Smart Energy Infrastructures and the Commercial Buildings Industry

An Industry Survey and Report | November 2011

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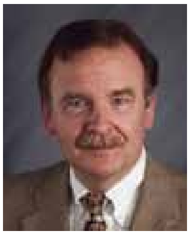
FOREWORD

Who Will Be the Energy Entrepreneurs in the Commercial Buildings Industry?



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The smart grid is a big idea, a challenge to grasp and to implement. It's not only the scale and complexity of rebuilding the nation's power grid, but also the fundamentally different paradigm. Today, commercial buildings consume electricity with little participation in the network that generates and transports this product to us. Tomorrow, power consumption will be a two-way affair that functions more like a commodity exchange where prices move continually.

The smart grid and smart building infrastructures offer building owners new options and capabilities to manage their electrical cost and consumption. But for some owners, it will likely be much more than that. They will become a new breed of energy entrepreneurs, operating buildings that have a competitive edge due to their greater efficiency, onsite power generation, and the energy services that they offer to tenants and occupants.

This survey and report are designed to look at the energy attitudes and practices of commercial building owners today, the future opportunities for smart applications, and the tipping points that will drive implementation.

At *BUILDINGS* we look forward to researching and monitoring smart buildings *and* smart owners. We are grateful to Siemens for its sponsorship and enthusiastic support of this project.

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SMART INFRASTRUCTURE and INTELLIGENT CONTROLS

Smart technologies are based on interoperability and the capacity of systems to exchange digital information and utilize intelligent digital controls. Digital controls create opportunities for greater speed, efficiency, and performance.

For years, digital controls have been used in various building systems (HVAC, energy management, lighting, security, etc.). Similarly, the power grid is increasing its reliance on digital controls and smart technology to identify and correct outages, improve reliability, etc. However, the concept of the smart grid takes smart technology to a new level because it allows building systems and the power grid to become interoperable by exchanging information with each other.

Two-way communication between power consumers and power suppliers allows greater control over the power grid's balance of supply and demand. Because most electricity is generated for immediate use, the balance must be maintained continuously due to the fact that electricity cannot be stored efficiently with today's technology.

Factors Driving Smart Grid Technology

One factor driving the smart grid and smart technology is the spikes of demand at peak periods. Peak demand imbalances can lead to brownouts and blackouts, which create slowdowns that cost businesses billions of dollars in today's digital economy. Moreover, the cost of maintaining capacity to meet peak demand is enormous given

Anticipated Benefits of the Smart Grid

- Provides better power reliability and quality
- Enables better utilization of power-generating facilities and the capacity necessary for peak demand
- Supports predictive maintenance and "self-healing" responses to grid problems
- Accommodates renewable energy sources, possible new energy storage options, and two-way flows of electricity
- Reduces greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduces consumption of fossil fuels by reducing the need for inefficient power generation during peak periods
- Supplies more options for consumers

the expense and environmental impact of constructing and operating power plants. The Federal Energy Regulatory Committee estimates the smart grid's potential for reducing peak electricity demand is equivalent to as much as 20 percent of national peak demand—enough to eliminate the cost of operating hundreds of backup "peaker" power plants, which tend to be less efficient generators of electricity than main line plants.

Renewable power sources like wind and solar are also driving smart technology because their output is variable based on weather conditions. As a result, they require a higher degree of control in order to maximize their efficiency. In addition, these renewable sources can be used as onsite generators of power that is supplied back to the grid. Such two-way flows of power also require new levels of two-way communication and control to ensure that the power grid maintains an efficient balance of supply and demand.

The smart grid model also anticipates widespread use of plug-in electric vehicles (PEVs) and electric vehicle charging stations. These developments would create a brand new set of dynamics for the power grid and even the possibility of two-way flows of power if vehicle batteries were to supply short-lived power to the grid. In effect, this would make electric vehicles both a mode of transportation and a medium of energy storage for the power grid.

Smart Grid Capabilities

While views vary of the benefits that the smart grid can offer to building owners, they typically include increased power reliability and quality, the two-way flow of power and communication, intelligent sensing and monitoring, near real-time reporting of power usage, remote control options, automated response to power events, dynamic pricing and price signals, and integration of alternative sources like solar and wind.

The smart grid enables electric vehicles to be a transportation mode and a medium of energy storage.

Like the Internet in its early days, much about how the smart grid will work is not yet known. Rate structures and regulation will change to encourage utilities and users to be energy efficient. In other words, the energy marketplace will change. But from a technical point of view, smart infrastructures do not require new technology so much as they require new interfaces among existing systems and new relationships among power suppliers and consumers. For example, a common pathway for communications between buildings and the power grid is needed. Several existing technologies (WiFi, fiber-optic networks) could be used for this purpose, but a consensus needs to be reached on what the pathway will be.

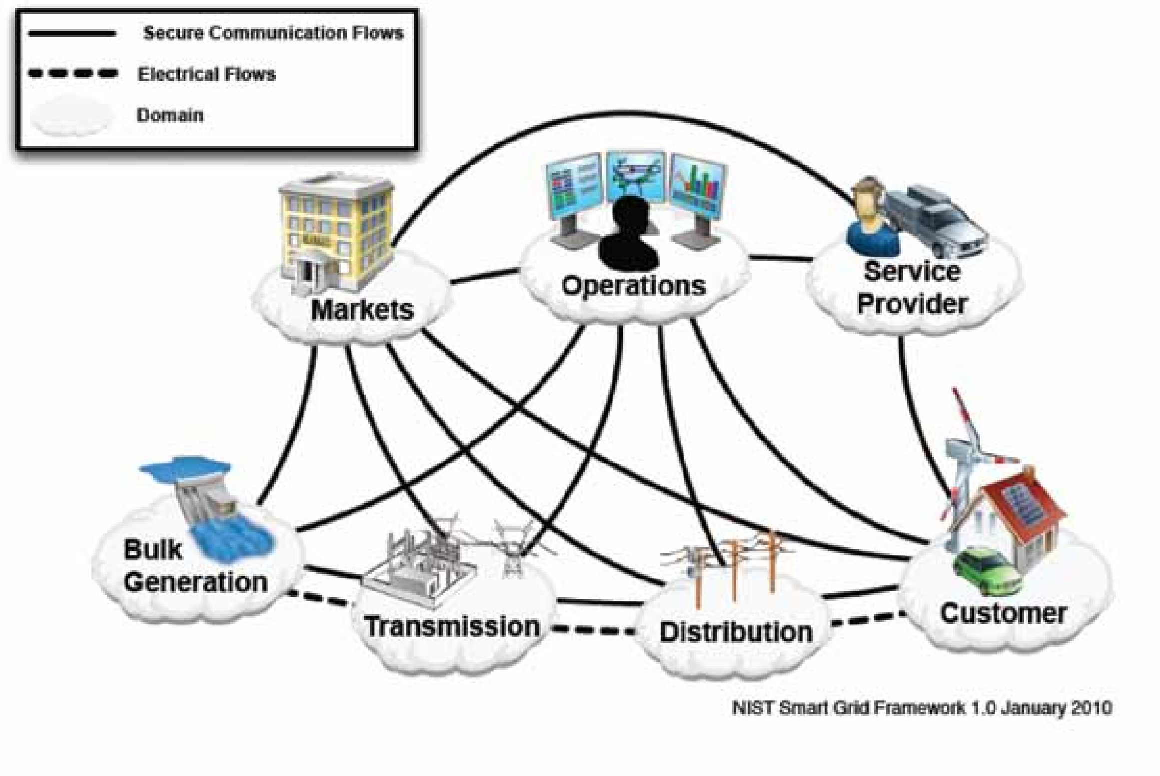
With new interfaces and relationships, smart infrastructures will require new standards. Under the *Energy Independence and Security Act of 2007*, the National Institute of Standards (NIST), an agency within the U.S. Department of Commerce, was given the primary responsibility to coordinate development of a framework for interoperability of smart grid devices. NIST is pursuing interoperability standards that are open and avoid domination by a single organization or group.

