

Executive Order 13514

# *Summit*

Virtual Building Tour  
White Paper



**Alliance for Sustainable  
Built Environments**

## Executive Summary

On April 6, 2010, the Alliance for Sustainable Built Environments (ASBE) and the International Facility Management Association (IFMA) hosted a one-of-a-kind event in response to Executive Order 13514, issued by President Obama on October 5, 2009. The event, held at the International Monetary Fund headquarters in Washington, D.C., brought together leaders of a number of Federal agencies to illustrate how they can achieve the many sustainability goals set forth in the Order.

This paper outlines the findings supplied in the Virtual Building Presentation which was delivered at that event. It takes an inside look at the sustainable solutions that not only help Federal agencies comply with the Executive Order, but helps facility managers in all sectors reduce the environmental footprint of their buildings and turns their facilities into high performance green buildings. This paper outlines three elements important to the renovation of a building: water, materials and energy

## Water

Executive Order 13514 mandates all Federal agencies reduce their water consumption by 26 percent by 2020 compared to 2007 baselines. That's a two percent reduction every year for thirteen years. To achieve this goal, facility managers need to take a hard look at their facilities.

Water use in buildings is generally separated into indoor and outdoor applications. "Indoor" applications include amenities water use (water for toilets and urinals, lavatory and kitchen faucets, and showers) and for dishwashing and laundry services, along with boiler makeup water and any process water, such as water used in laboratories. "Outdoor" applications include water for landscape irrigation and makeup water for cooling towers.

When examining the building in our example, amenities water use in the building was estimated at just about 1.1 million gallons per year. When looking inside the building, there are a number of obvious opportunities to conserve. Aerators that restrict flow to a half-gallon per minute still provide adequate water flow for hand washing but represent a low cost way to save water. Most toilets installed prior to 1994 require 3.5 gallons per flush while today's high efficiency toilets, or HETs, use no more than 1.28 gallons per flush. Like toilets, high efficiency urinals reduce water use from the old standard of one gallon per flush to one-half gallon and one-eighth gallon (or pint urinals) per flush. There are even non-water urinals available (If considering non-water urinals make sure to check your local codes, as they might require unique plumbing specifications).

These indoor upgrades to our virtual building provide a projected annual savings of 69 percent compared to the water usage baseline for amenities. That's 760,000 gallons of water per year which equates to nearly \$6,000 per year in reduced water and sewer charges.

There are also opportunities to conserve water outside the building. Water harvesting is the process of capturing non-potable water, typically rain water, storing it in large tanks or cisterns, and reusing the water for other purposes. Water harvesting systems are custom designed for each site,



**25 years old**  
**Washington, D.C.**  
**200,000 square feet**  
**Three floors**  
**500 occupants**  
**4,000 operation hours/year**  
**Basement and adjacent parking lot**  
**1/3 of the building envelope**  
**is windows**  
**Consumes 5.4 million kWh/year**  
**\$740,000 in annual electricity costs**  
**3,086 tons of annual carbon**  
**dioxide emissions**  
**Consumes 2,945,000 gallons of**  
**water/year**  
**\$14,500 in annual water and sewer**  
**rates/year**





taking into consideration the local environment, average monthly rainfall numbers, evapotranspiration rates, and any possible site restrictions.

With a water harvesting system in place, our virtual building could supply water to all the toilets and provide for the annual irrigation of the property, a total savings of 511,000 gallons of potable water every year. That's a significant reduction in water usage and around \$1,600 in annual water utility costs. In addition, the reduced storm water run-off, another point in the Executive Order, would significantly reduce the building's Equivalent Residential Units and storm water discharge fees, which could represent an annual savings of over \$5,000.

Following these recommendations inside and outside the building, our virtual building could reduce its total potable water use by 43 percent, or more than 1.2 million gallons and reduce O&M costs by more than \$12,700.

