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The Business Case for Decarbonization of a Healthcare Delivery System–A Case Study on Energy Management with Gundersen Health Systems

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The NYU Stern Center for Sustainable Business (CSB) was founded on the principle that sustainable business is good business. We provide education, conduct research, and influence industry practice by proving the financial value of sustainability for business management and performance. At CSB, we aim to equip future and current corporate leaders with updated business frameworks that embrace proactive and innovative mainstreaming of sustainability, resulting in competitive advantage and resiliency for their companies as well as a positive impact for society. For more information, visit www.stern.nyu.edu/sustainability

Decarbonization and Industry Action

Climate change is an emergency that affects humanity worldwide, and all players across all industries must take immediate action to keep warming below 2ºC targets. Healthcare accounts for 4.5% of greenhouse gas (GHG) emissions globally, and 8.5% of US emissions[1]. The healthcare sector must reduce its emissions, albeit in a safe way that does not undermine its pertinent role to society.

In April 2022, recognizing the impact of health care on GHG emissions, the Department of Health and Human Services (HHS) together with the White House, called upon all health care stakeholders to commit to tackling the climate crisis through a new initiative aimed at reducing emissions across the health care sector. The voluntary HHS pledge asks signatories to, at a minimum, commit to: (1) reducing their organization's emissions (by 50% by 2030 and to net zero by 2050) and publicly reporting on their progress; (2) completing an inventory of Scope 3 (supply chain) emissions; and (3) developing climate resilience plans for their facilities and communities.[2]

In our research, the NYU Stern Center for Sustainable Business (CSB), found numerous large integrated healthcare delivery systems among the early adopters of decarbonization practices. These institutions are sharing their experiences on platforms provided by the Commonwealth Fund, Practice Greenhealth, Health Care Without Harm, National Academy of Medicine, Office of Climate Change and Health Equity, and others. However, there remains an urgent and pressing need to catalyze larger scale action across the industry, particularly to reach those that have not started decarbonization. CSB's study of the Business Case for Healthcare Delivery System Decarbonization, funded by the Commonwealth Fund, is one such effort.

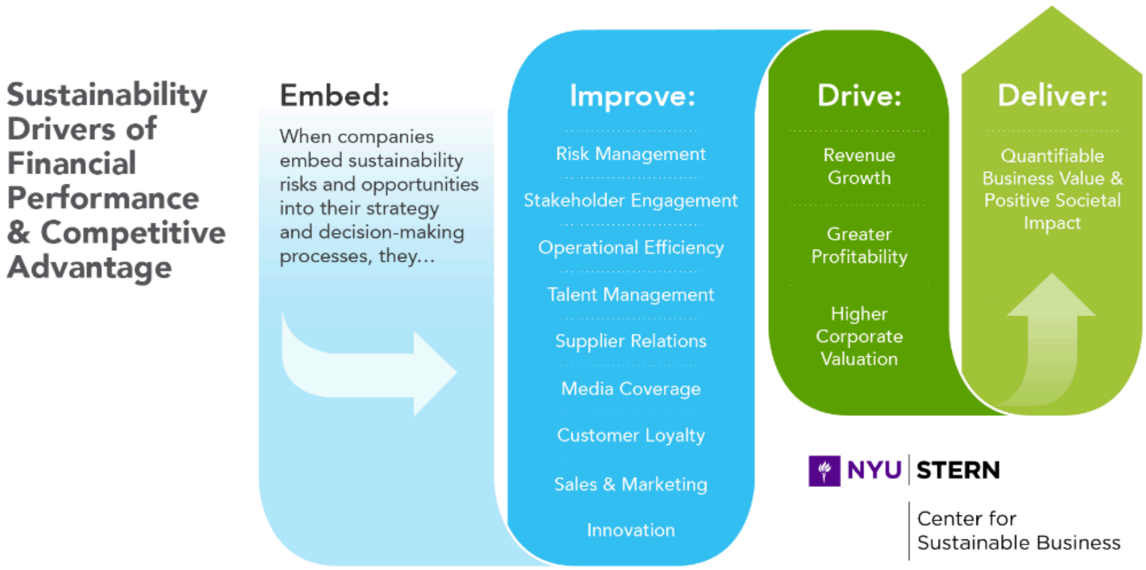
Healthcare facilities, are among the highest consumers of energy in the U.S., consuming close to 10% of the total energy used in the U.S. commercial buildings[3]. Hence, managing energy efficiently is a vital step in their decarbonization. Gundersen Health System was one of the early adopters of energy management programs in the U.S.[4]. CSB partnered with Gundersen Health System to determine the tangible and intangible benefits from energy management, more specifically, retrofitting Gundersen's outpatient clinic in Decorah, Iowa, with energy efficient, low GHG emitting measures; and incorporating low GHG emission measures into the design and construction of a new hospital building in Sparta, Wisconsin. The ROSI™ Framework model was used to quantify those benefits and calculate the return on investment.