For building owners, smart infrastructure should help to shift peak loads and reduce consumption. It can enable onsite renewable power generation to work with the grid and the opportunity for continuous energy commissioning of buildings through exchange of data with smart devices on the grid. Such infrastructure should also help manage the rising price of electricity.

With the smart grid, building owners will have more options for choosing power suppliers and power sources. However, in order to maximize their efficiency and minimize their costs, they will need to become more proactive participants in the energy supply process.

New rate structures and regulations will change the energy marketplace.

Model of the Smart Grid and the Actors



Domain	Actors in the Domain
Customers	The end users of electricity. May also generate, store, and manage the use of energy. Traditionally, three customer types are discussed, each with its own domain: residential, commercial, and industrial.
Markets	The operators and participants in electricity markets.
Service Providers	The organizations providing services to electrical customers and utilities.
Operations	The managers of the movement of electricity.
Bulk Generation	The generators of electricity in bulk quantities. May also store energy for later distribution.
Transmission	The carriers of bulk electricity over long distances. May also store and generate electricity.
Distribution	The distributors of electricity to and from customers. May also store and generate electricity.

Factors in Energy Procurement

For commercial building owners, energy issues revolve around costs—the cost of energy, the cost of smart technology, and the cost of energy-efficient materials.

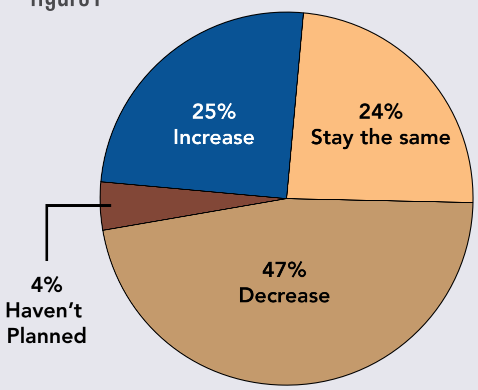
The cost of energy is volatile and perhaps more perplexing to forecast than it has ever been. Geopolitics, demand, the costs of fossil fuels (coal, natural gas) for generating plants, and safety concerns about nuclear generating plants have their impact. Factors that may have greater impact in the near future include changing weather patterns affecting demand and hydropower generation, increasing use of renewable sources, and regulations that affect the cost for building new generating plants and siting transmission lines.

Despite the uncertainties of forecasting, the consensus is that electricity prices are rising at an accelerating pace, as they did during much of the previous decade. Average retail prices to commercial customers climbed 10% from 1999 to 2003, and 24% from 2004 to 2009 (see figure 3). Most survey respondents believe that increases will continue in the near future, with 82% anticipating increases over the next five years (figure 2).

Anticipating increases in energy prices, 47% of respondents plan to decrease their per capita or square foot energy consumption in the coming years. However, 25% foresee increases in consumption, most prominently by healthcare buildings, 35% of which anticipate greater consumption.

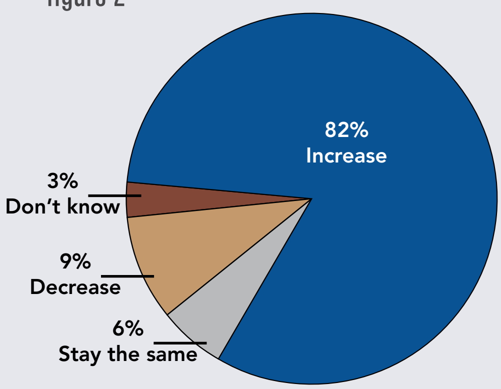
Respondents' Outlook for Energy Consumption and Prices

figure1



Over the next 5 years, are you planning for your buildings' per capita or square foot energy **consumption** to:

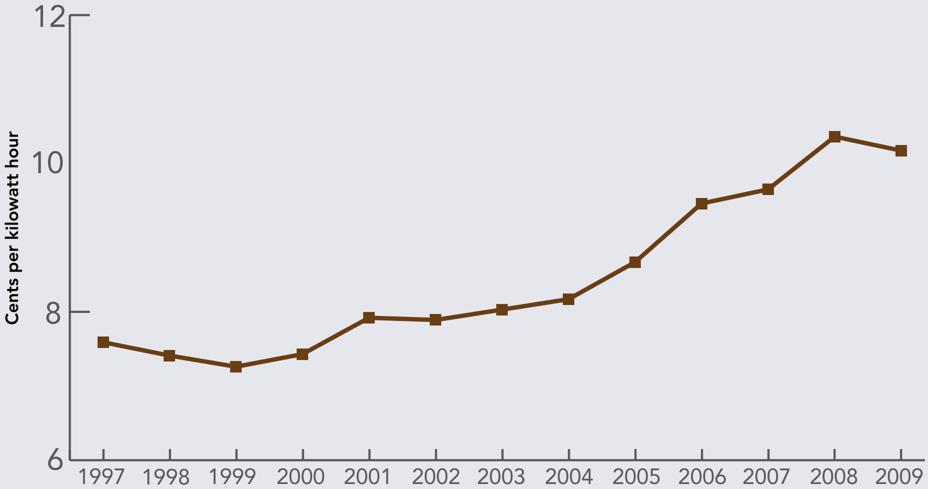
figure 2



Over the next 5 years, do you anticipate that the **rate** your buildings pay for energy will:

figure 3

Average Retail Price of Electricity to Commercial Customers, 1997-2009

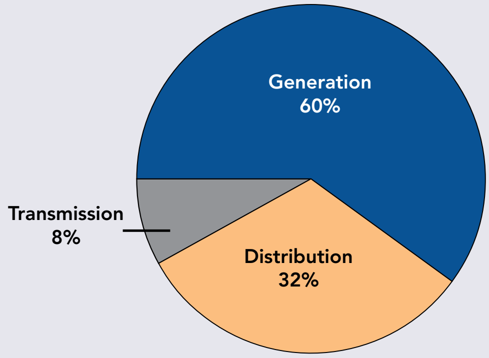


Source: *Annual Energy Outlook 2011*, U.S. Energy Information Administration

U.S. commercial customers saw an increase in electrical rates of 10% from 1999 to 2003, and then 24% from 2004 to 2009.

figure 4

Major Components of U.S. Average Electricity Price, 2010



Source: *Annual Energy Outlook 2011*, U.S. Energy Information Administration

Generation accounts for 60% of the average cost of electricity.

