2017 – THE YEAR OF THE HURRICANE

Gary Ladman

Vice President – Underwriting, Property

AEGIS Insurance Services, Inc.

Jim Vacek

Director of Insurance Risk Management

CenterPoint Energy, Inc.

Joshua Fleischer

Vice President – Loss Control Property Operations

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2017 – THE YEAR OF THE HURRICANE

Significant Events of 2017

- The Great American Solar Eclipse
- Houston Astros win the World Series for the first time
- Best year ever with highest surplus in AEGIS history
- The year of the hurricanes

2017 – THE YEAR OF THE HURRICANE

2017 Summary

Type of Storm	Name	Dates
Tropical Storm	Arlene	April 19 – 21
Tropical Storm	Bret	June 19 – 20
Tropical Storm	Cindy	June 20 – 23
Tropical Storm	Don	July 17 – 18
Tropical Storm	Emily	July 31 – August 1
Hurricane	Franklin	August 6 – 10
Hurricane	Gert	August 13 – 17
Major Hurricane	Harvey	August 17 – 31
Major Hurricane	Irma	August 30 – September 12
Major Hurricane	Jose	September 5 – 22
Hurricane	Katia	September 5 – 9
Major Hurricane	Lee	September 15 – 30
Major Hurricane	Maria	September 16 – 30
Hurricane	Nate	October 4 – 9
Major Hurricane	Ophelia	October 9 – 15
Tropical Storm	Philippe	October 28 – 29

2017 – THE YEAR OF THE HURRICANE

Overview

- Hurricane season in the Atlantic and Gulf coasts typically runs from June 1 through November 30
- The Atlantic hurricane season most active August through September with a peak at September 10
- 2017 was one of four Atlantic seasons to produce ten storms in a row that reached hurricane strength
  - Franklin to Ophelia
  - Five of these hurricanes occurred in September
  - On September 8 there were three active hurricanes
    - Irma
    - Jose
    - Katia

2017 – THE YEAR OF THE HURRICANE

Overview

- Hurricane strength is measured with Accumulated Cyclone Energy (ACE) values
- Until 2017 no entire season had more than two storms with values higher than ACE 40
- 2017 set a new record with three storms exceeding ACE 40
  - Irma – ACE 67
  - Jose – ACE 45
  - Maria – ACE 42

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2017 – THE YEAR OF THE HURRICANE

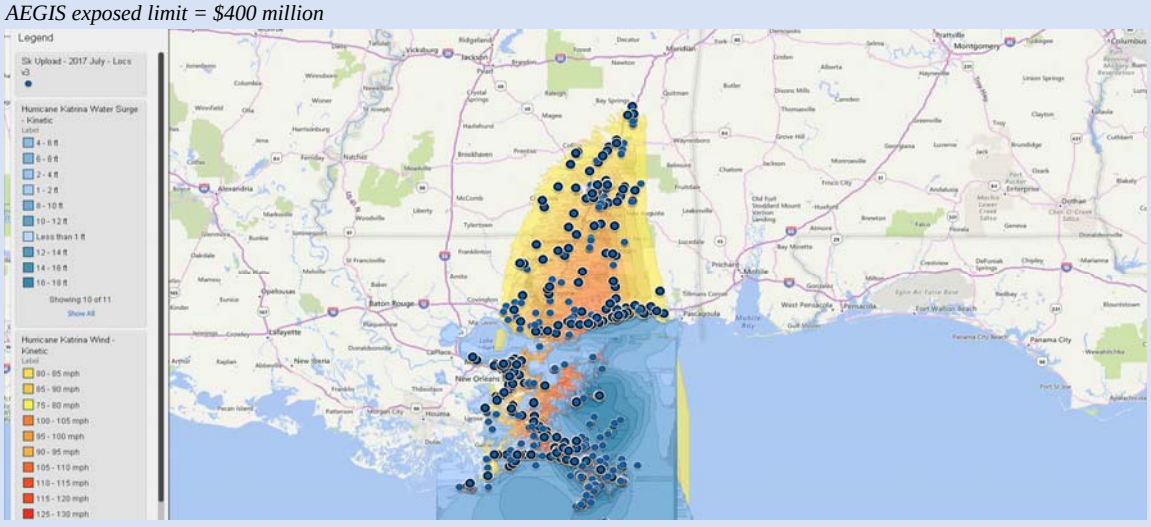
Statistics

- Number of storms, including depressions: 18
- Number of named storms (sustained wind speed of at least 39 mph): 17
- Number of hurricanes (sustained winds of 74 mph): 10
- Number of major hurricanes (CAT 3 or stronger): 6
- Total fatalities: 464
- Estimated total damages: $316 billion

