
Smarter Buildings Survey
Consumers Rank Their Office Buildings

IBM

April 29, 2010

“Buildings, too, are children of Earth and Sun.”

Frank Lloyd Wright

Seventy percent of all electricity in the US is consumed by buildings – and up to 50 percent of that is wasted. Commercial buildings lose as much as 50 percent of the water that flows into them. By 2025, buildings will be the single largest energy consumers and emitters of greenhouse gasses on our planet.

The skyscrapers, shopping centers and architectural masterpieces that were once a symbol of this country’s progress are in danger of becoming symbols of waste and overconsumption. But this level of consumption is not sustainable, and several factors are fuelling a search for alternatives among organizations that operate buildings and building portfolios:

- **Operational costs.** The combined effect of rising energy costs and a dwindling global supply of fossil fuels are motivating organizations to reduce energy consumption and find alternate energy sources.
- **Corporate reputation.** As part of the growing interest in corporate social responsibility, organizations are under pressure to report their carbon footprint, including the environmental impact of often sizable real estate portfolios. Forward-thinking leaders recognize this as an opportunity to develop a green strategy that enhances their corporate brand and sets them apart from competitors. According to the IBM CEO Study, environmental factors doubled in CEO importance over the past four years, and 80 percent of CEOs view sustainability as impacting brand value.
- **Empowered tenants** -- along with stakeholders and business partners – are demanding more responsible business practices and more efficiently run facilities from their employers and the managers of the office complexes and other commercial outlets where many people spend the majority of their days.
- **Regulatory compliance.** Compliance reporting is expected to increase in many countries as governments and non-governmental organizations seek standards in carbon footprint monitoring and carbon trade initiatives. Although regulation in the US is not as far along as countries like the UK, with its new Carbon Reduction Commitment (CRC) scheme, mandates from agencies such as the US Environmental Protection Agency are expected to increase the need for more eco-friendly business practices in the coming years.

Set up to Manage the Past

Buildings have been set up to manage the past. Many of the systems that constitute a building operate on historical patterns and are managed independently. Many of them are not managed at all for occupancy, energy use or thermal effect, due to a lack of the sensors and monitors required to achieve this.

A lack of standards for measuring energy use and carbon footprints isolates buildings' systems from each other and makes it harder to implement practices that can control and manage energy use. The lack of

standard interfaces across the wide range of devices and systems in a building makes centralized management of them nearly impossible.

However, smarter systems can enable building owners and tenants to make better decisions about the building's energy use—and can often let them rely on the building to "make those decisions" itself. Sensors can monitor everything from motion and temperature to humidity, precipitation, occupancy and light. The building doesn't just coexist with nature — it harnesses it.

A portfolio of interconnected smart buildings can extend those benefits even further -- sharing information and resources that reduce the buildings' carbon footprint, decrease costs and provide tenants with a better place to work or live. There is a growing interest in these types of technologies. According to Lux Research, the "green buildings" market is expected to increase from \$144 billion today to \$277 billion in 2020.ⁱ

Yet, despite the role that buildings can play in significantly reducing energy consumption and CO2 emissions, and despite the long hours that employees log in buildings every day, there has been little research on how efficient and environmentally friendly people perceive their office buildings to be, and how involved they are willing to get in contributing to solutions.

To help unearth these insights, in April 2010 IBM conducted an online survey of adults working full- or part-time in office buildings in 16 major US cities. There were 6,486 responses, with at least 400 in each city, and a 5-point margin error when comparing cities. The majority of respondents work full-time (88 percent) vs. part-time, and more than three quarters work in downtown/interior city areas. More than half of the office buildings are 10-40 years old (57 percent), with 20 percent less than ten years old, and 23 percent more than 40 years old.

Evidence of "Intelligence Gap"

The survey shows that US office buildings have failed to keep pace with the revolution in automation that pervades modern life. While cars, transportation systems, electrical grids and other systems are being instrumented and interconnected to be more efficient and user friendly, the majority of office buildings remain rooted in the past. As a result, this intelligence gap is taking a measurable toll in lost productivity and unnecessary spending.