Readiness to Pay for Renewables

While the price of electricity from renewable sources is higher than that from traditional sources, some building owners are willing to pay a premium for renewable sources for at least a portion of their demand. Among all survey respondents, 44% report that they are willing to pay a premium for renewable energy (figure 6). Some 26% of respondents would pay 5% more for renewables and 18% would pay 15% or more. Nonetheless, only 16% of survey respondents currently purchase renewable energy credits (RECs), and only 25% use power purchase agreements (PPAs), which typically involve solar or wind power (figure 5). Healthcare and hotels/motels were most likely to use PPAs (35%), significantly higher than the average for all respondents.

figure 5

Which energy procurement practices does your organization currently use?

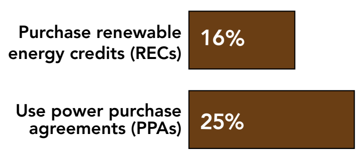
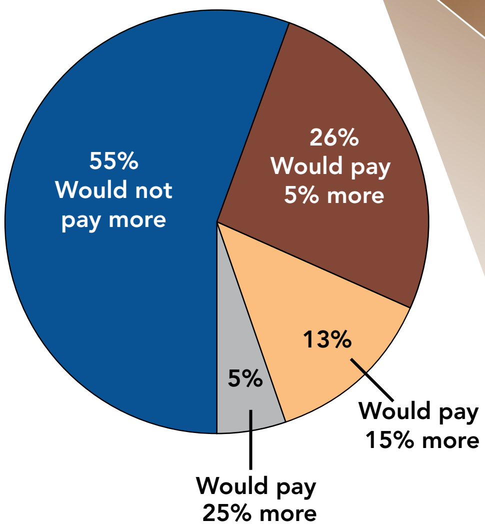
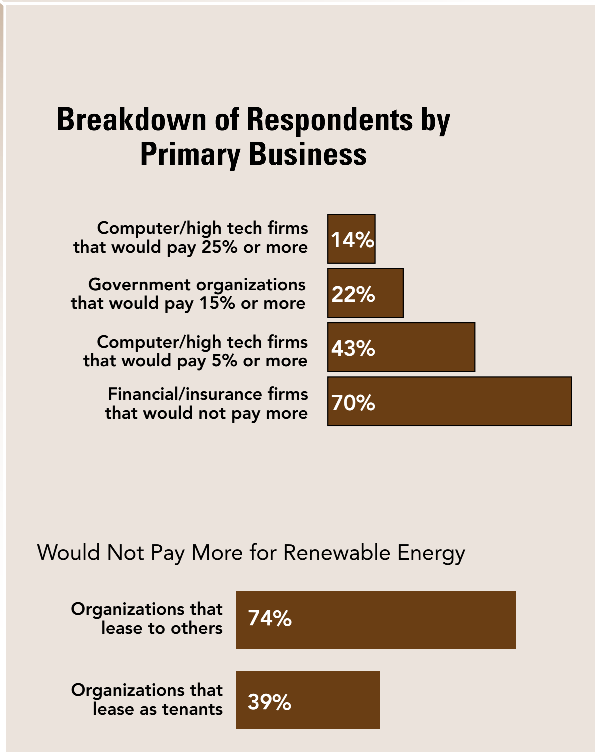


figure 6

What premium is your organization willing to pay today for renewable energy and/or lower greenhouse gas emissions?

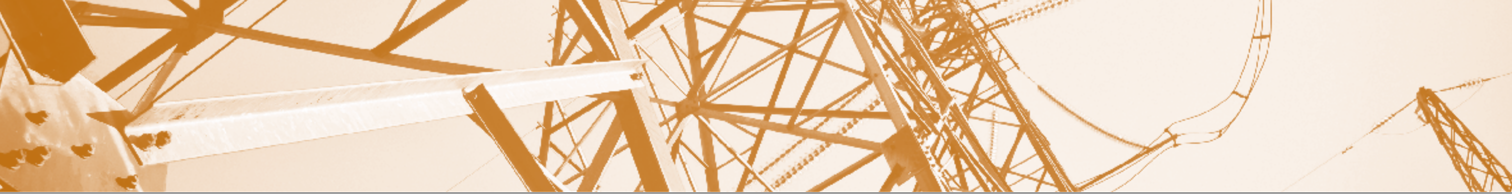
All Respondents





Among all respondents, a little more than half (55%) are unwilling to pay any premium for renewable energy and/or lower greenhouse gas emissions. However, the primary business of the respondent could cause a significant deviation from the 55% average. For example, among financial/insurance firms, 70% would not pay for renewable sources. Conversely, 14% of computer/high tech firms and 12% of retail/chain respondents would pay a premium of 25%, more than double the average for all respondents.

There were also significant differences among organizations depending on whether their respective buildings were owner-occupied or leased. Organizations that lease their buildings to others were more likely to decline any cost premium for renewable energy (74%), whereas firms that are tenants and lease their space were less likely to decline a premium (39%).



CURRENT ENERGY MANAGEMENT PRACTICES

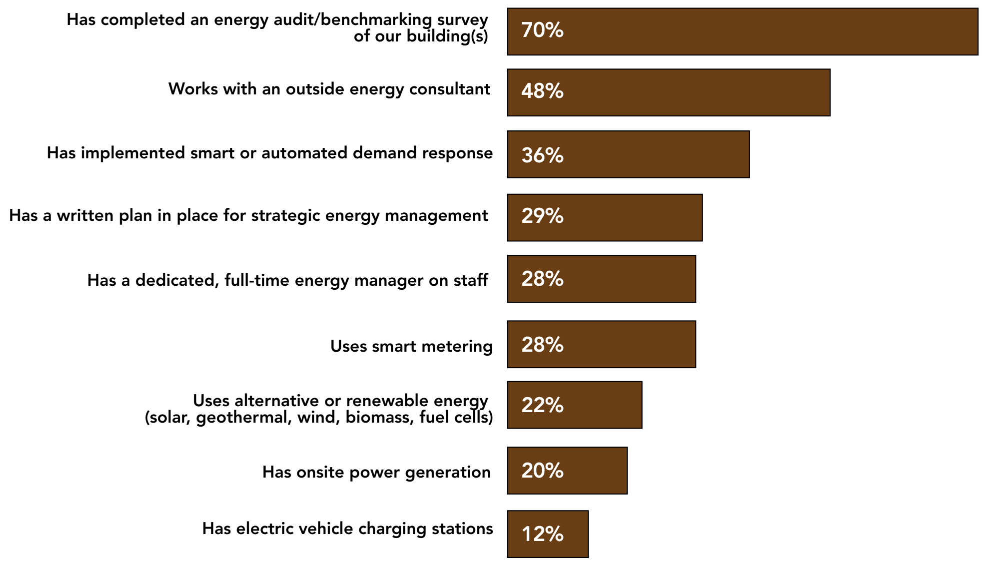
As illustrated previously in figures 1 and 2, 82% of the commercial building respondents expect that rates for electricity will accelerate in the near future, and 47% say they plan to reduce their per capita or square foot consumption. But what are those 47% doing now to reduce costs and consumption?