KATRINA WIND AND SURGE FOOTPRINTS AND AEGIS MEMBER LOCATIONS

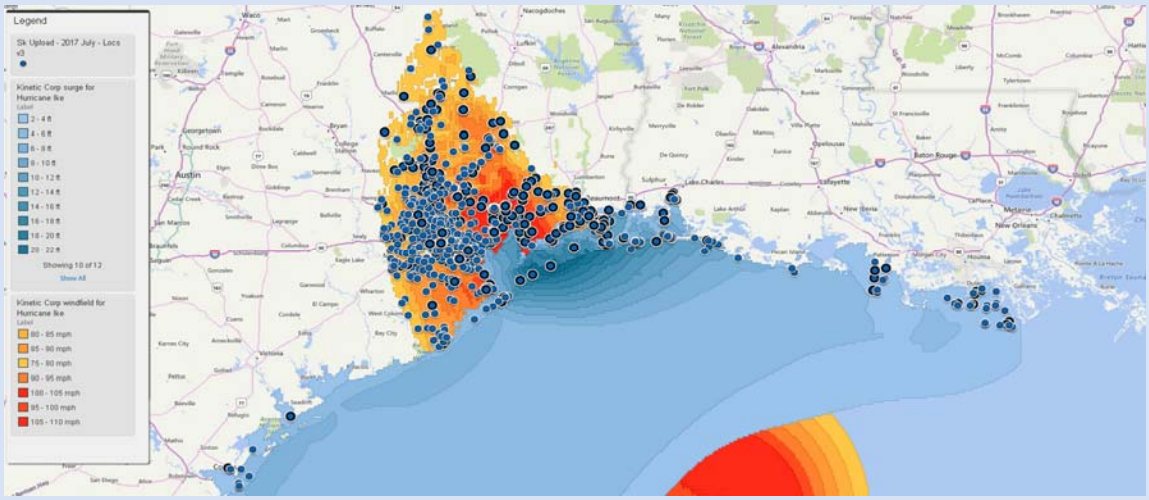
August 23-31, 2005

AEGIS exposed limit = $400 million



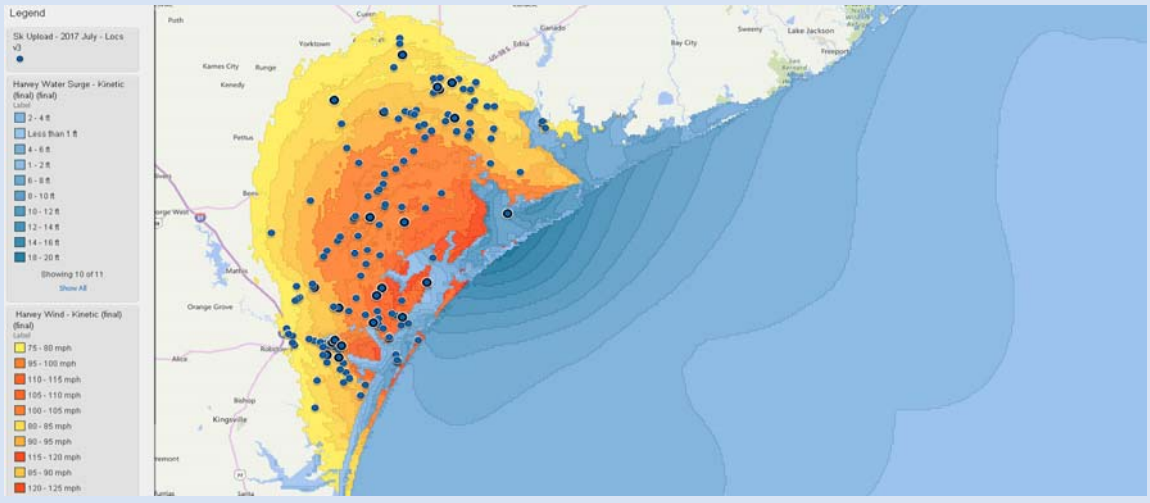
IKE WIND AND SURGE FOOTPRINTS AND AEGIS MEMBER LOCATIONS

AEGIS exposed limit = $1 billion



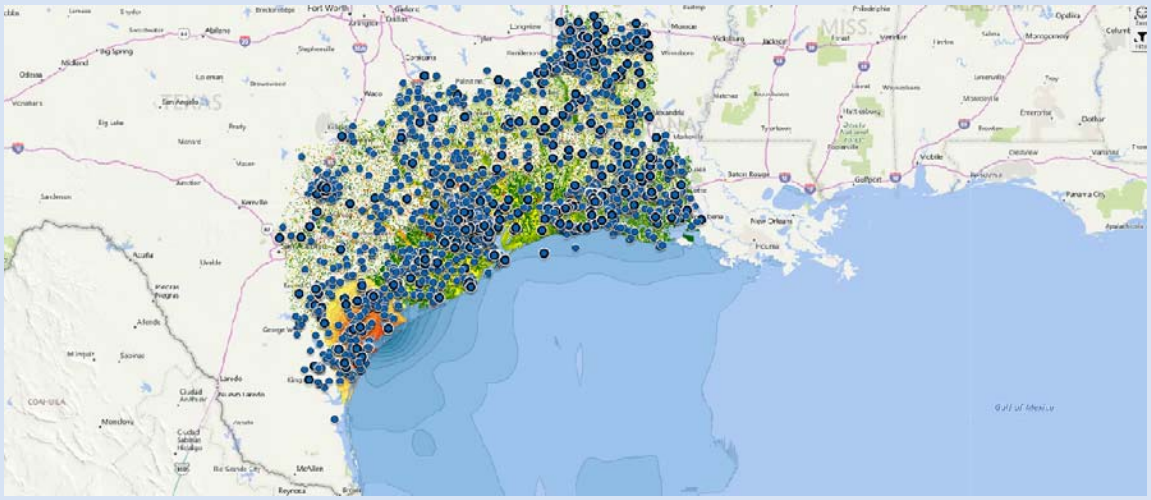
HARVEY WIND AND SURGE FOOTPRINTS AND AEGIS MEMBER LOCATIONS

AEGIS exposed limit = $690 million



HARVEY WIND AND SURGE FOOTPRINTS AND AEGIS MEMBER LOCATIONS

AEGIS exposed limit = $1.14 billion



2017 – THE YEAR OF THE HURRICANE

Harvey

- Harvey was identified as a potential hurricane in late August
- Was a weak storm until it reached Bay of Campeche off coast of Mexico
- Rapidly intensified – reached hurricane status August 24; become a Category 4 on August 25
- Made landfall in US on August 26
  - First Category 4 hurricane to make landfall since Charley in 2004
  - First hurricane to hit Texas since 2008
  - Remained a named storm for 117 hours (five days) after landfall
    - Previous longest named storm was 54 hours (Fern, 1971)
  - Stalled over Southeastern Texas for two days as a tropical storm

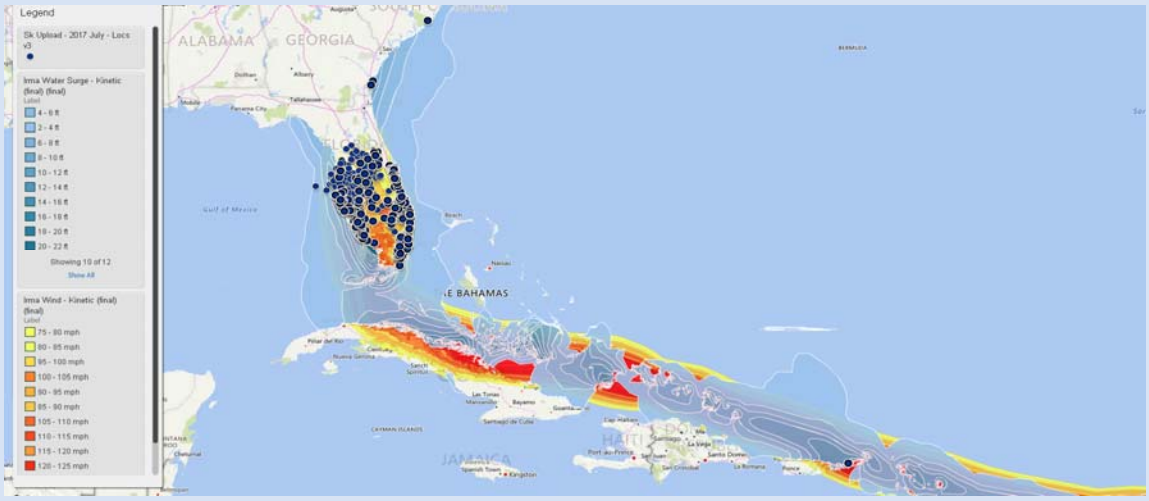
2017 – THE YEAR OF THE HURRICANE

Harvey

- Set a rainfall record of more than 60 inches of rain in Nederland, Texas
- Set a rainfall record for Bush International Airport with a one-day total of 24.44 inches
- Created record flooding and spawned many tornados around Houston area
- Most of the floods occurred in areas not classified as flood zones

IRMA WIND AND SURGE FOOTPRINTS AND AEGIS MEMBER LOCATIONS

