CenterPoint. Energy	Criteria	Department:	Engineering Standards
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the existing pole does not pass, it will require replacement with a stronger appropriately sized wood or engineered pole.

Removals, or minor replacements/additions (such as fuses) or service poles will not require replacement with a new pole. Various heights of H1 and H2 wood poles have been added to the inventory and are available in DDS to alleviate the height transition and avoid up lift conditions.

5.2 Hardening for Cold Weather

CenterPoint Energy will utilize the existing Q09 delta/vertical tangent pole framing in areas experiencing problems with galloping conductors. This special tangent pole should be used for construction when any of the line segments are in an open area (not sheltered by buildings, trees, or other structures). A map showing the recommended areas for special tangent ice framing construction within CenterPoint Energy territory will assist designers and operations.

5.3 Non-Wood Engineered Structures

CenterPoint Energy evaluated alternate materials to provide options as EWL is adopted across the system. Use of non-wood, engineered materials in certain design situations will increase overall system resiliency.

The approved alternate materials, their material properties, and notable design features are listed below:

1. Concrete – Allows for higher strengths but has highest weight. Installation requires truck accessibility. In most cases, concrete poles are not field customizable and must be manufactured with known framing hole standard(s) in advance.
2. Ductile Iron (DI) – Also allows high strengths but weighs like wood poles. DI poles are field drillable and fully coated for corrosion protection. DI poles are preferred material for certain applications due to their ability to field drill for various configurations and the customization they offer. Due to the installation practices and weight, DI poles require less installation time and coordination.
3. Modular Fiberglass – These are modular, light weight, field customizable, and high strength but deflection is higher than other pole materials. Fiberglass pole modules can be carried by hand and allow for installations without a truck. Fiberglass poles are advantageous in difficult to access locations.

5.3.1 Equipment Poles Criteria

All new pole or equipment installation shall be designed to meet EWL criteria. If a designed wood pole with equipment could be accessed and installed in any easement situation with our existing field equipment, then the proposed design utilizing wood poles should be followed. In situations, where crews will be constrained in either accessing the easement, field equipment capabilities exceeded, or ease and efficiency in construction is achieved non-wood, engineered poles like fiber glass or ductile iron should be considered. The below installation guide is evaluated and recommended by engineering:

Installations to utilize ductile iron (All ductile iron installations will require PR and QR framing standards and fiberglass arms):

1. IGSD installations*
2. Regulator Racks (on exterior poles) *
3. Large Three-Phase Transformer Banks (3-250kVA and larger) *
4. Double Circuit Poles (Truck Accessible)

Installations to utilize fiberglass poles (All fiberglass installations can follow PR and QR framing standards):

1. Horizontal and Vertical Pole Top Switches **
2. Poles in inaccessible locations where we could not install our typical wood poles (as has been our recent practice)
3. Capacitor Banks
4. Three-Phase Terminal Poles
5. Junction Poles
6. Substation Getaways
7. Double Circuit Poles

New IGSD, Regulator Racks, and Large Transformer Banks must be installed on ductile iron.

New Pole Top Switches must be installed on fiber glass.

Fiber glass poles and ductile iron poles are approved and are available in DDS. Periodic communication will be shared regarding inventory of non-wood, engineered poles at CenterPoint Energy's warehouses.

Refer to Appendix A – Engineered Pole Matrix for an overview of the above recommended installations.

5.3.2 Substation Getaways Criteria

Substation getaways are unique to each location. Distribution Planning determines the scope of each substation getaway design. Here is the general criteria for new and existing feeder designs to consider.

- New Feeders:
  - For developed areas (where there is no big vacant land near the substation), build underground getaway to the first optimal (access, exposure) location for the new and future feeders. Try to place terminal poles away from busy streets/intersections. First overhead section (from the terminal pole to the first switch) shall use non-wooden structures. If a switch is not planned for more than ½ mile for 12 kV & 1.5 miles for 35 kV from the substation, should call to install a switch.

  - For undeveloped areas (where there are vacant lands or potential future developments near the substation), build underground getaway to outside of the substation fence. Try to place terminal poles away from busy streets/intersections. First overhead section (from the terminal pole to the first switch) shall use non-wooden structures. If a switch is not planned for more than ½ mile for 12 kV & 1.5 miles for 35 kV miles from the substation, should call to install a switch.

- Existing Feeders:
    - If the terminal poles of the circuit getaways are already outside of the substation fences, and they are not all placed at the same general area, leave them there. First overhead section (from the terminal pole to the first switch) shall use non-wooden structures. If a switch is not present within ½ mile for 12 kV & 1.5 miles for 35 kV from the substation, should call to install a switch.

    - If the terminal poles of the circuit getaways are already outside of the substation fences, but they are all placed at the same general area, should call to scatter these terminal poles and try to place them away from busy streets/intersections. First overhead section (from the terminal pole to the first switch) shall use non-wooden structures. If a switch is not present within 1.5 miles from the substation, should call to install a switch at 1.5 miles from the substation to break the long circuit section.

    - If the terminal poles of the circuit getaways are inside of the substation fences, evaluate relocating the fence for access or call to extend the underground circuit getaway to the outside (see above) of the substation fence and try to place them away from busy streets/intersections. First overhead section (from the terminal pole to the first switch) shall use non-wooden structures. If a switch is not present within ½ mile for 12 kV & 1.5 miles for 35 kV from the substation, should call to install a switch.

5.3.3 Freeway Crossings Criteria

Underground construction will be the first design option for all freeway crossings. If underground installation is not possible, and an overhead crossing is necessary, concrete poles shall be utilized. Concrete is the only material that can offer the ability to tight dead-end on a freestanding structure.

5.3.4 Equipment Removal and Replacement Criteria

CenterPoint Energy grid resiliency criteria applies not only to new installations but also for equipment removal projects. This section will provide engineering recommendation for removals and replacement to assist in the design process:

- For applications where equipment will only be removed or minor replacements/modifications (such as fuses or jumper conductor) made on the pole, then the existing pole could remain in-place.
- On unplanned critical equipment replacement situations, the existing structure will be visually inspected and if deemed in good condition, the pole could remain in-place.
- On trouble work orders where follow-up planned work would require replacement of critical equipment, the existing structure shall be replaced with an engineered pole.

Refer to Appendix B – Summary of design application and criteria for above recommended installations.

5.4 Trip Savers

Trip savers are cut-out mounted reclosers installed as an alternate to fused cutouts to protect overhead lateral circuits to reduce the number of truck rolls for momentary faults. At present, trip savers can be installed at 12kV multi-phase laterals and 35kV single-phase laterals. The criteria to install trip savers in the order of priority for 12kV lateral circuits is:

- Available fault current is less than 6300A
- The circuits must be street accessible and able to perform hot fuse
- Preference is given to circuits in underserved communities with reliability concerns
- Prioritize 3-Phase laterals, then 2-Phase, and last would be 1-Phase

In the second stage of prioritization, 12kV terminal pole locations and rear easement locations would be considered. An implementation plan is being developed for approximately 25K line fuse locations.

5.5 Wood Pole Usage & Embedment Criteria

Wood poles are still predominantly used across CenterPoint Energy. Wood poles of adequate strength for EWL as determined through DDS should be continued to be used. Various heights of H1 and H2 wood poles have been added to the inventory and are available.

The following poles sizes, classes (03-400), and SAP numbers are available for designers to plan and design to EWL resiliency criteria:

STANDARD STOCK SIZES, TREATED POLES
(PART NO.)

POLE LENGTH	POLE CLASS									
	H2	H1	1	2	3	4	5	6	7	9
25 FT.									100000	100270
30 FT.								100047		
35 FT.				100296		100281			242012	
40 FT.				100304		100297	248006			
45 FT.	258248	285247	285246	100001	286447	100305	248007			
50 FT.	100015	285249	258629	100011	100006	248009				
55 FT.	285251	285250	258630	100013	100026	248011				
60 FT.	100017	285252	258631	100014						
65 FT.	285254	285253	100016							
70 FT.	285256	285255	100019							

Pole setting depths are dependent on the class of wood poles. For example, for pole classes 2 through 9, poles shall have a minimum embedment of 10% plus 2 feet. For pole Class 1, H1, and H2, shall have a minimum embedment of 10% plus 3 feet. On larger equipment poles (transformer banks > 250kVA) that require an H2, poles are set deeper as shown below.