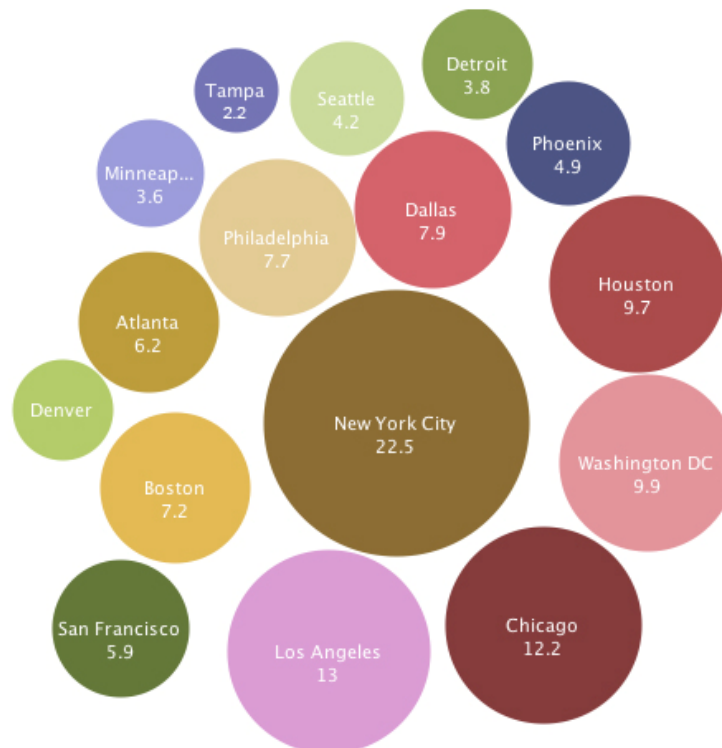
The survey results illustrate lost opportunities for productivity or cost savings in a range of areas:

- Office workers spent a cumulative 33 years stuck in elevators in the past 12 months. In New York City, for example, 14 percent of office workers say they've been stuck in an elevator at work in the past year (see Table 1)

- Even more time was spent waiting for elevators – 92 years in total over the past 12 months (see Table 1)
- A quarter of respondents said the elevators in their office buildings are not coordinated properly – for example, too few or too many at any one time or insufficient capacity
- Less than one-third (30 percent) report that the lights in their office buildings shut off at a predetermined time each evening
- Similarly, only 27 percent work in office buildings that can automatically sense when people are in a room and adjust lights and/or temperature accordingly. Los Angeles has the highest percentage of these, at 40 percent
- A much smaller percentage – 14 percent – report that their office buildings make use of solar energy or another renewable energy source. Surprisingly, that number drops to 11 percent in Phoenix, a city with one of the highest numbers of sunny days per year

Going Down?

Elevators: The Time Cost



This chart compares the total amount of time -- measured in years -- that office workers in 16 U.S. cities spent either waiting for an elevator or stuck in one during the past twelve months. Source: The IBM Smarter Buildings Survey, April 2010.

TABLE 1: TIME SPENT STUCK IN OR WAITING FOR ELEVATORS

City	Labor Force -1/10 bls.gov	Adj Elevator Pop	Years Stuck in Elevators	Years Waiting for Elevators
Atlanta	2,664,311	683,800	1.9	4.3
Boston	2,529,949	693,000	1.8	5.4
Chicago	4,832,372	1,213,400	3.2	9.0
Dallas - Fort Worth	3,211,548	743,220	2.4	5.5
Denver	1,347,934	348,300	1.0	2.3
Detroit, MI	2,076,045	387,140	1.1	2.7
Houston	2,881,612	878,460	2.9	6.8
Los Angeles	6,412,821	1,230,240	4.3	8.7
Minneapolis – St. Paul, MN	1,842,087	539,768	0.5	3.1
New York	9,436,392	2,053,548	5.9	16.6
Philadelphia	2,990,914	663,625	1.7	6.0
Phoenix - Prescott	3,137,804	666,000	0.8	4.1
San Francisco-Oakland-San Jose	2,229,581	691,730	1.4	4.5
Seattle- Tacoma, WA	1,889,840	506,400	1.0	3.2
Tampa – St. Petersburg (Sarasota), FL	1,309,090	263,800	0.6	1.6
Washington, DC-Hagerstown, MD	3,133,022	1,137,570	2.2	7.7
		TOTAL	32.7	91.5

The time spent “stuck in” or “waiting for” elevators has been calculated for each city based on the Bureau of Labor Statistics January 2010 estimates for labor force size, and IBM’s projections on the number of workers in elevator buildings in each location.

