The ROI of Building Automation in Retail Healthcare Facilities

by Jaimie Giarrusso and Estelle Schweizer

Executive summary

The trend toward retail healthcare has resulted in healthcare enterprises having to operate dozens and sometimes hundreds of small remote facilities equipped with little or no energy control capabilities, except for simple thermostats. By retrofitting these facilities with intelligent controllers and building management systems, facility managers will see rapid ROI through reduced energy costs of up to 30%, improved patient comfort, and higher staff productivity.

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Schneider Electric

Introduction

In recent years, healthcare providers have been expanding their network of services by opening remote and satellite clinics and offices, to meet the changing demands and expectations of consumers and governments. These retail outlets comprise many different functions, including:

- Medical office buildings
- Diagnostic and imaging units
- Outpatient rehabilitation
- Aged care centers
- Retail health centers

What's more, this trend is worldwide, despite the variety of cultures and healthcare delivery systems. Consider:

- 63% of U.S. providers plan to expand local care centers in communities[1]
- In Europe there is a distribution shortfall, as providers can't keep up with demand for local healthcare[2]

Energy costs typically represent 2-5% of a hospital's total operating budget.

Source: Students and Directors, EHESP School, Advanced Studies in Public Health. Intermedica Hospital Expo, 2008

Many large healthcare networks now have dozens or even hundreds of remote offices sprinkled around a country or region, mostly acquired in the last five or 10 years. This rapid growth rarely involves new buildings; instead, providers rely on acquisitions, mergers, and the purchase or lease of existing structures.

Retail healthcare delivery makes sense in terms of both finances and patient care, but the widespread use of legacy buildings creates two costly energy-related problems. First, providers inherit whatever temperature controls come with the building, which are usually simple thermostats. Without intelligent controls, money is wasted on lighting, heating, cooling, ventilation, and other building systems. Second, without effective building controls, there is no way to ensure that patients and staff have a proper, comfortable, and productive environment.

It's estimated that the lack of energy management can cost larger provider networks millions of dollars per year. Lack of patient and staff comfort, while harder to measure, is taking a toll as well.

This paper examines how healthcare providers can use intelligent room controllers to manage building systems in a distributed, retail healthcare environment, achieving lower costs and rapid ROI, as well as improved patient satisfaction. It then proposes a broad strategy for phasing-in building automation that essentially pays for itself through energy savings.

The need to control energy costs

Cost control has never been more important to healthcare providers. Surveys show that "financial challenges" top the list of CEOs' greatest concerns, as they strive to meet the demand for affordable, quality healthcare.

Hospitals are large consumers of energy, and the trends have been toward both higher usage and costs (see **Figure 1**). Energy use in the healthcare market has increased by 36% since 1995 due to changes in technology and data center requirements, as well as an increase in patients. Meanwhile, energy costs have increased by approximately 20% in the

[1] http://www.hfmmagazine.com/display/HFM-news-article.dhtml?dcrPath=/templatedata/HF_Common/NewsArticle/data/HFM/Magazine/2014/Oct/cover-health-facility-design-survey

[2] "Current and emerging issues in the healthcare sector," European Agency for Safety and Health at Work, 2014 (https://osha.europa.eu/en/publications/reports/current-and-emerging-occupational-safety-and-health-osh-issues-in-the-healthcare-sector-including-home-and-community-care)

same time period.[3] In most European countries, the high percentage of older buildings makes hospitals among the least energy-efficient public buildings.[4]

