INDOOR AIR QUALITY: A SLEEPING GIANT THAT SENSORS WILL AWAKEN

Erin Grossi Chief Economist

Indoor Air Quality: A Sleeping Giant That Sensors Will Awaken

ABSTRACT

Organizations like LEED in the United States and BREEAM in Europe disrupted the building market roughly twenty years ago when they established solid sustainability criteria for buildings to meet. By asking buildings to meet new design measures, these organizations fundamentally changed the way people think about structural design and construction. Now that a track record has been established by the world's "green" buildings, UL has developed a study of the elements of the sustainable building movement that have been generating consistent returns on investment for building owners, operators and investors.

Many building constituents in the United States, in particular, are not paying enough attention to air quality, partly because the most substantial human health benefits of investing in this area are not as easy to measure and track over time.

The findings, published in a white paper called "Dawn of the Building Performance Era," indicate that while some value has been established by architects and developers through enhanced design practices, exceedingly more value will be found as owners and investors start focusing in more on the actual performance of building systems on the operations side to ensure they can truly deliver enhanced energy management, water conservation and improved indoor air quality.

This acute focus on building performance achievement that is taking shape in the marketplace will be catalyzed by new building technologies emerging as part of the "smart building" movement, including sensors, monitors, and dashboards integrated with the building systems. These technologies will allow people to be increasingly sensitized to the ways their buildings are managing natural resources and providing occupants clean and healthy air to breathe. While the market has been slowly adopting these technologies to date, the large tech-savvy millennial generation coming up the ranks, combined with the increasing retirements of existing operations personnel are going to push technology to the forefront of the building industry.

While it was not surprising that energy and water savings were two areas most building constituents claimed as benefits of the sustainability movement, the fact that indoor air quality emerged as an area driving returns on investment for investors of all kinds was a less obvious finding of the study. Many building constituents in the United States, in particular, are not paying enough attention to air quality, partly because the most substantial human health benefits of investing in this area are not as easy to measure and track over time. That said, we feel it certainly makes economic sense for building owners (that are also building occupants) or for tenants to find ways to measure air quality and track resulting impacts on personnel. As Jones Lang LaSalle has pointed out, a 1 percent impact on productivity is significantly bigger than energy savings.

The asset protection benefits associated with good indoor air quality, especially protecting buildings from potentially disastrous mold and moisture issues, are resonant with most building owners and investors. The increase in awareness of mold as a cause of human health complications has catalyzed an uptick in related lawsuits in the United States in a way that is reminiscent of asbestos cases. One only needs to search the internet to realize that the number of personal injury and property damage lawsuits brought by tenants against building owners and entities in the construction process (including claims for defective

The scientific community is also falling increasingly behind in studying chemical exposure and its impacts on human health. UL's scientists estimate that there are 80,000 chemicals in international commerce today, with only 3 perct having been fully evaluated for health impacts.

construction and exposure to toxic mold) is a burgeoning area of litigation. The number of pending building mold cases around the United States is now more than 14,000 and with juries awarding multimillion dollar settlements for it, building owners and their attorneys are actively looking for ways to protect against mold and moisture problems.

Another major cause of poor indoor air is the growing amounts of chemicals in buildings, which can emanate from technology hardware, construction materials, furniture and furnishings, and cleaning products. Chemical exposure in indoor environments is actually exacerbated by all of the efforts to conserve energy by sealing building envelopes, which traps the harmful chemicals inside in the process, often causing indoor air to be between 2 and 5 percent more polluted than outdoor air. The scientific community is also falling increasingly behind in studying chemical exposure and its impacts on human health. UL's scientists estimate that there are 80,000 chemicals in international commerce today, with only 3 having been fully evaluated for health impacts. They discover about 50 new chemical compounds in products they test every month on average.

