

# World Energy Engineering Congress

Washington DC  
September 21-23, 2016

Kat Janowicz, MSME, MBA, CEM, LEED GA, ENV SP  
President, 3COTECH, Inc.



## Plan Better for Resilience to Save Lives and Businesses

Businesses and governments need to take resiliency seriously and plan for it. If they don't, they are subject to litigation, not only revenue can be lost, but also lives.

Climate change is happening. Disruptive companies interfere with established markets. With added complexity and unexpected events, more projects get delayed, budgets overrun. Uncertainty is the new reality. Nobody can prepare for every possible outcome. The traditional response doesn't work anymore. We need to plan better.

### Climate change

Global climate change has caused a series of severe events, such as extreme weather, disasters, water rise, temperature rise, ocean acidification, drought, impact on crops, etc. The consequences of global warming are difficult to predict but certain effects seem likely, for example intense rains, and will be occurring more often in the future. We should be prepare for that.

Due to the climate change, the weather is getting more extreme. The intensity, frequency, and duration of extreme events will increase within the next decades. The predominant potential risks include heat waves; drought; more intense and longer lasting rains with potential for flooding and landslides; Sea Level Rise (SLR) with

potential for high surges and flooding; hurricanes and superstorms; snowfalls; and high winds and wildfires.

Global Mean Sea Level (GMSL) rose by 4 to 8 inches in the last hundred years. However, the rate in the last decade is nearly double that of the last century. Rapid sea levels rise can have devastating effects on coastal habitats, fresh water, and infrastructure. It can cause flooding, contamination, erosion, and loss of habitat for species. It can trigger more powerful storm surges. Low-lying lands could be submerged completely. Hundreds of millions of people live in areas that will be increasingly impacted by flooding. They eventually will have to abandon their homes and relocate. Scientists predict that the warming of the planet will likely accelerate and oceans will continue to rise. But it's difficult to predict how high it will go. According to NOAA expected SLR is 1.24 ft by 2050, other sources estimate even higher numbers. Coastal areas will face 30 or more days of flooding each year because of SLR.

The Earth has warmed since 1880. Most of this warming has occurred since the 1970s. The 20 of the warmest years occurred since 1981 and 10 of the warmest years occurred since 1998. 2015 was the hottest year on record. The global annual average temperature has increased by more than 1.5 degrees F between 1880 and 2012. The number of record high temperature events in the United States has been increasing, while the number of record low temperature events has been decreasing, since 1950. Global temperatures and carbon dioxide levels are rising, will continue to rise, and it will accelerate significantly if global emissions of heat-trapping gases continue to increase. Human-induced warming is superimposed on a naturally varying climate, the temperature rise has been and will fluctuate across the regions and seasons or over time. Extreme climate and weather [disasters in 2012 alone cost the American economy more than \\$100 billion.](#)

## U.S. billion-dollar weather & climate disasters

The U.S. has sustained 188 weather and climate disasters since 1980. Overall damages and costs reached or exceeded \$1 billion. The total cost of these 188 events exceeds \$1 trillion. The [National Centers for Environmental Information \(NCEI\)](#) identified seven distinct disaster types of events, such as Drought, Flooding, Freeze, Severe Storm, Tropical Cyclone, Wildfire, Winter Storm.

The [U.S. Billion-dollar disaster events from 1980-2014](#) are dominated by tropical cyclone losses. Land falling tropical cyclones have caused the most damage (\$545 billion) and have the highest average event cost (\$16.0 billion per event).

Drought (\$213 billion), severe storms (\$156 billion) and inland flooding (\$89 billion) have also caused considerable damage. Severe storms are responsible for the highest number of billion-dollar disaster events (70) yet the average event cost is among the lowest (\$2.2 billion) but still substantial. Tropical cyclones and drought represent the second and third most frequent event types (34 and 22), respectively.

In 2015, there were 10 weather and climate disaster events with losses exceeding \$1 billion each across the United States. These events included a drought event, 2 flooding events, 5 severe storm events, a wildfire event, and a winter storm event. Overall, these events resulted in the deaths of 155 people and had significant economic effects on the areas impacted.

Analyzed costs have been adjusted for Consumer Price Index (inflation) in order to compare costs over time. The list of events shows events with less than \$1 billion in damage at the time of the event, but after adjusting for CPI, now exceed \$1 billion in damages.

