# CITIES, WEATHER, AND INFRASTRUCTURE

James Irwin
Mayors Innovation Project/COWS

# ABOUT COWS

- Building the High Road
- Projects:
  - Mayors Innovation Project
  - State Smart Transportation Initiative
  - Efficiency Cities Network
  - State Innovation Exchange

COWS

BUILDING THE HIGH ROAD


WALT HANDELSMAN ©2017 Newsday
NOW THAT'S SCARY!!
The Weather Channel
TRICK OR TREAT
TRICK OR TREAK

# VULNERABILITY

*Nearly 100 electricity facilities in the contiguous United States, including power plants and substations, are within four feet of high tide—and are therefore vulnerable to rising sea levels.*

SOURCE: ADAPTED FROM CLIMATE CENTRAL 2012.

# SEA LEVEL RISE, STORM SURGE, SALTWATER DAMAGE


*As sea levels continue to rise because of global warming, storm surge will reach farther inland, threatening our electricity infrastructure. Shown here is the extent of flood damage from storm surge during Hurricane Sandy in 2012.*

# INCREASED PRECIPITATION AND STORMS

© Wikimedia/U.S. Army Corps of Engineers

*The Fort Calhoun nuclear power plant closed from April 2011 to December 2013 because of record flooding on the Missouri River. Because they are sited near rivers and lakes, many power plants are vulnerable to inland flooding caused by extreme precipitation events.*

# HIGHER TEMPERATURES, HEAT WAVES, AND POLAR VORTICES

# WILDFIRES AND DROUGHTS

**Table ES-1. Relationship between climate change projections and implications for the energy sector***

| Energy sector | Climate projection | Potential implication |
|---|---|---|
| Oil and gas exploration and production | ▪ Thawing permafrost in Arctic Alaska | ▪ Damaged infrastructure and changes to existing operations |
| | ▪ Longer sea ice-free season in Arctic Alaska | ▪ Limited use of ice-based infrastructure; longer drilling season; new shipping routes |
| | ▪ Decreasing water availability | ▪ Impacts on drilling, production, and refining |
| | ▪ Increasing intensity of storm events, sea level rise, and storm surge | ▪ Increased risk of physical damage and disruption to offshore and coastal facilities |
| Fuel transport | ▪ Reduction in river levels | ▪ Disruption of barge transport of crude oil, petroleum products, and coal |
| | ▪ Increasing intensity and frequency of flooding | ▪ Disruption of rail and barge transport of crude oil, petroleum products, and coal |
| Thermoelectric power generation (Coal, natural gas, nuclear, geothermal and solar CSP) | ▪ Increasing air temperatures | ▪ Reduction in plant efficiencies and available generation capacity |
| | ▪ Increasing water temperatures | ▪ Reduction in plant efficiencies and available generation capacity; increased risk of exceeding thermal discharge limits |
| | ▪ Decreasing water availability | ▪ Reduction in available generation capacity; impacts on coal, natural gas, and nuclear fuel supply chains |
| | ▪ Increasing intensity of storm events, sea level rise, and storm surge | ▪ Increased risk of physical damage and disruption to coastal facilities |
| | ▪ Increasing intensity and frequency of flooding | ▪ Increased risk of physical damage and disruption to inland facilities |
| Hydropower | ▪ Increasing temperatures and evaporative losses | ▪ Reduction in available generation capacity and changes in operations |
| | ▪ Changes in precipitation and decreasing snowpack | ▪ Reduction in available generation capacity and changes in operations |
| | ▪ Increasing intensity and frequency of flooding | ▪ Increased risk of physical damage and changes in operations |
| Bioenergy and biofuel production | ▪ Increasing air temperatures | ▪ Increased irrigation demand and risk of crop damage from extreme heat events |
| | ▪ Extended growing season | ▪ Increased production |
| | ▪ Decreasing water availability | ▪ Decreased production |
| | ▪ Sea level rise and increasing intensity and frequency of flooding | ▪ Increased risk of crop damage |
| Wind energy | ▪ Variation in wind patterns | ▪ Uncertain impact on resource potential |
| Solar energy | ▪ Increasing air temperatures | ▪ Reduction in potential generation capacity |
| | ▪ Decreasing water availability | ▪ Reduction in CSP potential generation capacity |
| Electric grid | ▪ Increasing air temperatures | ▪ Reduction in transmission efficiency and available transmission capacity |
| | ▪ More frequent and severe wildfires | ▪ Increased risk of physical damage and decreased transmission capacity |
| | ▪ Increasing intensity of storm events | ▪ Increased risk of physical damage |
| Energy demand | ▪ Increasing air temperatures | ▪ Increased electricity demand for cooling; decreased fuel oil and natural gas demand for heating |
| | ▪ Increasing magnitude and frequency of extreme heat events | ▪ Increased peak electricity demand |