The figures for each city are shown in the table above. Our estimate is that across these 16 cities, in the past 12 months a total of 33 years has been spent stuck in elevators, and another 92 years has been spent waiting for elevators. These estimates are particularly high in larger population centers.

Calculations for “years stuck” in elevators: For each city, the estimated number of people in elevator buildings is adjusted based on the percentage reporting that they have been stuck. That number is then proportionately distributed across different “time stuck” categories based on response categories in the survey. The mid-point of each time interval is used as the estimate and that is multiplied by the number of people in the category to get total number of minutes stuck, which is then converted to hours, days, weeks and years. We do not count the “1 minute or less” category in the mix.

Calculations for “years waiting” for elevators: For each city, the estimated number of people in elevator buildings is the base. This number is proportionately distributed across the different “time waiting” response categories. The number of people in each category is multiplied by the midpoint of each time interval to produce total number of

minutes waiting, which is converted to hours, days, weeks and years. We do not count the “Less than 1 minute” category in the mix.

Not Seen as Environmentally Responsible

How do office workers rank their buildings overall? Only one-third rated their buildings “somewhat high,” “very high” or “extremely high” in terms of environmental responsibility. The city with the lowest ranking is Phoenix, where only 26 percent say their office buildings are environmentally friendly. San Francisco is highest at 45 percent.

Many of the factors that contribute to this perception show a pattern of emerging but not yet dominant presence in the nation’s office building infrastructure:

- Only 31 percent say their buildings have low-flow toilets. The city with the lowest percentage is Minneapolis-St. Paul, at 23 percent
- Just over half (53 percent) say they work in office buildings with places to secure a bicycle. New York and Dallas have the fewest, at 35 percent and 39 percent, respectively. Denver (67 percent), Minneapolis (66 percent) and Seattle (65 percent) have the most
- More than one quarter (26 percent) say that products to improve air quality, such as low VOC paint, sustainable carpet that meets NSF/American National Standards Institute 140-2007 standard at its Gold level, and bio-based cleaning fluids, are used at their office buildings. Los Angeles has an above average rating (35 percent), while Philadelphia (20 percent) and Washington, DC (20 percent) are at the low end.

Employees Willing to Play Active Part

The Smarter Buildings Survey shows that a clear majority of office workers across the country are already participating in some form of conservation and many are willing to do more. Consider these findings:

- 79 percent say they conserve resources such as water or electricity as part of their regular routine at work
- 65 percent are willing to help redesign their workplace to make it more environmentally responsible

These findings are in line with a broader trend of increasingly empowered consumers. A January 2010 IBM study of 32,000 consumers, for example, showed that the majority of respondents were ready to collaborate with retailers to co-create new products and services that meet their needs.

Respondents in the Smarter Building survey also indicated that they are willing to conserve and share resources – but within limits:

- 80 percent are willing to share with other buildings as long as it does not affect their comfort level
- 75 percent report that they are more likely to conserve if they are rewarded

Smarter Buildings Index – How the Cities Stack up

Based on the survey results, IBM created a Smarter Buildings Index ranking the cities on a scale from one to 10, with 10 being the most environmentally responsible (see Table 2). The Index is composed of ten elements: elevator wait times, Internet access, badge access, lights that turn off automatically in the evening, presence of sensors that adjust lights and temperature when people enter and leave rooms, use of renewable energy sources, low-flow toilets, use of air-friendly products, respondents' opinion of how environmentally-friendly the building is, and respondents' desire to participate in building redesign.