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TANGENT AND GUYED ANGLE POLE EMBEDMENT DEPTHS FOR WOOD POLES IN LEVEL GROUND										
POLE LENGTH FEET	70	65	60	55	50	45	40	35	30	25
EMBEDMENT DEPTH IN FEET CLASS 2-9 POLES	9	8.5	8	7.5	7	6.5	6	6	5.5	5
EMBEDMENT DEPTH IN FEET CLASS 1 - H2 TANGENT POLES	10	9.5	9	8.5	8	7.5	X	X	X	X
EMBEDMENT DEPTH IN FEET H2 EQUIPMENT POLES	X	X	12	X	9	X	X	X	X	X

Crushed limestone will be used as the backfill material for all hydro excavated new pole installations to improve embedment strength.

5.6 Enhancing Existing Facilities

CenterPoint Energy evaluated alternate materials to provide options as EWL is adopted across the system. Use of non-wood, engineered materials in certain design situations will increase overall system resiliency.

5.6.1 Cable Injection Technology

CenterPoint Energy has a strong aging infrastructure criteria where the life cycle of aging assets would be strategically addressed either by replacing or rehabilitating. The Underground Residential Distribution (URD) cable infrastructure program addressed the aging cable through replacement of bad cable spans, which is a costly process and requires lengthy outages to complete.

With the approval of the cable injection technology, CenterPoint Energy now has the option to repair damaged cable segments using Siloxane fluid injection process. A fluid injected into the conductor strands will diffuse to the insulation and repairs damage caused by existing water trees and other di-electric defects, thus extending the useful life of the cable.

Cable injection locations will be managed though the Cable Life Extension Program (CLEP) program based on the cable health and analytics (install date, critical customer count, last maintenance evaluation including partial discharge test results etc.)

5.6.2 Pole Maintenance Program

Beyond new installations, existing infrastructure can be enhanced to comply with the newly adopted extreme wind loading criteria by various methods. For our pole inspection program, assuming the evaluated pole does not meet the adopted extreme wind loading criteria, the pole shall be upgraded by the following methods:

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1. If the structure falls into one of the categories above for Equipment Pole, Substation Getaways, or Freeway Crossings, the pole shall be replaced as described with the appropriate pole material.
2. If a structure, after being evaluated by our inspection contractor, is deemed acceptable for an ET-truss, it can be upgraded to comply with the wind speed requirement in which it is located.

3. If the structure is found to be below the 90% remaining strength requirement for ET-truss usage, the pole shall be replaced according to the criteria established above for new installations.
4. If the structure is found to be below the 90% remaining strength requirement for ET-truss usage, and the pole is in a rear easement where truck accessibility is restricted, a modular fiberglass pole shall be utilized.

Cross Arms, Brackets, and Insulators

CenterPoint Energy utilizes multiple framing design standards across the system that include assembly combinations of several commodities like cross arms, brackets, and insulators. The standards have evolved over the years with the adoption of various new materials along with the use of special designs and construction practices in some parts of our system. CenterPoint Energy has previously approved limited use of fiberglass cross arms, fiberglass brackets, and polymer insulators in contaminated areas and has seen improved performance in those areas.

Use of non-wood, alternate materials like fiberglass/steel cross arms, fiberglass/steel brackets and polymer insulators will increase overall system resiliency. As part of the grid resiliency strategy, CenterPoint Energy will obsolete the wood cross arm assemblies and recommend the use of alternate materials throughout the system.

For existing facilities, if a wood pole is deemed in good condition and wood cross arms are deteriorating, the designs shall replace wooden cross arms with fiberglass crossarms, fiberglass brackets, and polymer insulators or utilize the existing armless designs with an assembly combination of brackets and insulators.

5.6.3 Step-Down Transformer Removal

Where appropriate, 35kV to 12kV step down transformers will be removed, converting downstream facilities to 35 kV operation. Step down transformer locations will be ranked to optimize the conversions to improve system reliability based on exposure (customer count, wire length, TkVA, rated kVA etc.) and performance (SAIDI). This will be a 15-year program that will require replacement of approximately 80 step downs per year, with an average length of approximately 1 mile for each lateral.

5.6.4 URD Loop Remediation

Experience has shown that mild steel transformers are prone to rust than stainless steel transformers. Transformer tank rusting is the primary cause of oil leaks, which can result in transformer failure. Hence, CenterPoint Energy has converted to using stainless-steel URD transformers to reduce the number of failures due to leaking transformers. CenterPoint Energy has also transitioned to using Kearney dual-vent fused cutouts and the use of K-fuses at 35kV URD loop terminal poles for added protection.

To further remediate URD transformer failure concerns, there is also an active inspection program for 35kV URD loops. The URD loops to be targeted annually will be prioritized based on 4-miles proximity from the substation and that were installed in the years 2000 to 2010.

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5.6.5 Strategic Hardening of Facilities: Circuit Re-build Reliability Program

A list of targeted circuit miles - 150 in the first year and 400-500 miles per year in the subsequent years - based on the system wide benefit like community/city outreach, critical customers who are exempt from load shedding, emergency operations services, and priority reliability circuits will be developed to be retrofitted as part of the overall grid modernization strategy. The entire distribution system will be targeted to be re-built and hardened in 20 years.

For circuits that have been identified as part of the circuit rebuild reliability program, all structures including cross arms shall be evaluated and upgraded to EWL through a combination of trussing, cross arm replacement or pole replacement with an appropriate structure (Appendix A).

For any critical equipment structure, the existing structure shall be replaced with an engineered pole unless approved by the Grid Resiliency Steering Committee (Appendix B).

6 Document Review

This distribution resiliency and reliability criteria document is reviewed and updated periodically as the needs of CenterPoint Energy and its stakeholders change. It is also reviewed when a new NESC code is issued every five years or PUCT adopts or enforces new grid hardening rules.

7 Records Retention

The final approved distribution grid resiliency and reliability criteria document will be hosted on CenterPoint Energy's Standards and Materials webpage and will adhere to engineering records retention policy.

8 Additional Information

8.1 Appendix A – Engineered (Non-Wood) Pole Matrix

The following matrix recommends the type of engineered pole to be used for certain design applications.

Design Application	Fiberglass	Ductile Iron
IGSD		X
Regulator Rack (Exterior Poles)		X
Large Transformer Banks (3-250kVA and above)		X
Double Circuit Poles	X	X
Junction Poles [1]	X	X
Substation Getaway (Within 1st Section) [1]	X	X
Capacitor Banks [1]	X	X
Pole Top Switches	X	
Three-Phase Terminal Poles (Major Under Ground, MUG Pad mount, MUG Feeder dip, Substation Terminal Poles)	X	

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[1] Fiberglass is the preferred option.

8.2 Appendix B – Summary of Design Application & Criteria

The following matrix summarizes the design criteria for the different applications designed on distribution capacity projects and circuit re-build reliability programs.

Design Application	Criteria	New Structure	Re-Use Structure
New Installs	Section 5.3.1 Appendix A	X	
Equipment Removals Only	Section 5.3.4 Remove equipment		X
Critical Equipment Replacement (Unplanned Work)	Section 5.3.4		X
Critical Equipment Replacement (Planned Work) & Circuit Re-Builds	Sections 5.3.4 & 5.6.5	X	

8.3 References

NESC IEEE C2 – 2017

ODS Vol I, Vol II & UDS Standards

Extreme Wind Map with Zones

Substations by Wind Zone List

Special Tangent Framing Criteria Application Map

Step-by-Step Process in DDS to Design for EWL Criteria

8.4 Contact Information

For any questions about the distribution criteria, grid resiliency initiatives, standards and materials changes, and field execution, contact Chau Nguyen, Clint King, Colby Gravatt, Dan O'Connell, James Davis, Kyle Miller, Mythili Chaganti, Susan Chavez-Maharajh, and Yingying Huang.