# RESILIENCE

- "…the capacity of individuals, communities and systems to survive, adapt and grow in the face of changes, even catastrophic incidents."


*Wreck at Coleman's Station, New York & Harlem R. R., March 15, 1888*

# HOW DOES A CITY BECOME RESILIENT?

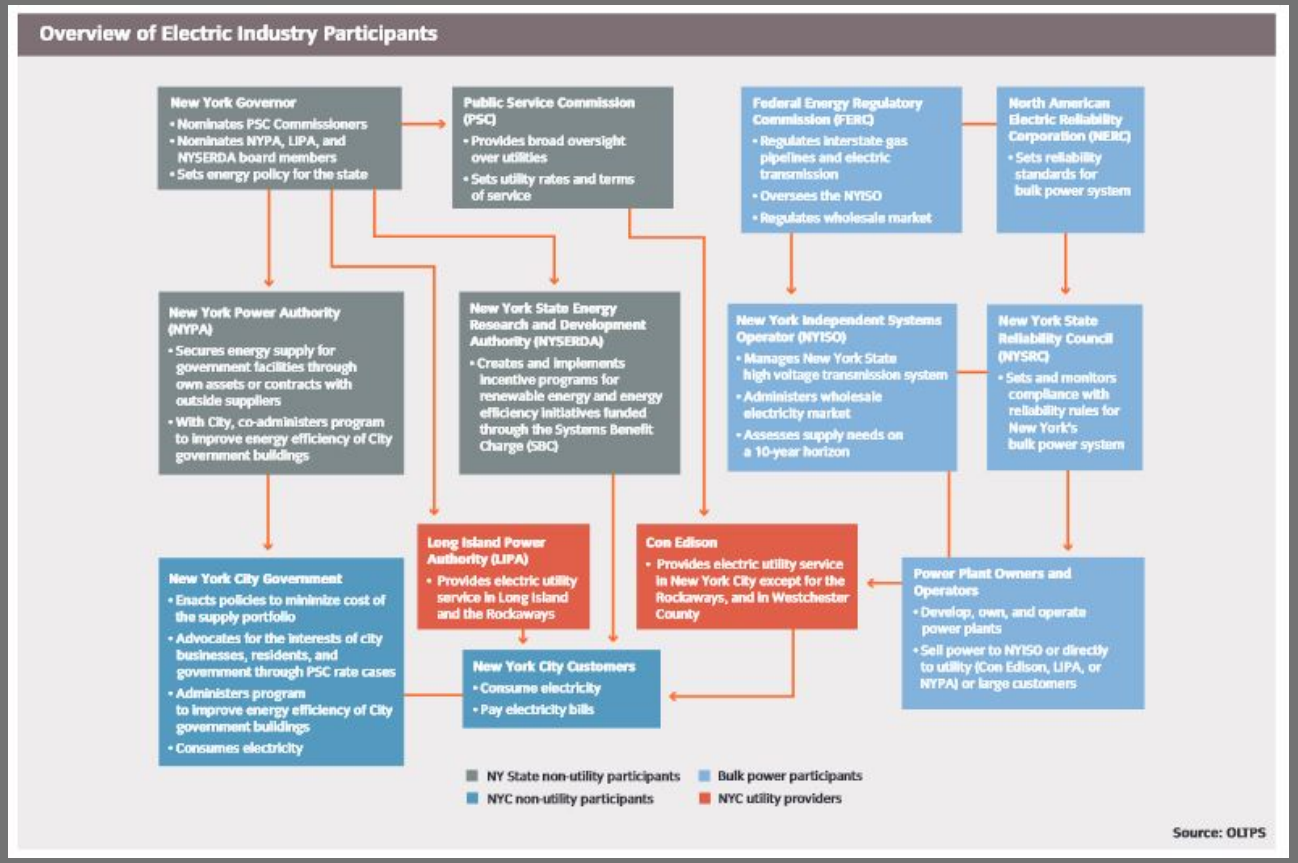
- Focus on the issue
- Decrease demand
- Distributed generation
- Renewable generation
- Green stormwater infrastructure
- Harden infrastructure

