Broward County Energy Initiatives

Resilient Utilities Coalition

March 7, 2019

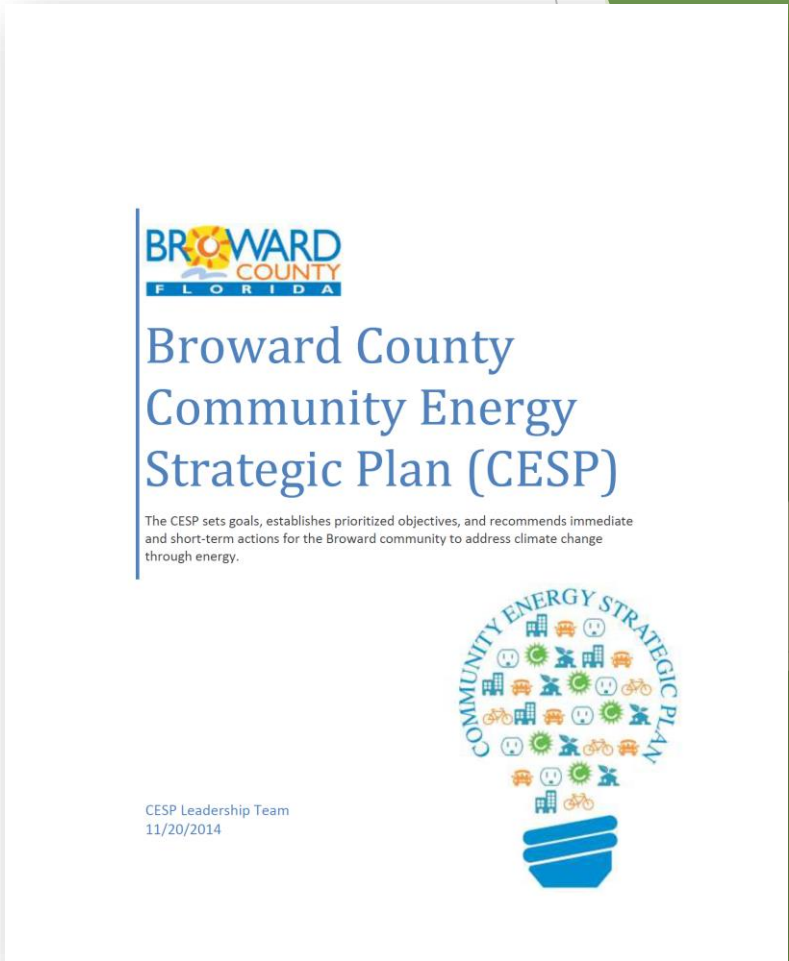
Environmental Planning and Community Resilience Division

Climate Action Plans and Mitigation Commitments

- 80 % reduction in GHG emissions by 2050
- 20% renewable energy goal
- 7% below 1997 by 2015
- 0% emissions by 2030

Diverse Community-wide Energy Initiatives

Efficiency	**Action** Host a countywide energy efficiency and conservation challenge
	Action Propose amendments to local energy building code
	Action Inventory community resources and increase stakeholder collaboration
	Action Promote energy benchmarking guidelines for commercial buildings
	Action Create and maintain an energy efficiency and conservation information hub
Renewable	**Action** Develop a web-based community renewable energy toolkit
	Action Promote solar financing options, specifically a county-wide PACE program
	Action Engage the community on renewable energy through community awareness projects
Transportation	**Action** Provide guidelines for PEV-ready residential and commercial (re)development
	Action Improve outreach and incentives to increase car/vanpools and non-auto modes
	Action Expand commercial use of alternative fuel and low-emitting fuel efficient vehicles
	Action Support transit fare interoperability
	Action Advance bike/pedestrian network strategy and greenways emphasizing access to transit