[1] Health Care's Climate Footprint (Health Care without Harm & ARUP, 2019)
[2] Department of Health and Human Services, Office of Climate Change and Health Equity
[3] Practice Greenhealth/About Energy
[4] https://www.gundersenenvision.org/envision

Introduction to the ROSI™ Framework

Traditional profit and loss analyses generally do not identify and quantify fully the benefits and costs of doing business in a more environmentally and socially responsible way. Often, these impacts are not measured and hence not embedded into an organization's strategic decision making process. The Return on Sustainability Investment (ROSI) framework (refer schematic below) is a way of measuring the benefits and the costs of an organization's sustainability-conscious initiatives and systematically assigning a financial value to the resultant impacts. The ROSI process helps monetize the benefits and calculate a return on sustainability-related investments using the lens of nine mediating factors namely-risk management, stakeholder engagement, operational efficiency, talent management, supplier relations, media coverage, customer loyalty, sales and marketing, and innovation.

Fig 1: The ROSI Framework



Using ROSI, the NYU Stern CSB team created the Healthcare Delivery Systems Decarbonization Framework. The framework identifies strategies to decarbonize, the various benefits and costs that accrue as a result of these activities and provides guidance on how to monetize the impacts. The framework provides new research and analysis that will aid in **increasing the rate of adoption of decarbonization practices by highlighting the financial implications** of the tangible and intangible benefits of the actions that healthcare delivery systems can take. Refer to Appendix 2 for a list of energy management practices and their relative ranking in terms of emission reduction potential and investment required.

Introduction to Research Partner

Gundersen Health, Inc. ("Gundersen Health System" or "Gundersen" or the "Organization") is an integrated healthcare delivery system providing care with hospitals and clinics in Minnesota, Iowa and Wisconsin[5]. Gundersen, a signatory of the HHS Pledge[6], has environmental goals around energy conservation, recycling and renewable energy. Gundersen's environmental program Envision® has been providing consulting support on various energy management techniques to other healthcare systems in the U.S. Envision's objective is to show that sustainable approaches to energy utilization go hand-in-hand with solid financial business decisions.

Intrigued by the ROSI framework that quantifies both tangible and intangible benefits, the Envision team was keen to understand the Center's approach to calculating total benefits from energy management and sharing it with other healthcare systems.

Applying ROSI to Energy Retrofits (Decorah clinic)

For the ROSI analysis, the first building selected was the Gundersen Decorah Clinic. It is an outpatient clinic in Iowa that provides a range of medical care services from preventive medicine to surgical and diagnostic treatments. The building has a total facility area of 40,500 sq.ft. and had an energy use intensity (EUI) greater than 100kBTU. This was considered higher than other comparable clinics and thus the Envision team set out to reduce the building's EUI to ~ 75 kBTU in line with their sustainability goals. They evaluated retrofitting options and ultimately implemented the following measures:

1. Replaced fluorescent light fixtures with LED
2. Reduced the hours of HVAC operations
3. Created a renewable source of energy (100 kW of solar rooftop and 202 kW of solar ground mount)

The total investment made in energy efficiency measures was ~$449,021. The ROSI framework was used to answer the question on the tangible and intangible benefits of retrofitting this outpatient clinic in Decorah, Iowa with the energy efficient, low GHG emitting measures described.

Our analysis showed a net positive financial benefit for Gundersen Health with a ~10 year payback for the energy retrofits. On an average annual basis, emissions reduced by 7% or 68 MT Co2 eq. as compared to the emissions prior to implementation of the retrofits and the retrofits returned a benefit of ~$1 per sq.ft. to Gundersen Health.

