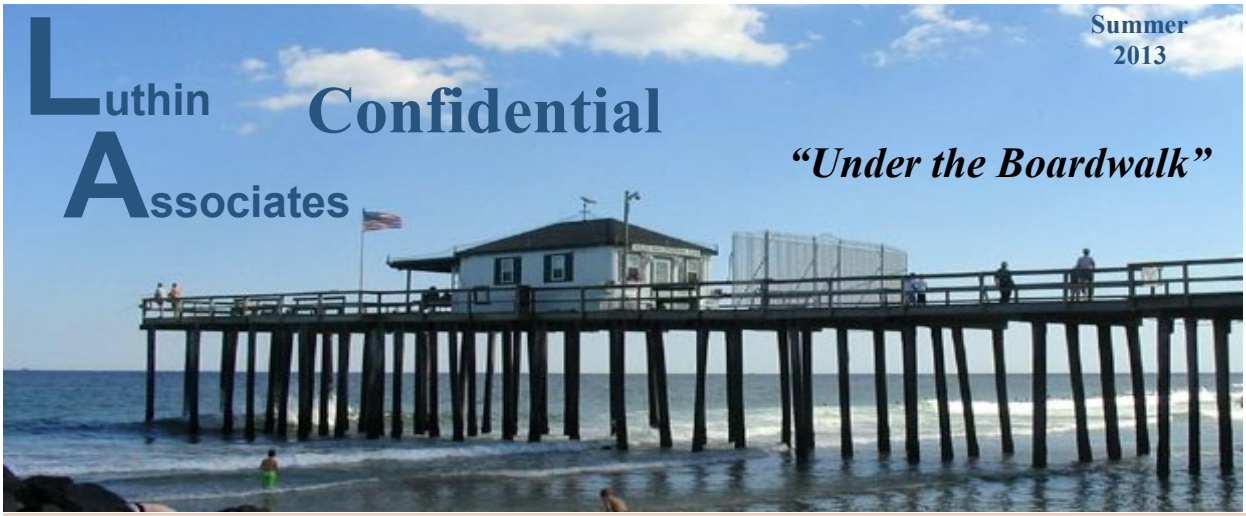

Getting Stronger than the Next Storm

Pictured above: Ocean Grove, NJ Fishing Pier, now in the process of being re-built.

Superstorm Sandy was a wake-up call for many who had not previously felt Nature's fury. It not only destroyed miles of boardwalk and thousands of NJ beachfront homes and businesses but it also invaded many skyscrapers in New York City's financial district. Even where it did no direct damage, it knocked out utility services to thousands of buildings. Many were closed for a week or more before re-opening, losing business and productivity during service restoration. The major lessons of this event are still being learned, but here are a few to consider right now.

1. Review and reduce the vulnerability of your electrical and mechanical systems.

Many facilities that were otherwise not badly damaged had to shut down for extended periods due to flooded electrical and mechanical rooms. Water and wiring don't mix well, and many panel boards, breakers, meters, etc. had to be replaced due to contact with seawater. In some cases, utilities would not restore power until electric services had been professionally inspected for fear that doing so might start fires or cause more damage. Burners, boiler controls, and water heaters also suffered when their electrical components (e.g., motors) were flooded.

Raising such equipment several feet higher or relocating it to a higher floor or roof setback is an obvious solution. Merely reducing ways in which water can enter basements, however, is a quick first step.

Many facility managers are installing movable flood shields at exterior doorways and basement windows that may be quickly deployed prior to arrival of severe weather. Installation of floor drains (where feasible) and pumps powered by on-site generation or natural gas may also reduce risk and water damage.

Merely sealing cracks in and around foundations will slow or block basement flooding.

2. Plan ahead for business continuity.

Assume that your building or facility will lose power for days, and communications perhaps for weeks (many buildings didn't get their phone and internet services fully restored for over a month). Some subways and tunnels were out of service for a week, and district steam service was lost for several days even in buildings far from the flooding. How will you maintain communication with your employees and clients during such an interruption?

Create a plan that includes off-site access from a temporary command center to your server and web site. Add a page – now, not later – detailing steps to be taken by supervisors and employees during a sustained outage. Doing so may avoid serious business losses while maintaining company cohesion. If employees are able to work at home from their own computers, have all their contact information available at a secure off-site location. Assemble a list of service providers for emergency generators, temporary boilers, etc. so business can restart and keep going even during a sustained outage. For retail, service, or warehouse operations, have a backup sales/paperwork plan for receipts, work orders, etc. that uses paper instead of screen-based transactions.

3. Build resilience into projects and new construction.

New York City will soon be announcing a variety of changes to its building code. Staying abreast of such requirements, and designing them into upgrades and alterations to facilities, will keep you ahead of the curve. If no on-site emergency generation presently exists, consider installing such a system, even if merely several portable units. (*cont on pg 3*).

Inside this issue:

What May Climate Change Mean to You?

It's tough to sit under the Boardwalk if the ocean has decided to do so instead. As sea levels rise and extreme storms tear away at the beaches, at what point must action be taken to literally stem the tide?