AEGIS exposed limit = $750 million



2017 – THE YEAR OF THE HURRICANE

Irma

- Irma made first landfall on Barbuda September 6
  - Destroyed 95% of structures on the island
  - Continued to gain strength and battered more Caribbean islands
  - The strongest hurricane to ever impact the Leeward islands
  - On September 8 made landfall in Cuba as a Category 5 storm (first since 1924)
  - Wind speed reached 160 knots (strongest ever for an Atlantic hurricane outside the Gulf or Caribbean)
  - Maintained 160 knot wind speed for 37 hours – previous record was 24 hours in 2013

MARIA WIND AND SURGE FOOTPRINTS AND AEGIS MEMBER LOCATIONS

AEGIS exposed limit = $92 million

2017 – THE YEAR OF THE HURRICANE

Maria

- Made landfall in Dominica on September 18 as a Category 5 storm
- Strongest storm ever to strike Dominica
- Landfall on Puerto Rico on September 20
  - First Category 4 storm to hit Puerto Rico in 85 years
  - Storm then tracked northeast causing damage in the Dominican Republic and Haiti
  - Weakened and went by Outer Banks of North Carolina on September 26

CAT LOSS SUMMARY

US $ millions

	Event	Gross	Ceded	Net
Group	Harvey	89.0	67.0	22.0
	Irma	49.0	30.5	18.5
	Maria	21.0	6.8	14.3
	Wildfires	35.0	30.0	5.0
	Mexican earthquake	9.0	1.0	8.0
	Total	**203.0**	**135.3**	**67.8**
AEGIS US Mutual	Harvey	45.0	37.0	8.0
	Irma	10.0	7.5	2.5
	Maria	5.0	3.8	1.3
	Wildfires	35.0	30.0	5.0
	Total	**95.0**	**78.3**	**16.8**
AEGIS London	Harvey	44.0	30.0	14.0
	Irma	39.0	23.0	16.0
	Maria	16.0	3.0	13.0
	Mexican earthquake	9.0	1.0	8.0
	Total	**108.0**	**57.0**	**51.0**