## *Sustainable Materials*

The second element of a green building renovation, sustainable building materials, are more than recycled or reused materials and components. In order to be truly sustainable, the end product must be carefully examined from the time its raw materials are harvested to the time of its ultimate disposal. The areas that sustainable building products will have the most impact on the Executive Order include the following.

- Eliminating Waste
- Leveraging Agency Acquisitions to foster markets for:
  - Sustainable technologies
  - Environmentally preferable...
    - Materials
    - Products
    - Services
- Operating high performance sustainable buildings

For non-carpet flooring, there are few options more in line with the Executive Order than all-natural linoleum. The USDA created the BioPreferred<sup>sm</sup> program to increase the purchase and use of renewable, environmentally friendly, biobased products. There are linoleum brands currently available that were tested under the USDA's program and achieved a 100 percent biobased content rating. These same brands offer third party reviewed life cycle assessments (LCA's) that verify this flooring has the lowest embodied energy, is the lowest contributor of CO<sub>2</sub> emissions of all resilient flooring products and emit little or no volatile organic compounds (VOCs).

In addition, the recommended maintenance of these biobased flooring options do not require stripping away the heavy metals of a floor finish with harsh chemicals. So, neither the chemicals nor the metals end up going down the drain and impacting our wastewater treatment facilities, further reducing your building's overall impact.

Carpeting can also have dramatic impact on the interior of a building. When looking for sustainable carpeting, one needs to look beyond the design and color and examine its other features and benefits, a broad range of factors that ensure support of green initiatives and compliance with EO 13514.





For carpeting, one must ask:

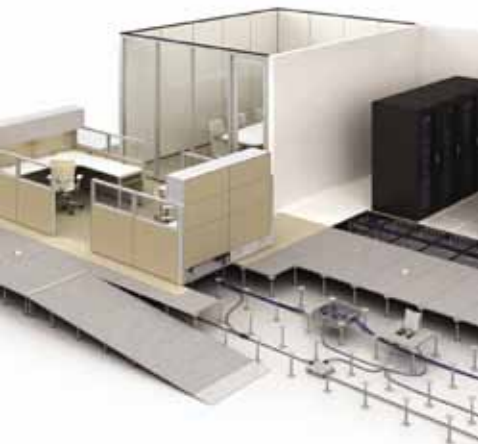
- Are the products certified as carbon neutral?
- Do they meet standards for NSF 140 and SMaRT® certification?
- Are they CRI Green Label Plus certified for IAQ?
- Do they meet the GSA Texture Appearance Retention Rating guide lines?
- Can the product contribute to LEED® certification of your facility?
- What does the product's Life Cycle Assessment say?

For carpet manufacturers, one must ask:

- Does the manufacturer seek or achieve LEED® certification for its facilities?
- Is the manufacturer certified as being carbon negative?
- Does the manufacturer achieve OSHA VPP Star safety?
- Are the manufacturing plants ISO 14001 certified?

Sustainable solutions are not just found on the floor. Some are found under the floor. In multi-story new construction, a commitment to underfloor air distribution can reduce the amount of space required as well as energy used to heat and cool the space. For example, the required slab-to-slab heights for overhead systems require up to 3 feet above the ceiling to accommodate equipment and ductwork whereas an underfloor system requires only 12-18 inches. That compression from deck-to-deck can save a significant amount of space. One such building was able to place 15 stories in a building shell the size of a 14-story building. Underfloor air distribution also delivers a faster exchange of fresh air and better overall air quality as well as individual temperature and air flow control.

Above the floor, workstations throughout a building can be utilized to integrate products, connection logic, plug-and-play power and cabling, components, design aesthetics and fabric and finish solutions to create a cohesive, flexible workspace. The outcome of this organic workspace solution is adaptability for change, improved resource efficiency and reuse without loss of value or function. These systems also allow access to daylight and views, driving daylight deep into a space by varying panel heights, managing site lines, and including furniture, walls and exterior glazing for optimum views and light.