# "HARDENED" INFRASTRUCTURE

- Building protective sea walls
- Restoring naturally occurring protections, such as sand dunes, beaches, and wetlands
- Elevating or relocating important electrical equipment along the coasts, to protect it from flooding
- Burying transmission and distribution lines underground where feasible
- Reinforcing aboveground poles with sturdier materials, to reduce damage during storms and wildfires

# BUT IT'S NOT THAT EASY

- Jurisdiction
- Funding
- Regulation
- Political will and capacity
- Complexity and scope of solutions

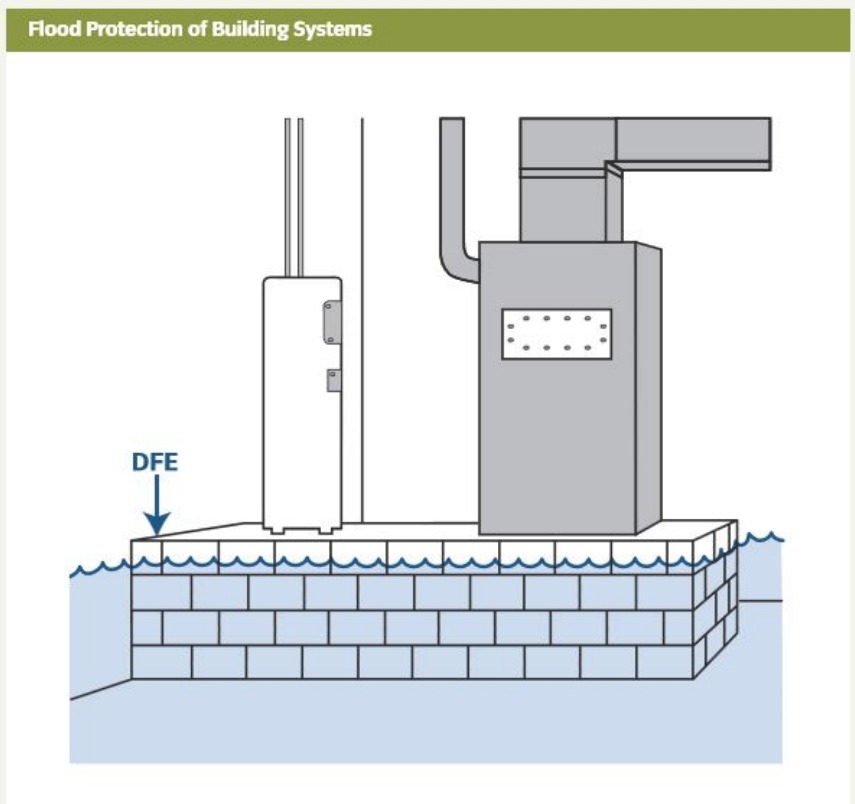


# MOVING FORWARD

- Regulation: building codes, tax incentives, zoning, for new construction and renovation
- Protecting shoreland and wetlands
- Invest in solutions with multiple benefits
- Municipal operations
- Infrastructure financing and job creation
- Advocacy for Federal and State Action
- Political leadership
- **Building upgrades**
- **Utility upgrades**