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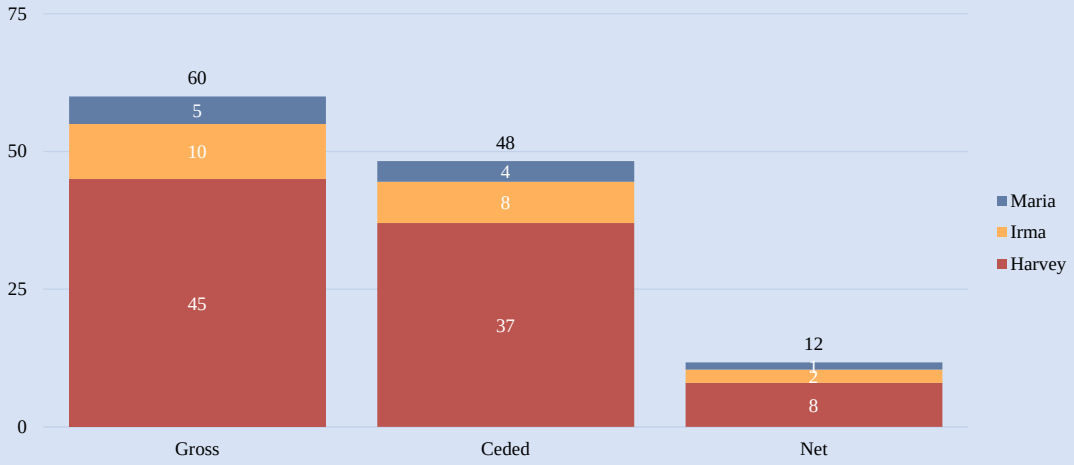
HURRICANE LOSS SUMMARY

US $ millions



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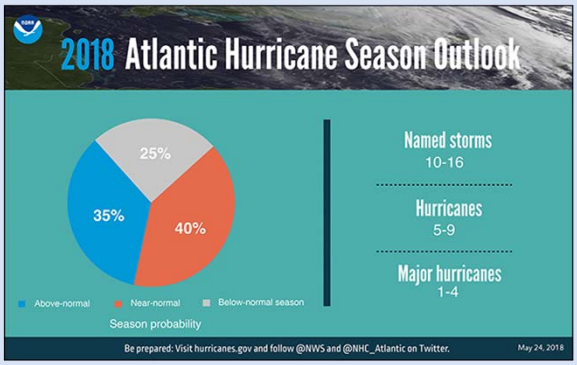
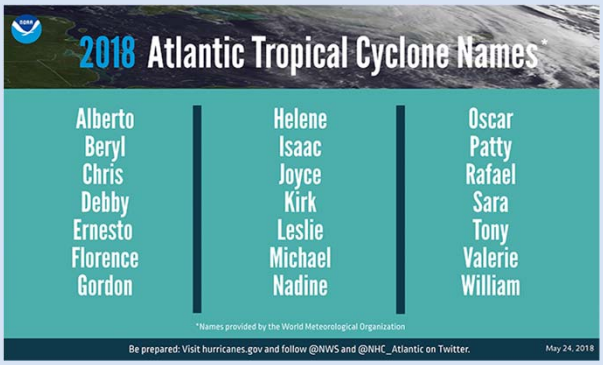
2017 – THE YEAR OF THE HURRICANE

A Look Ahead





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2017 – THE YEAR OF THE HURRICANE

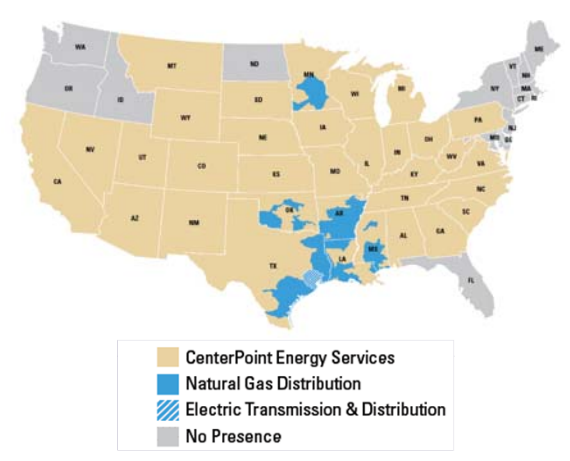
Jim Vacek

Director of Insurance and Risk Management

CenterPoint Energy, Inc.