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8.5 Revision Information

Version	Approved By	Date	Section	Description
1	Manager, Standards	02-01-2022	All	New Document
2	Manager, Standards	03-04-2022	4.2.1 and 5.3.1	Included junction poles
3	Manager, Standards	07-25-2022	5.3.4, 5.6.5 Appendix A & B	Noted additional design criteria
4	Manager, Standards	08-15-2022	5.6.2	Added design recommendations for assembly commodities

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-05

QUESTION:

For RM-1: Provide documentation, presentation, or analysis showing:

a. composite poles are more cost effective than other poles;
b. ductile iron poles are more cost effective than other poles;
c. how priority of pole replacements is determined; and
d. a breakdown on the anticipated number of non-wood poles to be used.

ANSWER:

a. Compared to other pole material types, composite (fiberglass) poles can be more cost effective due to their longer life expectancy, lower remediation costs, improved material performance, lower weights, and ability to withstand and absorb impacts from extreme weather events.

b. Compared to other pole material types, ductile iron poles can be more cost effective due to their longer life expectancy, lower remediation costs, improved material performance, lower weights, and ability to withstand and absorb impacts from extreme weather events.

c. Decision to brace, replace or upgrade a pole is made based on the pole health determined through pole inspections, loading criteria for the pole location and tree fall-in risk and accessibility based on LiDAR data.

d. Based on the LiDAR based analysis completed on historical pole inspection data, it is estimated that 23% wood poles will be braced, 73% will be replaced with wood poles and 4% will be upgraded to composite poles.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-06

QUESTION:

For RM-2: Provide data showing the existing age, type, and condition of facilities at each location proposed to utilize this measure.

ANSWER:

Age: Most of the overhead facilities identified for undergrounding in RM-2 were installed on average within the past 30 years.

Type: All overhead distribution facilities. 12kV and 35kV distribution voltages.

Condition: The condition of existing overhead facilities identified for undergrounding in RM-2 does not currently pose a threat to the stability of our distribution system outside of a resiliency event.

SPONSOR:
Eric Easton and Randy Pryor

RESPONSIVE DOCUMENTS:
None

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-07

QUESTION:

For RM-2: Provide data to show the historical cost vs. the reduction in outages.

ANSWER:

The undergrounding of existing distribution overhead facilities at the scale proposed in the 2026-2028 System Resiliency Plan is a new measure for the company. Please refer to 5.3.4.2 Revisions from the Prior System Resiliency Plan on page 83 of Guidehouse's independent assessment of CenterPoint Houston's SRP.

The company is at early stages of gathering data to measure the efficacy of RM-2. Nonetheless, the company analyzed a sample of existing distribution feeders to assess the outage performance based on the ratio of underground vs overhead distribution. RM-2 is not intended to expand the company's number of dedicated underground feeders, but it was included in the analysis to serve as a reference point.

Please refer to attachment HCC RFP 04-07 Confidential Outage Performance of Partially Underground Feeders.pdf

SPONSOR:
Randy Pryor

RESPONSIVE DOCUMENTS:
HCC RFP 04-07 Confidential Outage Performance of Partially Underground Feeders.pdf

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-08

QUESTION:

For RM-3: Please provide the peer utility benchmarking survey results obtained on IGSD deployment practices.

ANSWER:

The benchmarking survey did not explicitly ask about IGSD deployments. The measures addressed in the survey are summarized in ELS-2, Appendix A, Figure A-2, on page 271 (PDF page 1426). As shown in Figure A-2, seven of nine respondent utilities have included smart grid upgrades in their resiliency plans, and IGSD upgrades are an example of a relevant Grid Modernization upgrade.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-09

QUESTION:

For RM-3: Please provide information about the peer utility location, size, number of customers or other defining characteristics that CEHE used to determine that the benchmarking utility was a peer utility.

ANSWER:

Please see response to TIEC 1-32 and HCC RFP 01-01 Attachment 3 CONFIDENTIAL.pdf, which indicate the survey was conducted “blind” with respect to respondent names, locations and other characteristics. The starting point was a group of Utilities that annually participate in Utility surveys conducted in collaboration with First Quartile Inc. The Resilience Benchmark Survey was designed to include Utilities from that larger group that had similar characteristics and challenges (i.e., geographical, coastal locations) to CEHE. The aim was to evaluate the types of resilience investments planned or performed in similar geographies.

As for the jurisdictional benchmarking research (Appendix B of ELS-2), the research was intended to provide a broad view of resiliency planning by utilities across the country and did not explicitly include or exclude utilities based on location, size, or number of customers. However, most of the utilities noted within Appendix B of ELS-2 are investor-owned T&D utilities operating in jurisdictions with established policy and/or regulation intended to promote energy infrastructure resiliency.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-10

QUESTION:

For RM-3: Provide training materials used for determining the location of IGSDs.

ANSWER:

No such training materials were used, but please see the response to HCC RFP04-11 for a description of the engineering protocols used to determine the locations for IGSD installation.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-11

QUESTION:

For RM-3: Provide engineering protocols for determining the location of IGSD on a feeder.

ANSWER:

A LiDAR based analysis was used to determine the prioritized list of circuits for installation of restoration IGSD. The location of second switch from the substation on a circuit is the general location for installing restoration IGSD since this switch is used in the cut-clear process of emergency restoration to restore the substation breaker when damages or faults occurs downstream from this switch. Replacing this switch with IGSD will allow the Company to automate cut-clear process and reduce restoration time. Actual location of installation of the IGSD is determined during the design phase and could slightly vary from the location of the second switch to account for any specific design, engineering, or operational considerations.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-12

QUESTION:

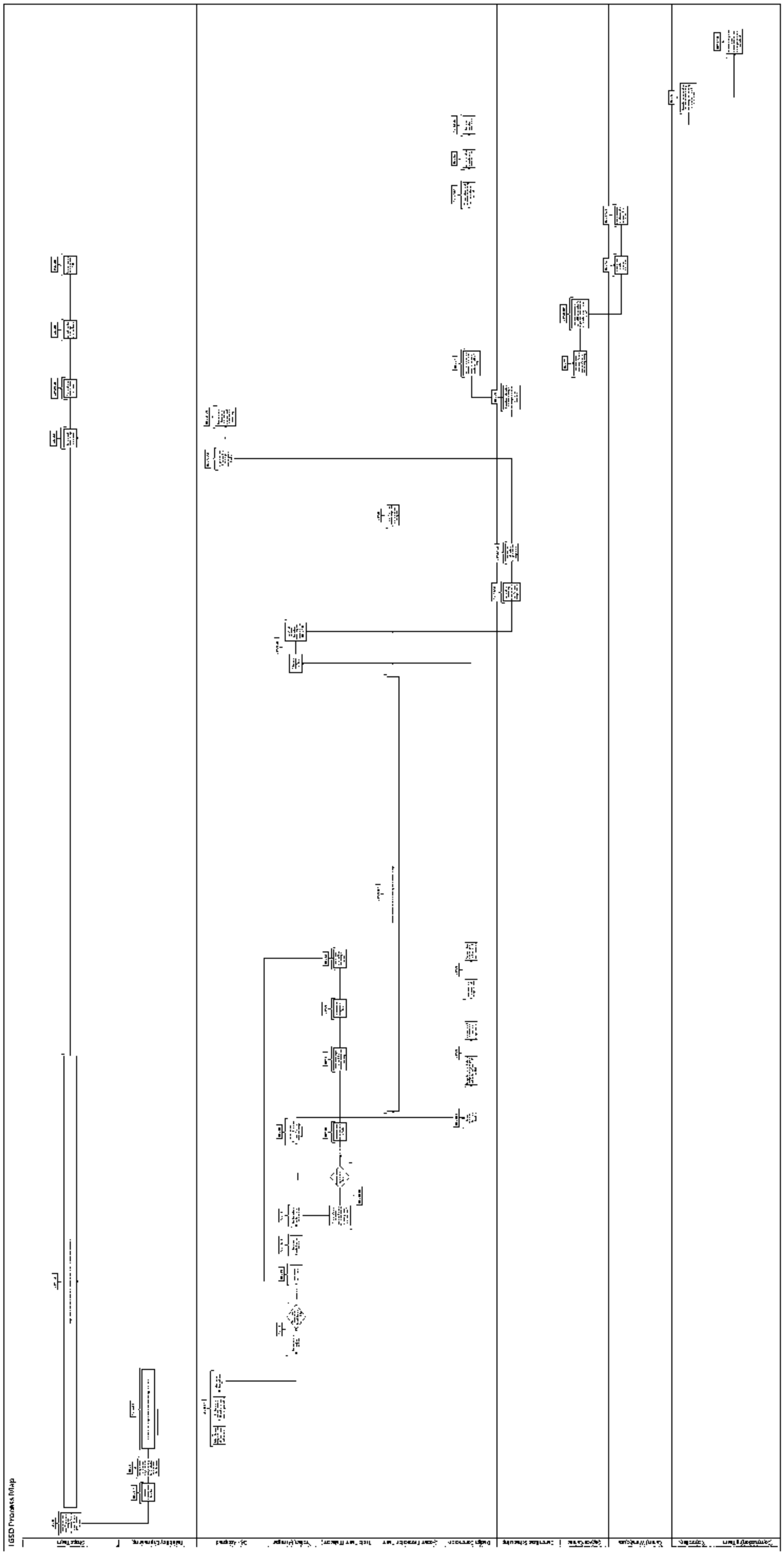
For RM-3: Provide the protocol for roll out of these devices on the system.