PACE Broward By The Numbers thru 12/2018

BROWARD COUNTY FLORIDA

9,021
PACE
Projects Completed

Energy Savings Potential*
$1,449,278
**Based on FPL $.1025 kWh rate*

$166,115,145
Financed

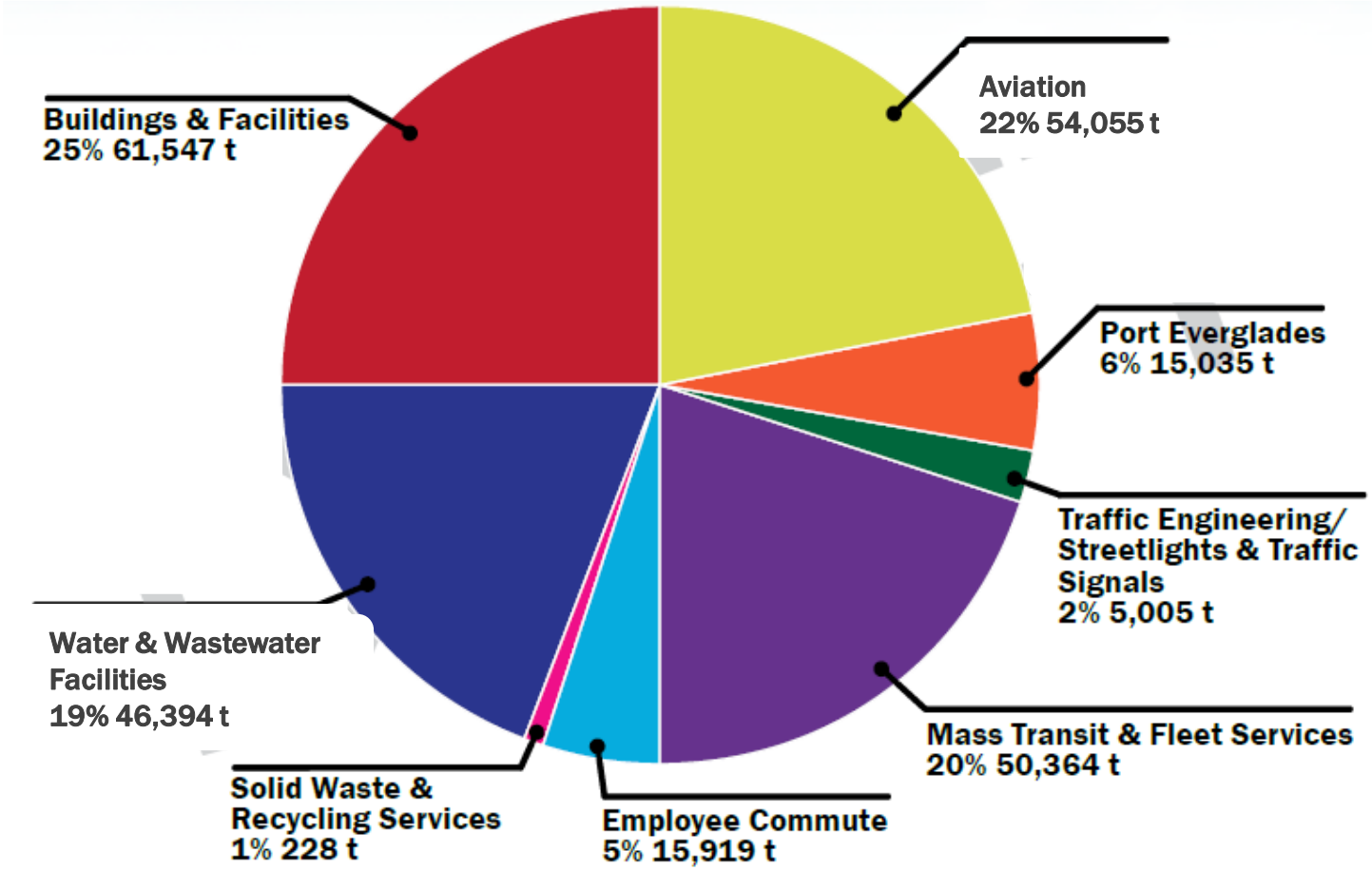
Enough Energy Saved to Power
1197
Homes

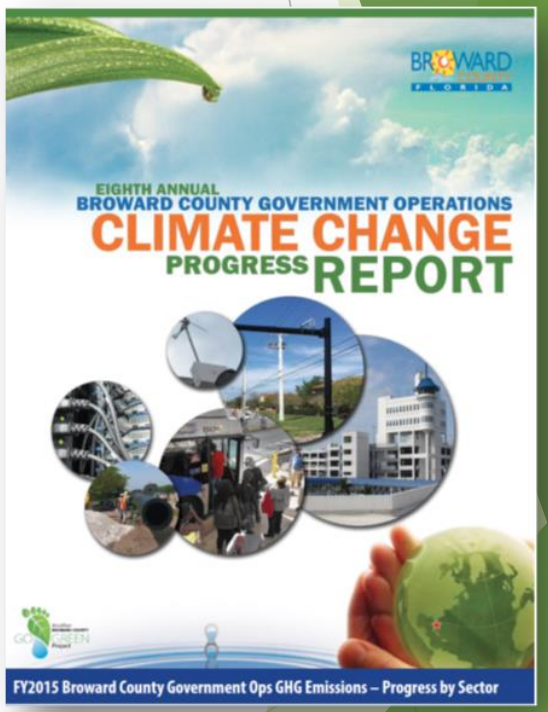
64%
Funds Used for Hurricane Protection

4,923 kW
Solar Capacity Installed

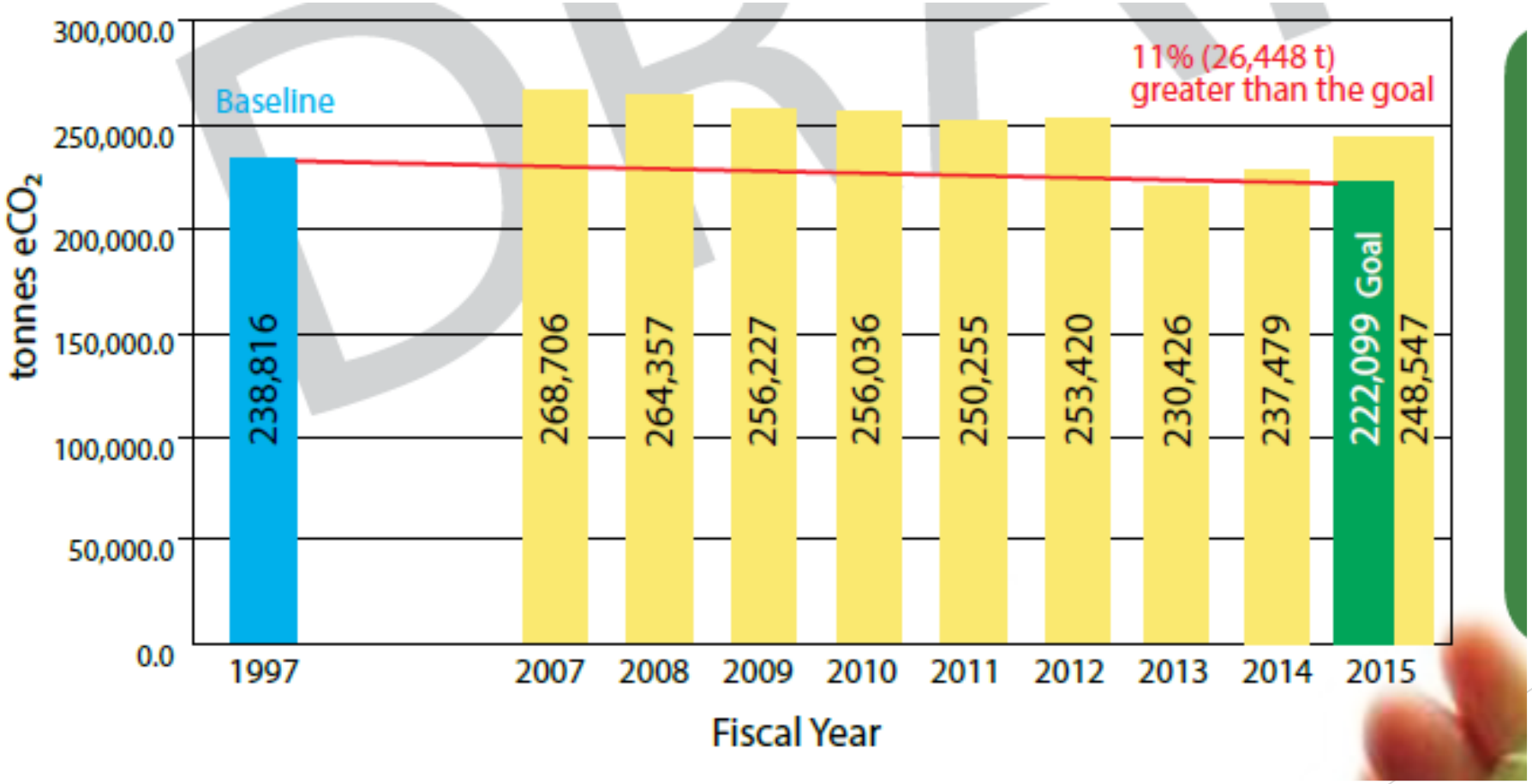
Broward.org/GoGreen

FY ’15 Greenhouse Gas Emissions Inventory





County GHG Emissions Trend



Broward Go Green Certification

To Date: 35 Certified initiatives, 18 agencies

- purchasing policies
- parks
- fleet services
- construction management
- Others

Alternative Fuel Paratransit Vehicles

- 184 of 252 diesel/gasoline paratransit vehicles replaced. 100% by 2021.
- 55 new propane vehicles for Community Shuttle Service by 2020
- estimated 12,800,000 fewer pounds of CO2 over the useful life of the vehicles.
- The estimated cost savings of $11,100,000 over the useful life of the vehicles for first 120+ vehicles .

New Electric Bus Initiative

- Five 45-foot over-the-road coach buses ordered for new I-75 express service
- Fifteen 40-foot buses to be purchased for existing local service
- Improvements at two existing Transit maintenance facilities to add electric bus charging infrastructure
- Addition of new solar canopies to offset new electric loads

Water and Wastewater Services (WWS) Cogeneration

- Project Description:
  - Biogas Cogeneration, or combined heat and power
  - Installation of a generator fired with renewable biogas, currently flared, to offset purchased electricity
  - Injection of Fats, Oils, and Grease (FOG) into digesters enhancing biogas production and increasing the amount of electricity generated.

- Project Benefits:
  - Expected to generated 2 MW of power
  - Reduce E consumption by 30%
  - Save $27 Million over 17 years
  - Reduces the wastewater treatment plant's annual purchased energy consumption by 12,000,000 kWh
  - Reduces carbon emissions by over 8,000 tons each year

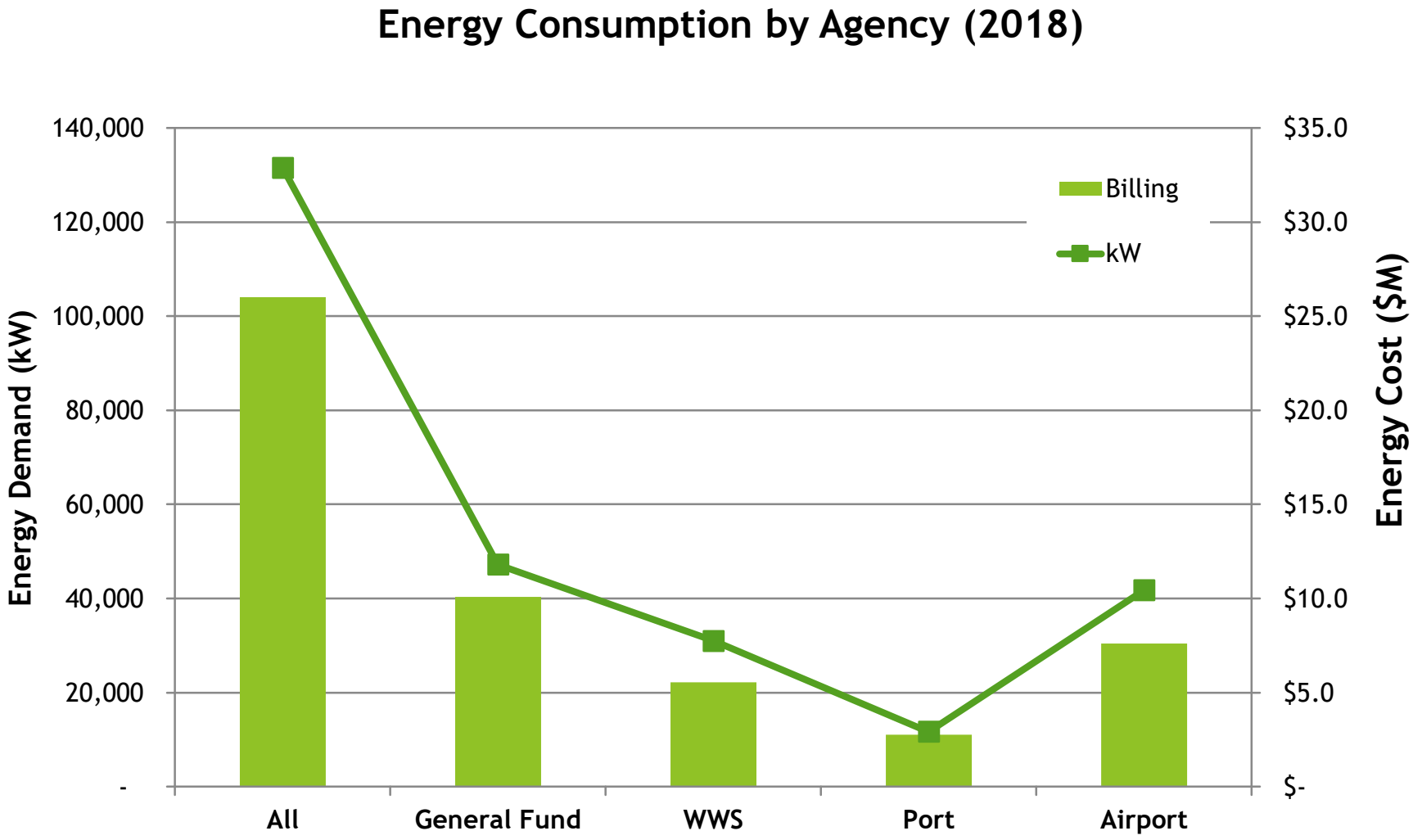
Solar Installations at County Facilities

- New construction will integrate solar
  - Broward Convention Center Hotel
  - Port Parking Deck
  - 8 sites totaling 2 MW proposed
    - Rooftop
    - Parking Canopies
    - Offset 54% of site demand
    - Integrated E/V
- Opportunity with each new reroofing project

FPL Solar Together Program

FPL plans to install 1,200 MW of solar by 2020

The FPL Shared Solar Program leverages the economies of scale of building Universal Solar, bringing a cost effective, hassle-free solar alternative to our customers.