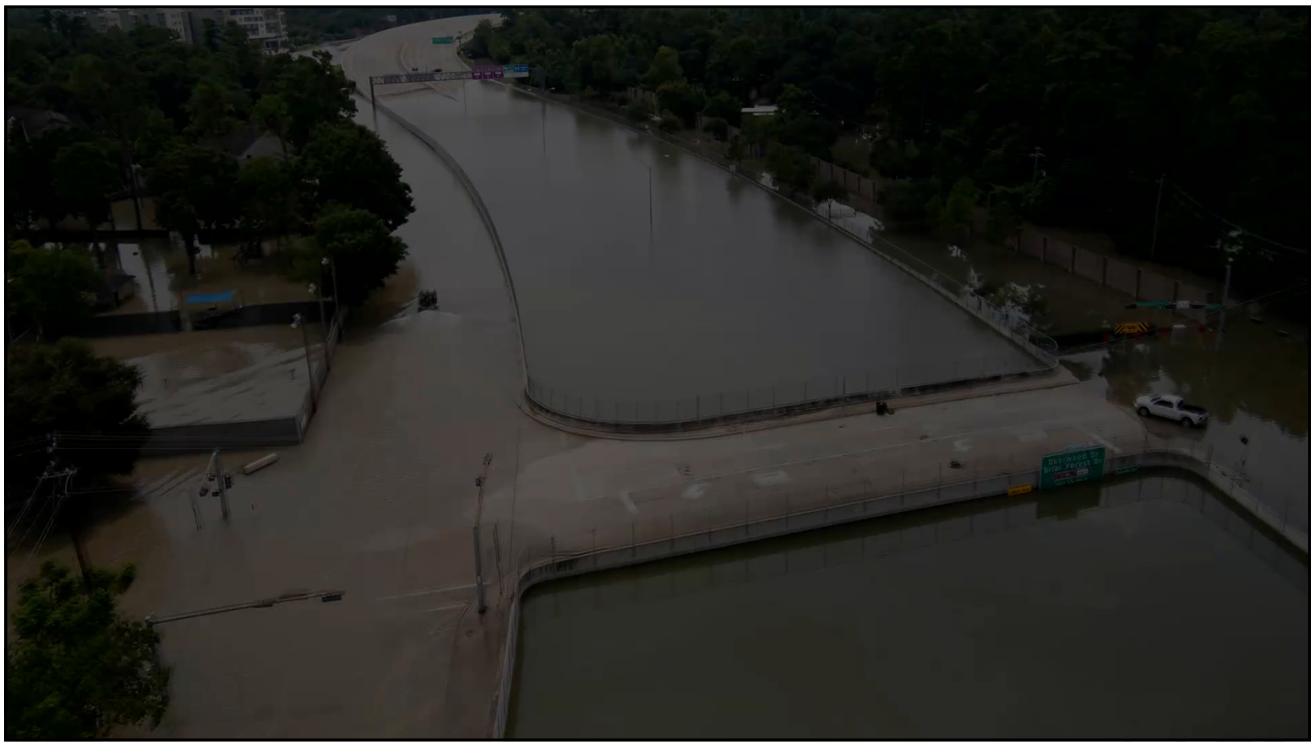
ABOUT CENTERPOINT ENERGY

Vision: Lead the Nation in Delivery of Energy, Service, and Value



[1] As of Dec 31, 2015 per EEI and AGA

- Electric transmission & distribution
  - Electric utility operations with ~2.4 million metered customers across ~5,000 square miles in and around Houston, Texas
  - 19th largest US investor-owned electric utility by customer base[1]
  - 88,636,000 MWh delivered in 2017
- Natural gas distribution
  - Regulated gas distribution jurisdictions in six states with ~3.5 million customers
  - 6th largest US gas distribution company by customer base[1]
  - Delivered 412 bcf of natural gas in 2017



ADVANCED PREPARATIONS

Emergency Operations Plan

- An annual Emergency Operations Plan (EOP) drill is conducted to test CNP's emergency response
- Our EOP is coordinated with state and local officials
- Works within a mutual assistance network which allows CNP to provide / receive assistance to / from other utilities across the country following natural disasters
- Contracts for fuel, lodging, and materials are executed in advance

HURRICANE HARVEY TIMELINE

Preparation	Outreach	EOP	Harvey makes landfall	Resources	Operations	Employee assistance	Status
Aug. 22, 2017	**Aug. 23, 2017**	**Aug. 24, 2017**	**Aug. 25, 2017**	**Aug. 26, 2017**	**Aug. 26-Early Sept., 2017**	**Sept. 1, 2017**	**Sept. 7-8, 2017**
Electric and gas operations, logistics, fleet, service centers, and facilities made preparations Began posting storm readiness tips and safety information on social media	Regulatory and government relations worked with officials News release distributed on hurricane preparedness Email to employees on preparedness	Electric and gas operations activate EOP Media interviews Published social media messages on preparedness and safety Increase in employee messages EOP assignments	Harvey made landfall as a Category 4 hurricane near Port Aransas, Texas Over the next five days, Harvey dropped more than 50" of rain across the service territory	Activated Incident Command Center Issued news release on damage assessment and restoration update First wave of mutual assistance crews for gas and electric ops	Electric operations built a mobile substation to restore service to the Memorial area Gas operations helped the city of Beaumont address a breach in the pipeline under the Neches River	CNP announced Employee 1st Fund to support impacted employees CNP announced $1.25 million to assist Harvey recovery	Electric ops. resumed normal operations for most employees on Sept. 7 Gas ops resumed normal operations on Sept. 8 A corporate response team was established to manage ongoing issues

HURRICANE HARVEY

A Record-Breaking Storm

After making landfall as a Category 4 storm near Port Aransas, Texas, Hurricane Harvey stalled, impacting south Texas, southeast Texas, and Louisiana for days