ANSWER:

Please reference the attached process map for the deployment of IGSD devices.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC-RFP04-12 IGSD Process Map.pdf


IGSD Process Map

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REQUEST NO.: HCC-RFP04-13

QUESTION:

For RM-3: Provide catalog cut sheets for each of the IGSD devices to be used.

ANSWER:

Please reference the attachments.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC RFP 4-13 Attachment 1 RC2S - CONFIDENTIAL.pdf
HCC RFP 4-13 Attachment 2 RC3S - CONFIDENTIAL.pdf

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-14

QUESTION:

For RM-4: Provide the priority criteria and scoring used to weigh the factors for tree fallin risk, accessibility, number of customers served, type of customers served, SAIDI and SAIFI performance, and pole age.

ANSWER:

Weights used

Fall In Severity	Weight		Accessibility	Weight
Clear	1		Accessible from road	1
Near Miss	1		Maybe Accessible	3
Level 1 - Trunk	10		Accessible away from the main road	5
Level 2 - Branch	7		Not Accessible	10
Level 3 - Limb	5			

Risk Impact Score = (Aggregated fall in severity X accessibility) * weighted customer count

Additional ranking is done depending on whether the circuit has a relay-exempt priority customer.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-15

QUESTION:

For RM-4: Provide electronic data for each of the 30,000 poles (or total number of poles by age and measure) showing the ages and which measure will be used.

ANSWER:

For RM-4, the Company plans to inspect approximately 421,343 poles over 3 years and is forecasting to replace, upgrade, or brace approximately 30,000 poles based on inspection results and LiDAR based analysis. Please see the table below for the approximate age range for the poles we plan to inspect in 2026-2028.

Decade	Pole Count
Unknown	14,535
<1960	10,967
1960-1969	39,000
1970-1979	82,910
1980-1989	87,038
1990-1999	64,139
2000-2009	74,644
2010-2019	48,110
Total	421,343

Based on the LiDAR based analysis completed on historical pole inspection data, it is estimated that 23% wood poles will be braced, 73% will be replaced with wood poles and 4% will be upgraded to composite poles.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

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HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-16

QUESTION:

For RM-4: Provide data showing the strength comparisons made for wood, fiberglass, and ductile iron poles.

ANSWER:

Please see the attachments for Wood, Fiberglass, and Ductile Iron specification sheets which detail pole strengths and criteria.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC RFP 4-16 Attachment 1 Ductile Iron - CENTER POINT H3045 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 2 Ductile Iron - CENTER POINT H3050 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 3 Ductile Iron - CENTER POINT H3055 - 12kV IGSD CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 4 Ductile Iron - CENTER POINT H3055 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 5 Ductile Iron - CENTER POINT H3060 - 35kV IGSD CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 6 Ductile Iron - CENTER POINT H3060 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 7 Ductile Iron - CENTER POINT H3065 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 8 Ductile Iron - CENTER POINT H3070 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 9 Fiberglass - 40ft - RS Modules 3-4-5 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 10 Fiberglass - 45ft - RS Modules 2-3-4 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 11 Fiberglass - 45ft - RS Modules 3-4-5 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 12 Fiberglass - 50ft - RS Modules 2-3-4 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 13 Fiberglass - 50ft - RS Modules 3-4-5 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 14 Fiberglass - 55ft - RS Modules 2-3-4-5 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 15 Fiberglass - 60ft - RS Modules 2-3-4-5 CONFIDENTIAL.pdf
HCC RFP 4-16 Attachment 16 Wood Poles - ANSI 05.1 Fiber Stress and Pole Classification (Strengths) CONFIDENTIAL.pdf

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-17

QUESTION:

For RM-4: Provide presentation, report, or memos regarding the strength of fiberglass poles for extreme wind and ice.

ANSWER:

Please see the attachments for fiberglass pole case studies for extreme wind and ice applications.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC RFP 4-17 Attachment 1 Case Study - Critical Infrastructure.pdf
HCC RFP 4-17 Attachment 2 Case Study - Ice Hardening.pdf
HCC RFP 4-17 Attachment 3 Case Study - Hurricane_Extreme Wind Grid Hardening.pdf

CASE
STUDY

Critical Structures and Circuits

RS Poles | Dec 17, 2024

RESILIENT STRUCTURES

Challenge

Building resiliency into critical structures and circuits is at the core of improving a utility's overall system reliability. The cost and impact of failure is immense. When critical structures fail, the electric equipment they support, including transformers, reclosers and more, go out of service. Often the equipment is damaged and unusable. These poles and their associated equipment then take longer and cost more to restore in spite of their importance to the system.

Similarly, critical circuits are mission critical for infrastructure, hospitals, and other key community services. Their failure has a profound impact on the community and local economy. Investing to protect these important assets is a strategic imperative for leading utilities.

Age, exposure to the elements, and extended replacement cycles lead to the gradual degradation of the average strength of wood structures. These structures are then far more prone to fail when facing challenges such as:

Severe Weather

The impact of severe weather on electric infrastructure is unmistakable. Hurricanes, tornados, derecho winds, and ice storms have devastated communities across North America.

Fires

Wildfires are increasingly a risk that cannot be ignored. From pole top fires originating on the structure itself, to naturally caused wildfires burning utility structures, the impact on critical structures and circuits is the same. It takes only minutes for fire to cause a wood structure to fail.

Ice Storms

Heavy ice buildup on overhead lines and equipment places extreme pressure on the poles supporting them. Without the ability to absorb the elastic strain, failure of these critical structures and circuits is increasingly inevitable.

Solution

Targeted use of composite poles on critical structures and circuits can dramatically improve the overall performance of an electric system. Wood, and alternative poles will always have a role as utility structures, but when it comes to protecting a utility's most important assets, nothing surpasses the performance of composites. Composite poles from Resilient Structures are engineered to perform in all extreme weather conditions. The advanced material science creates an engineered pole capable of ensuring the mission-critical operation of selected elements of the system.

Resilient Structures composite poles are strong and resilient thanks to advanced design and company support:

- The mean ultimate strength of our composite poles is up to 100% greater than the published strength, substantially more than that of other engineered materials.

- Resilient Structures poles are non-conductive and do not support combustion, mitigating fire threats.
- Our composite poles absorb significant elastic strain energy in high-load situations, with the ability to prevent cascading failures of adjacent wood or steel poles.
- A dedicated and qualified team of experienced engineers is ready to partner with structural analysis, hardware review and drawings specifically for your project. Every Resilient Structure pole features a 41-year limited warranty and a projected service life of 80+ years.