Energy Consumption by Agency (2018)
Energy Demand (kW)
Energy Cost ($M)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
$35.0
$30.0
$25.0
$20.0
$15.0
$10.0
$5.0
$-
Billing
kW
All
General Fund
WWS
Port
Airport

FPL Solar Together Program

- Proposed subscription cost: $6.76/kW (fixed—will not increase)
- Subscribers receive credit of $0.0308/kWh (credit amount therefore depends on energy produced); credit rate rises each year
- Broward County finalized pre-register for 132 MW subscription
- Intended to offset 100% of County operations electricity consumption

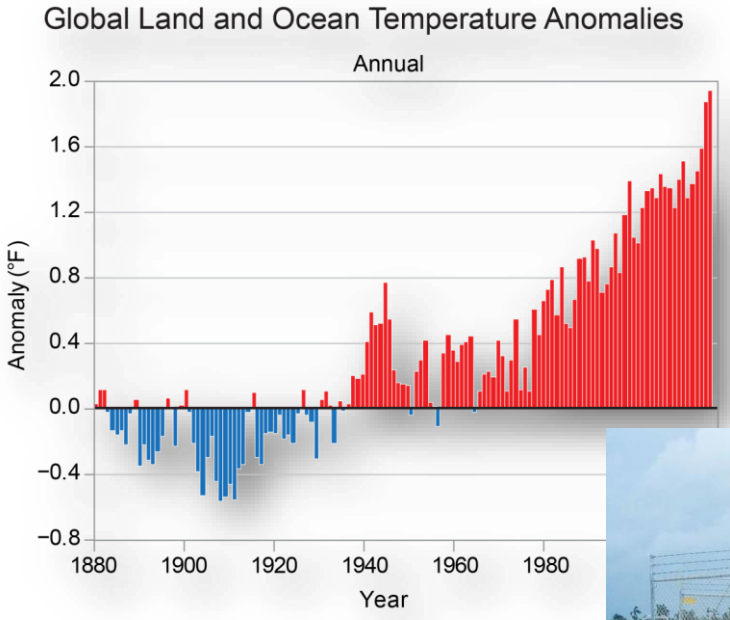
Fiscal Considerations

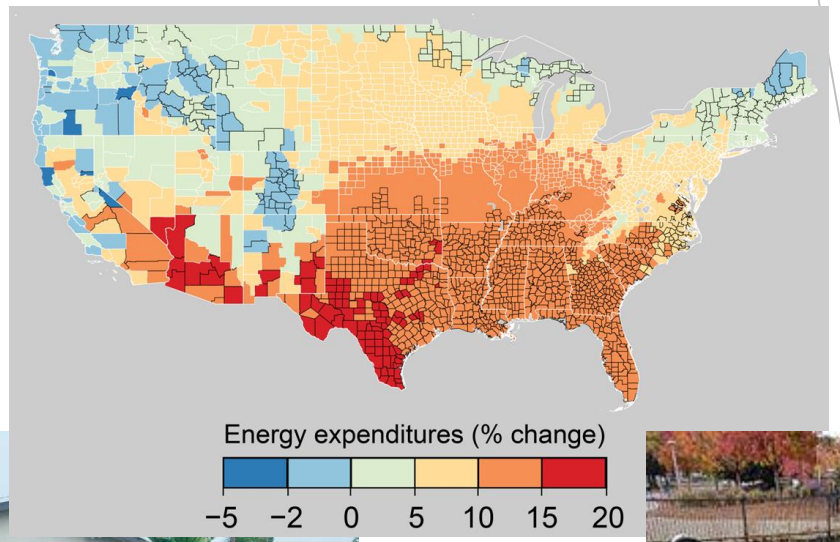
- Subscription cost in 100% scenario is approximately $362,000
- Declines annually with “credit” and by year 5, County is earning money
- By year 7, County recovers initial higher expenditures and cumulative impact is positive

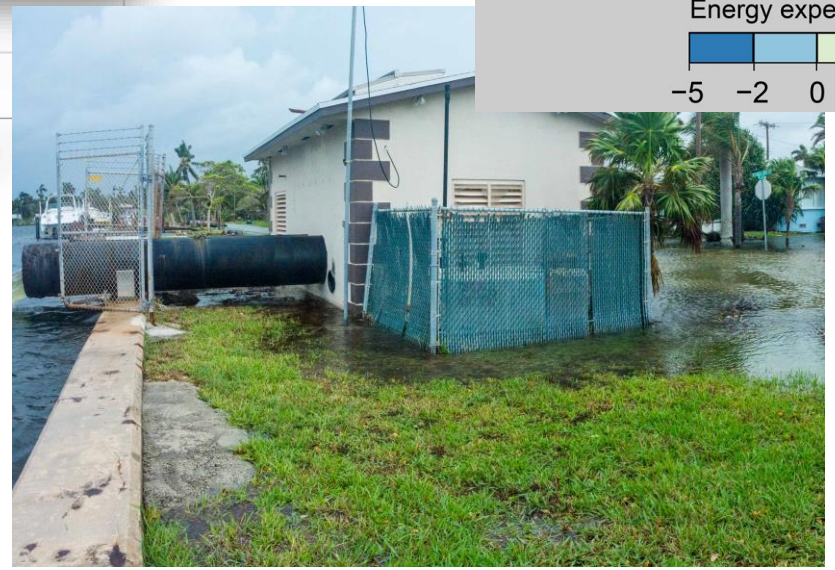
Reflections

- Many components to regional and agency emissions
- There are both economic and environmental bases for energy and conservation investments
- No single strategy will deliver the reductions we seek
- Plus continued growth in population and operations has the potential to offset our advancements
- What is more…

Additonal Challenges in our Future: The Energy and Water Nexus







Utilities must play a lead role

- Demand and pilot innovation in energy-efficiency and high temperature performance
- Integrate large-scale renewable, energy recovery, and clean energy projects
- Foster and model the one-water concept
  - Especially green infrastructure and stormwater reuse
- Pursue new finance strategies
- Partner in regional projects that offer economies-of-scale
- Ramp up water conservation efforts

Combined Heat and Power

Stormwater Reuse

Questions?

Dr. Jennifer L. Jurado

Chief Resiliency Officer and Director

Environmental Planning and Community Resilience Division

jjurado@broward.org

WSP USA Inc.
Energy Resilience for Utilities

Miami, FL
March 7, 2019

Michael Case, PE, LEED®AP | Warren Andrews, PE, Chris Nystrom, PE

ASCE
FLORIDA SECTION

Thank you for attending!

All attendees must sign the ASCE Florida Section sign-in sheet to receive credit for today's seminars. **No signature will mean no certificate.**

Michael Case, PE
VP, Director of Power Generation

- 14 years of experience in planning and implementing energy management projects.
- An expert in project management and electrical design for diverse facilities, including mission-critical facilities.

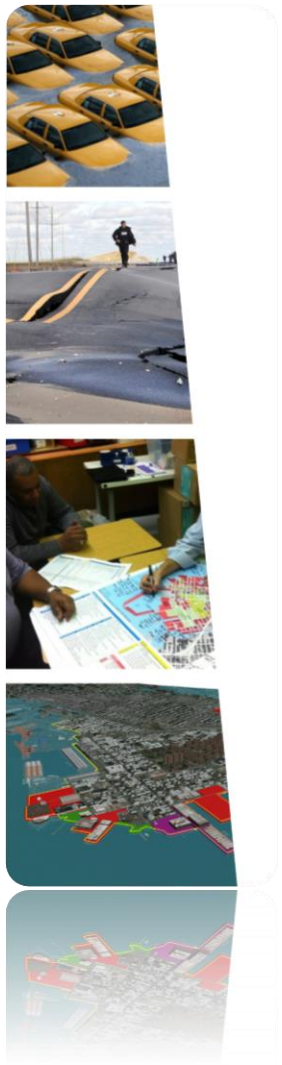
Warren Andrews, PE
VP, Southeast Regional Manager, Director of Transmission and Distribution

- 30 years of experience in electrical engineering design and program/project management.
- Provided project management, design and commissioning for electrical systems as well as oversight for major transmission line and substation projects.

Chris Nystrom, PE
VP, Northeast/Central Regional Manager

- 25 years of experience in central heating, cooling, and power plant projects.
- An expert in the planning, design, installation, and commissioning of central utility plants and cogeneration systems, with extensive operations and maintenance experience.

