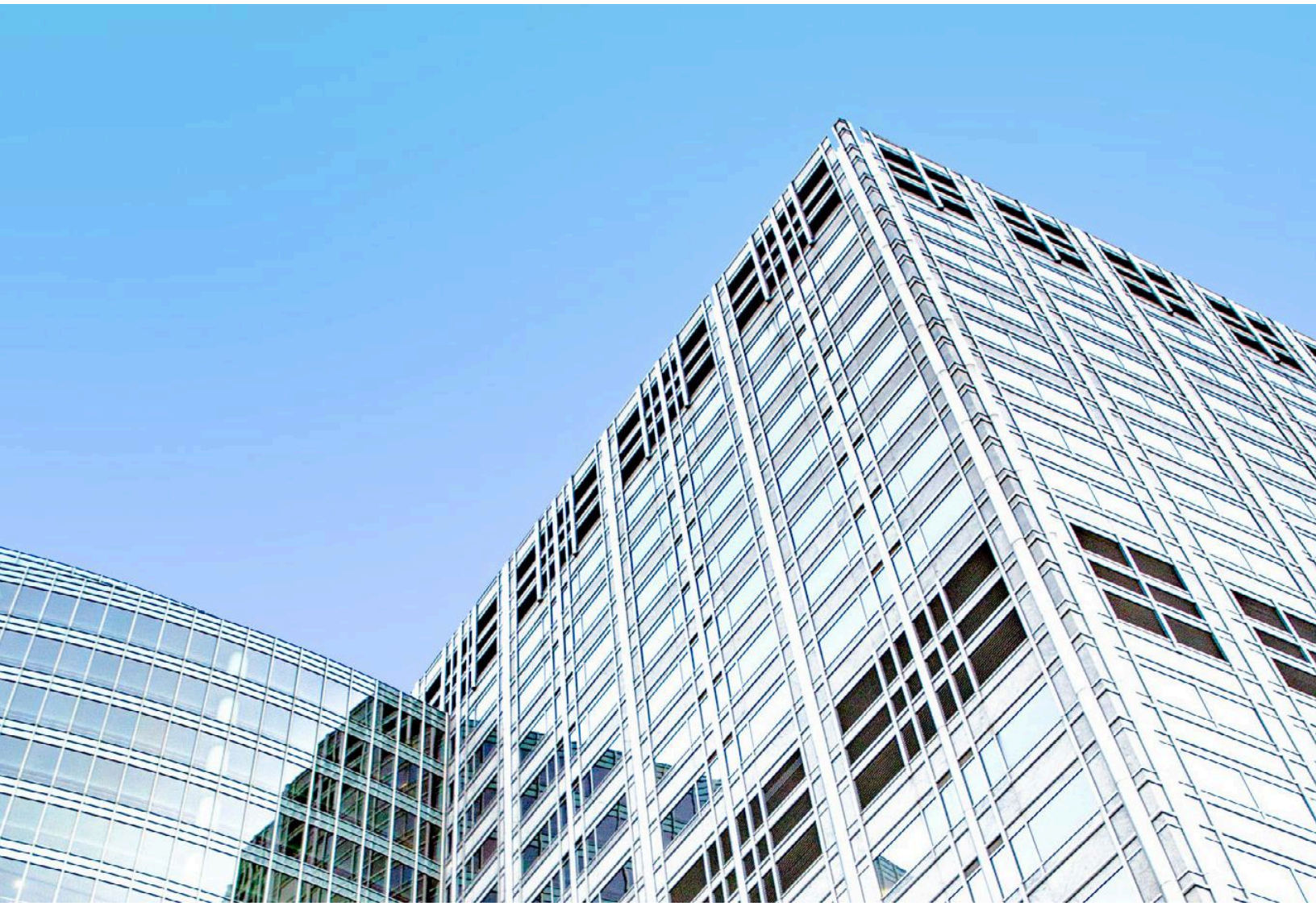
tagup.ai

Table of Contents

Introduction

Commercial HVAC systems are responsible for the majority (approximately 52%) of energy use in large buildings. Hospitals and healthcare facilities differ from other building types in that their energy intensity is nearly three times the average. It takes significant power to run lighting, medical equipment, sterilization processing, laboratories, and refrigeration units around the clock—and all of these elements generate heat. Maintaining a comfortable facility for staff and safe conditions for patients presents two challenges for hospital and healthcare building operators: the cost of electricity and the cost of emissions.