High Load and Hurricane Evidence

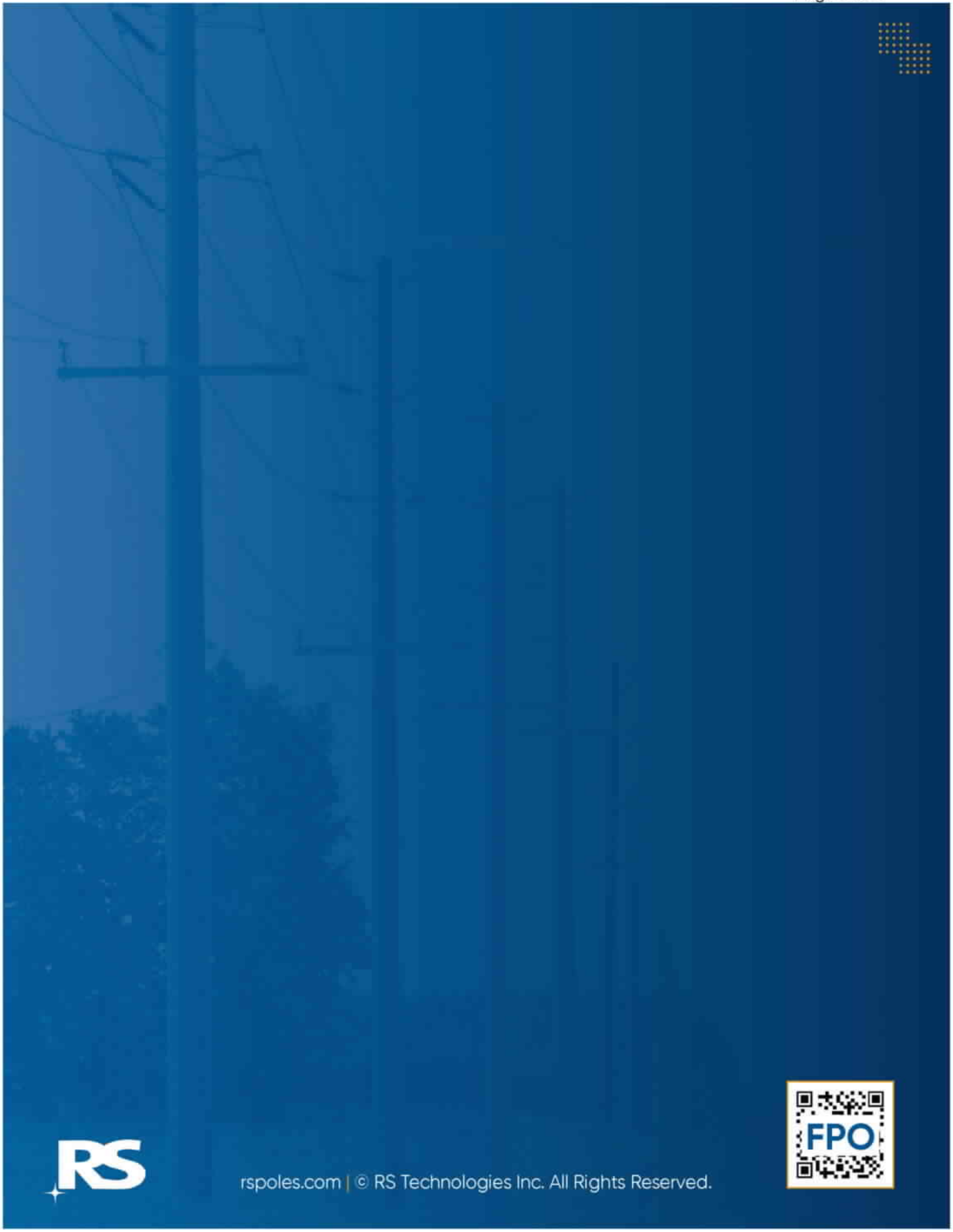
In December 2021, a series of record-setting tornadoes tore through Western Kentucky. After the tornadoes had passed Hopkinsville, within the service territory of Pennyrile RECC, over two miles of 13kV wood distribution poles lay on the ground from a wind-load-induced cascading failure. However, three Resilient Structures composite poles installed in 2012 stopped three different cascading wood pole failure events on the circuit, preventing further damage to the system and protecting nearby critical substation components.

Similarly, Resilient Structures poles used on a 22-mile, 69kV line in Grand Bahama have repeatedly proven their resilience to hurricanes. In 2016, the island was hit by Hurricane Matthew, a Category 4 storm with winds of 140 mph. A direct hit destroyed approximately 10% of the area's poles, over 2,300 in all. As the restoration efforts began, it became clear that Resilient Structures composite poles stood strong during the hurricane, with zero failures. Then, in 2019, Category 5 Hurricane Dorian brought wind gusts up to 220 mph and $7 billion in damage. However, a text message from Grand Bahama Power Vice President Frank Woodworth confirmed that the Resilient Structures composite poles had survived… "again."

Fire and Ice Storm Evidence

Resilient Structures is a pioneer in engineering utility pole solutions to address the growing risk of failure due to fire and ice. Faced with an intensifying challenge and desperate to mitigate their fire threat risk, California's utilities needed a pole that would not burn. Newly named gigafires, fires that destroy 1 million acres or more, were wreaking havoc, but Resilient Structures had a solution. In 2011, unsatisfied with the existing industry fire tests, Resilient Structures partnered with University of Alberta fire expert Mark Ackerman to develop a full-scale test that simulated the realities of a wildfire. This test, known as the RS-Ackerman Fire Test, has become the industry standard all California utilities use to evaluate a pole's fire performance. Resilient Structures composite poles passed the test and outperform the alternatives, making them safer for line crews and the public.

On the opposite end of the spectrum, Kentucky experienced a severe ice storm in January 2009 that caused $240 million in damage to jurisdictional utilities alone. West Kentucky Electrical Co-operative (WKREC) was already in the process of a pilot evaluation of 10 Resilient Structures poles when this disaster struck. The high-performance Resilient Structures poles went undamaged in the storm and even carried the load of a neighboring steel pole when it collapsed. The superior resiliency and reliability demonstrated here provided unyielding confidence in Resilient Structures poles – which are now used not only in the WKREC's highest priority sections of their grid but many other global utilities as well.


RS
FPO
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ICE STORM GRID HARDENING

Kentucky experienced two "one-hundred-year storms" in a span of less than 5 months: Hurricane Ike hammered West Kentucky's territory in September 2008, and in January 2009, a severe ice storm struck – causing $240 million in damage to jurisdictional utilities alone.

West Kentucky Electrical Co-operative (WKREC) was already in the process of a pilot evaluation of 10 **RS poles** when disaster struck. These high-performance RS poles went undamaged in the storm, and even carried the load of a neighboring steel pole when it collapsed. The **superior resiliency** and reliability demonstrated here provided unyielding confidence in **RS poles** – which are now used in the WKREC's highest priority sections of their grid, including carrying the lines out of a new **substation** and a new 69kV **transmission** line.

RS composite poles have now become the preferred solution at many utilities that are faced with increasing natural disasters including damaging high winds and ice storms.

"You can't beat the warranty. We like to use RS poles to harden our infrastructure in critical, high value locations."