Concepts



RESILIENCY DEFINED

VULNERABILITIES AND THREATS TO THE POWER GRID

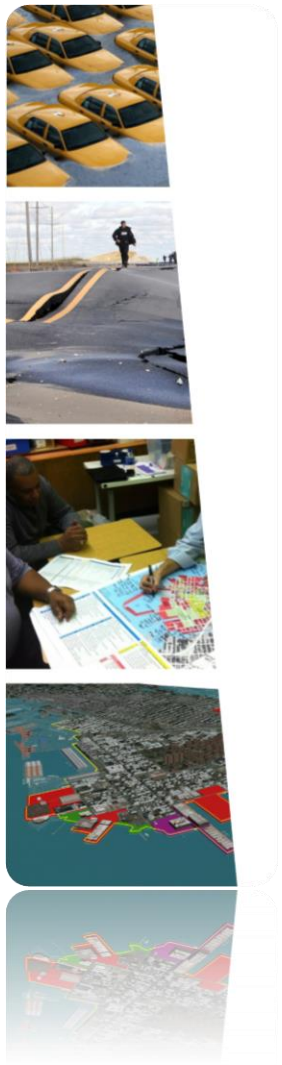
BEST PRACTICES vs. PRACTICAL ALTERNATIVES TO ENERGY RESILIENCY

TECHNOLOGY / MARKETS TRENDS FOR ENERGY RESILIENCY

POTENTIAL / SIMILAR FUNDING STREAMS

WSP's RESILIENCY INITIATIVES

Concepts



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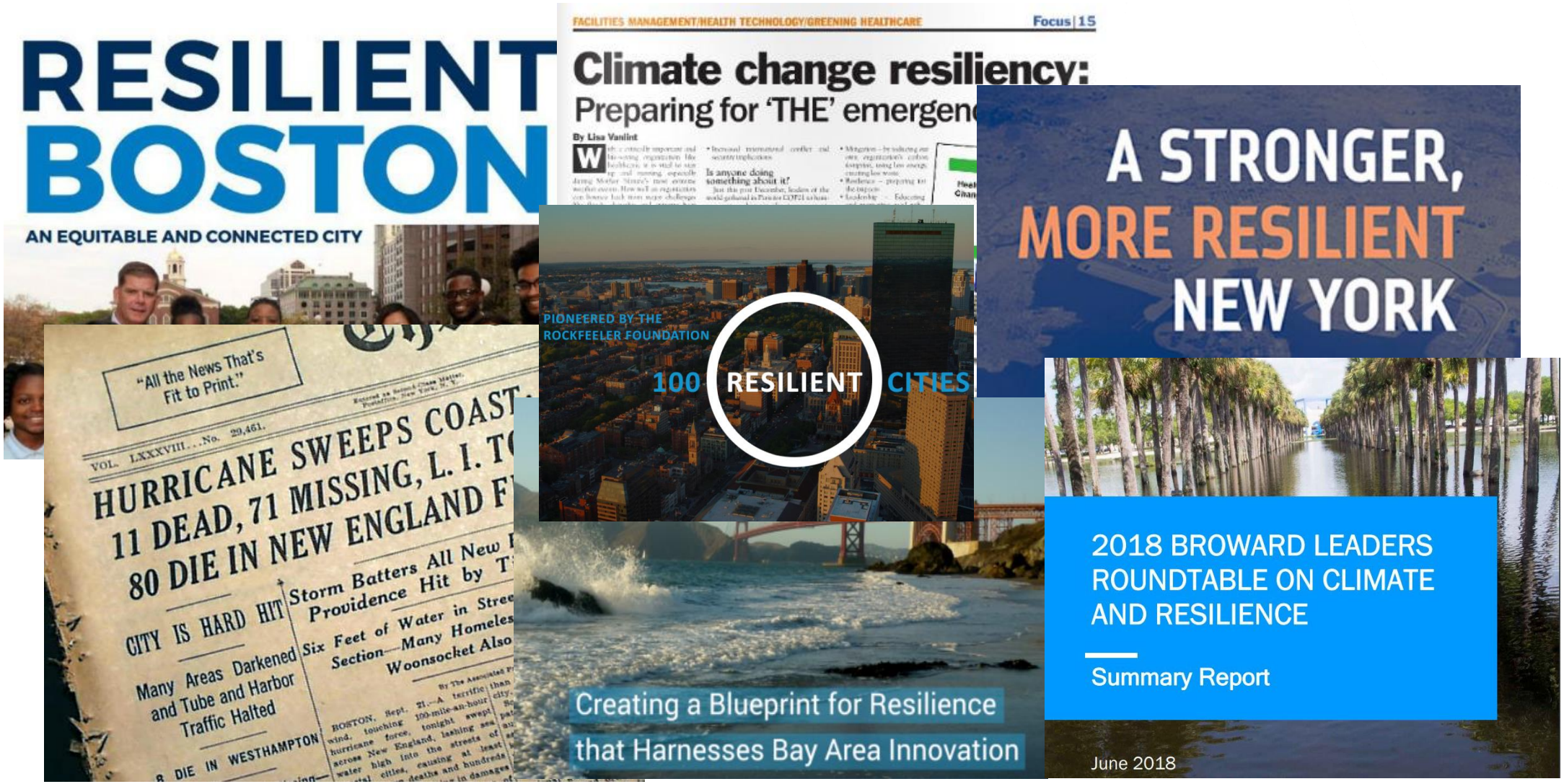
Resilience – What Does this Buzzword Really Mean?



Resiliency Defined

"...**RESILIENCE**: how to help vulnerable people, organizations and systems persist, amid unforeseeable disruptions. Where **SUSTAINABILITY** aims to put the world back into balance, **RESILIENCE** looks for ways to manage in an imbalanced world."

Andrew Zolli, 'Resilience: Why things bounce back (2012)'

Presidential Policy Directive (PPD) 21

Critical Infrastructure Security and Resilience

"the ability to *prepare* for and *adapt* to changing conditions and *withstand* and *recover rapidly* from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents."

Resiliency Defined

Resilient Utility Coalition

Resilience is the ability of an asset or system to withstand an attack or natural hazard without interruption of performing the asset or system's function or if the function is interrupted, to restore the function rapidly

Power Grid Resiliency

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

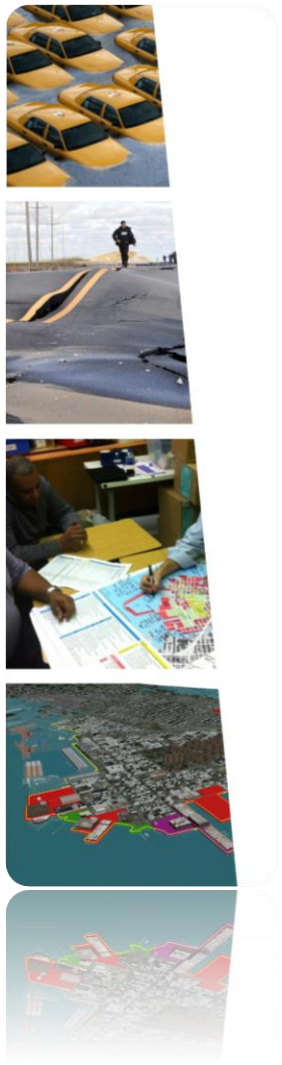
Efforts to *"harden"* the electricity grid must focus on three elements:

Prevention
Preventing damage in the distribution system ***will require changes in design standards, construction guidelines, maintenance routines, inspection procedures***, and recovery practices through the use of innovative technologies.

Recovery
Proper resiliency planning ought to provide for rapid damage assessment, prompt crew deployment to damaged assets and readily available replacement components.

Survivability
Survivability refers to the ability to maintain some basic level of electrical functionality to individual consumers or communities in the event of a complete loss of electrical service from the distribution system. The key elements of survivability include communicating with customers; using resilient technologies to supply critical infrastructures such as traffic signals, prisons, hospitals, and cell phones; ***and equipping and enabling consumers to use distributed generation***.