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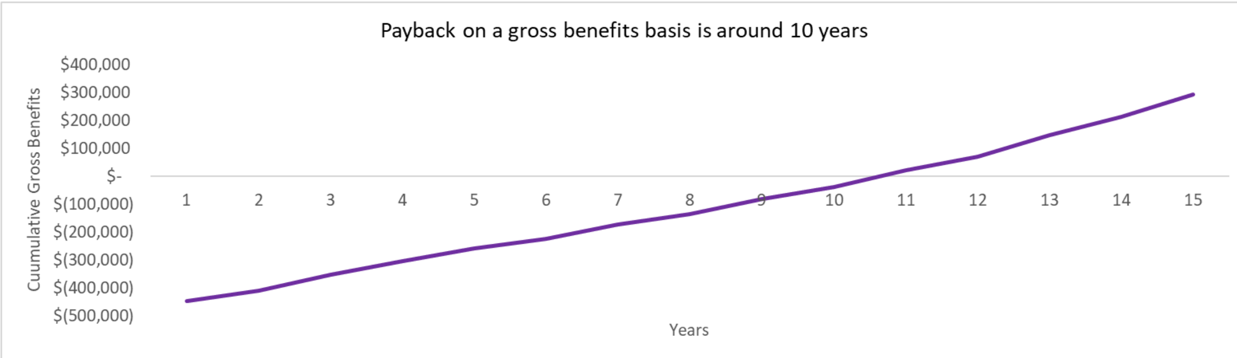
[5] Gundersen Health, Annual Report, 2022
[6] Health Sector Pledge https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/actions/health-sector-pledge/index.html (accessed,12.14.23)



Several benefits in operational efficiencies, stakeholder engagement, risk management, sales and marketing, and talent management were assessed across Gundersen Health's operations. Of these, five different benefits in operational efficiency and risk management were monetized by gathering data and building a financial model. A description of the monetized benefits is provided below:

- Operational efficiencies include reduced electrical and thermal energy costs, reduced repairs and maintenance expense and a reinvestment benefit
- Risk management includes savings from lower GHG emissions

Potentially additional benefits such as improved regulatory compliance in risk management, improved patient outcomes in customer loyalty, higher employee productivity in talent management, improvement in long term property value, benefit of lower insurance premium in operational efficiency, and additional revenue from energy sale in sales and marketing, were identified, however they were not monetized due to limited internal data availability and limited concrete external research evidence.

ROSI Monetization Explained (Decorah Clinic)

CSB undertook desktop research, interviewed key staff from the Envision team at Gundersen Health to learn about how the various energy initiatives were implemented, and monitored the impacts they had on the building's energy performance. CSB also interviewed senior leadership to get their perspectives on Gundersen Health's sustainability initiatives and their impact on employee engagement and patient outcomes.

As described, the ROSI analysis identified benefits from operational efficiency, comprising reduced electrical and thermal energy costs, reduced repairs and maintenance, and a reinvestment benefit. An additional benefit addressed risk management through lower emissions. The monetization process and the results are explained in detail below:

Benefit I: Reduced Energy Costs

Description

Savings in energy and associated costs from implementing energy retrofits, namely 1) energy efficient measures such as replacing light fixtures with LED and 2) creating a renewable source of energy (100 kW of solar rooftop and 202 kW of solar ground mount). Reduced reliance on external energy sources also helps manage price volatility.

Type of Data

- Annual energy usage units from utility bills
- Utility charges per unit
- Sub-metering data by appliance type, if available
- Annual energy generation from solar
- Research on weather normalization factors[7]
- Equipment costs and installation
- State utility rebates and incentives

Methodology

Using data from utility bills, calculated weather-normalized annual electrical energy usage and costs before switching to energy efficient lighting and the renewable energy equipment. Calculated weather-normalized usage after switching and subtracted to get the difference between the two. Considered the capital investment made and reduced ongoing program costs as applicable.

Benefit Value

This emerged as the largest benefit for Gundersen Health with expected average annual earnings benefit assessed at $26k with a 15-year Present Value (PV) totaling to $316K.

Benefit II: Reduced Thermal Energy Costs

Description

Reduction in thermal energy costs after implementing energy efficient measures such as reducing the hours of HVAC operations.