This white paper will address these challenges. You'll learn the impact of healthcare systems on our climate, how regulations on building emissions limits will lead to fines, why energy efficiency makes financial sense for hospitals, and how to reduce cooling system costs and emissions by as much as 30% without affecting comfort or safety.



Do Less Harm: Healthcare's Impact on our Climate

Hospitals and medical care facilities are critically dependent on their HVAC systems to ensure healthy and safe operations, as well as comfort for staff and patients. They must also comply with ASHRAE Standard 170, which requires adherence to specific ventilation system designs for individual rooms based on their purpose. While operating 24/7, it's not hard to see why inpatient healthcare buildings (and their HVAC systems) consume energy at a rate three times higher than the average building.

While healthcare professionals take the Hippocratic Oath of "Primum non nocere," or "first, do no harm", the buildings that they work in contribute a significant amount of greenhouse gas emissions responsible for climate change. Air pollution, severe weather, wildfires, and other consequences of global warming already contribute to millions of deaths each year.

Hospital cooling in the U.S. represents 23.15 billion kWh of electricity and 9 million metric tons of CO2e emissions per year. That's more than the total carbon footprint of Tucson, AZ. Consider the energy saving opportunities from cooling optimization alone.

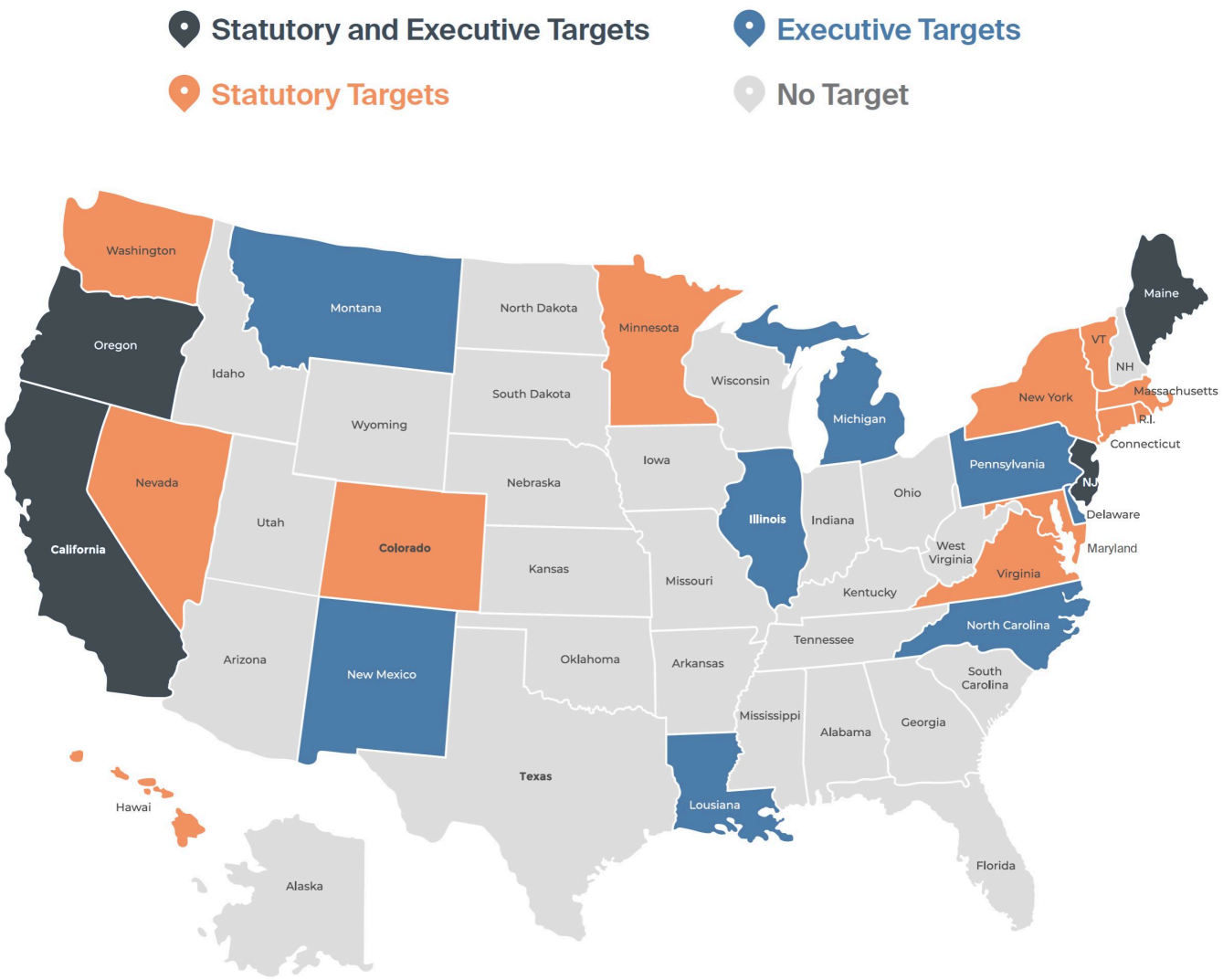
Fast Facts

- The healthcare industry accounts for 8.5% of greenhouse gas emissions in the United States.
- U.S. healthcare facilities account for about 10% of total commercial building energy consumption at a cost of more than $8 billion annually.
- The U.S. health sector accounts for 27% of global healthcare emissions — the highest of any country in the world.
- If healthcare were a country, it would be the fifth largest emitter of greenhouse gas pollution in the world.

Beyond public health and climate change, excess energy consumption means excess costs. Each hospital and medical facility has an opportunity to lessen both environmental and economic costs. Continue reading to find out how.

Green Legislation: The Cost of Inaction