Concepts



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WSP's RESILIENCY INITIATIVES

Hurricane Irma (September 2017)

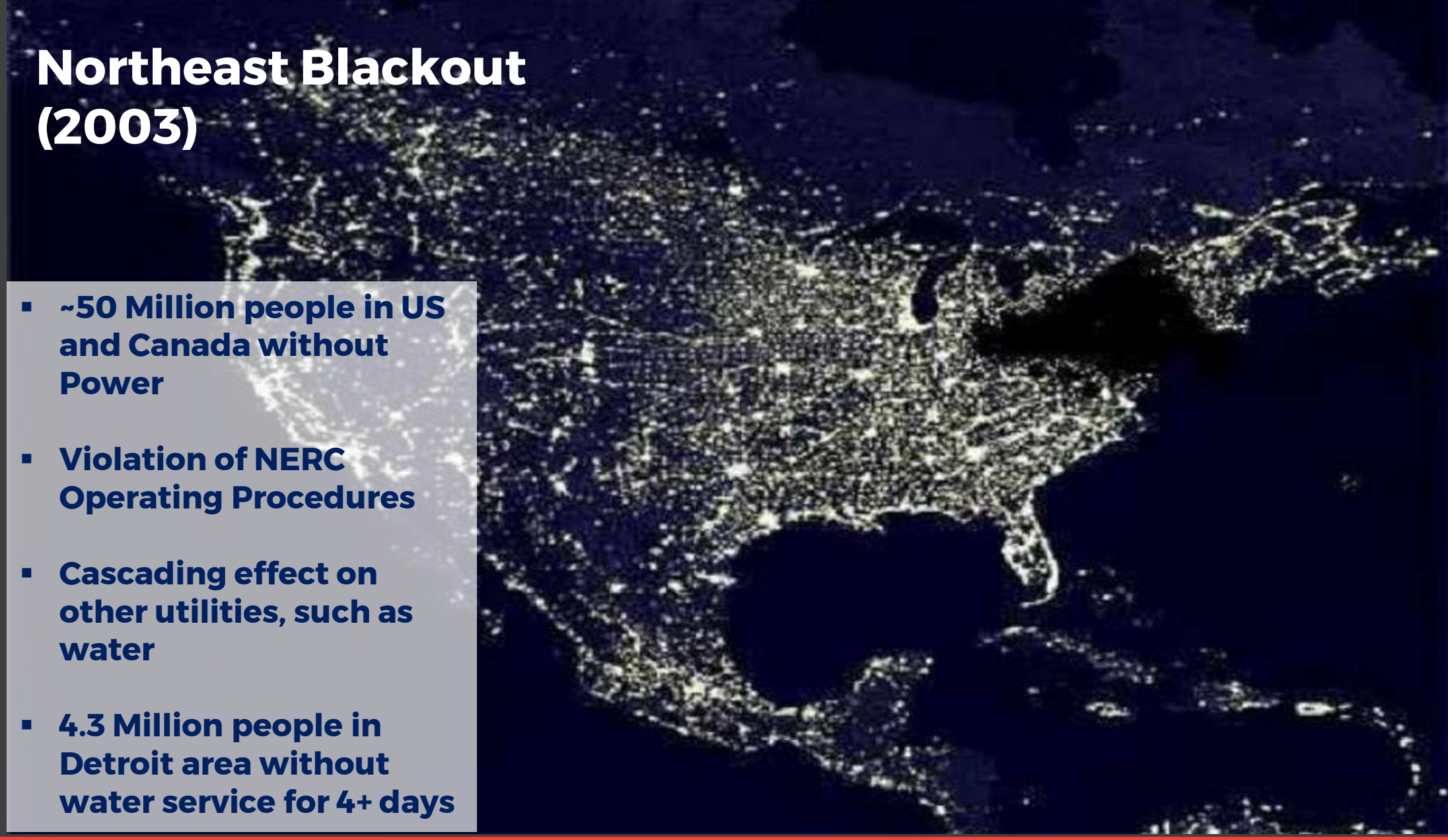
- 6.7 Million Customers without Electricity
- Electricity demand fell to 7.2GW compared to 38.1GW 4 days later
- 60K Utility Employees Supporting the Restoration Efforts
- ~$64 Billion in Damages

Vulnerabilities and Threats to the Power Grid

California Wildfires (October 2018)

- 52,00 Wildfires during 2018 season burned 8.5 million acres
- Fires blamed mostly on downed power lines, leading to planned outages
- PG&E has filed for bankruptcy, facing $30B in liability costs
- Destroyed 13K single residences

Northeast Blackout (2003)

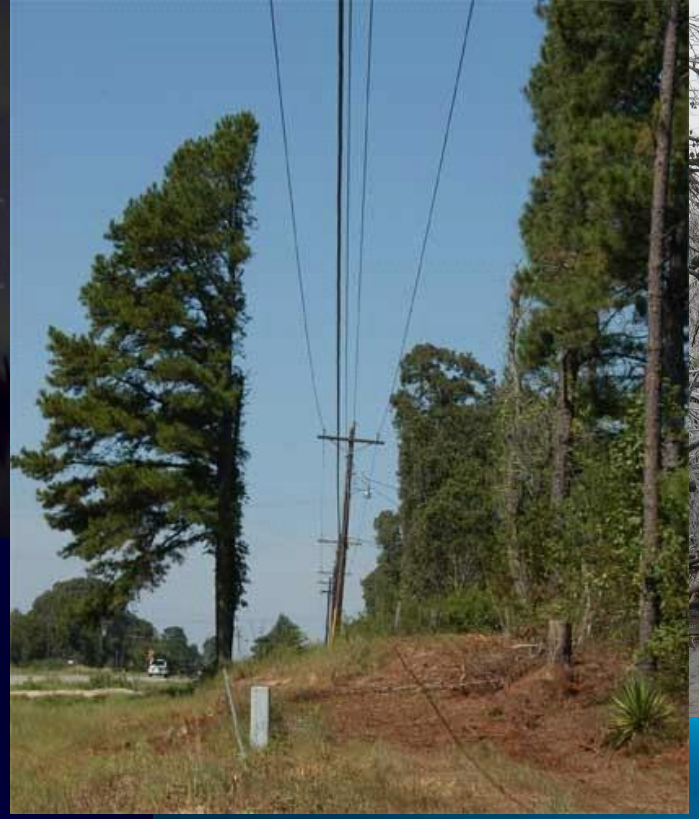


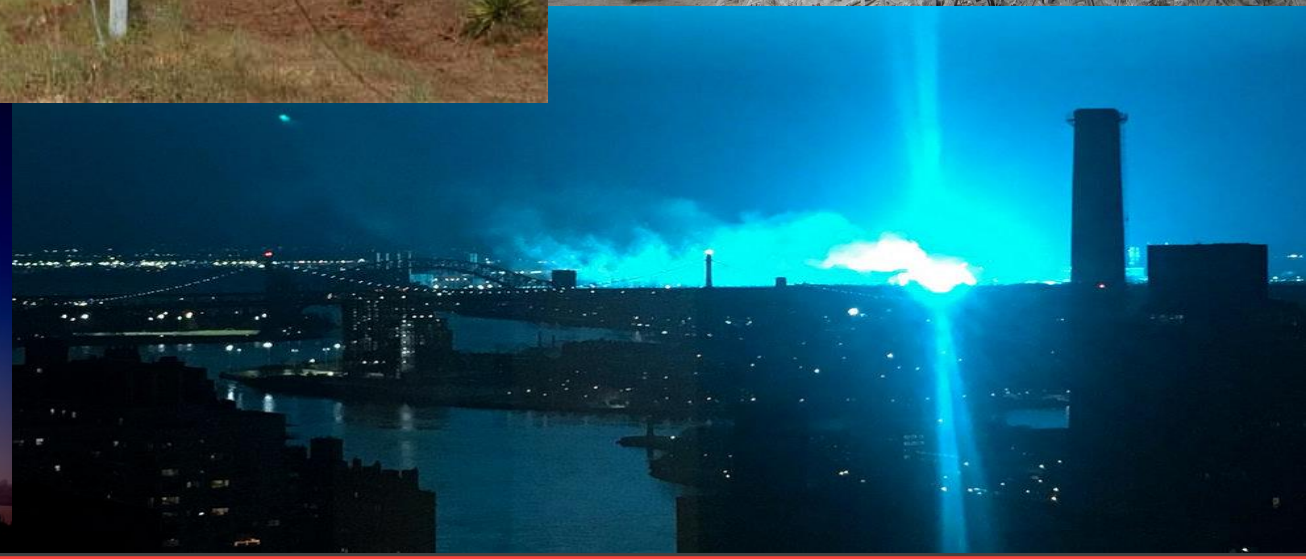
- ~50 Million people in US and Canada without Power
- Violation of NERC Operating Procedures
- Cascading effect on other utilities, such as water
- 4.3 Million people in Detroit area without water service for 4+ days

Various Cybersecurity Attacks

- Internet of Things (20 Billion Devices by 2020)
- Industrial Control Systems such as SCADA increase vulnerability
- Hackers, Malware, Viruses (Trojan, Worm, Dragon)
- US Utilities plan to spend $7+ Billion on Cybersecurity by 2020

Vulnerabilities and Threats to the Power Grid





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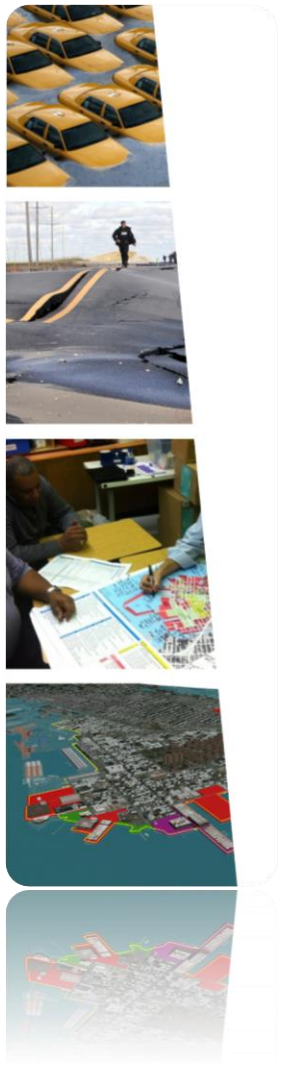

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WSP's RESILIENCY INITIATIVES