Type of Data

- Annual energy usage units from utility bills
- Utility charges per unit
- Weather normalization factors[8]

Methodology

Using data from utility bills, calculated a weather-normalized annual thermal energy usage and costs before reducing the hours of HVAC operations. Also, calculated a weather-normalized

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[7] **Weather normalized energy** is the energy a building would have used under average weather conditions. The Energy Star Portfolio Manager tool provides technical guidance on weather normalized energy consumption here (Accessed Oct 13, 2023)

[8] As above

usage after the change and subtracted to get the difference between the two.

Benefit Value

Expected average annual earnings benefit are $280 with a 15-year PV totaling $3,400.

Benefit III: Reduced Repairs and Maintenance Costs

Description

Replacing light fixtures from traditional to the longer lasting LED lights may result in savings in replacement and maintenance expenses.

Type of Data

- Number of lighting fixtures
- Price of LED and other fixtures (net of discounts and rebates)
- Average lifespan of different types of fixtures
- Average actual hours spent on replacement and maintenance

Methodology

Estimated the annual material cost of replacing fixtures, equipment etc. Estimated the labor cost by apportioning staff time spent on repair and replacement and multiplying the hours with an average hourly staff cost. Similarly, estimated the material and labor cost of replacing energy efficient equipment e.g. LED bulbs. Calculated the difference between the two scenarios for the annual net saving.

Benefit Value

Expected average annual earnings benefit is $7K with a 15-year PV totaling $88K.

Benefit IV: Reinvestment Benefit

Description

Investing in energy efficiency measures today rather than waiting to fund them from a future budget may be more beneficial[9]. Reinvesting those energy savings (without reducing future operating budgets) into new energy saving measures can yield further savings.

Type of Data

- Opportunity cost of funds
- Average savings from operating budget

Methodology

Estimated the annual savings from “quick win” retrofits that can be reinvested into installing additional energy efficiency measures, and how much additional savings year over year can be generated. Subtracted the opportunity cost of funds (i.e. market interest rates that funds, if invested, could earn). The difference was estimated as the reinvestment benefit.

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[9] EPA’s Energy Star Portfolio Manager

Benefit Value

Expected average annual earnings benefit is $13K with a 15-year PV totaling $149K.

Risk Management

Benefit V: Reduced Emissions

Description

Switching part of the energy consumption from non renewable to renewable sources can lower GHG emissions.

Type of Data

- Annual energy consumption by type i.e. purchased from the grid, generated by solar
- GHG emission factors
- Internal price of carbon/carbon cost

Methodology

Calculated the energy consumption by energy type (i.e. purchased from the grid and solar) before and after the retrofitting measures and multiplied by the related emission factors* to get the associated emissions by energy type under both scenarios. Multiplied the emissions with a carbon offset price or an internal cost of carbon to calculate the savings in carbon offsets or a carbon tax.

Benefit Value

On an average annual basis, emissions will reduce by 7% or 68 MT Co2 eq. Expected average annual earnings benefit is $5K with a 15-year PV totaling $62K.

Lessons Learned

In this section, we share some considerations for healthcare delivery systems exploring energy efficiency retrofits on their premises as these have the potential to enhance the returns/benefits.

During discussions with the Gundersen Envision team, we found that the Decorah clinic does not have a battery to store the excess generation from solar on the site and thus the excess generation is exported back to the grid. Addressing this issue by right sizing the solar equipment capacity and having onsite battery storage, can provide dual benefits of greater resilience and monetary saving as it can reduce reliance on the grid. We also found that an overall reduction in energy consumption from the grid, may translate to a higher price per unit of energy paid to the grid, given the grid's billing includes both a fixed demand charge and variable unit charges. Investment costs for the battery storage equipment however would need to be considered. Additionally, we found that the success of an emission reduction program may be enhanced by setting an internal price of carbon, if carbon offsets are not being purchased. As organizations can account for the benefits of reducing carbon emissions using a calculated carbon cost.