– Steve Coltharp,
West Kentucky Rural Electric Co-operative

HURRICANE GRID HARDENING

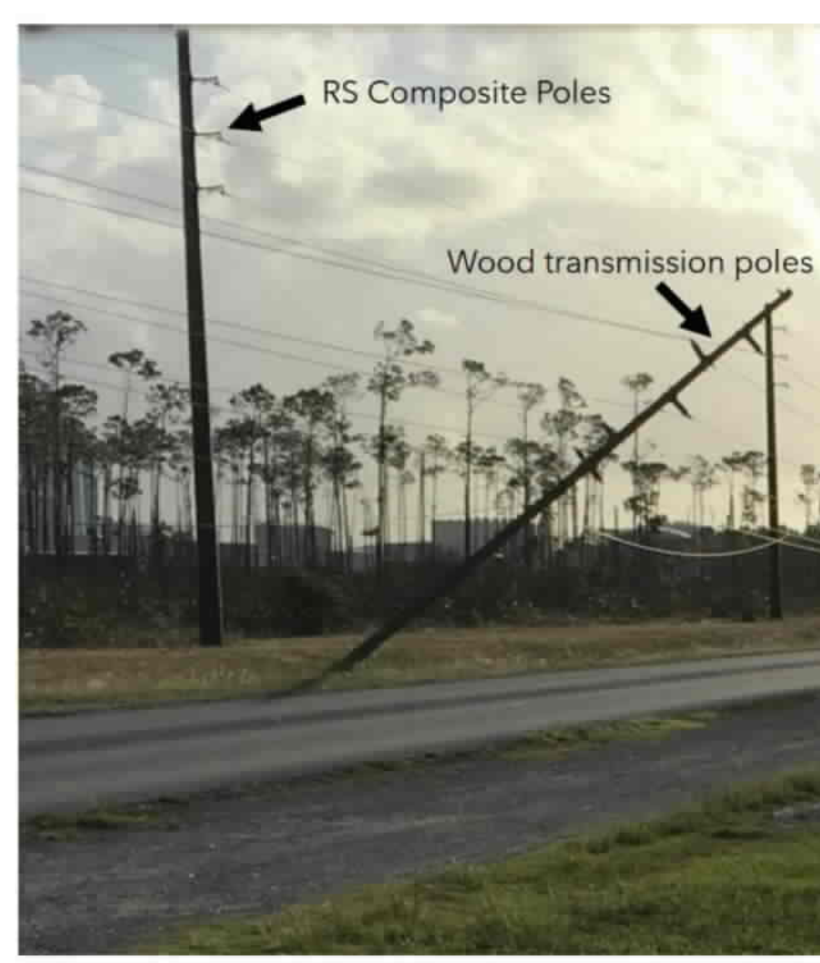
A significant development in Grand Bahama required a new 22 mile [35.4 km] 69kV line to be built. With frequent hurricane exposure, the project needed to push the limits of accepted overhead line storm resilience to reliably deliver service to the west end of the island.

The island location presented many project challenges. Because of hurricanes, salt spray and soil pH corrosion of steel and concrete poles as well as logistical challenges and costly material handling, **RS composite poles** were selected as the best solution. Up to 65 ft. [19.8 m] lightweight, inert, and modular nesting composite poles can fit into standard sized 40 ft. intermodal shipping containers. Furthermore, **RS poles** have an 80-year service life, requires no scheduled maintenance, and are covered by a **41-year warranty**.

In 2016, Grand Bahama was hit by **Hurricane Matthew**, a Category 4 storm with winds of 140 mph [62.6 m/s]. The island's west end took a direct hit and about 10% of the island's poles were downed, over 2,300 wood poles. As the restoration efforts continued, there was one observation that became clearer: the **RS composite poles** had stood strong during the hurricane.

On September 1st, 2019, **Category 5 Dorian**, packing wind gusts to 220 mph [98.3 m/s]. Dorian's slow pace of 25 miles [40 km] in 24 hours resulted in damage of $7 billion. 1,000's of wood poles were lost. A text message from Grand Bahama Power Vice President, Frank Woodworth, confirmed that the **RS composite poles** had survived... "again."

RS composite poles mitigate the threat of hurricane damage and speed restoration efforts because the poles stand strong.



CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-18

QUESTION:

For RM-4: Provide the protocol for determining when a brace is to be used instead of replacing the pole.

ANSWER:

Decision to brace a pole is made based on the pole health data, the loading criteria for the pole location and tree fall-in risk and accessibility based on LiDAR data. If the pole needs to be upgraded to a non-wood pole to mitigate tree fall-in risk, wind loading criteria or to other resiliency criteria for highway crossing, terminal pole etc., bracing is not an option. A steel truss (CTE) may be used when the steel truss will restore the remaining pole strength of a pole to over 75%, but only if the pole is not overloaded. On resiliency circuits, an upgraded brace (TTU or TTE) may be used to enhance the effective class of the pole if it is not located near a road. For an upgraded truss, the pole must meet a list of criteria (not a highway crossing, on a road right of way, terminal pole, etc.) and must be approved through a CenterPoint engineering review. Please see the attachment HCC RFP 4-18 Specification CONFIDENTIAL.pdf.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC RFP 4-18 Specification CONFIDENTIAL.pdf

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-19

QUESTION:

For RM-5: Please provide a copy of the hazard tree removal program.

ANSWER:

Please see the attachment HCC RFP 4-19 Hazard Tree Program 1_28_25.pdf.

SPONSOR:
Randy Pryor

RESPONSIVE DOCUMENTS:
HCC-RFP04-19 Hazard Tree Program 1_28_25

Hazard Tree Program

CenterPoint Energy's Hazard Tree Program is designed to proactively address risks posed by hazard trees. Our program aims to reduce incidents that could lead to power outages, fires, and injury. We engage third-party contract inspectors to conduct Level 1 Tree Risk Assessment on main feeder, which is a limited visual inspection focusing on trees or groups of trees identified as high-risk. Additionally, hazard trees are identified and mitigated during our planned maintenance circuits, as well as through requests from customers and employees.

Targeted Area of Concern

Currently, we concentrate our efforts in Kingwood, The Woodlands, and Pinehurst. These regions are particularly vulnerable due to the prevalence of pine tree species, which are more susceptible to insects and disease during adverse conditions. The frequency of our inspections is dictated by environmental conditions. During drought periods, we conduct inspections quarterly, while in more favorable weather, we may reduce this to twice a year. Additionally, we analyze the previous year's performance data, specifically the 300% and repeating top 10% poor performing circuits. This data driven approach allows us to prioritize our inspections, ensuring that these critical circuits are evaluated twice annually.

Hazard Tree Mitigation Process

Currently we utilize a spreadsheet that indicates the location, quantity, and type of trees identified as potential hazards. The inspector sends the spreadsheet to the forester for approval.

CenterPoint Energy's normal clearance standard is 7 to 10 feet; however, our hazard tree program allows inspectors to expand these criteria to identify any tree that could potentially fall into the main feeder.

It is important to note that many of these trees may be located outside of the easement, often on private property. The contractor must secure permission from the property owner when removing a tree or trees unless otherwise directed by the forester. Additionally, the contractor is responsible for documenting and keeping record of permission.

If CenterPoint Energy approves the removal of a live tree or trees, the contractor will remove all debris. In the case of the removal of a dead tree or trees/hazard trees, the cut logs and debris will be stacked by the contractor and left on the resident's property, which is included on the permit.

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-20

QUESTION:

For RM-5: Provide annual costs and annual budget for hazard tree removal costs by year for the last 5 years and next 5 years.

ANSWER:

Please see the attachment HCC RFP 4-20 Hazard Tree Budget.xls.

SPONSOR:
Randy Pryor

RESPONSIVE DOCUMENTS:
HCC RFP 4-20 Hazard Tree Budget.xls

HAZARD TREE ANNUAL BUDGET

2020	2021	2022	2023	2024
$ 750,000.00	$750,000.00	$603,000.00	$523,000.00	$1,723,000.00

HAZARD TREE ANNUAL COST

2020	2021	2022	2023	2024
$ 262,334.00	$ 431,879.00	$ 1,146,869.00	$ 3,660,267.00	$ 2,884,046.00

HAZARD TREE PROJECTED BUDGET NEXT 5 YEARS

2025	2026	2027	2028	2029
$ 1,660,000.00	$ 1,660,000.00	$ 1,660,000.00	$ 1,660,000.00	$ 1,660,000.00

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-21

QUESTION:

For RM-5: Provide the priority criteria, assessment methods, and scoring used to prioritize the distribution circuits.