Building owners cannot manage their energy if they have not measured it. The first and fundamental step is auditing energy consumption, and most respondents (70%) have completed an energy benchmarking survey of their buildings, often using Portfolio Manager, ENERGY STAR's free, online benchmarking tool (figure 7).

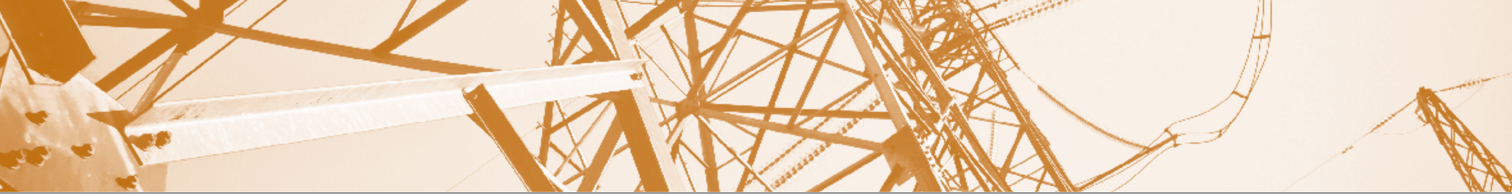
Whether building owners have taken clear steps as a result of benchmarking is a different matter. Only 29% of respondents have a written energy management plan in place -- far fewer than those who have completed an audit. Facility professionals in federal buildings (46%) and the hospitality industry (47%) are the groups most likely to have a written energy management plan in place. Organizations managing the largest amounts of space were also more likely to have a written plan in place. More than half (55%) of organizations with 10 million square feet or more have a strategic energy plan, but only 21% of those with 100,000–250,000 square feet have one.

figure 7

Which energy management practices currently apply to your organization?



While most survey respondents (70%) have taken the first step of benchmarking their building's energy profile, fewer than half of those report that they have a written plan in place for energy management.



"There are no clear rules for how to implement an audit's findings," says energy and sustainability consultant Jennifer Woofter. "Who should be involved, how much you should spend, how long you should wait before you make your money back – only you can answer these questions, because the right answers vary so widely."

Perhaps due to managing vehicle fleets, respondents who manage certain institutional buildings (correctional facilities, military facilities, airports) were most likely to have implemented electric vehicle charging stations (31%). Shopping centers were most likely to have implemented smart meters (41%) and demand response (63%).

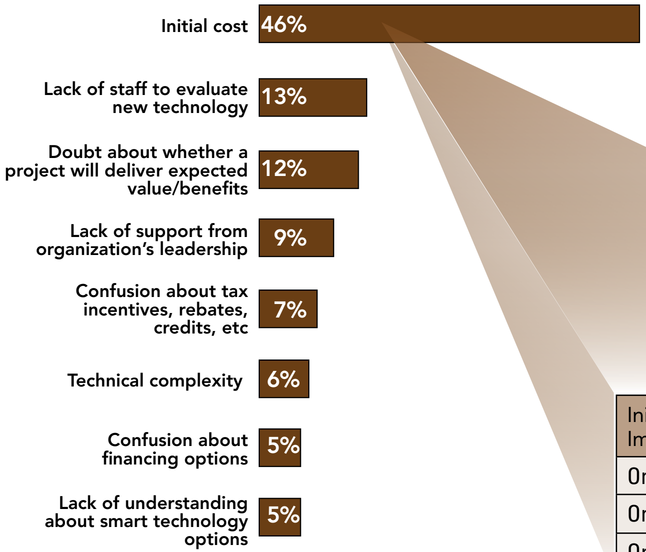
Initial Cost Is the Highest Hurdle

Many actions that might be outcomes of an audit have a price tag associated with them, and initial cost is by far the greatest obstacle to implementing smart technology (figure 8). Among all survey respondents, 46% cite initial cost -- some three times more than those who mention the second-rated obstacle, which is lack of staff to evaluate new technology (13%).

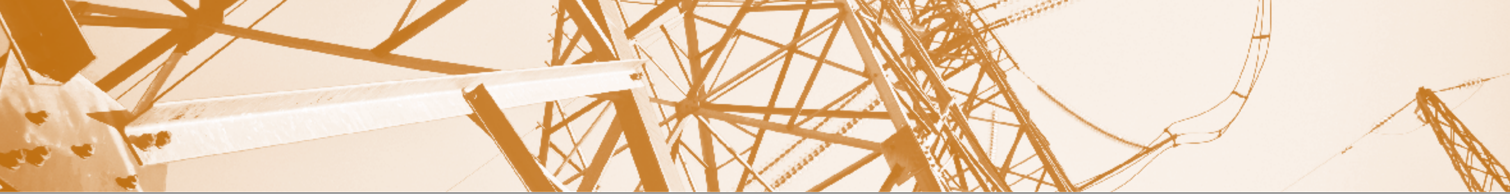
"For our corporate clients in owner-occupied facilities, if we bring them ideas and recommendations that need capital expenditures, these clients can generally find the capital if there is a good business case and a reasonable payback," says Dan Probst, chairman of energy and sustainability services for Jones Lang LaSalle. "For investor-owned buildings, it has been quite the opposite. Even for projects with an attractive payback, financing the upfront capital has been an issue."

figure 8

What are the most difficult obstacles to your organization's implementation of smart energy infrastructure?



Initial Cost Cited as the Most Difficult Obstacle to Implementing Smart Technology	
Organizations that own and occupy	46%
Organizations that lease as tenants	52%
Organizations that own and lease to others	66%



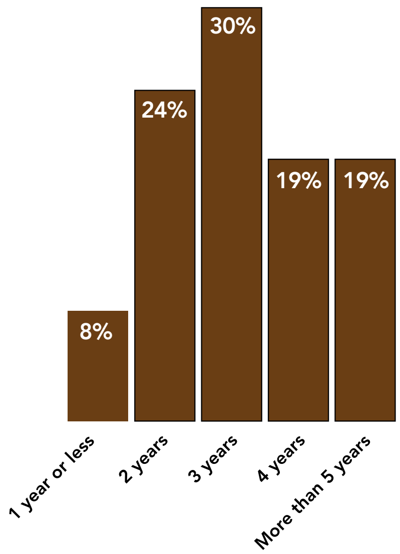
Payback Horizon Varies by Primary Business

For more than half of all survey respondents, a payback of two or three years is necessary to justify initial cost (figure 9). However, there are significant differences between organizations that own and occupy their space and those that own and lease to others. The former are far more likely to bear longer payback periods, with 45% accepting four or five years. In contrast, among organizations that own and lease their buildings, only 14% are willing to carry such paybacks for energy projects.

figure 9

What payback would your organization require for any energy improvement project undertaken today?

All Respondents



Breakdown by Owned and Leased Buildings

Owner-occupied buildings

1 year or less	6%
2 years	19%
3 years	30%
4 years	24%
More than 5 years	21%

Leased buildings

1 year or less	11%
2 years	43%
3 years	31%
4 years	11%
More than 5 years	3%

Due to rounding, total may not equal 100%.