Maximum sustained winds were **130 mph** at landfall

51.88 inches of rainfall in Houston, Texas, breaking the single-storm record of 48 inches set in 1978 and more than the 10-year annual average

More than **42,000** lightning strikes across the electric service territory

Hurricane Harvey spawned tornadoes in southeast Texas, Louisiana, Alabama, Mississippi, Tennessee, and North Carolina

RESTORATION PRIORITY

Restore Power Safely and Efficiently

1. Restore service to key facilities vital to public safety, health and welfare, and secure downed power lines
2. Repair major lines and fuses that restore power to the greatest number of customers
3. Repair transformers, which typically serve about ten customers each
4. Repair individual electric drops to homes

IMPACT OF GRID MODERNIZATION

Benefits of Advanced Metering System (AMS) and Intelligent Grid

- The SmartGrid allowed CenterPoint to quickly isolate problems on our grid and restore service to customers through those devices
  - Operated more than 250 of these devices during the event, impacting more than 140,000 customers
  - Able to avoid almost 41 million outage minutes for CNP customers

IMPACT OF GRID MODERNIZATION

Benefits of Advanced Metering System (AMS) and Intelligent Grid

- AMS meters increased efficiency during the storm
  - Executed 45,000 orders remotely at 97% performance
  - Billed 700,000 accounts with actual readings at 98.9% performance
  - Executed remote turn off / on for safety reasons
- Use of real-time analytics to assess, monitor, and resolve cases
  - Aided in developing better situational awareness
  - Correlated weather and flooding information with outages to provide critical decision-making tools
  - 1.27 million customers impacted. Restored an average of 5,300 customers per hour

USE OF TECHNOLOGY DURING THE STORM

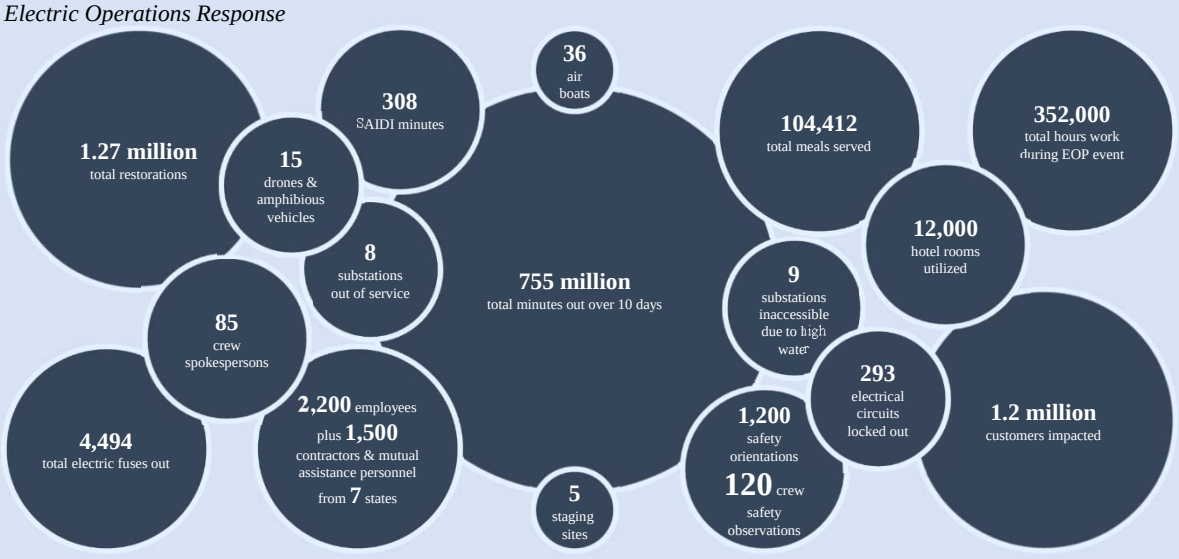
- Drones helped to assess damage and evaluate working conditions
  - More than 500 locations were tracked using 15 drones
  - Enabled real-time situational awareness, accelerating restoration assessments
  - Allowed CNP to efficiently direct crew to accessible locations
  - Infrared capabilities helped identify equipment that needed further inspection

USE OF TECHNOLOGY DURING THE STORM

- Mobile data on each crew kept outage management efficient
- Ability to use Power Alert Service (PAS) to keep customers informed
  - AMS meters provide outage information that enables predictive analytics engines to supply data to PAS and IVR systems, ultimately allowing for better, more detailed customer updates

HARVEY BY THE NUMBERS

Electric Operations Response



HURRICANE HARVEY LOSSES

Electric Operations

Loss Category	Total Value of Loss
Substations	$6,625,750
Major underground vaults	$11,310,975
Facilities	$762,242
Fleet	$149,757
Environmental clean-up	$1,494,501
Telecommunications	$103,799
Computer equipment	$7,168
Extra expense	$99,415,665
T&D within 1,000 feet	TBD
Transmission roads	$1,000,000
Total	**$120,869,857**