ANSWER:

Please reference the CEHE System Resiliency Plan page 87 (PDF page 122) for the prioritization criteria. LiDAR data is used to determine vegetation encroachment risk impact analysis of each circuit.

Risk Impact Score = (Aggregated encroachment severity X accessibility)

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-22

QUESTION:

For RM-5: Provide SAIDI/SAIFI statistics for outages caused by trees off of right-of-way for the last 5 years.

ANSWER:

The Company does provide its crews with an application to track the cause of a particular outage, and the causes that can be chosen include fallen tree inside the easement and fallen tree outside the easement. However, the application also includes the following options, among others: strong wind, falling dead tree (with no reference to location), and hurricane. Crews, focusing on the rapid restoration of power, are not always precise in their selection of options. Therefore, the Company does not believe this source of information is reliable for answering vegetation related questions during a major event.

However, in the interest of transparency, the Company is providing the response found on HCC-RFP04-22 VM Outages Outside of Easement.xlsx.

SPONSOR:
Eric Easton and Randy Pryor

RESPONSIVE DOCUMENTS:
HCC-RFP04-22 VM Outages Outside of Easement.xls

HCC RFP 4-22: For RM-5: Provide SAIDI/SAIFI statistics for outages caused by trees off of right-of-way for the last 5 year

V3 - Fallen Tree Outside of Easement Events Only Excluding Major Event (PUCT Reporting Standard)		
Year	SAIDI Contributed to System	SAIFI Contributed to System
2020	6.15	0.059
2021	5.43	0.042
2022	5.59	0.046
2023	7.51	0.065
2024	5.62	0.052

V3 - Fallen Tree Outside of Easement Events Only Including Major Event (PUCT Reporting Standard)		
Year	SAIDI Contributed to System	SAIFI Contributed to System
2020	11.62	0.076
2021	12.65	0.054
2022	5.59	0.046
2023	13.30	0.079
2024	93.62	0.100

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-23

QUESTION:

For RM-5: Provide projected SAIDI/SAIFI reduction for outages caused by trees off of right-of-way for the last 5 years.

ANSWER:

Please see the response for HCC RFP 4-22. The Company does not have sufficient data to perform this analysis.

SPONSOR:
Eric Easton and Randy Pryor

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-24

QUESTION:

Provide the documents containing all reports, memos, and presentations containing, discussing, describing, and analyzing the studies that were used to determine priorities for:

a. structure replacement in RM-6;
b. structure replacement in RM-7;
c. tower replacement in RM-8;
d. fiber installation in RM-12;
e. installation of air flow spoilers in RM-14;
f. IGSD installation in RM-15; and
g. coastal section replacement in RM-9.

ANSWER:

a. Please refer to (i) the Company's System Resiliency Plan (SRP) at Section 5.1.5.6 (Transmission System Hardening), Prioritization, found at page 90 (PDF page 125) and (ii) the Direct Testimony of Eugene Schlatz, Appendix ELS-2, Guidehouse's independent Analysis and Review of CenterPoint Energy Houston Electric's System Resiliency Plan, Section 5.3.8 (Transmission System Hardening), beginning at page 97 (PDF page 1252).

b. Please refer to (i) the Company's SRP at Section 5.1.5.7 (69 kV Conversion Projects), Prioritization, found at pages 93-94 (PDF pages 128-129) and (ii) the Direct Testimony of Eugene Schlatz, Appendix ELS-2, Guidehouse's independent Analysis and Review of CenterPoint Energy Houston Electric's System Resiliency Plan, Section 5.3.9 (69 kV Conversion Projects), beginning at page 101 (PDF page 1256).

c. Please refer (i) the Company's SRP at Section 5.1.5.8 (S90 Tower Replacements), Prioritization, found at pages 97-98 (PDF pages 132-133) and (ii) to the Direct Testimony of Eugene Schlatz, Appendix ELS-2, Guidehouse's independent Analysis and Review of CenterPoint Energy Houston Electric's System Resiliency Plan, Section 5.3.10 (S90 Tower Replacements), beginning at page 105 (PDF page 1260).

d. Please see confidential attachment HCC RFP 04-24 Confidential Fiber Installation.pdf. Please also refer to (i) the Company's SRP, Section 5.2.5.3 (MUCAMS), Prioritization, found at page 122 (PDF page 157) and (ii) the Direct Testimony of Eugene Schlatz, Appendix ELS-2, Guidehouse's independent Analysis and Review of CenterPoint Energy Houston Electric's System Resiliency Plan, Section 5.4.5 (MUCAMS), beginning at page 119 (PDF page 1274).

e. Please refer to (i) the Company's SRP, Section 5.3.5.1 (Anti-Galloping Technologies), Prioritization, found at page 137 (PDF page 172) and (ii) the Direct Testimony of Eugene Schlatz, Appendix ELS-2, Guidehouse's independent Analysis and Review of CenterPoint Energy Houston Electric's System Resiliency Plan, Section 5.5.3 (Anti-Galloping Technologies), beginning at page 125 (PDF page 1280).

f. Please refer to the Company's report on Circuit Segmentation Study in PUCT Project No. 55182 (55182_29_1424702.PDF). Please also refer to (i) the Company's SRP, Section 5.3.5.2 (Load Shed IGSD Installation), Prioritization, found at page 140 (PDF page 175) and (ii) the Direct Testimony of Eugene Schlatz, Appendix ELS-2, Guidehouse's independent Analysis and Review of CenterPoint Energy Houston Electric's System Resiliency Plan, Section 5.5.4 (Load Shed IGSD), beginning at page 128 (PDF page 1283).

g. Please refer to (i) the Company's SRP, Section 5.1.5.9 (Coastal Resiliency Upgrades), Prioritization, found at page 101 (PDF page 136) and (ii) the Direct Testimony of Eugene Schlatz, Appendix ELS-2, Guidehouse's independent Analysis and Review of CenterPoint Energy Houston Electric's System Resiliency Plan, Section 5.3.11 (Coastal Resiliency Projects), beginning on page 108 (PDF page 1263).

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC RFP 04-24 Confidential Fiber Installation.pdf

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-25

QUESTION:

For RM-6: Provide electronic data for each of the 1,473 structures showing:

a. the structure type;
b. the structure age;
c. failure probability; and
d. the replacement structure type and cost.

ANSWER:

The metric of approximately 1473 structures represents an initial estimate of new structures that would be installed on RM-6 Transmission System Hardening projects. This does not reflect an exact number of existing structures that would be replaced on RM-6. The exact number of structures that will be replaced on RM-6 will not be known until detailed engineering is complete for each identified project.

Based on preliminary estimates, approximately 1364 Structures will be removed on RM-6 projects. This structure replacement count is subject to change pending the outcome of detailed engineering.

a. Approximately 653 of these structures are wood pole structures as referenced in CenterPoint Energy's answer to TIEC 1-10 (a) and (b). The approximately 711 remaining structures are either concrete or steel structures.

The approximate breakdown of structure type for the preliminary structures identified:

Wood Pole – 653
Concrete Pole – 117
Steel Pole – 109
Steel Tower – 485

b. Approximate average age of structures to be replaced:

Wood Pole – 1985
Concrete Pole – 2008
Steel Tower – 1962
Steel Pole – 2018 (53 of the 109 steel poles identified for replacement on this resiliency measure are steel poles used mainly for restoration efforts. These poles are installed to facilitate the restoration of service to customers as quickly as possible while a permanent solution is designed and constructed, at which point the restoration steel poles are removed. Note that these are preliminary identifications, and based on engineering design criteria these structures may or may not be replaced based on the outcome of detailed engineering analysis).

For structures with foundations, CenterPoint Houston tracks the installation of the foundation as a metric to identify the age of the structure in question. For example, if a steel lattice tower with a foundation originally installed in 1950 had an additional extension installed in 2020 which required a new foundation, but the original tower was not replaced. The age of the structure would be updated to reflect the new foundation installed in 2020.

For direct-embed structures, the structure age will reflect the installation year of the direct-embed structure.

Please see table below for breakdown of approximate age of structure, by decade, by structure type.