Best Practices v. Practical Alternatives

Simple Solution

- ✓ Raise all Critical Equipment above 500yr Design Flood Elevation / Localized Walls
- ✓ Provide 100% Backup Emergency / Standby Power Generation w/ 7 day Fuel Supply
- ✓ Build a coastal flood wall to protect areas prone to inundation
- ✓ Utilize deployable flood barriers prior to event to provide localized protection of critical equipment.

$$$ & Real Estate Make these Solutions Impractical

Best Practices v. Practical Alternatives

More Realistic Design Challenges

- ✓ Re-distribution of critical electrical loads to limit amount of standby or islanded power generation required (load shedding schemes)
- ✓ Wet vs. Dry flood proofing
- ✓ Upgrade to Submersible Pumps
- ✓ Re-purposing valuable real estate to accommodate on-site generation and electrical distribution above design flood elevations (DFE)
- ✓ Updates to Emergency Operating Plans / Procedures
- ✓ Effects on the surrounding properties

Best Practices v. Practical Alternatives

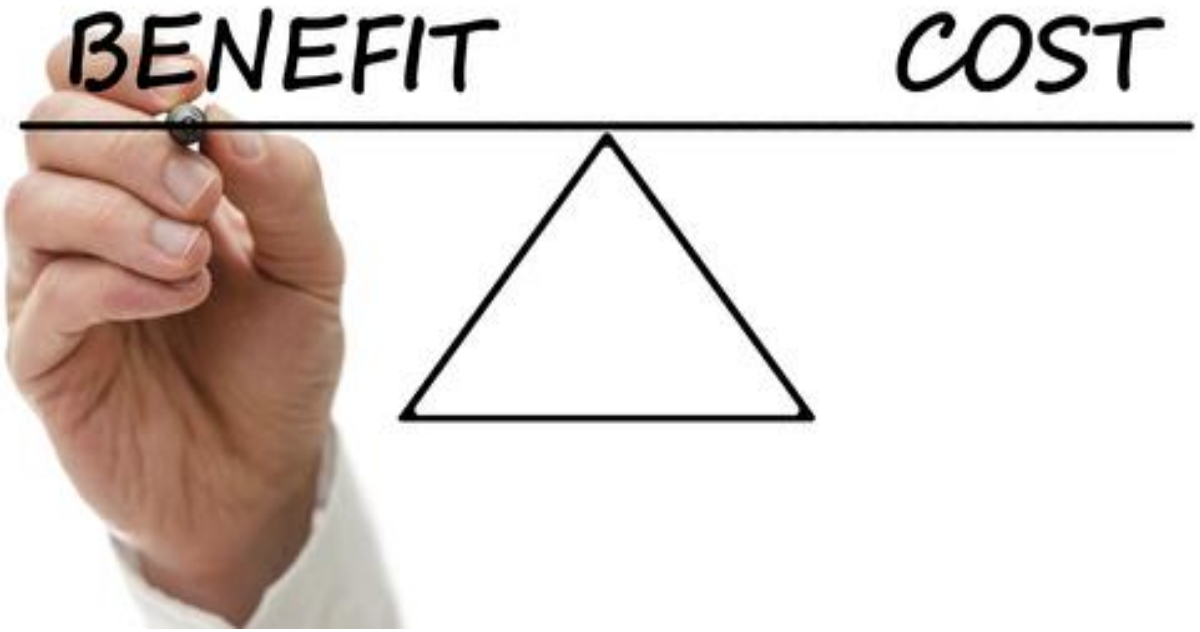
Understanding Electric Utilities Resiliency / Mitigation Plans

- ✓ Close coordination with local electrical distribution utility to understand their current plans for resiliency / mitigation
  - Since 2005 Florida Power & Light has invested nearly $3 Billion in making its energy systems “smarter, stronger and more storm-resilient”
  - Improving infrastructure rather than simply restoring it to it’s previous storm following an event
  - Undergrounding of distribution system; replacement of wood poles with concrete/steel; increasing wire sizes; redundant services to critical end users

Best Practices v. Practical Alternatives

Benefit-Cost Analysis

- ✓ Method by which the future benefits of a hazard mitigation project are determined and compared to its cost.
- ✓ Numerical expression of the "cost effectiveness" of a project. Ratio >1.0
- ✓ Mitigation capital costs compared to estimated damage/restoration costs, operational losses, claims, etc.



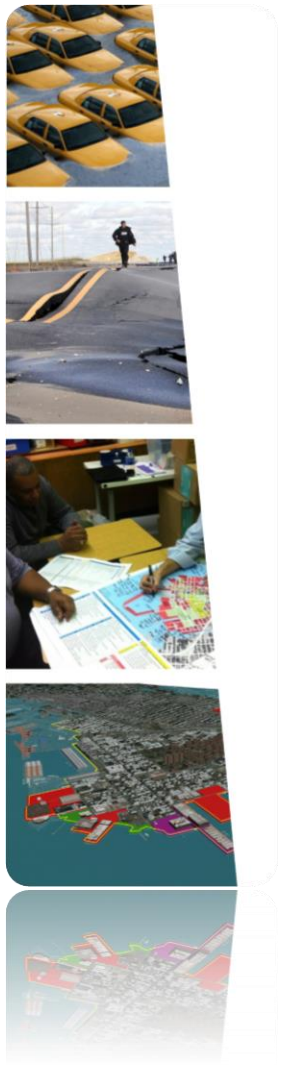
Best Practices v. Practical Alternatives

Updated Codes / Standards

Changes to design standards, construction guidelines and associated codes are required to adapt to the changing environment

- ✓ International Building Code (IBC)
- ✓ Local Jurisdiction Codes, such as Florida Building Codes
- ✓ National Fire Protection Agency (NFPA)

Concepts



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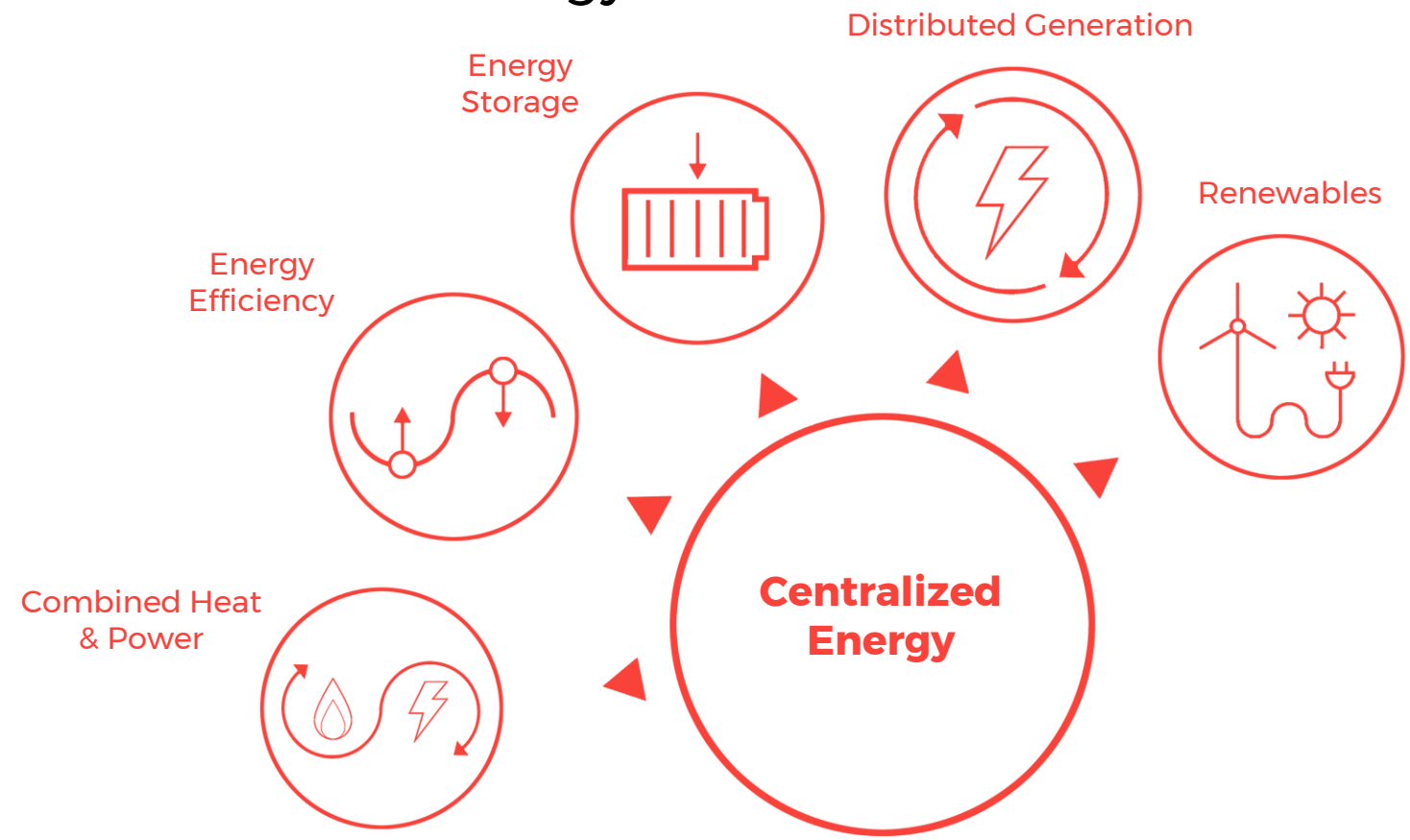
WSP's RESILIENCY INITIATIVES

Technology / Market Trends

Centralized energy supply is giving way to distributed technology, providing business with smart, secure and affordable solutions to the energy challenges they face today.