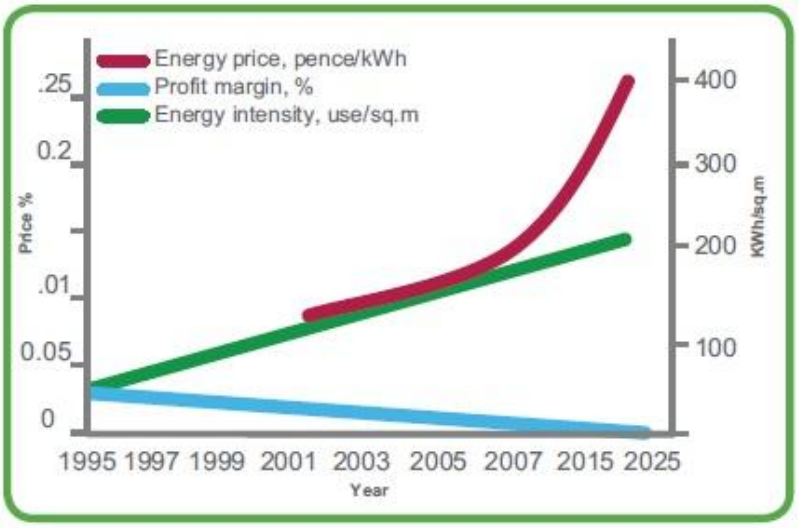
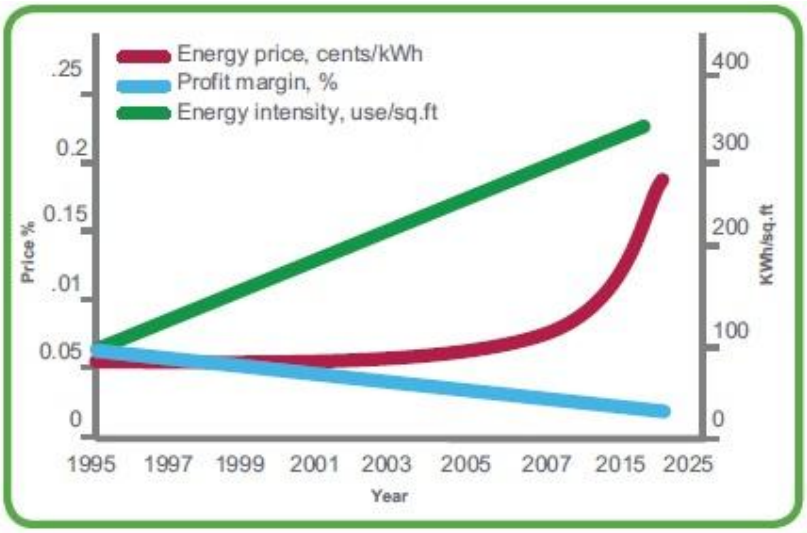


Figure 1

Energy use and costs have increased significantly in the past decade.

Healthcare energy trends in Europe



Healthcare energy trends in U.S.

These cost challenges have been exacerbated by the trend toward retail healthcare delivery, where most buildings have few or no energy control systems and were not purpose-built for healthcare services. Remote facilities often operate at full energy use even when the offices are closed, with equipment, temperature settings, and lights operating around the clock. Any gains achieved by installing energy-efficient lighting (a common and easy upgrade), have been offset by energy-consuming technology such as electronic imaging equipment and fully digital recordkeeping.[5]

The total cost of wasted energy in healthcare varies by building, region, function, and other local factors, but in Schneider Electric's experience, a "typical" clinic or other remote facility can be losing up to USD 27,000 annually per building on avoidable energy use. For a network with hundreds of locations, the loss can be in the millions.

[3] "Commercial Buildings Energy Consumption Survey," Department of Energy, US Energy Information Administration (EIA)

[4] http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=297290

[5] "Grumman/Butkus Associates releases 2014 hospital energy and water benchmarking survey results," Building Design and Construction, March 2015 (http://www.bdcnetwork.com/grummanbutkus-associates-releases-2014-hospital-energy-and-water-benchmarking-survey-results)

Impact on staff productivity

In addition to direct costs, a growing body of evidence suggests that the environmental conditions inside a building affect both staff and patients.

A study by The World Green Building Council found 81% of workers have difficulty concentrating if the temperature is higher than the norm, while 62% say it takes up to 25% longer to complete a task when they are too hot.[6]

In another study, workers did better at tasks such as typing, addition, reading comprehension, and creative thinking in spaces that had "high performance building ventilation, thermal control, and lighting control environments."[7]

Consider the financial impact of just 1% employee productivity improvement in a healthcare facilities network. For example, the healthcare sector has an average revenue per full-time employee (FTE) of $173,931/per quarter. A 1% employee productivity increase would thus equate to $7,000 per year in additional revenue per employee.