Mandates targeting qualified buildings, including hospitals, are already a major driver of change. Federal and local regulators have set either targets or limits on direct and indirect building emissions. Currently, 25 states and the District of Columbia have enacted emissions targets. Click here to learn about your state's goals for reducing greenhouse gas emissions.



Source: Center for Climate and Energy Solutions

Below are two examples of local laws that will impact hospitals and healthcare facilities, and their associated penalties for non-compliance.

Washington State

Commercial buildings are the second-largest polluter in Washington, releasing 27% of statewide emissions. The Clean Building Performance Standards, signed in 2019 and expanded in 2022, aims to improve building energy efficiency and significantly reduce GHG emissions. It also packs a punch for non-compliance.

Starting in 2026, large buildings must monitor and report on all energy use, produce an energy management plan, and meet energy use intensity (EUI) targets. The maximum current fine for non-compliance is $5,000 plus $1 per square foot.

The average inpatient facility is about 265,000 square feet, which means the average hospital will face $270,000 in fines for each year of non-compliance.

New York

In New York City, 73% of greenhouse gas emissions come from buildings. The city's 50,000 buildings produce a staggering 52.9 million metric tons of carbon dioxide (CO_2) per year. To naturally sequester that much CO_2 it would require more than 230 million acres of forest. As a result, the NYC Council has implemented legislation specifically targeting commercial buildings.

Local Law 97 requires building owners to start submitting compliance reports in 2024. This law sets carbon emissions caps that increase over time. Its goals are:

40%
carbon reduction from buildings by 2030

80%
reduction in citywide emissions by 2050

Healthcare facilities (and all buildings) that exceed annual emissions limits will have to pay $286 per ton of carbon dioxide equivalent (CO_2e) over the limit. Avoidance won't help, either. Not turning in a report will cost you 50 cents per square foot, per month, until it is received.

Let's take an example of a 346,000 square foot hospital. 2024 carbon emissions limits allow for 8.46 kg of CO_2e emissions per square foot, meaning the hospital's limit is 2,927,160 kilograms of emissions for the year. The hospital is currently producing 11.2 kilograms of emissions per square foot, putting them at 3,875,200 kilograms, or 903,040 kilograms over the limit. This hospital would have to pay $242,015 for exceeding its emissions limitation.