Respondents in owner-occupied buildings are far more likely to accept 4- and 5-year payback periods than those in leased buildings.

DRIVERS OF SMART BUILDING TECHNOLOGIES

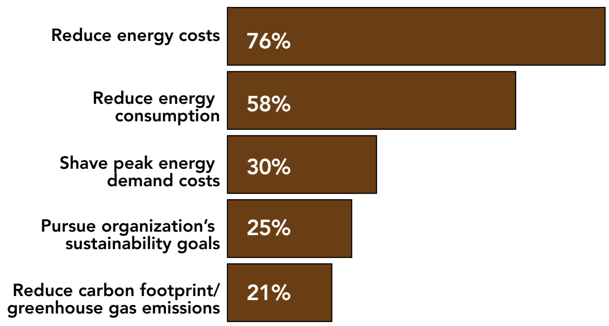
The most frequently cited factor that drives smart technology is reducing energy costs. Among survey respondents, 76% say energy costs are the priority, and 58% say reducing energy consumption is an important driver (figure 10). A driver for 30% of respondents is shaving peak demand charges.

Achieving goals for sustainability and carbon footprint are significantly less important factors than reducing energy costs. Across all respondents, an average of 25% say that pursuing sustainability goals is a most important factor, and 21% say that reducing carbon footprint/greenhouse gas emissions was most important.

However, there are significant variances across different groups. Respondents managing federal buildings are twice as likely (50%) to mention sustainability goals as an important factor, followed by correctional/military/airport facilities (42%) and building development firms (39%). Similarly, respondents most likely to cite the importance of carbon footprint/greenhouse gas emissions goals manage federal buildings (32%) or correctional/military/airport facilities (47%).

figure 10

What are the most important factors driving your organization's adoption of smart energy technologies?



Reducing energy costs is the factor mentioned more often than any other in driving smart technology.

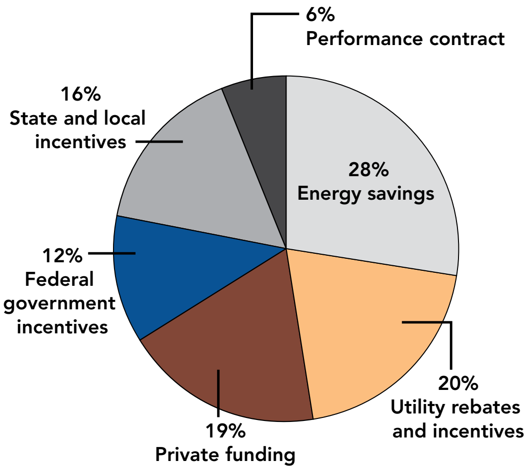
Rating the Importance of Green Goals

Respondents by primary business who ranked sustainability goals as a most important factor	
Federal buildings	50%
Correctional/military/airports	42%
Building development firms	39%
Building management firms	30%
Schools/higher education	27%
Financial/insurance	15%
Computer/high tech	14%
Healthcare	12%
Retail/chain stores	13%

Respondents by primary business who ranked reduction of carbon footprint/greenhouse gas emissions as a most important factor	
Correctional/military/airports	47%
Building development firms	33%
Federal buildings	32%
Building management firms	25%
Schools/higher education	24%
Financial/insurance	15%
Computer/high tech	14%

figure 11

Which of the following would be the primary source to fund a smart energy retrofit project in your building(s)?



Plans and Funding Sources for Energy Projects

Energy management system projects are most likely to be implemented by survey respondents (46%) over the next 24 months, followed by smart lighting control projects (38%). Although many energy projects are funded by a variety of sources, the single most likely source among respondents is the energy savings. Finally, respondents are much more likely to acquire new smart building technology by purchasing new equipment rather than by contracting with an energy service company. (figures 11, 12, and 13).

figure 12

Which of the following energy systems are you most likely to implement during the next 24 months?

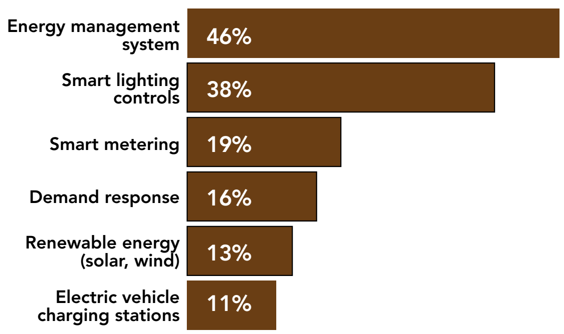
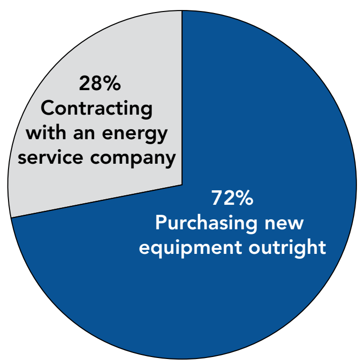
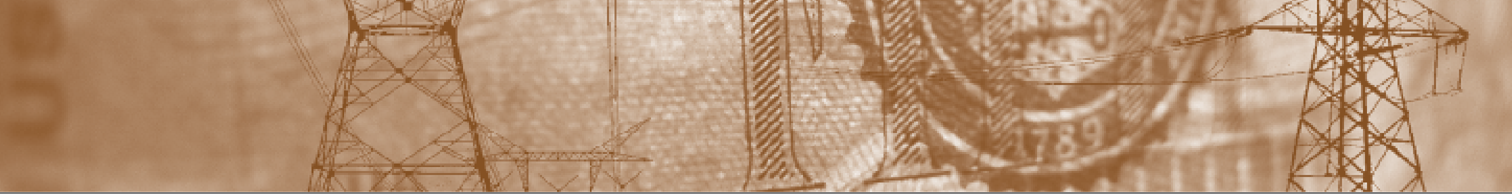


figure 13

How will your organization likely acquire new smart building technology?





THE OWNER'S NEW ROLE IN THE ENERGY MARKETPLACE

Smart infrastructures and the smart grid will enable building owners to play a new role in an emerging energy marketplace. In the new paradigm, owners will be able to participate in the wholesale energy market, where only very large businesses had access in the past.

The owners' participation will be scalable; that is, owners participate at different levels depending on their knowledge, choices, and the smart infrastructure in their buildings. Some participate in event-based demand-response programs; others participate continuously in price-responsive demand-response programs. Based on their onsite generation capabilities (fuel cells, solar power, wind power), entrepreneurial energy managers can choose to trade energy in the marketplace.