Another important design factor within workspaces is light reflectance. Simply stated, the higher the light reflectance, the less energy needed to evenly illuminate work and common areas. Passive design elements such as light shelves can distribute indirect lighting deeper into the space, dramatically enhance the work environment and improve lighting efficiencies by as much as 45 percent.

A building material's longevity or durability can also impact the office space. From an environmental standpoint, the greenest material is one that is already there and needs no maintenance or replacement. From a financial standpoint, replacement or repair of existing materials will cost over three times initial installation costs, and that does not count disruption, down-time, and lost productivity due to reconstruction. In gypsum wall plasters, for example, only 20 percent of the original installed area will need to be repaired or replaced over each 50 years of use.



While water and energy may have more quantifiable impacts on our virtual building, greening one's supply chain with a sustainable purchasing program – one featuring sustainable building materials – has an even greater impact on our global community than just greening a building. By demanding more sustainable products and services, it not only ensures vendors are sustainable, but that a company's vendors' vendors are as well.

While the Executive Order does not quantify green purchasing, the more sustainable the building products used, the more one can improve IEQ, lower absenteeism, increase productivity, and reduce costs. Through good IEQ design, one can expect savings of at least three percent in productivity improvements per year, or \$9.00 per square foot. This savings in our virtual building would be \$1.8 million.

## *Energy*

Energy efficiency mandates from the Executive Order offer incredible savings opportunities, both in terms of money and sustainability issues such as reducing greenhouse gas emissions, pollution and waste. As the old saying goes: you can't move forward until you know where you are. One of the first steps in any energy efficiency program is to conduct an energy benchmark or audit. This will illustrate how the building is performing compared to other facilities in the area and against facilities that are considered best-in-class. It also identifies the opportunities available to reduce energy consumption and reduce greenhouse gas emissions.

For the virtual building, the original general office lighting would be almost 2,500 traditional 2'x4' T12 troffer fixtures found in most drop ceilings. In addition, down lighting in conference rooms and private offices would add roughly 750 60-watt incandescent bulbs. Also, the parking lot would have about 50 250-watt HID lamps in cobra head fixtures. From these fixtures alone the building would consume 1,654,000 kWh annually. That's more than \$226,000 a year and 942 tons of annual CO<sub>2</sub> emissions.

By replacing the old troffer fixtures with new high performance T5 lighting fixtures, replacing the down lights with new LED down light technology and replacing the cobra head fixtures with LED products, the virtual building could cut its lighting energy use by 58 percent. That translates to nearly a million kilowatthours every year. In financial terms, that equates to an annual savings of more than \$131,000. And in environmental terms, that equates to 548 tons of annual carbon dioxide emissions reductions.

The Executive Order is going to require more than simply retrofitting antiquated lighting systems. There must be processes or technology in place to make sure that those lighting systems are off when unneeded and dimmed when natural lighting is available. Due to misguided, short-term solutions to previous initiatives, fairly simple and unsophisticated meters are being installed and abandoned when yet another system is put into place.

Savvy business leaders are reusing previously installed metering systems and simply augmenting them, tying their metering data together (power, natural gas, water, etc.) and presenting it as a seamless and real-time dashboard. This information then is used to manage GHG emissions in





real-time to be used as alerts for problems and as diagnostics tools to get things back on track. Following these recommended solutions, the virtual building could save up to 24 percent of its annual electricity usage, a savings of 1,296,000 kWh, \$177,000 and 738 tons of emissions.

While lighting systems are typically more high-profile targets when considering reductions in building energy usage, building transportation systems (elevators & escalators) can account for up to 10 percent of a building's energy use. Machine Room-Less elevators have a permanent magnet gearless motor that is 93 percent efficient compared to a hydraulic motor which is 65 percent efficient. Another feature of the new technology is the elimination of the petroleum-based fluids required by hydraulic elevators, reducing the risk of contamination of the ground and water tables of the surrounding community.