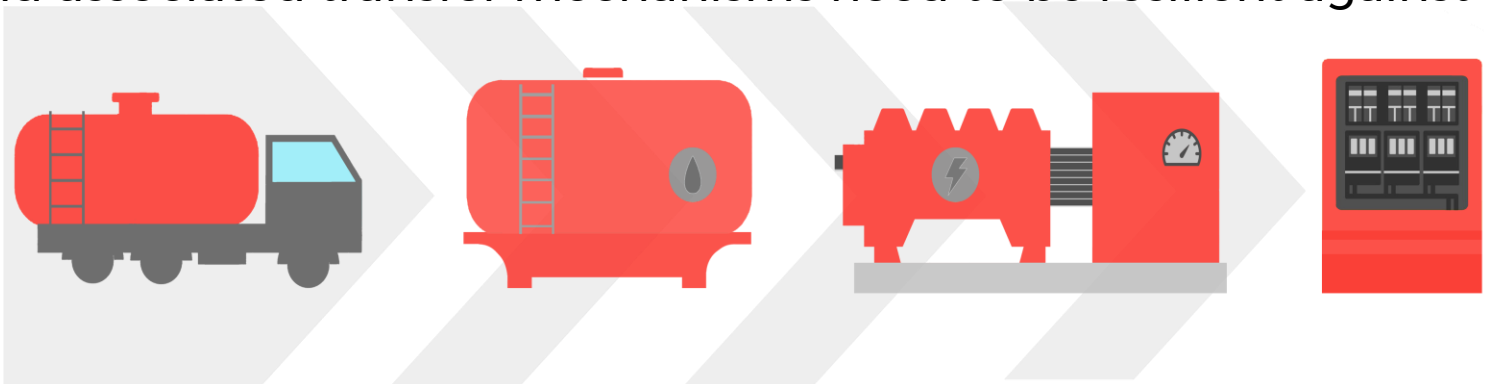


Technology / Market Trends

Conventional Backup Power Supply

Trending away from conventional diesel fuel oil emergency / standby power

- Emergency / Standby Power is limited in size and connected loads to maintain proper operations during a prolonged utility outage;
- Longer duration outages, require dependencies on fuel oil supply, which can become scarce following disasters;
- Requirements for additional on-site fuel oil storage (space, permitting, capital costs, etc.);
- Fuel oil storage and associated transfer mechanisms need to be resilient against natural disasters

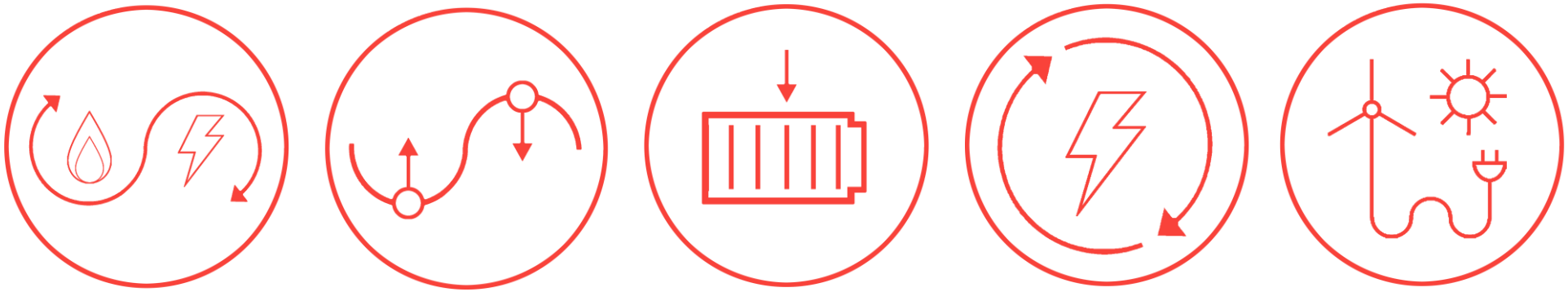


Technology / Market Trends

Distributed Energy Resources, interconnected or islanded from the utility grid are becoming more prevalent as a reliable source of power generation and distribution.

Benefits

- Decentralize;
- Modular and more flexible technologies;
- Located close to the loads they serve.



Distributed Energy Resources

Modes of Operation:

- Grid Independent (Complete Island)
- Grid Interconnected (Standby / Buy-Back)
  - Island Mode w. Black Start Capabilities
  - Potential revenue streams available

Various Types of Distributed Generation

- Gas Reciprocating Engines
- Gas/Steam Turbines
- Fuel Cells
- Microturbines
- Solar/PV
- Wind
- Battery Storage

Combined Heat & Power (CHP)

Engines are almost twice as efficient as traditional generation; utilize captured heat on-site for critical operations and processes; and create a more efficient and resilient energy state.

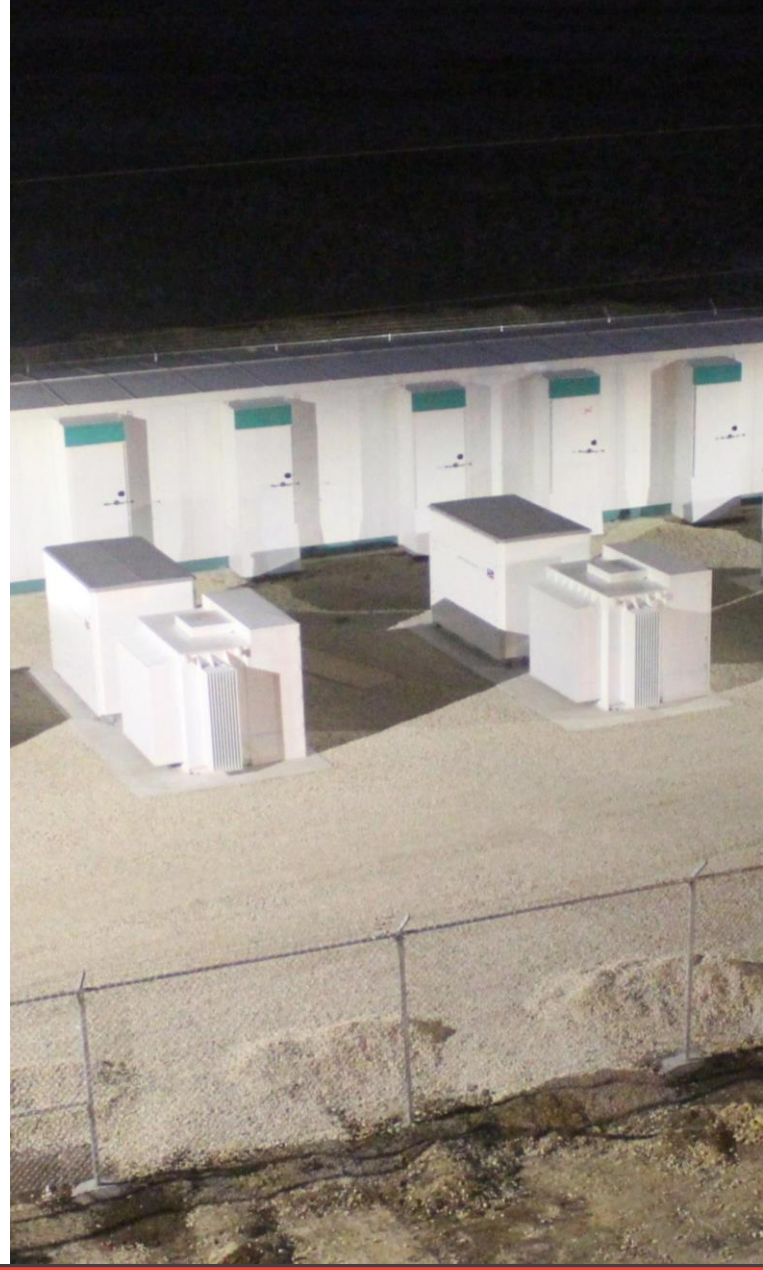
- Requirement for black start capabilities to operate in island mode upon utility outage.
- Use of heat recovery in the form of heating (process loads, domestic hot water, heat) or cooling (absorption chillers) to increase efficiency of unit compared to convention power generation.
- Biogas, Digesters, Effluent Heat Pumps

Technology / Market Trends

Energy Storage

Fully scalable, rechargeable, can be utilized to create a revenue stream and help meet carbon emission targets.

- Ensures your organization keeps running in the event of loss of power, zero impact transition
- Storage of on-site power to use later (i.e. peak periods to reduce demand)
- Improve the flexibility of on-site renewables (if applicable)
- Access financial incentives using stored power to assist the grid balance (i.e. demand response, frequency response, etc.)
- Limit the need for enhanced grid connections and create an independent energy system.