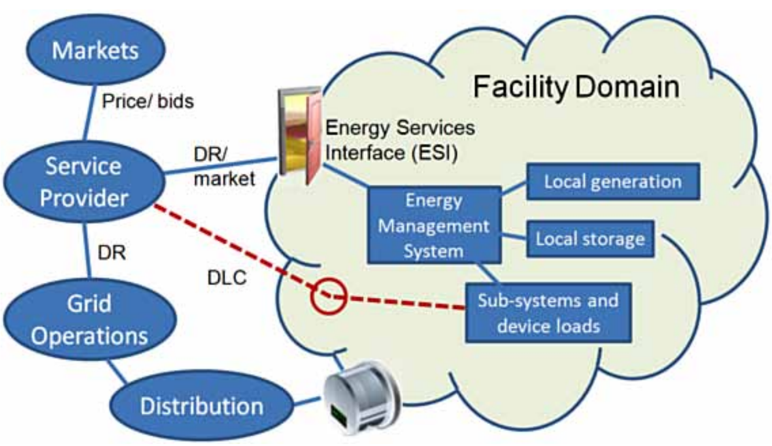
These managers can also make money-saving decisions about which fuel source to tap at any given time for their buildings' heating and electricity demands. Their decisions to switch to onsite sources are communicated to the utilities, who will routinely exchange information with consumers on the power grid's available power supply, outages, etc. Building owners can elect to band together and create their own microgrid, conducting their transactions as a group in the retail energy market.

An open, standardized language for demand response makes it easier for owners to work with different providers. Data on weather forecasts and submetered loads allows astute owners to sharpen the performance and efficiency of their buildings.

This concept of the energy marketplace, in which building owners buy and sell energy, requires standards and interfaces to support the exchange of information between buildings and the utilities. The energy services interface (ESI) under development by the National Institute of Standards (NIST) anticipates exchanges of information, including:

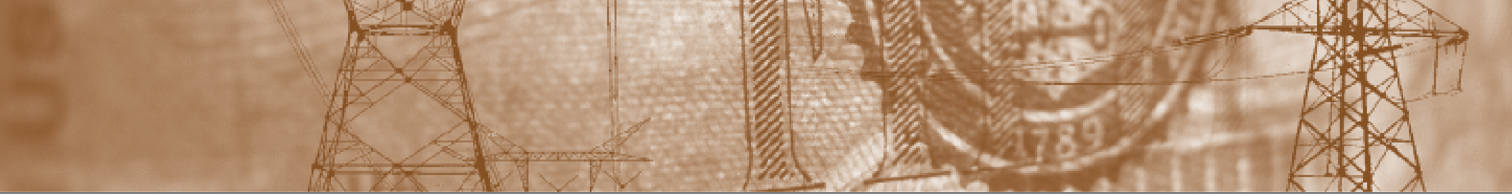
- Weather
- Power quality
- Pricing information
- Energy emissions
- Present demand of facility
- Present demand of subloads
- Available shedable load
- Critical loads
- Existing demand thresholds
- Onsite generation capabilities and availability
- Onsite energy storage and availability
- Historical interval usage
- Loads to shed
- Demand forecast
- Historical demand of loads

Architecture of the Energy Services Interface



In the typical architecture for an energy services interface (ESI), the facility is linked to a service provider, which in turn provides access to power grid operations and to energy markets for price and bid information.

SOURCE: *CUSTOMER ENERGY SERVICES INTERFACE WHITE PAPER*, NATIONAL INSTITUTE OF STANDARDS (NIST)

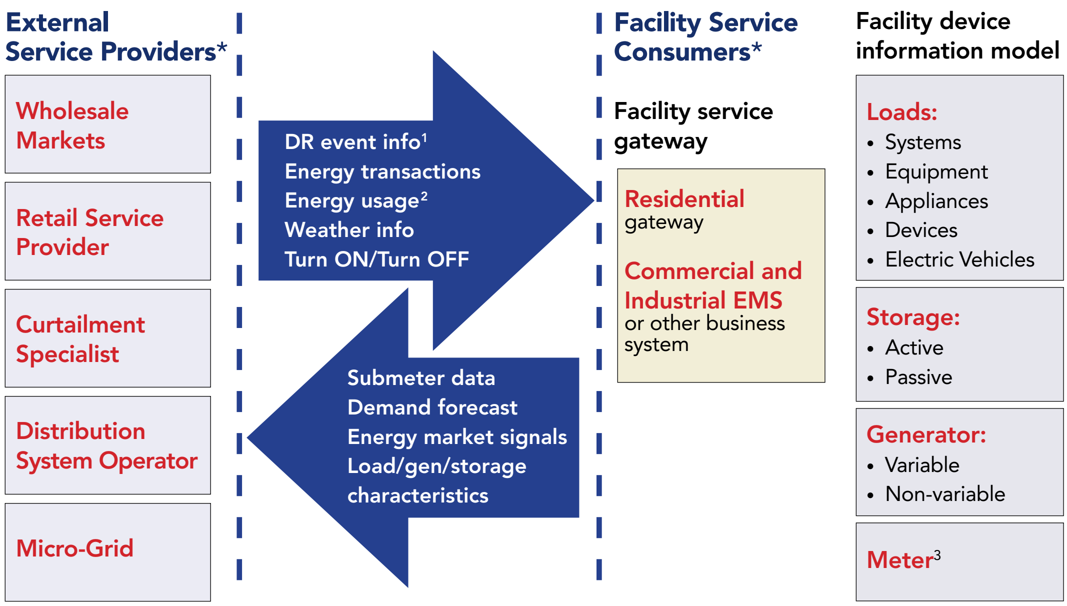


ASHRAE is working with the National Electrical Manufacturers Association (NEMA) on developing a standard for a common language for information exchange among building systems. Entitled ASHRAE/NEMA Standard 201, Facility Smart Grid Information Model, the standard will define an abstract, object-oriented information model to enable appliances and control systems in buildings to manage electrical loads and generation sources in response to communication with a smart electrical grid and to communicate information about those electrical loads to utility and other electrical service providers. It provides a common basis for electrical energy consumers to describe, manage, and communicate about electrical energy consumption and forecasts.

According to NIST's David Holmberg, demand response is heading toward "an all-the-time approach" where consumers receive forward price signals and can respond by utilizing intelligent controls, ice or other thermal storage, energy storage via electric vehicles, and local power generation with solar panels, a fuel cell, or a backup generator. "Owners are going to have intelligent management of all these assets to minimize their energy consumption, minimize their cost, and avoid annoyance to tenants and occupants," Holmberg predicts.

Information Exchange between Facilities and the Power Grid

Energy Services Interface (ESI)



The exchange of information between facilities and energy providers includes data from building systems (loads, storage capabilities, onsite generators) and external data such as weather, price, and transaction information.

[1] DR event notification, start time, duration, shed level/price, bid acceptance
[2] Energy usage, per NAESB ESPI standard, provides validated meter data from utility back end.

[3] The meter shown here in the facility domain is a submeter. The utility revenue meter may also provide data to the facility owner using the facility meter data model.
* The service providers and consumers listed here are given as examples and not meant to be comprehensive.

Source: *Customer Energy Services Interface White Paper*, National Institute of Standards (NIST)

Pilot Programs Envision Smart Grid Applications

Although a number of smart pilot programs have been undertaken by cities across the country, few focus primarily on commercial buildings rather than homes. Programs in Chicago and Charlotte for downtown buildings are exceptions.

In Chicago, the local BOMA chapter has enlisted a group of member buildings to participate in a micro-grid program. The buildings will be equipped with common metering systems that will relay usage data to a network operating center built by BOMA or a third party. The data for each building will be sufficiently granular to identify spikes for particular building systems and equipment, and it will be available the same day. A previous pilot provided some similar usage data but not until the following day.