In low-rise buildings, technological advances in the area of car lighting, fan equipment, doors and brakes as well as signalization equipment has reduced the amount of standby energy needed in today's elevators. In high-rise buildings, energy recovery systems - like hybrid vehicles - convert, store and use energy generated from the up and down movement of the elevator to provide standby energy when the elevator is idle. These advanced transportation systems would save up to 86 percent in its annual electricity usage, a savings of more than 37,000 kWh, \$5,100 and 21 tons of CO<sub>2</sub> emissions in our virtual building.

There's more to energy conservation than installing quality equipment. It takes initial and ongoing commissioning to be sure all systems are running at maximum efficiency. Building commissioning has emerged as the preferred method of ensuring that building systems are installed and operated to the design intent, returning \$4 in savings for every \$1 spent. It's the Building Automation System (BAS) that makes commissioning possible. And not just for HVAC systems, but also for emissions, lighting, fire safety, security and other equipment.

A BAS allows facility managers to:

- Get macro-level energy efficiency and facility performance data presented in easy-to-understand formats
- Track energy, greenhouse gas, maintenance costs and savings via executive level dashboards
- Analyze historical and real-time energy and demand use by site
- Compare energy use, costs and savings between sites
- Create short and long-range energy forecasts by site and enterprise-wide
- Link real-time facility data to original design criteria, ensuring optimal operating efficiencies
- Automatically benchmark their buildings through ENERGY STAR®
- Manage the future risks of a volatile energy market
- Monitor real-time energy savings enterprise-wide
- Report GHG equivalents to key constituents



When taken together, the products and services offered by ASBE members could reduce the virtual building's overall energy consumption by more than 45 percent, more than double the 20 percent energy efficiency goals set forth in the Executive Order. That equates to 2.4 million kWh per year and more than \$330,000 in annual savings.

## Summary

If the facility manager of the virtual building were to retrofit her building with all the products and services offered by the members of ASBE, she could reduce the building's water use by 1.27 million gallons and electricity use by 2.4 million kilowatthours each year, a total savings of more than \$342,000. From an environmental standpoint, that 45 percent energy reduction is equivalent to a 45 percent reduction in greenhouse gas emissions, or 1,389 tons of CO<sub>2</sub> that never makes it into our atmosphere.

However, the total cost to incorporate every possible green building solution offered by ASBE members could very well exceed the value of the building. In most cases, the facility manager wouldn't do everything but rather pick and choose the most relevant sustainable solutions for her particular situation. One funding vehicle that is extremely attractive for Federal facilities looking for a more comprehensive, long-term approach is an Energy Savings Performance Contract (ESPC) which repays the initial investment for new equipment with the accrued cost savings realized from reduced energy and water use.

Using data provided by Johnson Controls, Inc., a company prequalified to work on indefinite delivery / indefinite quantity contracts for the DoE, the GSA and the Corps of Engineers, ASBE extrapolated the numbers to get a sense of what an ESPC might look like for our 200,000 square-foot virtual building. Such a contract would guarantee the 20 percent energy savings and 26 percent water savings mandated by the Executive Order, it would implement green building best practices and procedures (including a green purchasing program), and it would reduce waste. These combined efforts would generate about \$172,000 in annual O&M savings and would repay the nearly \$2.5 million of capital investment and financing charges in less than 15 years, a typical duration for an ESPC in the public sector.

Again, this is an extrapolation of more than 1,200 sample contracts. Because there will be FMs and agencies that merely want to achieve the mandates set in the Executive Order while others will far exceed mandates to show their dedication to sustainability, individual contracts will vary greatly. Regardless of the contract specifics, ASBE members have shown they can help Federal facility managers across the country save energy, save water and save money. They have also shown the ability to significantly green the supply chain, reduce waste and pollution, and allow FMs to check off a host of mandates itemized in the Executive Order.