How Energy Efficiency Can Boost the Bottom Line

Though the impact on climate change is important for some, executives at healthcare systems are focused on financial challenges. Between their lighting, heating and cooling, water, and complex equipment needs, the energy costs to operate a hospital are in the millions of dollars.

As of April 2023, according to the Energy Information Administration, the U.S. average commercial electricity rate was 14.71 cents per kWh. The average inpatient hospital has a square footage of 264,800, and uses 28.8 kWh per square foot per year. That means the average hospital's monthly electric bill is around $93,485.

Taking steps to become more energy efficient can not only reduce energy expenses, it also comes back to the facility in the form of hard cash. Every dollar a nonprofit healthcare organization saves on energy corresponds to $20 in savings for hospitals and $10 for medical offices. According to the American Council for an Energy-Efficient Economy, the average return on investment for energy-efficient upgrades is 20%.

> "Within facility expenses, energy use accounts for 51% of spending, so even modest cuts are significant.
>
> Kara Brooks, Sustainability Program Manager
> American Society for Healthcare Engineering
> *Source: MedCity News*

Demonstrating tangible outcomes through quick wins will prove efficacy and encourage the approval of larger investments. These efforts will yield long-term financial returns that can be reinvested toward staffing, better equipment, medical research, and anything that supports a mission of improving health.

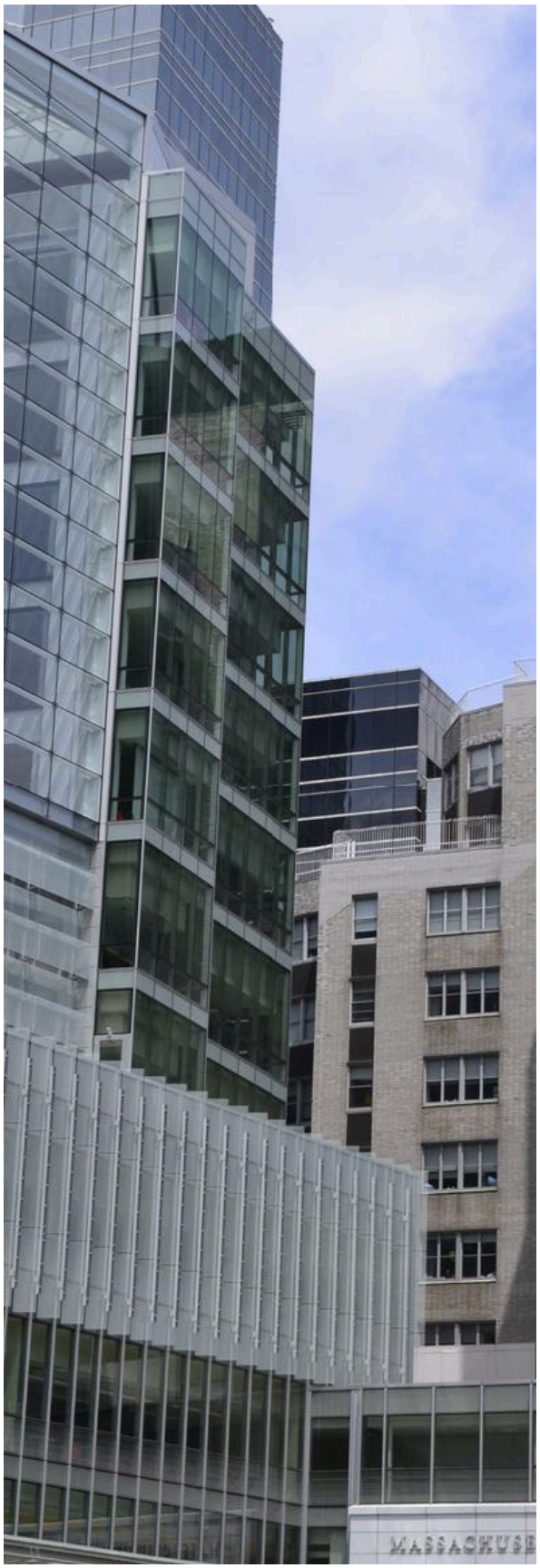
Here are two ways Massachusetts General Hospital has reduced its energy and emissions costs:

1. Replacing/retrofitting lighting fixtures reduced CO_2 emissions by 283 metric tons. Using the commercial electricity rate in Boston of 16.88 cents per kWh, this step yielded a electricity cost savings of $56,000.