Applying ROSI to Net Zero New Building Design and Construction (Sparta Clinic)

The second building, Sparta, is an outpatient clinic in Wisconsin. The clinic provides residents in and around Sparta with access to medical care, physical therapy, digital mammography, cardiac rehabilitation, and more. The building, constructed in 2017, was designed with an ambitious **net zero target.** To achieve this target, an EUI goal of 35 kBTU was set, i.e. to operate at an energy intensity of 50% less than the average of other clinics. The Gundersen Envision team engaged energy modelers to compare the costs and the EUI of various sustainability features within the building to understand how they could keep the building running with the targeted EUI. Features were compared in the following areas[10]:

1. Insulation options for the building's exterior and its roof
2. Windows and frames
3. HVAC system options
4. A snow melt system for some of the building's parking lot and entrance areas
5. Plug load analysis by equipment type[11]
6. Renewable energy generation

Based on the energy modeling assessment and a cost (net of rebates from the State's utility provider) comparison of the various features, the team ultimately chose to implement the following key measures:

- Spray foam insulation
- Windows (energy efficient and double pane)
- HVAC
    - Installation of decentralized heat pump systems
    - Heat recovery systems
- Occupancy sensors
- LED Lighting
- Renewable energy generation
    - Onsite solar generation (~100 kW roof)
    - Offsite solar generation (~220 kW)
    - Geothermal wells

The incremental investment (total costs of a net zero energy building with a targeted EUI of 35kBTU vs. a standard efficiency, ASHRAE[12] code compliant building) was calculated at approximately $1.6M. Refer to Appendix 3 for a comparison of costs and analysis of a net zero energy vs. standard efficiency building.

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[10] Energy modeling assessment report for Sparta
[11] Plug load analysis determines how much time an equipment will run for and how much energy it will consume
[12] ASHRAE is an abbreviation for American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE specified building code 90.1 2007 was considered.

The ROSI framework was used to **determine the tangible and intangible benefits of incorporating these low GHG emission measures into the design and construction of the new hospital building. CSB's analysis showed a payback of the incremental capital investment over a 24 year period. On an average annual basis, a reduction of 30%[13] or 383 MT Co2 eq. in GHG emissions and $2 per sq.ft in annual benefits were calculated.**

Benefits in operational efficiencies include reduced electrical and thermal energy costs, and lower GHG emissions in risk management. Potential additional benefits such as regulatory tax credits and subsidies in stakeholder engagement, improved patient outcomes in customer loyalty, and higher employee productivity in talent management, were identified but not monetized due to limited evidence and applicability in this specific case. **Of these benefits, the regulatory tax credit and subsidies in the Inflation Reduction Act, 2022, available to institutions on implementing such decarbonisation measures, can help reduce the cost of investment and thus the payback period**. Refer to Appendix 1 for more information on how the IRA can help reduce costs.

ROSI Monetization Explained (Sparta Clinic)

The CSB team undertook desktop research, interviewed key staff from the Envision team at Gundersen Health to learn about how the various energy initiatives were implemented, monitored and the impacts they had on the building's energy performance. The CSB team reviewed data on energy including consumption and onsite generation. CSB also interviewed senior leadership to get their perspectives on Gundersen Health's sustainability initiatives and its impacts on employee engagement and patient outcomes.

The monetization process and the results are explained in detail below

Operational Efficiency

Benefit I: Reduced Energy Costs

Description

Reduction in energy costs driven by energy-related measures included in the building design

Types of Data

- Annual energy usage units based on benchmark EUI
- Utility charges per unit
- Annual energy consumption
- Outlook on prices, inflation

Methodology

Using a benchmark EUI for standard efficiency buildings and actual and projected energy

[13] Net zero as compared to a standard efficiency building designed to comply with ASHRAE specified codes

prices, estimated the energy costs for the building. Calculated the actual and projected energy costs based on actual consumption. Calculated the cost difference between the two scenarios for the actual and potential savings.

Benefit Value

Expected average annual earnings benefit is $19k with a 25-year Present Value (PV) totaling to $358K.

Risk Management

Benefit II: Reduced Emissions

Description

Lower energy consumption from nonrenewable sources potentially lowers GHG emissions

Type of Data

- Annual energy consumption by type
- Emission factors
- Internal price of carbon/carbon cost

Methodology

Calculated the energy consumption by energy type based on the benchmark EUI and split between electrical and thermal energy and multiplied by the related emission factors* to get the associated emissions by energy type. Calculated the energy consumption by energy type based on the actual and projected energy consumed and split between electrical and thermal energy and multiplied by the related emission factors* to get the associated emissions by energy type. Multiplied the emissions with a carbon offset price or an internal cost of carbon to calculate the savings in carbon offsets or a carbon tax.