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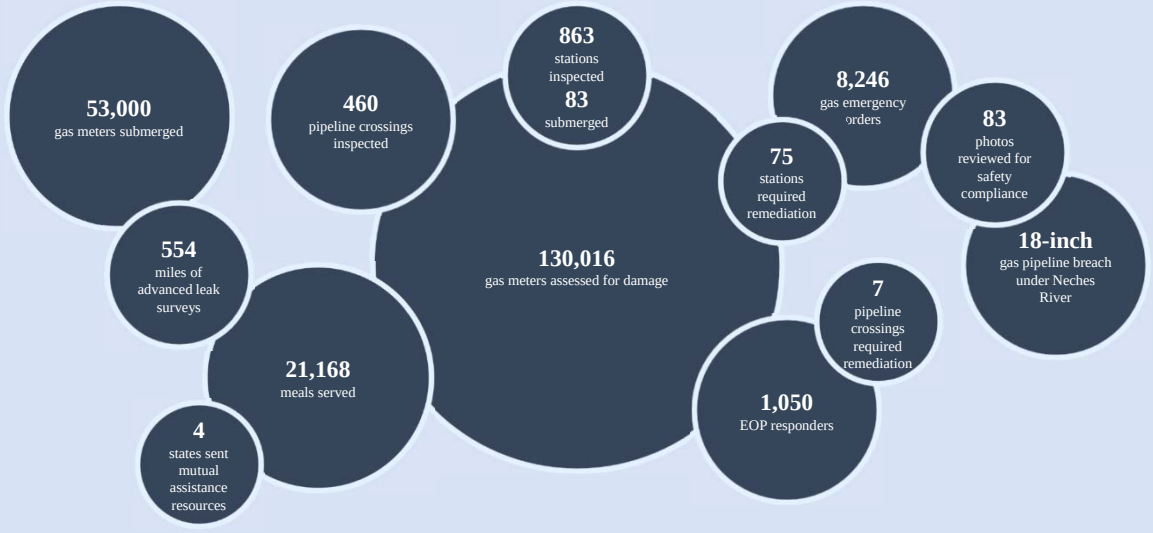
HARVEY BY THE NUMBERS

Gas Operations Response



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HURRICANE HARVEY LOSSES

Gas Operations

Loss Category	Total Value of Loss
Gas meter replacement	$13,608,591
Pipeline crossings	$2,736,476
Facilities	$252,379
Fleet	$135,195
Environmental clean-up	$17,002
Extra expense	$9,836,469
Total	**$26,586,112**

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HARVEY BY THE NUMBERS

Customer Service Response

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LESSONS LEARNED

Hurricane Harvey

- What worked well
  - No significant employee safety incidents
  - Unmanned aircraft system surveillance program proved to be very successful
  - Use of social media to advise the public and employees
  - Successful deployment of multiple staging sites across CenterPoint operational footprint in difficult conditions

- Where we can improve
  - Continued development of the training program to deal with flooding situations
  - Considerations for additional flood protections around critical infrastructure
  - Consider acquiring boats and high-water vehicles for use in high water situations
  - Wireless capabilities at multiple locations limited the functionality of many first responders

LESSONS LEARNED

Future Considerations

Transmission

- Implement cascading tower design to prevent multiple pole failures
- Strategic replacement of all wooden H-frame structures with steel or concrete in conjunction with system upgrades

Substation

- Install flood walls and/or raising elevation of substation equipment in flood prone areas
- Increased investment in mobile substations

Distribution

- Increase size of poles in key locations and reduce span lengths to add strength to system
- Proactive replacement of broken, damaged, or loose down and span guy wires
- Increase pole inspections and vegetation management prior to hurricane season

Major Underground

- Large commercial transformer banks installed as pad mounted and no longer installed on poles
- Partner with key customers to relocate vaults above ground in flood prone locations (i.e. Texas Medical Center)

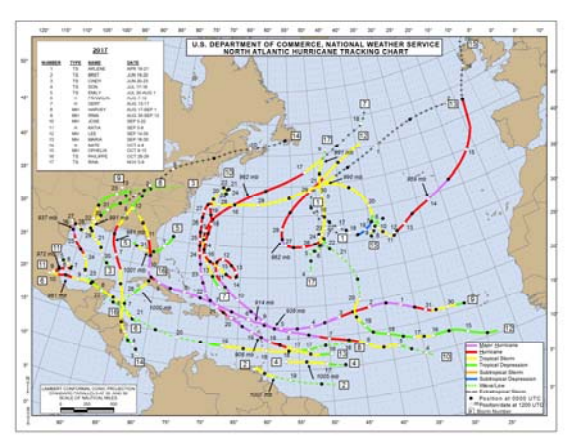
Joshua Fleischer

Vice President – Loss Control Property Operations

AEGIS Insurance Services Inc.

PROPERTY LOSS CONTROL

2017 Tropical Cyclones / Harvey



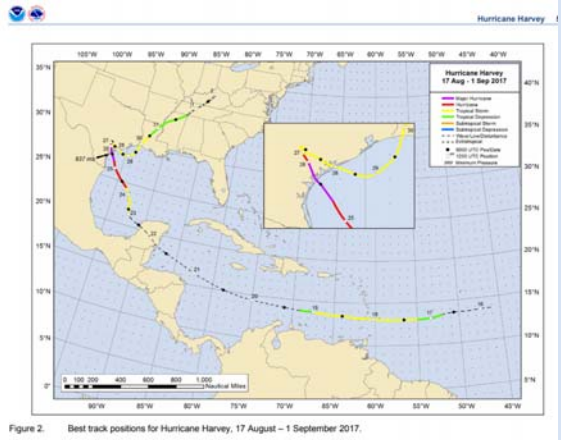


Figure 2. Best track positions for Hurricane Harvey, 17 August – 1 September 2017.