Impact on patient care

Many cost-cutting measures can have a negative impact on the primary mission of patient care. Energy efficiency is the exception, because it actually helps provide a healthier environment, not only through better facilities control and more productive staff, but also through operating in a greener, more sustainable manner.

For these reasons, many governments are adopting stricter regulations for energy use. In the U.S., for example, the Affordable Care Act ties federal dollars to the patient experience, which includes the quality of air. Australia is also seeing a shift to local, smaller facilities and has issued guidelines for energy efficiency in healthcare. While legacy facilities have lower requirements than new ones, many sites will need upgraded energy controls for management as well as government reporting.

Operating remote facilities more efficiently

Healthcare enterprises can significantly improve both energy and operational efficiency in retail facilities by using building automation technology. In this section, we look at the range of solutions that are available, from stand-alone room controllers to full building management systems (BMS) that integrate buildings and enterprises into a unified system for visibility, reporting, and control (see **Figure 2**).

Intelligent room controllers

Intelligent room controllers are the foundation for building automation. Like thermostats, they allow control of local rooms or zones according to preset schedules and thresholds. In addition, they can incorporate a range of intelligent features that directly reduce a building's energy costs by ensuring that systems operate at appropriate levels and only when needed, rather than 24/7.

"Many cost-cutting measures can have a negative impact on the primary mission of patient care. Energy efficiency is the exception."

Intelligent room controllers can include any or all of the following capabilities:

Occupancy sensors. Occupancy sensors use infrared, ultrasonic, or microwave technology to detect motion in a room, and then adjust the heating or air conditioning accordingly. Essentially, occupancy sensors override the standard settings of the room controller, based on actual room usage allowing for dynamic space control. Thus, if the patient load is light and an examination room is unused, the occupancy sensor will detect this and, after a certain length of time, revert to the appropriate, lower, set point.

Door/window sensors. Some room controllers offer the ability to link to sensors that can detect when doors and windows are open, and then take appropriate action – such as sending an alert to a Building Management System, and/or automatically turning off the

[6] "Research Note: Thermal Comfort," World Green Building Council, 2003 (http://www.worldgbc.org/files/6714/1372/1194/140918_Research_note_-_Thermal_comfort.pdf)
[7] "Greening America's Schools: Costs and benefits," G. Kats, Oct. 2006 (http://www.usgbc.org/Docs/Archive/General/Docs2908.pdf)

HVAC system. Also, these sensors can add security value (such as indicating a possible illegal entry) for healthcare buildings that have expensive equipment, and they can be linked to video and access control systems for additional security benefits.

Lighting control. Room controllers can be equipped to control lighting, as well as heating and air conditioning. This is usually accomplished through simple wiring connections that any certified electrician can install. With this capability, lighting can be scheduled like temperature controls; also like HVAC, lighting can be controlled dynamically by an occupancy sensor so that lights are turned on and off based on actual use.

CO_2 ventilation control. Room controllers can include CO_2 sensors with the ability to control ventilation fans. This allows for accurate control of the amount of fresh outside air that needs to be brought into the building, ensuring that CO_2 levels are within limits. Tempering outside fresh air is extremely costly compared to tempering recycled indoor air, and using this kind of ventilation control can equate to large savings in cold and hot weather climates. It improves indoor air quality for patients while reducing energy costs and fan wear by running the fans only when required and only introducing the correct amount of outside air.