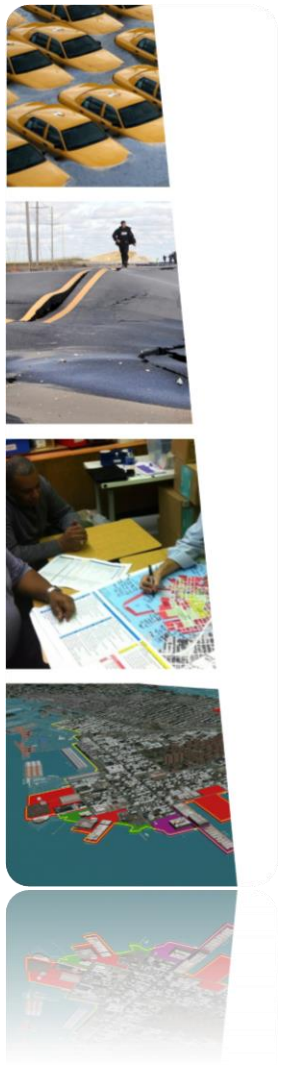


Technology / Market Trends

Development of Microgrids, utilizing on-site distributed generation assets and associated electrical distribution networks to interconnect critical infrastructure to operate in an island mode upon utility failure.

Benefits	Challenges
Improved electrical reliability and enhances resiliency	State/Utility regulation and policy
Lower energy costs and carbon footprint	Single Point of Common Coupling with the Utility
Improved community well being	Easements, ROW
Brings economic value to society	Controls / Security

Concepts



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TECHNOLOGY / MARKETS TRENDS FOR ENERGY RESILIENCY

POTENTIAL / SIMILAR FUNDING STREAMS

WSP's RESILIENCY INITIATIVES

Potential / Similar Funding

New Jersey Distributed Generation Coalition, supported the efforts for state legislation to create the *NJ Energy Resilience Bank* administrated by NJ Economic Development Authority and funded with $200M for distributed energy projects for Water/Wastewater and Hospital applicants.

- Established to minimize impacts of future major power outages and increase energy resiliency;
- Financing through the bank is used to develop or enhance distributed energy resources at critical facilities;
- CHP requires an annual system efficiency of at least 65%;
- Must be able to disconnect and operate independently of the electric grid and have blackstart capability.
- Applications submitted for eligibility are reviewed and scored on the following categories: Technical; Low/Moderate Income Area Benefit; Most Impacted Communities; Readiness to Proceed; Criticality; Microgrid; Facility Energy Efficiency

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

NEW JERSEY ENERGY RESILIENCE BANK

Building a solid foundation for the future

NEW JERSEY ECONOMIC DEVELOPMENT AUTHORITY

Similar Funding

US Department of Housing & Urban Development

Community Development Block Grant Disaster Recovery (CDBG-DR)

National Disaster Resilience (NDR) and Rebuild by Design

Connecticut was one of 13 grantees across the region being provided funding through US DOH National Disaster Resilience Competition (NDRC) to advance resilience planning and implementation in the Sandy-affected region of the state.

- $35.6M allocated to City of Bridgeport Eastern South End Storm Surge Protection
    - Includes a district energy / microgrid component within the project

Similar Funding

Federal / State / Local / Utility Incentive Programs

Connecticut

Under Public Act 12-148, Section 7, Connecticut created a ***Microgrid Program*** to help support local distributed energy generation for critical facilities. Critical facilities, as defined by Public Act 12-148, Section 7 are "any hospital, police station, fire station, water treatment plant, sewage treatment plant, public shelter or correctional facility, any commercial area of a municipality, a municipal center…" Grants under this program are not to exceed $15 million each year.

New York

The ***NY Prize Competition*** is administered by NYSERDA, with support from the Governor's Office of Storm Recovery, to support community grid planning and development. NY Prize offers support for feasibility studies (Stage 1) - $100K provided to 83 project; audit-grade engineering design and business planning (Stage 2) - $1M provided to 11 projects; and project build-out and post-operational monitoring (Stage 3).

Similar Funding

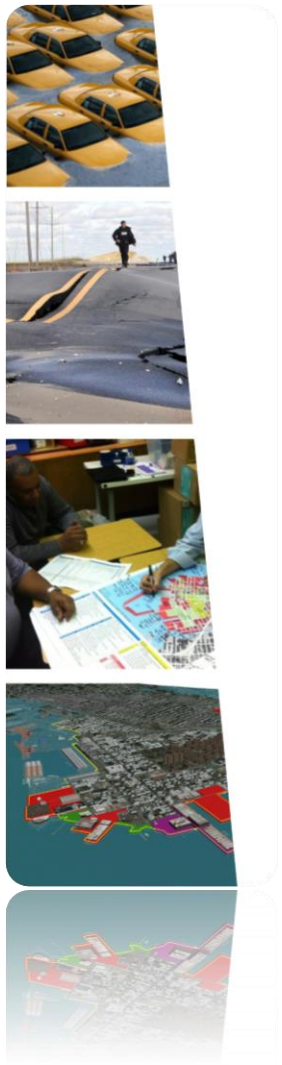
State Legislation / Initiatives – Florida

HB 1133/SB 1888: Energy Security and Disaster Resilience Pilot Program
Provides for issuance of grants to offset costs relating to onsite solar storage systems for certain facilities located in areas of critical state concern
3-10-18: Died in Energy and Utilities Subcommittee and Appropriations Subcommittee on the Environment and Natural Resources

CS/SB 1586: Energy Grid
Energy Grid; Requiring the Public Service Commission to hold public hearings to determine a disaster preparation and energy grid improvement plan for each public utility; requiring the commission to issue orders for the public utilities to implement their plans, etc.
3-10-18: Died in Regulated Industries

Center for American Progress and the CLEO Institute recommend that state leaders create a ***"Florida Future Fund."*** This state fund would use a blend of public and private investment—as well as financing products—to support innovative transportation and energy infrastructure projects and flood protections in areas that need them the most. The fund would provide low-interest or interest-free loans, loan guarantees, and other financing products.

Concepts



RESILIENCY DEFINED

VULNERABILITIES AND THREATS TO THE POWER GRID

BEST PRACTICES vs. PRACTICAL ALTERNATIVES TO ENERGY RESILIENCY

TECHNOLOGY / MARKETS TRENDS FOR ENERGY RESILIENCY

POTENTIAL / SIMILAR FUNDING STREAMS

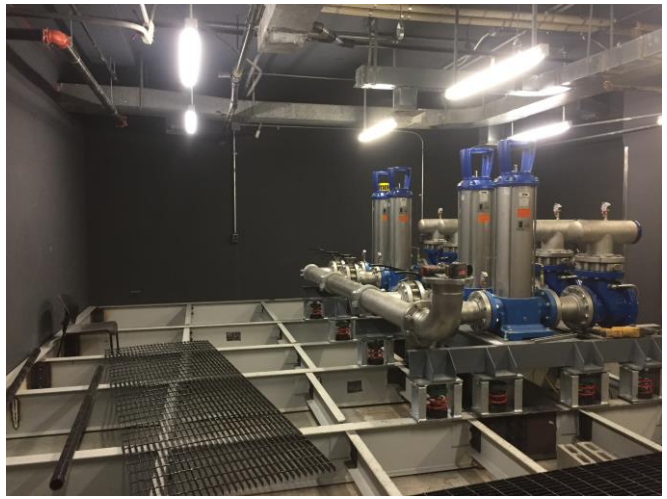
WSP's RESILIENCY INITIATIVES

WSP's Resiliency Initiative

WSP has been providing resiliency services for decades. This initiative provides an integrated framework for our various resiliency services.

Mission: "Creating resilient infrastructure, cities, organizations, and systems through an integrated multidisciplinary approach."

Bellevue Hospital – Largest Level 1 Trauma Center in NYC



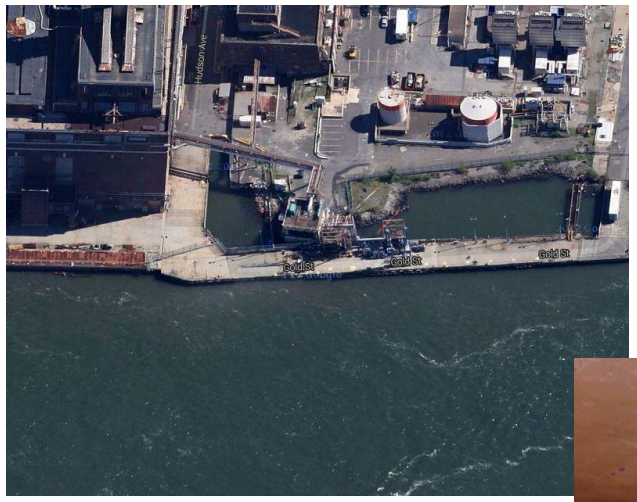
Replacement / Relocation of Domestic Water Pumping System to above 500yr DFE

Portable/Mobile Fuel Oil Transfer Pumps
Submersible Fuel Oil Transfer Pumps

Replacement / Relocation of On-Site Power Generation to above 500yr DFE

Portable/Mobile Domestic Water Pump

Con Edison – Utility Storm Hardening



Replacement / Relocation of Critical Infrastructure to above 500yr DFE

Storm Hardening of Gas / Electric Transmission Tunnels / Head Houses