Due to increased demand for high-value environmental data and information, NOAA's former three data centers—the [National Climatic Data Center](#), the [National Geophysical Data Center](#), and the [National Oceanographic Data Center](#), which includes the [National Coastal Data Development Center](#)—have merged into the National Centers for Environmental Information (NCEI). NCEI, as a Nation's Scorekeeper, develops national and global datasets of severe weather and climate events with their trends and anomalies. The datasets help to maximize the use of our climatic and natural resources while minimizing the risks caused by climate variability and weather extremes.

## Widespread impacts

The widespread impacts of the global climate change interact with other environmental, cultural, and socioeconomic factors. The types and magnitudes of impacts vary across the regions, cultures, and over time. It affects human health, infrastructure, water supply, agriculture, indigenous peoples, ecosystems and biodiversity. Children, seniors, the sick, and the impoverished are particularly vulnerable. The harm will increase significantly if the global emissions of green house gases will not be greatly reduced. Decision-making strategies have substantial influence on these impacts, such as:

- Multiple System Failures During Extreme Events, e.g. Hurricane Katrina;

- Expanded Combined Impacts, e.g. coral reef ecosystem collapse due to combination of ocean acidification caused by increased carbon dioxide, rising ocean temperatures, and a variety of other factors caused by human activities;
- Cascading Effects Across Sectors, including agriculture, water, energy, and transportation.

Various examples are evident that past successful strategies for managing climate-sensitive resources and infrastructure are already ineffective. These complex decisions are particularly challenging due to the fast pace of the changes, long time lags between human activities and the climate response, the high economic and political stakes, complicated scientific data, and the influence of various stakeholders.

To support the effective and informed decision-making while dealing with uncertainties the key elements to consider are improved communication and collaboration across the industries and disciplines, and adaptive risk management as a decision support.

Lessons learned from other communities prove that considering various scenarios with combined impacts and cascading effects is significantly more effective than focusing on analyzing individual impacts when developing and improving resiliency strategy. The impacts and resilience strategies should be assessed proactively rather than reactive to the events.

## Backups do not always work

Failure of diesel backup generators and their restrained fuel supplies during hurricane Sandy are good examples.

In October 2012, Hurricane Sandy, also known as Superstorm Sandy, has caused extensive damage across many northeastern states (MD, DE, NJ, NY, CT, MA, RI) due to high wind and coastal storm surge, particularly NY and NJ. Damage from wind, rain and heavy snow extended to other states (NC, VA, WV, OH, PA, NH). Sandy's impact on major population areas resulted in 159 deaths, 72 direct and 87 indirect. 650,000 houses were damaged or destroyed. Superstorm Sandy caused widespread interruption to critical water and power services. Disruptions occurred in the systems that provide transportation, fuel supply, and telecommunications. Sandy was also the reason to close the New York Stock Exchange for two consecutive business days. It happened before, in 1888, due to a major winter storm. Total estimated costs of this extreme weather event is \$67.6 Billion.

Particularly devastating was Sandy's impact on energy infrastructure. Power lines were destroyed due to high winds. Rising waters flooded electric substations and generators, as storm surge reached 12.65 feet in New York. In some cases the equipment was wiped out. Over 8.5 million customers lost power within the impacted area. Fuel distribution networks were disabled. Critical terminals for petroleum were damaged. Due to lost power or other damages, many service stations couldn't pump gas. In addition, thousands of roads were closed preventing trucks to deliver fuel, even if they were able to obtain it. Flooded generators or lack of fuel reserves, and a subsequent loss of power caused hospitals to evacuate over 2,000 patients. In some cases, fuel had to be carried to generators. Only 10 hospitals in NYC were able to remain open. Staff was unable to work, get to work, and to communicate with local, state, and federal officials.

In aftermath of Hurricane Sandy, gaps in planning, operations, and response were quickly revealed and lessons learned. For example, critical electrical equipment, such as breaker boxes and building connections—especially in flood zones—should not be located in basements or on ground floors. While it may seem obvious, building codes and standards do not address this issue. In summary, better advanced planning, such as improved communication and coordination, development of more integrated systems, and built resiliency would significantly benefit the communities.

### Emergency preparedness and recovery

Failure to prepare for emergencies can lead to litigation, e.g. class actions by Farmers Insurance against Chicago municipalities for failing to prepare for rainstorms and flooding. Some disasters could have been avoided and money saved.