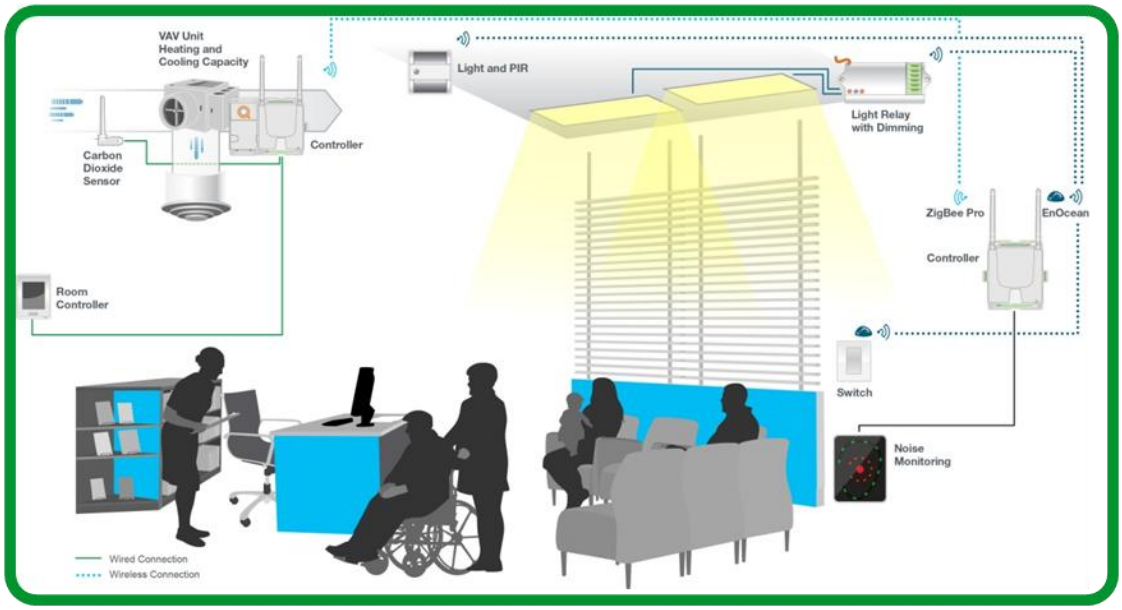


Figure 2
Sample diagram of solution architecture options

Ease of installation

Many room controllers are available with wireless communications, which makes them easy and nondisruptive to install in existing buildings. This is a critical consideration in retail healthcare, where there are so many legacy buildings.

Wireless devices can be installed with no special wiring, which means no renovation, no working through ceilings, no repainting – and most importantly, no disruption to healthcare staff and patients. Healthcare facilities can easily stay open while wireless room controllers are installed.

Schneider Electric research has shown that using newer application-specific integrated controllers instead of traditional direct digital controllers (DDCs) can reduce installation time and labor costs by 75% (see **Figure 3**).