Here is how the 16 cities in the survey stack up:

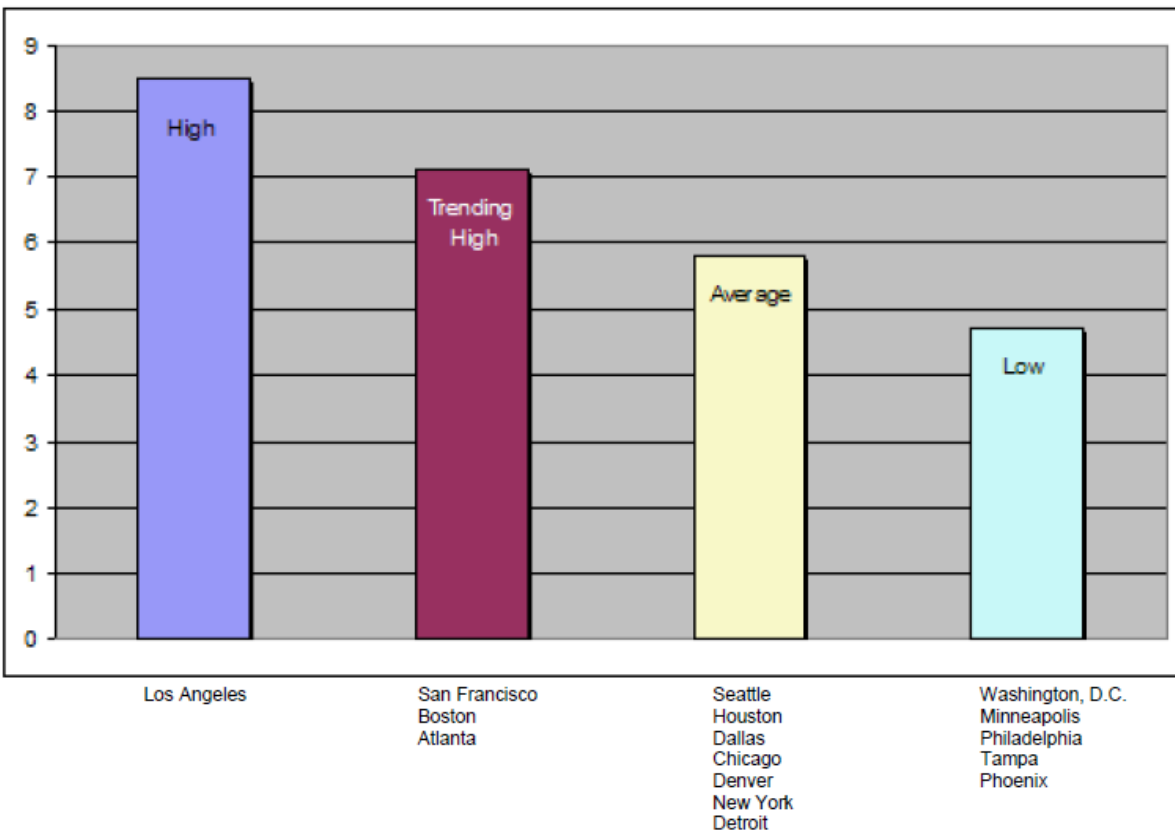


TABLE 2: SPECIFIC SCORING ACROSS THE CITIES FOR THE SMARTER BUILDING INDEX

Los Angeles / San Francisco / Boston / Atlanta / Seattle / Houston / Dallas / Chicago

(High Scores are +)	Total	LA	SF	Boston	ATL	Seattle	Houston	Dallas	CHI
12-LowWaitTimeElevator	57%	59%	58%	53%	64%	62%	50%	59%	57%
13-Internet	69%	71%	71%	70%	76%	71%	72%	70%	72%
14-BadgeAccess	72%	69%	69%	70%	76%	74%	77%	76%	74%
15-AutoLight	30%	40%	38%	35%	30%	37%	32%	31%	29%
17-SensePeopleinRoom	54%	160%	136%	132%	54%	60%	60%	56%	50%
18-RenewableEnergyinBldg	28%	88%	80%	80%	32%	28%	28%	22%	30%
19-LowFlowToilets	31%	39%	39%	30%	37%	31%	32%	35%	26%
21-AirFriendlyProducts	52%	140%	58%	56%	62%	50%	60%	52%	58%
23-BldgEnvirRating	116%	120%	124%	116%	118%	122%	118%	118%	116%
26-ParticipateInRedesign	65%	68%	66%	70%	67%	62%	67%	65%	67%
TOTAL	573%	854%	739%	712%	617%	598%	597%	584%	579%
INDEX	5.7	8.5	7.4	7.1	6.2	6.0	6.0	5.8	5.8