Why don't American workers think about and talk about air quality more or take interest in the indoor air quality performance of the buildings they work in? The level of public awareness about air quality is eerily similar to the level of social consciousness of water quality issues before 1990, when bottlers started to put water in lightweight, cheap, clear plastic bottles for the first time. This fairly unremarkable technological innovation sparked what is today an $11 billion industry in the United States. The conversation around bottled water in the 1990s quickly moved from something that could be considered fashionable, driven by clever marketing schemes, to something that may be healthier for people to consume than basic tap water. Bottled water soon became an essential travel item for Americans looking to protect themselves from local bacteria and other undesirable ingredients in the water supplies of other countries. Today, we are having conversations about the environmental friendliness of all of those plastic bottles we are using and the impacts of plasticizers in the bottles on human health. But the essential point is that a simple technological shift to a bottle suddenly made Americans conscious of water as a health issue, and it gave people a clear choice to leverage in the market. Before the bottle, water really didn't hit the radar in this way. People just didn't think about it.

Today, UL's air quality scientists estimate we are easily within five years of having robust and effective industrial and home detectors and monitors for air quality that can alert people when dangerous chemicals, allergens and particulate matter are present.

What might be the technological equivalent of bottled water for air quality that emerges in the world, causing people to pay attention to air issues and feel they have a viable choice that allows them to breathe purer air in their workspaces, hotels, homes and schools? UL's research into this question points to the explosion of wearable devices, handheld air quality detectors, and Nest-like home devices (e.g. the Birdi) outfitted with sensor technologies that are beginning to market themselves as capable of detecting volatile organic compounds (VOCs) and allergens as the most likely innovations to drive public consciousness of these issues over time. When live data on air quality in buildings is integrated with dashboards that engage building occupants, one can imagine how people can begin to pay attention to this information, in the same way we take note of ozone or pollen counts when they are reported on in the news. Today, UL's air quality scientists estimate we are easily within five years of having robust and effective industrial and home detectors and monitors for air quality that can alert people when dangerous chemicals, allergens and particulate matter are present.

Once these products visibly hit the mainstream market, people will quickly forget how they lived in a world where they didn't have access to information about the air they were breathing. Indoor air quality is clearly a "sleeper issue" today, with primarily a niche group of experts paying attention to the sources, causes, impacts and solutions. Technology is poised to awaken our social consciousness on a grand scale, pushing forward the next generation of scientific work on air quality.

Indeed, the early experiments that have already taken place with "future-ready" smart buildings that can connect all building systems and controls on one IP network that allows for continuous monitoring and preventive maintenance as well as predictive modeling on building performance under different circumstances is only the tip of the iceberg in terms of what will become the new standard for the building industry over the next decade. With the convergence of governments increasingly requiring building owners to publish their energy usage data and move towards more visible labels that trumpet building performance metrics like air quality, water usage and waste management, it is clear that the tipping point is coming over the next five to ten years, where it will no longer be economically viable to own and maintain low-performing buildings.

If building investors and owners want to ensure tenants will be attracted to properties in the future and if corporate owners and tenants wish to attract and retain the best talent to work in their facilities, ensuring buildings reflect innovative design and effectively perform in terms of technology capability, resource management, and promotion of healthy and productive environments will increasingly be regarded as the basic cost of doing business. Forward-leaning businesses are already starting to make the connection that the performance and sustainability of their assets is really part and parcel of their own success as a business. It not only makes good business sense to invest in higher building performance, because of the obvious returns on investment involved with lowering resource costs and bolstering the health and productivity of occupants, it also reflects the missions and values of the businesses themselves and their commitment to achieving high performance, and not simply relying on the appearances of things.

All of this groundwork will position the millennials well to continue the progress on performance from the essentials like energy and water conservation and air quality to far more sophisticated performance metrics, including the ability of buildings to detect and respond to any number of human actions and characteristics to achieve desired outcomes for people and the planet.

Erin Grossi serves as UL's chief economist, providing the organization with macroeconomic analysis, insight and trends. Read the full white paper "Dawn of the Building Performance Era" at www.ul.com.