2. Optimization of their heat pumps and chiller plant has reduced emissions by 848 metric tons and saved 1.2 million kWh of energy. That means the hospital realized more than $200,000 in savings from HVAC improvements.

Beyond direct financial returns, hospitals who take meaningful steps toward reducing energy consumption can also capitalize on tax incentives. Previously unavailable to nonprofits, the Inflation Reduction Act now allows hospitals and healthcare facilities to qualify for Section 179D. This Internal Revenue Code enables valuable tax deductions (as much as $5.00 per square foot) for making energy-efficient improvements or new construction.

Click here to find clean energy incentives and rebates in your area.



Cooling Problem, Cooling Solution

A healthcare facility is almost always heating up. Lighting and equipment are running 24/7, there's a steady flow of patients and staff producing body heat, and outdoor temperatures drive up indoor temperatures quickly — especially with frequent opening and closing of doors. How this heat is managed is often the difference between wasted energy (and sky-high utility bills) and a sustainably cooled, comfortable facility.

The Cooling Problem

Reducing the energy used in cooling improves sustainability and saves significant money, but HVAC optimization isn't easy to attain or maintain. Operating the cooling system efficiently requires consideration of external factors, and complex interactions between components — especially cooling towers and chillers.

- The most common control strategy for commercial cooling systems is a "fixed setpoint", where the control settings for activation are fixed and never change. This would be like leaving your home thermostat set to 72°F at all times. Cooling will activate if the temperature goes above the temperature threshold, and deactivate when the temperature is stable, or below the setpoint. This method is popular because it produces consistent results and does not put much strain on cooling equipment.
- Operators who prefer a more flexible control strategy often opt for what's called a "fixed approach", which uses the temperature of water leaving the cooling tower plus an average of 7°F.

In some cases, a fixed approach control strategy can create a reasonable balance between the competing needs of the tower and the chiller. However, the approach that minimizes total power can vary by more than 5 degrees fahrenheit. That discrepancy means that no matter how well-tuned a fixed approach control is, it can still leave as much as a 10% reduction in energy consumption on the table.

True cooling optimization historically required the employment of an expensive engineering firm, with many hours dedicated to a single site. Advances in technology have improved building automation, but optimization solutions typically only target HVAC components like air handling units and don't address the root causes of excess energy consumption. To properly optimize a hospital's cooling system, solutions need to integrate holistically, and operate dynamically.

Artificial Intelligence for Cooling System Optimization

Solving the cooling problem requires that all external factors and cooling system components are taken into account. Most hospitals are sitting on a treasure trove of unrealized value, missing cost-saving opportunities by operating cooling systems at the status quo.

Manifest, Tagup's machine learning software, integrates with your hospital's existing building automation or management system through a network gateway. It takes in live sensor data, such as flow rates, internal temperatures, weather conditions, utility rates, and power and water consumption. Then it uses machine learning to identify optimal setpoint controls, and either autonomously implements them or notifies operators to manually make adjustments. These optimization recommendations are delivered automatically and continuously, with savings accruing continuously over time.

Commercial deployments of Manifest have proven to reduce cooling operating costs by between 10-20%, with peak savings approaching 30% for electricity and greenhouse gas emissions. Healthcare systems around the world can use Manifest to maximize energy efficiency with confidence — enabling real-time, autonomous cooling optimization.