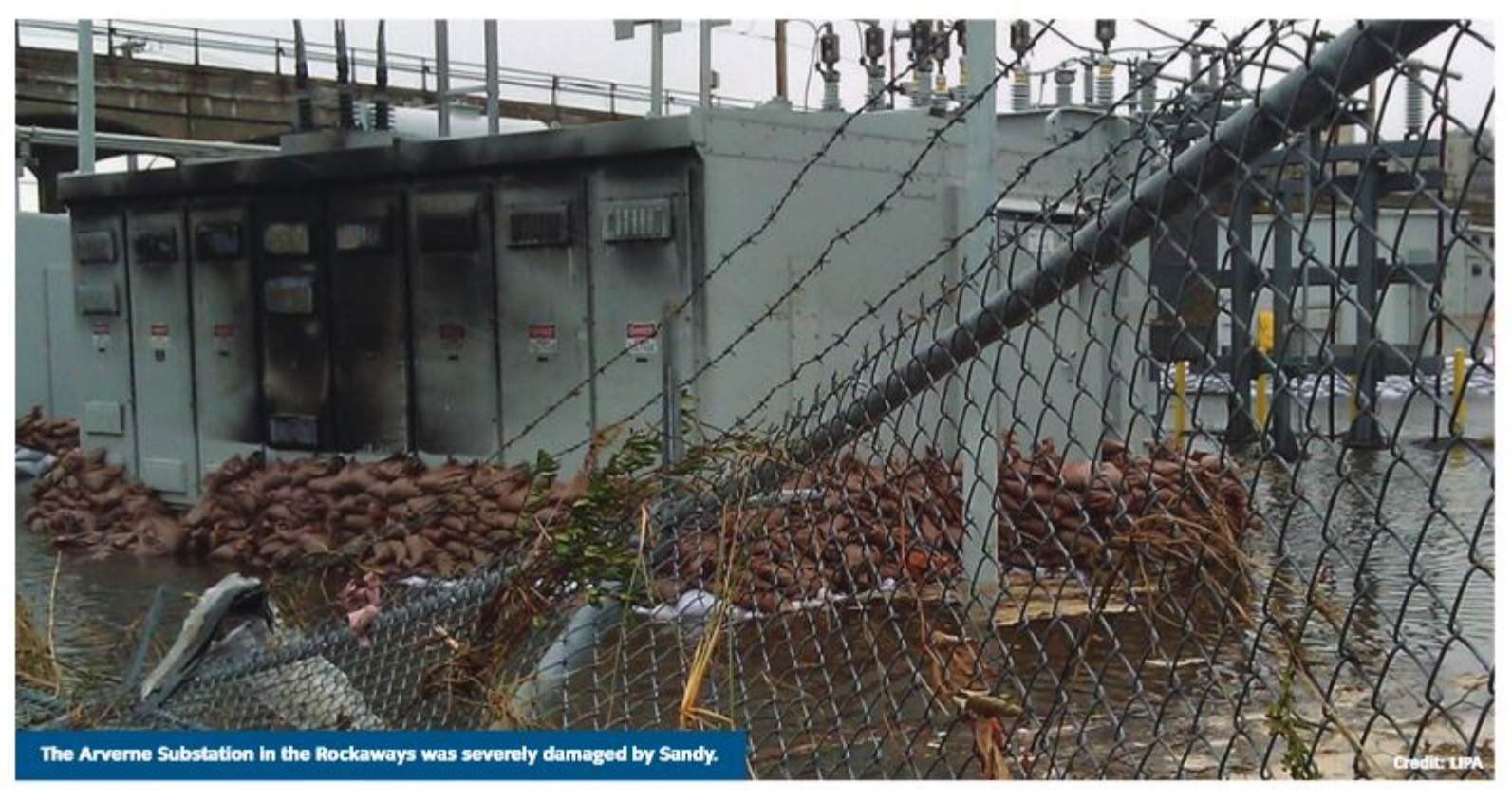
# RESILIENT BUILDINGS


The effects of flooding and storm surge resulted in severe structural damage to many buildings during Sandy.