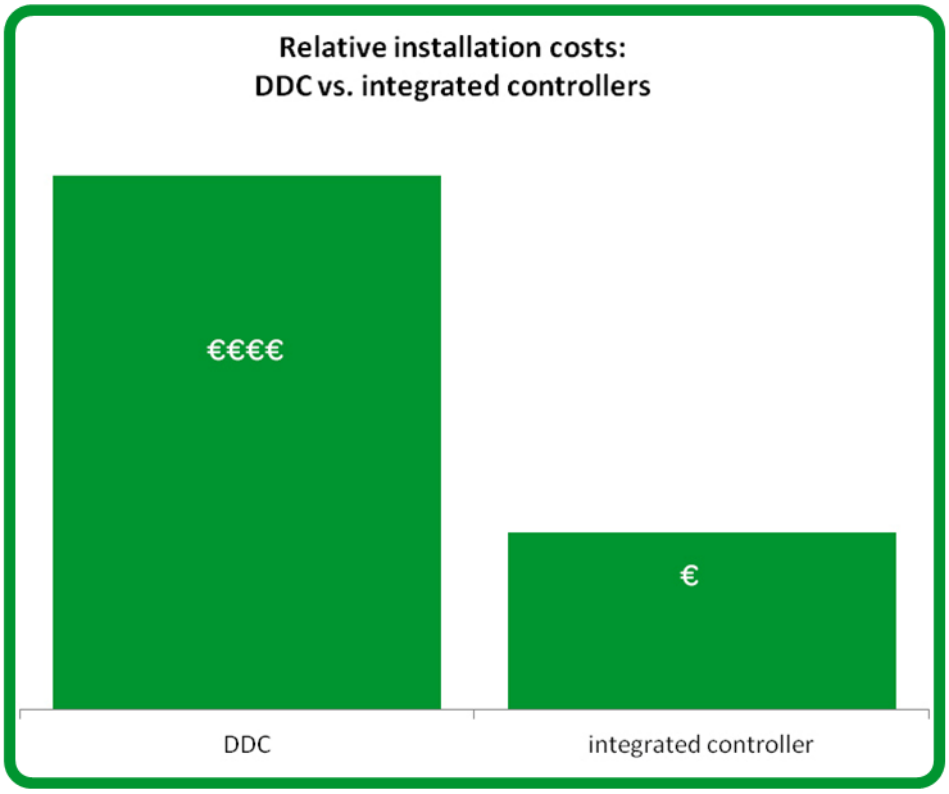


Figure 3
Application-specific integrated controllers can reduce installation time and labor costs by 75%, compared with traditional DDCs.

Expanding to BMS

The advantages of intelligent room controllers can be leveraged further by networking them into a building management system (BMS). A BMS is a software platform that provides a unified view of energy-related systems for monitoring, reporting, and control. A BMS can be used to manage a building, a campus, or an entire provider network. Remote sites can be linked via the cloud for easy integration into a single system.

"While specifics vary, every building should be able to benefit from improved energy control and management."

Improved staff productivity and patient comfort. Room controllers, especially when linked to a BMS, can improve occupant comfort and performance by:

- sending an alarm if a room or building's temperature is out of threshold
- making it easy to adjust room parameters remotely to meet special requirements
- detecting when a door or window has been left open for a long period of time.

Decreased maintenance costs and higher reliability. Repairing remote facilities can be costly. With networked room controllers linked to a BMS, maintenance staff can be proactive, resolving problems early and preventing breakdowns.

Better security. Linking room controllers to a BMS can also enhance security. With occupancy detection, the system is able to alert personnel if an office or zone is occupied during unused periods. This safeguards company property inside an area, and assures management that only authorized personnel are permitted to enter when the area is vacant.

Other advantages of a BMS include:

- Better visibility for decision makers
- Historical data and trends on temperature, people, and locations
- Ability to identify best practices and areas for improvement
- Validation of performance and savings
- Improved planning for future energy-saving measures and investments

Measuring the ROI

Savings and productivity gains depend on many factors. For example, regions with wide temperature fluctuations will usually see large savings in heating and/or cooling costs. Buildings with a strong southern light exposure can adjust HVAC and lighting based on actual conditions rather than on a fixed schedule, taking advantage of natural heat and light to reduce energy use. While specifics vary, every building should be able to benefit from improved energy control and management.

Just upgrading to stand-alone intelligent controllers can reduce lighting expenses by as much as 40%,[8] and cut overall energy costs by 20% or more. With full BMS implementations, savings of 30% and more are not uncommon.

Building automation further improves ROI in several ways. Access to real-time data across systems reduces the time it takes to diagnose and fix issues, provides new insights into how building systems work together, and creates opportunities to improve and optimize overall operations. Integration across buildings makes it easier to compare facilities and identify best practices or areas needing improvement – something that is difficult to do if all systems are managed individually.

For each medium-sized health clinic, energy savings can be USD 27,000 (see **Table 1**). Multiplied by the number of such facilities, we see the financial impact on the enterprise can be huge. A provider with 1,000 clinics could save USD 27 million annually.