Severe weather events across the country – such as the recent heatwave and last year's Superstorm Sandy – have spurred discussions about how to respond to them. But is climate change really happening, or are such extreme events merely random weather fluctuations? Are human activities behind climate change, and how may it affect your facility and its energy costs?

Is climate change really happening?

Although relatively new in the scope of public policy and education, scientists have been researching the earth's warming cycles for over 200 years. In 2007, the United Nations Intergovernmental Panel on Climate Change (IPCC) determined "warming of the climate system is unequivocal as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level." Climate change has been supported with empirical data (i.e. ice core rings, weather data) and is currently backed by the majority of climatologists; however, the exact rates of change and consequences are dependent on future human impacts and policies.

Is climate change responsible for extreme weather events?

It is difficult to say that any given extreme weather event is directly caused by global warming. IPCC states there has been a 'likely' (66-90% chance) increase in droughts and heavy precipitation events since the 1970s, which is consistent with a warming climate. Extreme weather events are inherently part of the earth's natural cycle, but climate change acts as a 'loaded die' by increasing the probability of occurrence and enhancing the intensity of a storm. Superstorm Sandy was especially devastating due to increased ocean temperatures and a rising sea level along the New York and New Jersey coastline, which resulted in the infamous 13-foot storm surge.

How do human activities influence climate change?

The earth has natural carbon dioxide (CO_2) and temperature cycles (i.e. ice ages) which are strongly correlated to each other but they develop over eons. We are now witnessing such changes across decades. Post-industrial CO_2 levels have risen to a point unprecedented in recent planetary history. While other greenhouse gases (GHG) such as methane also have an impact, CO_2 is the main GHG resulting from human activities, e.g., accelerating rates of fossil fuel consumption and deforestation. The exact consequences of increased CO_2 levels are unknown, but climatologists have offered several scenarios for the rise in average global surface temperatures by 2100 (Figure 1). When you look at the chart, note that the generally accepted threshold for keeping climate change within a range that allows us to readily adapt is a rise of about 2° Centigrade (i.e., about 3.4 ° F).

How may climate change affect my facility?

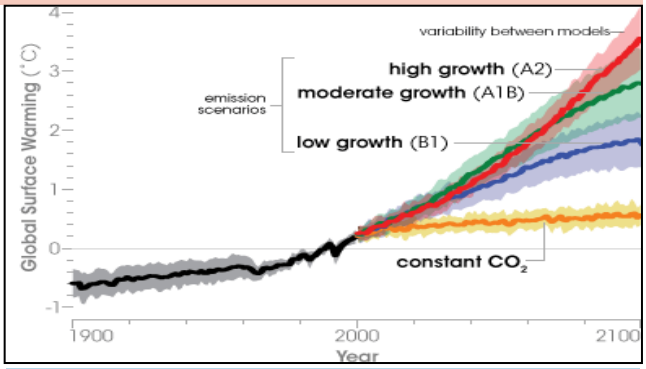

Figure 1: Observed global surface temperatures and future scenario projections from 1900 to 2100.

On June 25th, President Obama announced a national GHG reduction plan, focusing on three areas – 1) cutting carbon emissions from power plants through stricter EPA regulations, mostly on coal-fired units 2) improving end use energy efficiency through higher product standards, and 3) increasing renewable energy output from federal lands. The main immediate facility-level impact of his proposed policies may come from increases in electric rates.

While regions heavily dependent on coal may see a rise in their electric bills over the next few years, the price impact in our area is likely to be minimal: in New York and New Jersey, only 4-6% of electricity is generated from coal-fired power plants. Some of them are already scheduled for retirement or conversion to natural gas, making any price impact uneventful.

On a local level, Mayor Bloomberg recently released "A Stronger, More Resilient New York" which provides a variety of recommendations to increase the resilience of the City's infrastructure, buildings, and energy supply, such as "improve(ing) backup generation for critical customers" and "work(ing) with pipeline operators to expand and diversify natural gas supply."

As discussed in "Getting Stronger Than The Next Storm" on page 1, options exist for applying those lessons at the facility level. Doing so will help mitigate the impact of extreme weather events due to climate change. Whether such events are caused by human action, or through some natural cycle, being prepared for them before they happen again is the most constructive policy to pursue.

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Power Storage in Your Building

It's night. You're riding the Ferris wheel, enjoying the view as you reach the top. Suddenly the power goes out all over the boardwalk! There's no backup generator, but the ride's lights are still on and the wheel keeps turning, letting everybody off safely. What's going on?

This amusement pier is equipped with a power storage system that holds enough juice to run the facility's critical systems for an hour. The same thing could be done at your building. Welcome to the near future.

For decades, R&D firms have been striving to bring down the cost of large scale batteries to be cost-effective for utility scale power storage. Units have already been installed at a handful of US utilities, with systems having 10-20 MW of peak output. All are designed mainly to help grids ride through brief problems, such as failure of a power plant or transmission line, while power is switched to other sources or lines.