Benefit Value

Expected average annual earnings benefit is $47K with a 25-year PV totaling $808K

Lessons Learned

In this section, we share a few considerations for healthcare delivery systems that are considering investments in new buildings. The Sparta clinic does not have a battery to store the excess on site solar generation and thus excess generation, if any, is exported back to the grid. Addressing this issue by having onsite battery storage can provide dual benefits of greater resilience and monetary saving as it potentially reduces reliance on sourcing energy from the grid. We also found that lower energy consumption from the grid may translate to a higher price per unit of energy paid to the grid, given the grid's billing includes both a fixed demand charge and variable unit charges. Investment cost and feasibility for storage equipment however must be considered.

Our analysis included reviewing each of the energy efficiency measures, whether they can be retrofitted into a building, and how much the retrofitting would cost. Based on a discussion with the Gundersen team, an incremental cost of $ 250k could have been incurred for retrofitting and an additional annual cost of $521k if the project implementation had been postponed. This includes increases in costs of equipment and installation (due to equipment price increases outpacing annual inflation) and factoring in business disruption. Hence, healthcare delivery systems need to consider that equipment and installation costs change over time and the costs of waiting for future funding vs. acting now could be higher.   Also,leveraging incentives in the Inflation Reduction Act is critical to reducing costs.

We also found that success of an emission reduction program may be enhanced with an internal carbon price as organizations can then directly account for the benefits of reducing carbon emissions by evaluating projects using a calculated carbon cost.

Recognize the impact on broader outcomes

Empirical studies have found a relationship between access to appropriate lighting and improved patient outcomes such as reduced patient stress, reduced depression, reduced length of stay. Similarly, appropriate lighting also impacts decreased staff injuries, staff effectiveness and increased staff satisfaction. Healthcare delivery systems could establish ways of data capture to evaluate these outcomes.

Conclusion

Using ROSI to measure the value of an energy management program found positive financial benefits and lower emissions. While reasonable estimates of operational efficiencies (lower energy costs and repairs and maintenance costs) and risk management (lower emissions) were identified, potentially additional benefits may be identified with more data tracking and external research availability. These include regulatory tax credit and subsidies in Stakeholder Engagement (ROSI mediating factor), improved patient outcomes in Customer Loyalty (ROSI mediating factor), and higher employee productivity in Talent Management (ROSI mediating factor).

Given Gundersen Health has goals on energy conservation, recycling and renewable energy they can use the ROSI monetization developed as a tool for communicating the value of energy management internally across business functions and externally to other health care delivery systems. The ROSI analysis showed operational efficiency and makes a case for implementing energy efficiency programs to reduce GHG emissions.

Appendix 1

Highlights of tax credits from the Inflation Reduction Act, 2022[14]

Investment Tax Credit		
Maintains 30% credit for solar energy property, constructed before January 1, 2025	%	30%
Bonus for meeting domestic manufacturing requirements for steel, iron, or manufactured components	%	10%
- bonus for projects located in energy communities (defined as brownfield sites or fossil fuel communities)	%	10%
- bonus for projects located in low income communities or on tribal land	%	10%
Production Tax Credit		
Credit of electricity generated from qualified renewable energy sources where taxpayers meet prevailing wage standards and employ a sufficient proportion of qualified apprentices from registered apprenticeship programs.	$ per KwH	0.30
Provides a bonus credit of 10 percent for qualifying clean energy production in energy communities	%	10%
Section 179D deduction		
Energy efficiency being installed as part of a plan designed to reduce the total annual energy and power costs with respect to the interior lighting systems, heating, cooling, ventilation, and hot water systems of the building by 25 percent (50 percent for taxable years beginning before January 1, 2023) or ASHRAE code compliance: Base Credit Amount: $0.50-$1 per square foot, depending on increase in efficiency, with deduction over four year periods capped at $1 per square foot. Inflation adjusted. Alternatively, taxpayers can deduct adjusted basis in “qualified retrofit plans” that reduce a building’s energy use intensity by at least 25%. Bonus Credit Amount: 5 times the base amount if the project meets prevailing wage and registered apprenticeship requirements. Initial guidance on the labor provisions is available.	$ per sq.ft.	$0.50-$1 5x the base amount