PROPERTY LOSS CONTROL

- Wind
- Water
- Lightning
- Loss of services

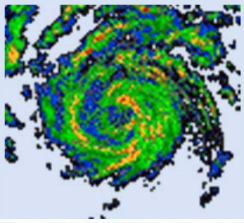
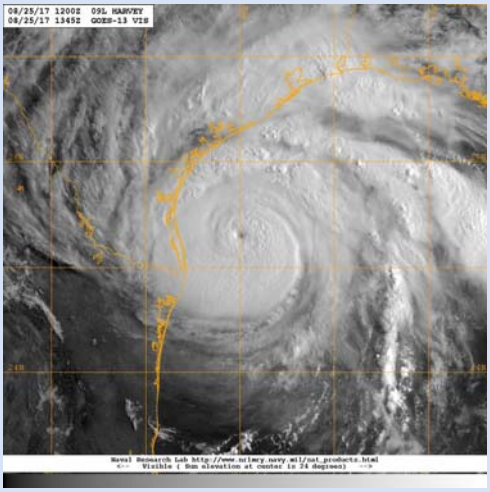
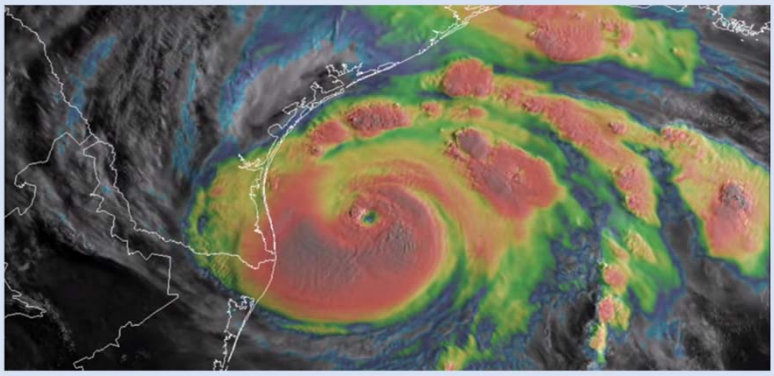


Figure 19. An example of the water rescues that were ongoing during Harvey in Houston on 27 August 2017. Photo credit David J. Phillip (Associated Press).



PROPERTY LOSS CONTROL

- Safety
- Communication
- Planning / mitigation
  - Design
  - Pre-storm
- Response / recovery



http://www.noaa.gov/media-release/forecasters-predict-near-or-above-normal-2018-atlantic-hurricane-season

PROPERTY LOSS CONTROL

- Planning / mitigation
  - Critical facilities list
  - Equipment design / hardening
    - Flood abatement walls
    - Drainage systems
    - Elevated equipment
    - Emergency operations
  - Pre-storm inspections

PROPERTY LOSS CONTROL

- Response / recovery
  - Plan for the expected and unexpected
  - Contingency plans
  - Test emergency plans / training
  - Periodically review / update emergency plans
  - Ensure proper inspection and testing prior to reenergizing assets

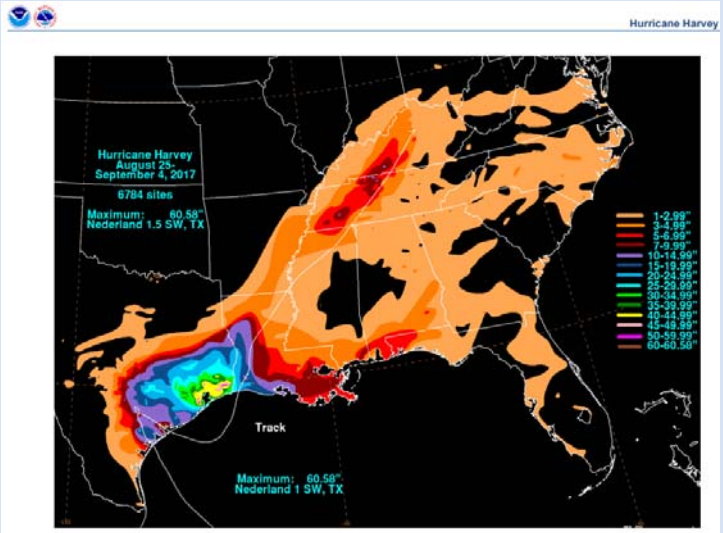


Figure 8. Observed rainfall totals (inches) in association with Harvey and its remnants. Figure courtesy David Roth (WPC).

PROPERTY LOSS CONTROL

Resources

- AEGIS Loss Control
- https://www.weather.gov/wrn/hurricane-preparedness
- https://community.fema.gov/AP_Login
- http://www.redcross.org/prepare/disaster/hurricane
- http://www.ready.gov/hurricanes
- http://www.nhc.noaa.gov/prepare/ready.php

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