Michael Cornicelli, executive vice president of BOMA Chicago, plans for the operating center to identify market opportunities for a demand-response transaction and implement it for the group. Once the usage profiles of the participating buildings have been well documented, he believes that bulk purchase of base-load electricity and other economies of scale will be available.

Envision Charlotte is a sustainability program encompassing energy, water, air and waste. The energy component, Smart Energy Now led by Duke Energy, includes some 70 buildings with 21.5 million square feet in the central Interstate-277 loop area. Building owners as well as tenants have signed voluntary agreements to participate in the program. For each customer account, Duke Energy has installed a digital smart meter next to the billing meter and a router to communicate the meter's consumption data over an independent wireless network.

Every building in the program will have an interactive digital display in the lobby that shows occupants the collective energy usage of all buildings, including real-time usage, load factors, and historical trends. The display will also supply energy and sustainability tips. Individual customers who want to see their own confidential usage data can log onto a secure portal.

The goal of the Smart Energy Now program is a 20% reduction in usage over five years. According to Vincent Davis, director of Smart Energy Now, behavioral change is estimated to account for 5% of the goal. The remaining 15% is based on anticipated investments in energy projects by businesses that will have better data to rationalize such investments. The program also includes training for facilities personnel. The training will be tiered to meet the differing needs and knowledge of facilities personnel at Class A, B, and C properties.

Davis believes that Smart Energy Now's technical platform is necessary but not sufficient for the program's success. "I speak a lot less about the platform and more about the customer engagement strategy. The technology enables the program, but the reality is, the technology can't carry the day if people don't change their behavior."

More than 70 participating buildings in downtown Charlotte will have interactive displays in the lobbies. The displays will show real-time energy usage for the group and supply energy tips for occupants.

CONCLUSIONS

Smart technology is changing the way electricity will be purchased and consumed by commercial buildings. It will not be your great-great-grandfather's power grid where the utility supplies electricity to the consumer, whose only role in the process is to pay a monthly bill. Like telecom deregulation in the 1980s and the Internet in the 1990s, the roles and actors in the process are changing the fundamental platform.

But the digital smart grid is not here yet. So what should facilities professionals do now?

1 Be proactive.

Passive was the old paradigm for power consumers. But those who do the work necessary to remain informed and alert to the changes that are taking place will likely profit. "Being aware and reaching out to the utility is a good strategy," says Eric Woodroof, founder of Profitable Green Solutions and president of the Association of Energy Engineers.

As Thomas Edison—who would still understand the basic workings of today's power grid—said, "The reason a lot of people do not recognize opportunity is because it usually goes around wearing overalls and looking like hard work."

2 Understand your energy profile and develop a plan.

First understand your energy usage as best you can and then look for ways to take action. Benchmark your building's energy usage. Investigate ways in which you can invest in smart sensors and near real-time data to capture more insights into the energy performance of individual building systems.

Then act on your energy usage profile. Write a strategic energy plan and take action. Many owners take the energy benchmarking step but fail to move forward on the next steps, which will be different for every owner.

3 Search vigorously for rebates and incentives.

Funding for energy initiatives is an issue for many owners, yet many have not availed themselves of easily attainable incentives. Rebates and incentives from federal, state, local, and utility programs often go unnoticed and untapped.

Two reasons are an aversion to IRS paperwork and a misalignment of goals within organizations, according to Bill Brissmeyer, president of energy consultant B&B Energy.

"People shy away from complicated returns and the IRS," he says. "And the people who are doing the taxes are not the same people who are paying the checks, and probably not the people who are really, really aware of energy and facility costs."

Brissmeyer, who has acquired the nickname of "Dr. EPAct" for his success in securing tax incentives under the Energy Policy Act (EPAct), says that it is often easier for a business to navigate the EPAct certification process than for an individual to claim a personal deduction for a charitable contribution.

4 Be an entrepreneur in the energy marketplace.

The new energy landscape offers entrepreneurial opportunities to building owners, not just to those who supply energy tools and services.

Owners will be able to participate in the buying and selling of energy, and those who embrace their new role in the marketplace will gain a competitive edge for their facilities. Another opportunity might be available with tenants: Would your tenants see value if you could provide them with money-saving counsel on energy matters? Many tenants may not expect help on energy matters or willingly share their energy profile with their building's owner. But energy disclosure and visibility are likely to become more of the norm, helping to create an atmosphere in which tenants value the owner's energy expertise.

5 Don't lose sight of the behavioral element.

Waiting for technology to supply a silver bullet for energy usage is fool's gold. Occupant behavior has an impact on energy consumption at every step of the way.

Even if the facilities department has a good grasp of the building's energy profile, does it also know how daily occupant behavior affects the profile? And do the occupants know? There's real gold in continually working on energy behaviors and ensuring that facilities personnel and occupants share the same information and goals.

Research has shown that real estate firms who are leaders in energy management are also likely to have better financial performance.[1] Is this a cause and effect relationship? Not at all likely. But perhaps these leaders are just as proactive about managing their other assets and opportunities while keeping a steady eye on the future, and that approach works equally well when applied to energy matters.

[1] *Energy Management & Investor Returns: The Real Estate Sector,* posted at www.energystar.gov/ia/business/guidelines/assess_value/reit.pdf

METHODOLOGY

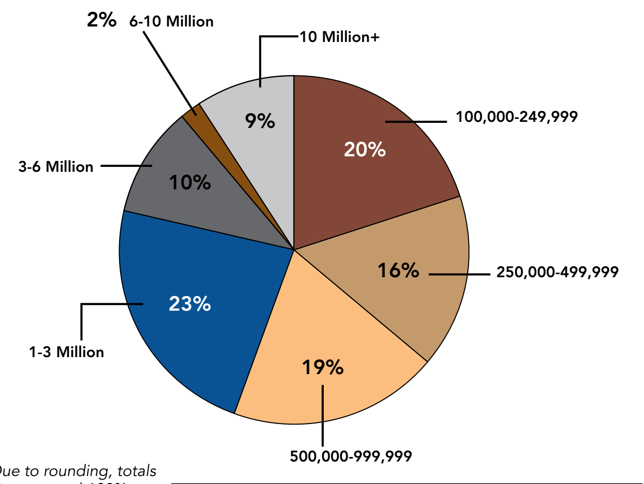
The research conducted by the Stamats Commercial Buildings Group for this project was both quantitative and qualitative.

The quantitative component consisted of a survey that was emailed in July 2011 to subscribers of *BUILDINGS* Media. The subscribers consist of building owners, facility managers, and other facilities professionals who manage and operate commercial and public buildings. Of 862 subscribers who opened the survey email, 586 subscribers (68%) completed the survey. The charts below provide a breakdown of the size and type of buildings in which the respondents are involved and a breakdown of their titles.

The qualitative component of the research involved phone interviews of energy experts and facilities professionals representing diverse businesses and building types. The names, titles, and organizations of some of these individuals appear on the following page.