Sitting on Unrealized Value

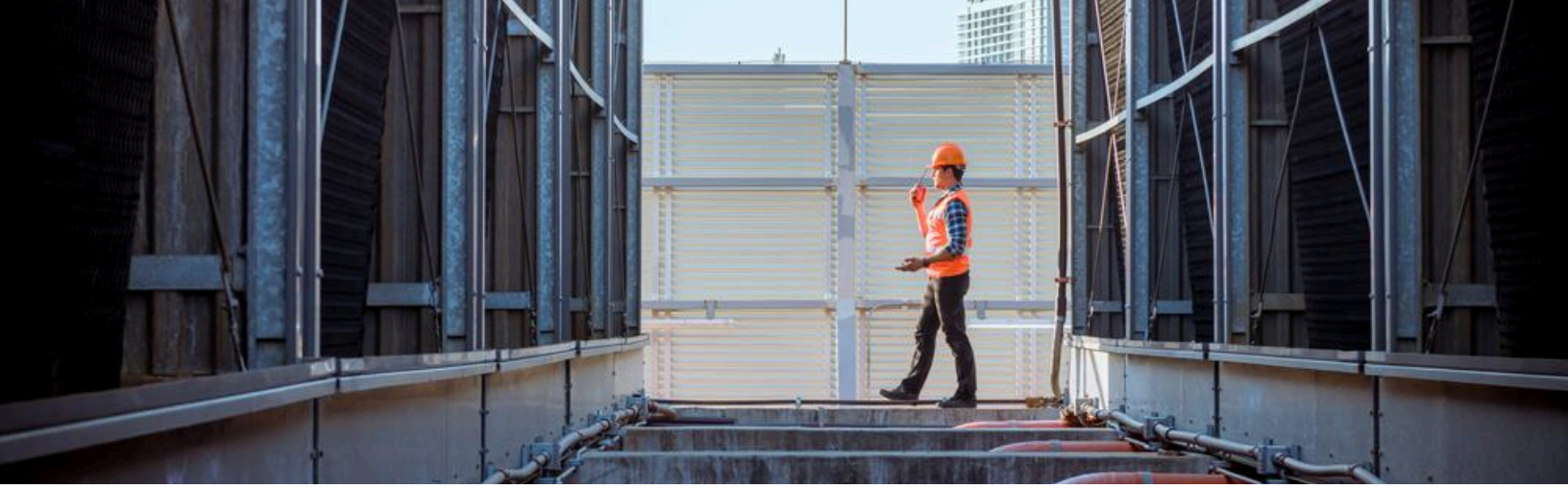
- **Reduced operating costs:** 20% average savings on water, energy, and chemicals
- **Environmental impact:** Meaningful reduction of carbon emissions to aid in hitting local and national compliance targets (up to 30%)
- **Extended equipment life:** Optimal performance resulting in lower maintenance and replacement expenses

Case Study: New York Hospital Deploys Manifest to Reduce Operating Costs

A cornerstone of New York's largest healthcare provider and private employer, this hospital is a 450-bed nonprofit research and academic medical center. It consists of ten buildings comprising an entire city block, and its facilities total a combined 780,000 square feet. Cooling from the condenser water loop costs $1.57 million per year.

It's estimated that Manifest will save the hospital $180,000 annually, and reduce its carbon emissions by 2,500 tons.

> "We've seen a meaningful reduction in our system costs. The setpoint recommendations are easy to interpret and implement. We're looking forward to seeing how the system improves further over time.
>
> Assistant Director of Engineering
> New York Hospital



Preventative Maintenance

With HVAC equipment costs ranging from tens of thousands to millions of dollars, it's critical for hospital operators to limit maintenance and replacement expenses. Manifest's predictive analytics technology, powered by machine learning, helps to do just that.

Integrating Manifest's predictive analytics technology into your hospital's building automation system provides visibility into HVAC event probabilities, forecasts time to specific events (failures, maintenance needs, etc.), and uses value modeling to turn predictions into economical, actionable recommendations. These insights allow operators to address issues before they become crises, saving on lifetime costs of equipment.

About Tagup

Tagup is a Boston-based defense technology company founded at MIT that is redefining logistics superiority with next-generation AI. The company's platform, Manifest, combines human expertise with proprietary Generative Reinforcement Learning™ to optimize complex, high-stakes decision-making across the public and private sector, delivering a decisive operational advantage in mission-critical environments.

For more information:

Visit **tagup.ai/hvac**
Email us at **info@tagup.ai**
Call us at **+1 617 804 1401**

Tagup

tagup.ai
info@tagup.ai
+1 617 804 1401