In 2014 Farmers Insurance Group filed nine class-action suits against nearly 200 communities in the Chicago area. The insurance company accused the Illinois municipalities of failing to prepare for harsher weather conditions, such as heavy rains and flooding. They argued that the local governments should account for rising global temperatures and ultimately a higher volume of rain; the rain would fall more intensely and for longer durations due to climate changes over the past 40 years. Failure to provide safe storm sewer systems and conduct adequate storm water mitigation is the responsibility of the local governments. According to the lawsuit—filed in the areas affected by flooding in recent years—the flooding is not an act of God and could be manageable. These areas projected the rise of the local river before the heavy rains and made sandbags ready to prevent rainwater breaches. The insurer claimed that the



local governments should be obligated to adopt reasonable stormwater management practices.

Moreover, the insurer made an unconventional argument that due to global warming similar problems will be occurring more often and governments should plan for that. The public agencies must adopt more rigorous emergency measures.

The lawsuits further alleged that the “common, central and fundamental issue in this action is whether the defendants have failed to safely operate retention basins, detention basins, tributary enclosed sewers and tributary open sewers/drains for the purpose of safely conveying stormwater.”

If successful, these lawsuits could require municipalities to pay significant damages to insurance companies. Despite that fact that the merits of the case are under scrutiny, the fundamental issue remains: When floods occur, who should pay for the damages?

Farmers spokesman Trent Frager said that the insurance company initiated this litigation to recover money for losses that could have been avoided, if properly addressed by the local governments. And they hope to encourage public agencies in taking preventative steps to reduce the risk of harm in the future.

Fortunately for the Illinois municipalities, the lawsuits were later withdrawn.

“We believe our lawsuit brought important issues to the attention of the respective cities and counties, and that our policyholders’ interests will be protected by the local governments going forward,” the Farmer’s statement reads. “Therefore, we have withdrawn the suit and hope to continue the constructive conversations with the cities and counties in Chicagoland to build stronger, safer communities.”

## Green Ports

For years environmental challenges were stalling major harbor development projects in San Pedro Bay. The Green Ports idea, now a global trend, sprung from litigations and protests challenging environmental impact reports, particularly related to air pollution.

After environmental and community groups challenged the environmental impact report of the China Shipping container terminal project in 2003, the Port of Los Angeles settled a lawsuit. The Port was required to prepare a new environmental impact report, the project was delayed, and the soaring costs included \$50 million for mitigation alone. In 2004, the Port of Long Beach pulled the plug on the redevelopment of the Pier J project as a result of similar environmental challenges.

Green Port Policies—adopted later in 2005—shifted environmental focus from regulatory compliance to long-term commitment for cleaner and greener port operations. One of the landmark measures enacted under the policy includes the San Pedro Bay Ports [Clean Air Action Plan](#) (CAAP).

The timing was quite unfortunate. The ports were recovering from congestion due to the prolonged labor negotiations in 2002 and increasing cargo volumes in 2004. The industry did not look favorably upon any environmental requirements that would negatively impact the cost of doing business.

The Green Port Policy included five guiding principles:

- Protect the community from harmful environmental impacts of Port operations;
- Distinguish the Port as a leader in environmental stewardship and compliance;
- Promote sustainability;
- Employ best available technology to avoid or reduce environmental impacts; and
- Engage and educate the community.

In 2006, the Ports of Long Beach and Los Angeles took an unprecedented joint action to improve air quality in the South Coast Air Basin by adopting the CAAP, an extensive plan aimed at significantly reducing the health risks posed by air pollution from port-related ships, trucks, trains, cargo-handling equipment and harbor craft. The CAAP creates a framework for reducing emissions, with a key component serving the power needs of yard equipment, ships at berth, and other applications.

Today major ports around the globe have similar green initiatives in place and the maritime industry agreed on an international standard for ships at berth to run on shore power. “Today no one is asking whether or not there is buy-in, the question is what’s the best way to move forward.” said Mario Cordero, former Harbor Commissioner at the Port of Long Beach—an attorney who led the efforts for the Green Port Policy—now Chairman of the Federal Maritime Commission.

Since 2005, the ports have cut emissions, i.e. Sulfur Oxides (SOx) by 97 percent, Diesel Particulate Matter (DPM) by 85 percent, Nitrogen Oxides (NOx) by 50 percent, and Greenhouse Gases (GHG) by 21 percent, while reporting container growth of 3 percent. In addition, sustainable practices have been incorporated into the ports’ planning, designing, construction, purchasing, and operations.

## Emissions and energy gap

Energy efficiency (EE) is extremely important but it's only part of the solution. Why? Energy efficiency saves money but employing EE alone is like cutting your monthly budget without adding to your paycheck.