Denver / New York / DC / Minneapolis / Philadelphia / Tampa / Phoenix

(High Scores are +)	Denver	NYC	Detroit	DC	Minn	PHIL	Tampa	Phoenix
12-LowWaitTimeElevator	60%	48%	56%	61%	68%	44%	61%	61%
13-Internet	69%	66%	76%	61%	68%	66%	72%	60%
14-BadgeAccess	66%	74%	74%	79%	76%	70%	59%	65%
15-AutoLight	31%	29%	32%	24%	23%	24%	17%	22%
17-SensePeopleinRoom	48%	54%	50%	60%	46%	48%	4%	5%
18-RenewableEnergyinBldg	32%	34%	18%	24%	24%	20%	18%	22%
19-LowFlowToilets	37%	26%	28%	27%	23%	26%	30%	28%
21-AirFriendlyProducts	50%	56%	48%	5%	44%	5%	42%	50%
23-BldgEnvirRating	114%	114%	110%	116%	114%	118%	110%	110%
26-ParticipateInRedesign	63%	63%	65%	64%	28%	70%	62%	28%
TOTAL	570%	565%	557%	520%	514%	492%	474%	450%
INDEX	5.7	5.7	5.6	5.2	5.1	4.9	4.7	4.5

Los Angeles scored higher than the other cities in several noteworthy “intelligent” and green building elements -- it has the highest percentage (40 percent) of office buildings that automatically sense and respond to the presence of people in a room (the average is 27 percent), use of renewable energy sources like solar energy (22 percent vs. a national average of 14 percent), and products promoting higher air quality (35 percent vs. 26 percent).

Conclusions and Recommendations: Managing the Future, Not the Past

Many buildings are showing signs of being more intelligent and green by reducing energy consumption, improving the efficiency of their operations and increasing the comfort and safety of the building’s tenants.

A growing focus on creating smarter buildings is also taking place, as energy efficiency incentives from regulatory bodies and utilities, as well as economic stimulus funds, have made it easier for businesses to achieve a faster return on their green building investments.

But as this survey shows, there is still room for improvement. Our buildings must become much smarter and more sustainable to rein in our energy costs and lower our CO2 emissions. They also need to be connected to intelligent utility systems (smart grids)—both electricity and water—to achieve even more efficiency.

The good news is that buildings don't have to be demolished and rebuilt to become smarter. Buildings around the world are now being retrofitted to incorporate sensors and intelligent systems that allow these buildings to perform more like living organisms. For example, Vancouver-based Goldcorp, one of the largest gold mining companies in the world, underwent a data center consolidation that made it possible to use excess heat from its data center heat to warm its warehouses during the cold Canadian winters.

Here are a few ways that organizations can evolve toward smarter buildings:

- Employees need to be empowered to make more informed decisions about what they consume and how they contribute to their employer's carbon footprint
- When searching for office or residential space, organizations should assess the environmental impact of the building and begin to choose and demand buildings that use energy wisely
- Organizations that are not planning to move in the near term can encourage office and building managers to identify ways to conserve energy and implement energy saving programs

We have only just begun to discover what is possible on a smarter planet. By systematically setting up buildings to manage water and energy use and greenhouse gas emissions more intelligently, organizations can achieve true sustainability while achieving real business benefits – and creating a healthier, more productive workforce. It's time to set buildings up to manage the future instead of the past.

Smarter Buildings for a Smarter Planet

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http://www.ibm.com/smarterplanet/us/en/green_buildings/ideas/index.html?re=spf

ⁱ Lux Research report "Diamonds in the Rough: Uncovering Opportunities in the \$277 Billion Green Buildings Market" April 2010.