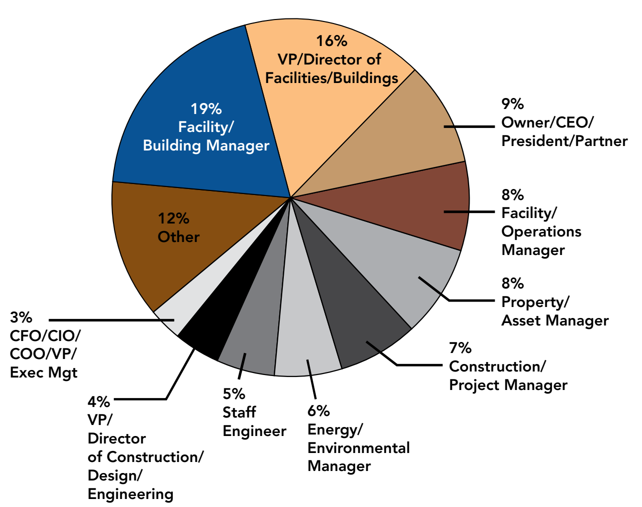
This report was written solely by *BUILDINGS* Media. Siemens, the project sponsor, did not contribute to the report's opinions or conclusions.

Total Square Footage Managed by Respondent

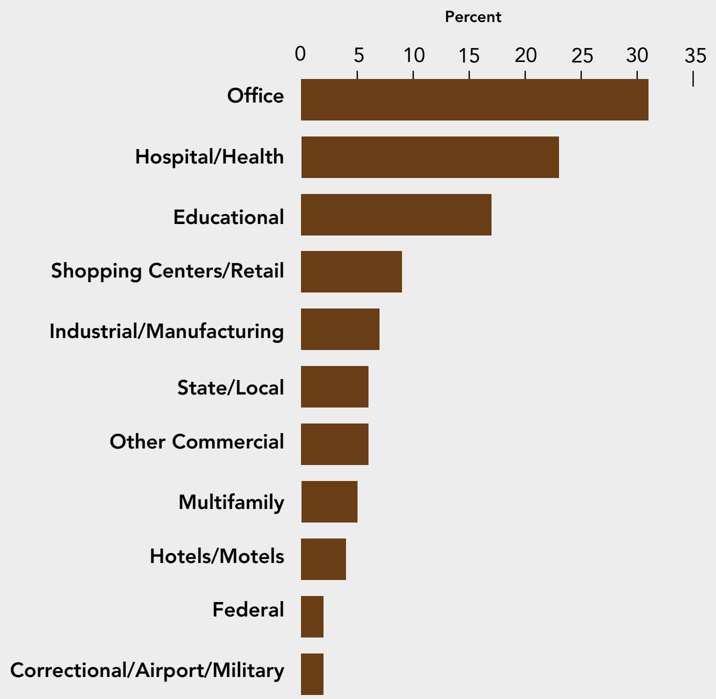


Due to rounding, totals do not equal 100%.

Respondent Breakdown by Title



Respondents' Involvement by Building Type



Total is more than 100% due to some respondents' involvement in more than one building type.

INDUSTRY INTERVIEWEES

Phil Adams
President and COO
World Energy Solutions

Ammi Amarnath
Technical Executive
Energy Efficiency & Demand Response
Electric Power Research Institute (EPRI)

David Holmberg
Mechanical Engineer
National Institute of Standards (NIST)

Aaron Binkley
Director, Sustainability Programs
Prologis

Bill Bissmeyer
President
B&B Energy

Michael Cornicelli
Executive Vice President
Building Owners and Managers
Association of Chicago

Jim Crosskey
Manager of Industrial Solutions
IBM Tivoli

Vincent Davis
Director, Smart Energy Now
Duke Energy

Michael Delev
General Manager
Hines

Gregory Herriman
Vice President, Engineering
Property Management
TRANSWESTERN

Dan Probst
Chairman, Energy and Sustainability Services
Jones Lang LaSalle

Larry Stinar
Engineering Manager
Hines

Clayton Ulrich
Senior Vice President, Engineering Services
Hines

Eric Woodroof
Founder, Profitable Green Solutions
President, Association of Energy Engineers, 2011

Jennifer Woofter
Founder and President
Strategic Sustainability Consulting

RESOURCES ON ENERGY and SMART INFRASTRUCTURES

Annual Energy Outlook 2011
An annual energy forecast prepared by the U.S. Energy Information Administration (EIA).
www.eia.gov/neic/speeches/newell_12162010.pdf

Buildings & Plants at ENERGYSTAR.gov
Tools and resources for energy management in commercial buildings, including Portfolio Manager, ENERGY STAR's free, online benchmarking tool.
www.energystar.gov/index.cfm?c=business.bus_index

Customer Energy Services Interface White Paper
A National Institute of Standards (NIST) whitepaper that describes the concept of an energy services interface (ESI) that facilitates interactions and transactions between energy providers and customers.
http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/B2GEnergyServicesInterface

EMIX Overview Version 1.0
A summary by the Organization for the Advancement of Structured Information Standards (OASIS) that describes the future energy marketplace and how the Energy Market Information Exchange (EMIX) enables it.
www.oasis-open.org/committees/download.php/43883/emix-over-v1%200-wd03.pdf

Energy Management & Investor Returns: The Real Estate Sector
A report that discusses how energy management practices can pose benefits and risks to a company's financial performance.
www.energystar.gov/ia/business/guidelines/assess_value/reit.pdf

Envision: Charlotte
Information on a functioning public-private collaboration in Charlotte, NC, designed to promote energy efficiency and smart-grid technology.
www.envisioncharlotte.com

The Green Grid: Energy Savings & Carbon Emissions Reductions Enabled by a Smart Grid
A description from the Electric Power Research Institute (EPRI) of the smart grid concept. Includes estimates of the energy savings and carbon dioxide reductions from smart grid infrastructure.
www.smartgridnews.com/artman/uploads/1/SGNR_2009_EPRI_Green_Grid_June_2008.pdf

Guidelines for Energy Management Overview
Tools and resources from the EPA and the ENERGY STAR program for energy management.
www.energystar.gov/index.cfm?c=guidelines.guidelines_index

IBM's Smarter Cities Challenge: Boulder Report
A summary of the outcomes from the Smart Grid City project in Boulder, CO, a pilot that employed smart-grid elements.
www.bouldercolorado.gov/files/Energy/SGC_IBM/IBM_SmrtCity_SGC_Report.pdf

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0
This document from the National Institute of Standards (NIST) describes a model for the smart grid and identifies standards applicable to its development, including security-related standards.
www.nist.gov/public_affairs/releases/upload/smartgrid_interoperability_final.pdf

SMARTGRID.GOV
A gateway to information on federal initiatives that support the development of the technologies, policies, and projects transforming the electric power industry.
www.smartgrid.gov

Smart Grid Resource Center
This site is the home for information about EPRI's Smart Grid research, demonstration projects, and the Smart Grid Use Case Repository.
http://smartgrid.epri.com

Xcel Energy Smart Grid: A Whitepaper
A vision of the smart grid and a description of the Smart Grid City initiative.
http://smartgridcity.xcelenergy.com/media/pdf/SmartGridWhitePaper.pdf

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www.buildingtechnologies.siemens.com/bt/us/

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