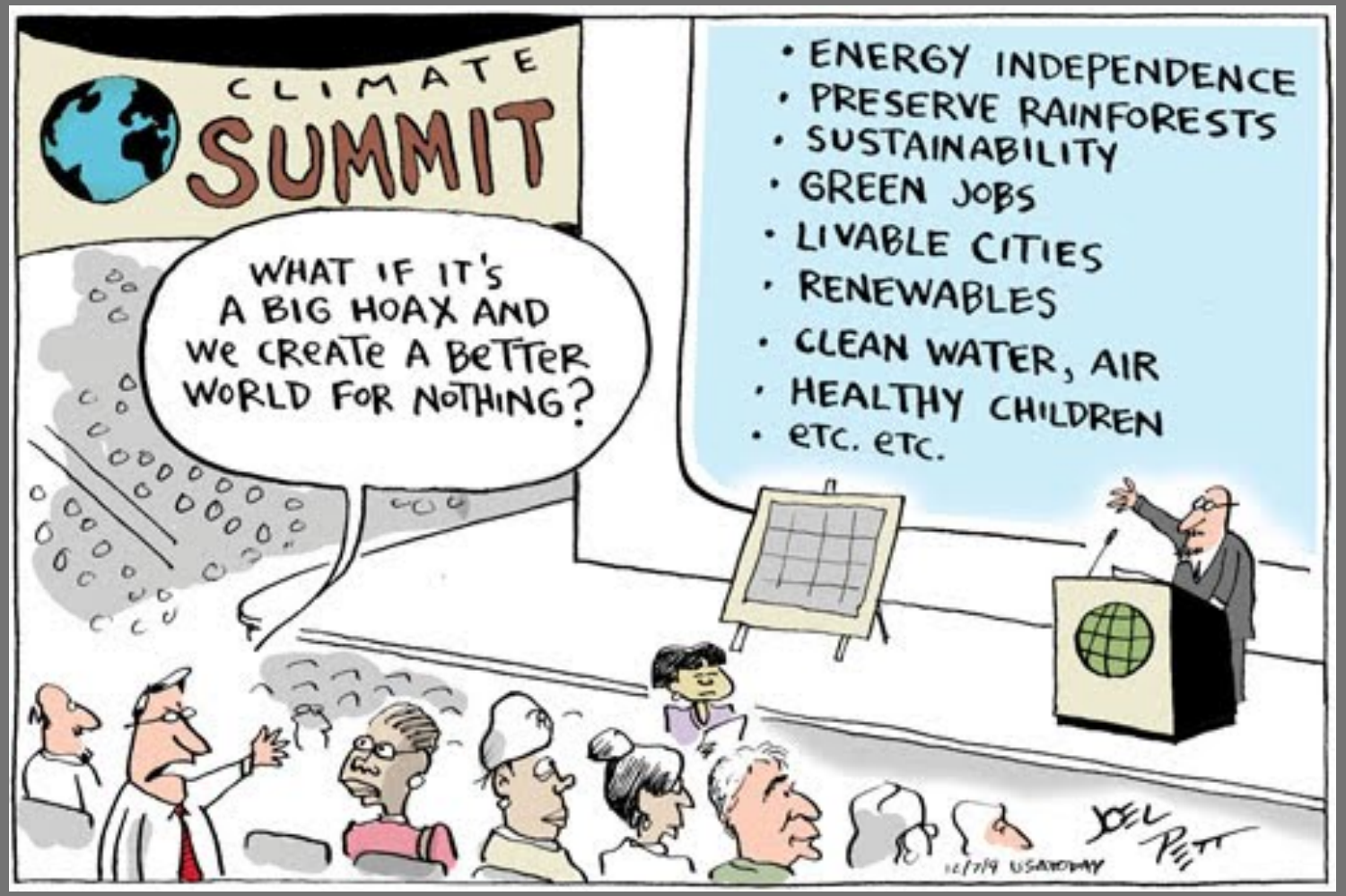



Example of a building hot water heater and furnace elevated above the minimum flood protection level via a platform.

# RESILIENT UTILITIES



# CONCLUSIONS



# CONTACT


- James Irwin
  608 262 6585
  JIRWIN@COWS.ORG