While energy efficiency is extremely important, today's energy landscape requires us to look at the bigger picture. Global climate change calls for significant emissions reduction and consequently a shift towards electrification. With growing electrification energy demand is increasing. At the same time the energy supply is decreasing. Existing power plants are scheduled to retire mainly due to environmental concerns but also due to unexpected incidents. The new renewable generation barely covers the retired production, not an increased demand.

A good example are the San Pedro ports which estimate that their energy demand will quadruple in the next few years due to shore power, electrification, automation, etc. The local utilities will not be able to guarantee the supply. Therefore the ports are seeking alternative solutions to meet growing demands, e.g. POLB's "Energy Island".

As we have just identified an imminent Demand/Supply Energy Gap, we have to take action today. Some of our clients and associates may not be yet aware of this Gap. What do we typically do when we need more energy? We believe that we will pay higher energy bill. Then we might consider to implement more robust energy efficiency measures. However it will be extremely difficult to meet our growing demands, if we don't generate enough energy.

As industry leaders, we need to help our customers and associates identify the potential gaps by assessing existing energy infrastructure and future demand. We need to tackle the energy gap from both, the demand and supply sides. We need to continue maximizing energy efficiency and productivity while encouraging the swift growth of new and clean generation. As we keep flattening the duck curve, we have to continue efforts towards energy storage, demand response, and micro grids. Our clients can still experience blackouts with new renewable generation because of our aging and under-maintained transmission and distribution network. Finally, we need to improve our efforts towards resiliency. Backups do not always work. A good example being the failure of diesel backup generators and their restrained fuel supplies during hurricane Sandy.



## Technologies to look out for

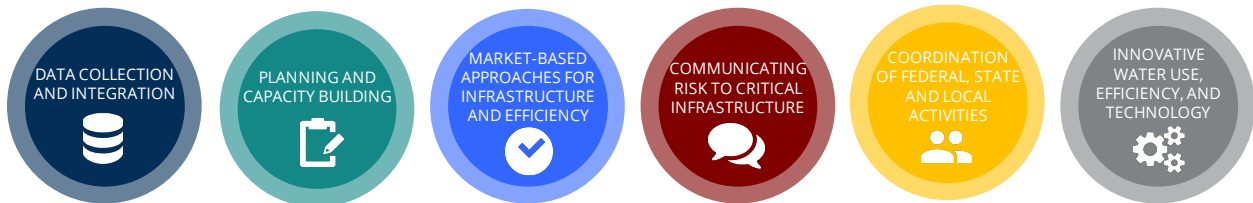
The McKinsey Global Institute identified twelve emerging technologies that have a potential to prompt the economic transformations and disruptions in the coming years. The report, titled as “Disruptive technologies: Advances that will transform life, business, and the global economy”, answers the question how these technologies could reshape the world, reviews the challenges and benefits, and provides guidelines on the response to the transformation. The awareness and preparedness is crucial for both public and private sector. The technologies include the following:



## Resilience and adaptation strategies

To reduce and mitigate the risks we can build higher bridges, and stronger infrastructure, adopt stormwater and energy management practices, and create backup plans. But when disasters happen we need to recover and adapt quickly.

When planning for resilience, the goals should include:



Cross-cutting recommendations for resiliency, based on the input from the White House and the NYS 2100 Commission, include the following:

	<b>PROTECT, UPGRADE, AND STRENGTHEN EXISTING SYSTEMS</b>
	<b>REBUILD SMARTER: ENSURE REPLACEMENT WITH BETTER OPTIONS AND ALTERNATIVES</b>
	<b>ENCOURAGE THE USE OF GREEN AND NATURAL INFRASTRUCTURE</b>
	<b>CREATE SHARED EQUIPMENT AND RESOURCE RESERVES</b>
	<b>PROMOTE INTEGRATED PLANNING AND DEVELOP CRITERIA FOR INTEGRATED DECISION-MAKING FOR CAPITAL INVESTMENTS</b>
	<b>ENHANCE INSTITUTIONAL COORDINATION</b>
	<b>IMPROVE DATA, MAPPING, VISUALIZATION, COMMUNICATION SYSTEMS</b>
	<b>CREATE NEW INCENTIVE PROGRAMS TO ENCOURAGE RESILIENT BEHAVIORS AND REDUCE VULNERABILITIES</b>
	<b>EXPAND EDUCATION, JOB TRAINING AND WORKFORCE DEVELOPMENT OPPORTUNITIES</b>

To save lives, avoid preventable litigation, ensure resources, and sustain successful business operations, we need to plan better and develop strategy for resilience.