BRANCH ENERGY MONITORING, SCHEDULING AND AUTOMATION: SIMPLE ROI ESTIMATE

Average Clinic	Building Size (m2)	Energy Density (kWh / m2/year)	Annual Energy (kWh)	ESTIMATES		Energy Cost ($ / kWh)
Building Characteristics	2,500	773	1,932,500			0.12
	Lighting	HVAC	Plug	Total	Energy Savings	Energy Cost Savings
Baseline (ratio, kWh, kWh / m2)	0.25	0.35	0.40			231,900
	483,125	676,375	773,000	1,932,500		
	193	271	309	773		
Estimated Energy Savings (%, kWh)	25%	15%	0%		11.50%	
	120,781	101,456	0		222,238	26,669
Post Retrofit (kWh, kWh / m2 / Ratio)	362,344	574,919	773,000	1,710,263		
	145	230	309	684	89	
	0.21	0.34	0.45			

Table 1
Example of estimated ROI, based on compilation of Schneider Electric client history

Case study

One of the largest health systems in Texas comprises hundreds of clinics. While remote clinics make up more than a quarter of the system's entire utility spend, management had no control or visibility into those facilities.

Recently the provider decided to implement a pilot program in three retail clinics. Legacy thermostats were replaced with basic intelligent controllers (no occupant detection or other extra features) and a wireless gateway to link them and provide a management and control dashboard.

[8] EnergyStar (http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/stamp-out-energy-waste)

The results have exceeded expectations:

- 35%+ savings over three months with basic schedules
- Payback evaluated at under a year

Retrofitting strategy

As in the case study above, healthcare providers can easily start with a few locations as proof of concept, and then expand to more facilities as the ROI justifies it. Since local electricians can usually complete the installation, the logistics of the retrofit are simplified. Most large providers will want to add BMS capabilities at some point to integrate building management, control, and reporting.

Following is a timeline for planning an energy-efficiency project:

Within the next 60 days: Begin to construct a roadmap for improving energy efficiency. Compare the energy consumption costs of satellite clinics and select the one with the highest energy costs. Make that location a test case by installing intelligent room controllers and monitoring energy costs.

Within the next six months: Using the data points acquired in setting up the test case, target other locations that run high on energy costs and arrange for intelligent room controller installation.

Within the next year: Track energy consumption for all locations to determine energy savings percentage and ROI. Consider consulting an energy management supplier to discuss the benefits of adding a building management system, such as increasing energy savings and improving building efficiency.

Within two years: Create a long-term plan for energy savings improvements regarding facilities that house satellite clinics. Establish a solutions model for ongoing facility acquisitions.

Conclusion

The rapid growth of smaller, satellite healthcare facilities has resulted in a challenge to manage energy and ensure patient comfort. By retrofitting these distributed facilities with intelligent room controllers and building automation, healthcare enterprises will be able to take control of energy use and patient comfort with ROI that is usually measured in months.

With financial challenges a top main concern for most hospital CEOs, managing energy use is an easy target and it begins with networking and collecting data from all the facilities in the system. Moreover, managing energy use can lead to reduced operational costs and an optimal environment for patients and staff. Finally, by using dashboards, facility managers can begin to identify areas where energy and maintenance should be addressed.

Healthcare facility stakeholders who are responsible for facility performance and wish to learn more about energy efficiency for healthcare facilities will find the following resources helpful:

Schneider Electric Solutions

- Video: Smart Energy Management for Any Size Building
- Video: SE8000 Series Room Controller

Related white papers:

- Integrated Application-Specific Controllers: A New Approach to Zone-Level Control
- Leveraging Wireless Technology to Reduce Building Energy Costs
- How Energy Efficiency Ensures Financial Health for Hospitals

With proper planning, healthcare enterprises can take control of remote building operations and keep pace with expanding facilities, improving both the bottom line and the patient experience.

About the authors

Jaimie Giarrusso is a Global Offer Marketing Manager for Schneider Electric. Jaimie is responsible for developing and driving successful strategic marketing campaigns and thought leadership initiatives for the Room Controller and SmartStruxure Lite solutions around the globe. She has more than 12 years of experience in the marketing arena for segments such as life sciences, hotels, retail, and education, as well as 10 years in the building automation and energy management industries. Additionally, Jaimie holds a B.S. in Business Administration from Southern New Hampshire University and is currently enrolled in the Masters Program for an MBA.

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