[14] A guidebook to the Inflation Reduction Act’s Investment in Clean Energy and Climate Action (accessed May 2023); Fact Sheet on Inflation Reduction Act (accessed May 2023)

Appendix 2

Introduction to Energy Management Practices for Decarbonization

CSB identified practices that reduce energy required and support switching to renewable energy sources

Energy efficiency

I: Implement energy efficiency retrofits within the building

Energy transition

II: Switch from non-renewable to renewable energy source by entering into a Physical or a Virtual Power Purchase Agreement

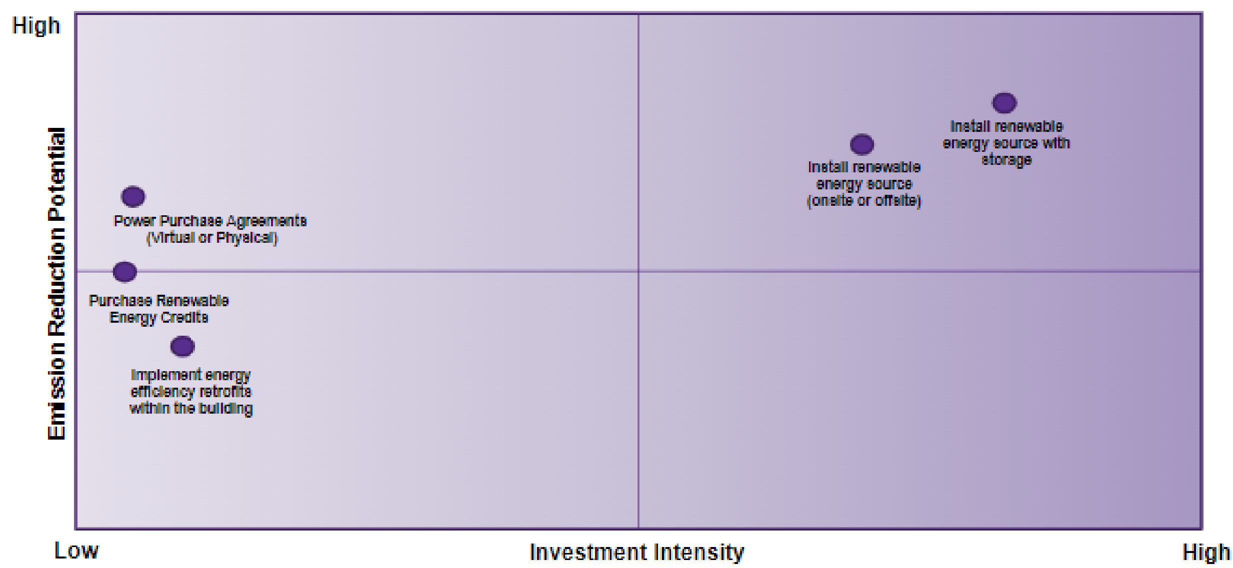
III: Purchase Renewable Energy Credits

IV: Install a new source of renewable energy (onsite or offsite)

Energy storage

V: Add battery storage on existing renewable energy sites (if it did not exist previously)

Relative Ranking of the identified Energy Management Practices



Note: The emission reduction potential and the investment intensity of the sub-practices is highly dependent on the type of healthcare delivery system, its scale of operations and its geographic location

Appendix 3

Comparison and Analysis of Net Zero Energy vs. Standard Efficiency Building[15]

Equipment costs	Additional Costs for a Net Zero Energy Building vs. standard efficiency building	Can this feature be retrofitted	Additional Costs to retrofit
Spray Foam Insulation	No difference	Limited	Business disruption
Windows (energy efficient, double pane)	50% higher	✓	0
HVAC	80% higher	✓	
-incl. installation of decentralized heat pump systems		✓	0
-heat recovery systems		✓	$ 250,000
Occupancy sensors	No difference	✓	
LED Lighting	No difference	✓	
Electrical	18% higher	Limited	
Energy Generation Equipment			
100 kW Roof Mount	100% higher	✓	
253 kW Solar Garden	100% higher	✓	
Geothermal Wells	100% higher	Limited	
Design costs (as relevant to the above)	100% higher		
Less: Rebates			
State Utility Rebate	100% higher	NA	
Difference between Net Zero and Standard Efficiency energy efficiency measures	$ 1,581,080		

[15] Source: Gundersen ROSI working papers

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