Of interest to facility managers, however, is the trickling down of that technology to the end user level. Development of electric vehicles has brought down the cost of lithium-ion batteries, and some competing technologies (e.g., zinc-air) have also been going down in price and up in reliability. Some are being scaled to capacities that could be used in:

- storing renewable power (e.g., from photovoltaic [PV] panels or wind turbines) for later use, improving PV economics by 40% or more

- peak shaving to counter brief high loads in buildings or manufacturing facilities

- demand response programs, including frequency regulation and spinning reserve programs previously done only at utility levels because they require very fast response times in the range of seconds or minutes.

- emergency backup power during utility outages (the vast majority of which last less than an hour), acting like a system or building-wide Uninterruptable Power System (UPS).

Several hotels in California, an apartment building in New York City, and part of a medical center in Philadelphia are already equipped with battery systems to help them perform such services. Prototypes will also soon appear in a NYC university and at some military installations.

(*Continued on page 4).*

Continued...Getting Stronger than the Next Storm

If not interconnected to the building's own electrical system, pre-position (above flood level) whatever power cords, strips, etc. may be needed to distribute its power.

When designing alterations to the building or its other systems (e.g., HVAC), assume another Sandy-level event, and review how such proposed changes will resist it.

The City's plans for dealing with future Sandys are laid out in its "Report on Rebuilding and Resiliency" available at www.nyc.gov/html/sirr/html/report/report.shtml.

The section on "Buildings" is especially relevant to facility managers.

Just as we learned ways to incorporate greater security into our facilities without compromising their appearance or operation, resilience for your facility in the future should become part of our planning.

Top Photo: Aftermath of Sandy, Avon-by-the-Sea NJ.
Bottom Photo : Avon's recovered boardwalk.

Continued...Power Storage in Your Building

All this has not occurred without casualties, however. In the last year, a flywheel battery firm and a major lithium-ion producer both filed for bankruptcy. The big hurdle is producing a battery that can be recharged many times without losing capacity over its lifetime, all for less than $400 per stored kilowatt -hour (kWh).

For example, to be cost effective, a battery able to store and discharge 100 kWh per cycle cannot cost more than about $40,000 (i.e., $400 x 100 kWh = $40,000), doing so for at least several thousand cycles. So far, only a few very large batteries have achieved that goal. Some battery pioneers, such as Eos Energy (www.eosenergystorage.com), believe they can eventually create long-lasting units costing only $160 per stored kWh.

To help make this happen, significant financial incentives are becoming available. In California, utilities recently began offering funding to cover up to 60% of the installed cost of on-site power storage systems. In New York, NYSERDA has been funding prototypes and field testing both utility and customer level power storage systems. It's presently supporting field testing of a 1,000 kW Eos system able to store up to 6,000 kWh. If successful, such a battery located in NYC could provide sufficient power to save over $250,000 a year in demand charges, yielding about a 4-year payback. A few power providers, demand response (DR) firms, and energy service companies have recently been dabbling in ways to apply power storage technology for their customers. By this time next year, expect to see several facilities in the New York metro area boasting of their power storage systems.

To achieve real dollar savings, it's essential to automatically manage battery output and charging. Software and/or battery storage to accomplish this is offered by several firms, such as STEM, Inc, Demand Energy and Viridity.

On A Personal Note...

I have an unusual relationship with some of my clients and colleagues, occasionally they sing to me.

Michael Huvane of NYPA sang the lyrics to this song to me when I was working on a past summer issue and was trying to identify a theme. I did not use it then, but it is this year's theme, so thanks Mike!

Michael and I grew up in the same decade, and often have similar influences. He and his family summered at the Jersey Shore and both of us recall the lyrics of "Under the Boardwalk," a song written by Kenny Young and Arthur Resnick and recorded by The Drifters in 1964. For those who cannot sing the lyrics from memory, (maybe slightly off key):

"Oh when the sun beats down and burns the tar up on the roof
And your shoes get so hot, you wish your tired feet were fireproof
Under the boardwalk, down by the sea, yeah
On a blanket with my baby is where I'll be

(Under the boardwalk) Out of the sun

(Under the boardwalk) We'll be havin' some fun
(Under the boardwalk) People walking above
(Under the boardwalk) We'll be falling in love
Under the boardwalk, boardwalk

From the park you hear the happy sound of a carousel
Mmm, you can almost taste the hot dogs and French fries they sell
Under the boardwalk, down by the sea, yeah
On a blanket with my baby is where I'll be"

Will our ancestors 100 years from now hear this song and wonder what a boardwalk was? The issue of our newsletter offers ideas and hopes for making a change. Just as the photos on page 3 illustrate, we can rebuild better and stronger. But can we rebuild year after year?

Each of our newsletter issues have suggested methods to use energy wisely and help mitigate potential impacts on the environment. We will have a role to play in this effort. Please come to the beach, ride the carousel, and think about how you can make a difference.

Have a great summer!

Catherine Luthin

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