Structure Type	1950's	1960's	1970's	1980's	1990's	2000's	2010's	2020's
Wood Pole	8	51	77	407	44	24	31	11
Concrete Pole	0	0	0	8	16	53	10	30
Steel Tower	193	260	12	2	3	7	4	4
Steel Pole	0	0	0	1	0	14	33	61

c. An independent third-party consultant (Guidehouse) has calculated failure rates for RM-6 that were presented in Section 4.2.1 (Hurricane Risk Profile) of Exhibit ELS-2. Figure 4-12, found on page 47 (PDF page 1202) of Exhibit ELS-2, presents the annual probability of occurrence for wind speeds for 2030. The probability that wind speeds are expected to exceed the design threshold for wood poles is 0.2% annually. Guidehouse did not derive failure rates for individual poles in its BCA calculations because there are over 1,000 structures that will be replaced for RM-6, it is not practicable to derive failure rates and BCA ratios for each pole.

d. All structures will be replaced with engineered materials (steel lattice towers, steel poles, or concrete poles) that meet current transmission design criteria. The exact structure replacement type will not be known until detailed engineering is complete for the projects included in this resiliency measure.

The costs included in the System Resiliency Plan filing do not distinguish between costs for individual structures, but rather, total project estimates. Due to the complexity and variability of individual structures within a project—such as differences in design requirements, site conditions, and construction methods—it is not practical to create estimates on a per-structure basis. Instead, the process produces an overall project estimate that accounts for the unique challenges and scope of each project. This approach ensures a more accurate and realistic projection of total project costs.

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-26

QUESTION:

For RM-6: Provide the documents containing all reports, memos, and presentations containing, discussing, describing, and analyzing all root cause analyses for each transmission structure that failed in the past five years. Also include:

a. The date of the failure;
b. The design criteria;
c. The replacement structure type and cost; and
d. Indicate if the structure was a hardened or non-hardened structure.

ANSWER:

For information regarding transmission structure failures caused by resiliency events, please see responses to TIEC 1-10 (n).

Outside of resiliency events, CenterPoint Houston has experienced 3 transmission structure failures in the past 5 years.

One structure failure was determined to be caused by a rotten wood pole. This structure was identified for replacement on a Transmission System Hardening project but failed prior to being replaced.

The two remaining structure failures were caused by a pipeline fire in a transmission right-of-way corridor. One of the structures was a concrete pole, and the other structure was a steel lattice tower.

a.

Rotten Wood Pole Failure – 9/29/2023
Pipeline Fire – 9/16/2024

b.

The National Electric Safety Code (NESC) standards for ice and wind loading design for coastal and inland areas apply to circuits, including structures. Circuits are designed for a given structure span length, wire size, and line angle, among other factors. Actual ratings achieved are dependent on overall circuit design and will, at a minimum, adhere to the latest applicable NESC standards at the time of design. CenterPoint Houston has consistently designed its transmission circuits to the latest applicable NESC standards for ice and wind loading design for coastal and inland areas which are updated every five years. CenterPoint Houston's practice of designing all new transmission lines to utilize Grade B loading requirements applies the highest geographically applicable NESC values for wind and ice loading as well as the highest safety overload factors. However, CenterPoint Houston does not have the original records reflecting the NESC codebook that was used at the time the failed structures were designed.

c.

Rotten Wood Pole – CenterPoint Houston had an actual spend of $304,619.30 to replace this failed structure with a steel pole from existing inventory.

Pipeline Fire - CenterPoint Houston has spent $2,004,891 as of 3/1/2025 and expects to spend an additional estimated $1,578,233 on restoration activities associated with the pipeline fire that occurred on 9/16/2024. Total restoration cost associated with the pipeline fire is expected to be $3,583,124. One structure was replaced with an equivalent concrete pole from inventory. One steel lattice tower was initially replaced with temporary steel poles from inventory to re-energize the transmission lines while detailed engineering analysis was performed to identify and procure a steel lattice tower which is expected to be installed this year (2025).

d.

All three of the structure failures described above were on structures that have not been replaced on Transmission System Hardening projects.

CenterPoint Houston has experienced no failures on transmission structures hardened in the last 10 years. For additional information regarding CenterPoint Energy hardening activities, see the storm hardening reports submitted by the Company in Project Nos. 38068 and 39339.

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-27

QUESTION:

For RM-6: Provide the documents containing all reports, memos, and presentations containing, discussing, describing, and analyzing the transmission structure inspections for the past five years.

ANSWER:

Please refer to the Company's filings in PUC Docket No. 38068 for years 2019 through 2024.

https://interchange.puc.texas.gov/search/filings/?
UtilityType=A&ControlNumber=38068&ItemMatch=Equal&DocumentType=ALL&SortOrder=Ascendin

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-28

QUESTION:

For RM-7: Provide data showing for each 69 kV circuit:

a. The circuit identity;
b. The capacity at 69 kV;
c. The capacity at 138 kV after conversion;
d. The current peak loading;
e. The projected peak loading due to load growth; and
f. The projected peak loading due to transferred load.

ANSWER:

a. & b.

Transmission Circuit 10A – Normal 90 MVA, Emergency 111 MVA
Transmission Circuit 12A – Normal 90 MVA, Emergency 111 MVA
Transmission Circuit 16C – Normal 193 MVA, Emergency 253 MVA
Transmission Circuit 16D – Normal 143 MVA, Emergency 143 MVA
Transmission Circuit 19A – Normal 90 MVA, Emergency 111 MVA
Transmission Circuit 23A – Normal 152 MVA, Emergency 193 MVA
Transmission Circuit 28A – Normal 90 MVA, Emergency 111 MVA
Transmission Circuit 31C – Normal 213 MVA, Emergency 227 MVA
Transmission Circuit 32A – Normal 193 MVA, Emergency 253 MVA
Transmission Circuit 33B – Normal 152 MVA, Emergency 193 MVA
Transmission Circuit 33C – Normal 180 MVA, Emergency 223 MVA
Transmission Circuit 34A – Normal 427 MVA, Emergency 454 MVA
Transmission Circuit 34B – Normal 111 MVA, Emergency 143 MVA
Transmission Circuit 40A – Normal 111 MVA, Emergency 143 MVA

c.

CenterPoint Energy's Transmission Planning Department has not completed studies for all projects included in RM-7. Available planning study reports for projects in RM-7 have been attached in document "HCC RFP 4-28 Available Transmission Planning Study Reports.pdf". While all Transmission Planning Studies and detailed engineering are not yet complete, any new conductor will likely have a normal rating of 854MVA and an emergency rating of 908MVA.

d.

The max instantaneous MVA recorded in 2024 for each of the 69kV transmission circuits identified in RM-7 based on a preliminary analysis is listed below.

Transmission Circuit 10A – 45.33MVA
Transmission Circuit 12A – 69.8MVA
Transmission Circuit 16C – 20.25MVA
Transmission Circuit 16D – 5.1MVA
Transmission Circuit 19A – 103.8MVA
Transmission Circuit 23A – 15.4MVA
Transmission Circuit 28A – 9.49MVA
Transmission Circuit 31C – 69.82MVA
Transmission Circuit 32A – 123.8MVA

Transmission Circuit 33B – 48.2MVA
Transmission Circuit 33C – 48.92MVA
Transmission Circuit 34A – 95.46MVA
Transmission Circuit 34B – 352.23MVA
Transmission Circuit 40A – 147.66MVA

e.

CenterPoint Energy's Transmission Planning department has not completed studies for all the projects included in RM-7. Available planning study reports for projects in RM-7 have been attached in document "HCC RFP 4-28 Available Transmission Planning Study Reports CONFIDENTIAL.pdf". Projected peak loading for all projects will not be available until completion of all Transmission Planning Study Reports.

It would be virtually impossible to differentiate between line loading due to load growth and transferred load. Line loading is mostly the product of being part of a networked system. In other words, the load on a transmission line isn't just about local demand or generation; it's the result of how the entire network shares and distributes power. If something changes elsewhere in the grid, it can impact the loading on a line hundreds of miles away.

f.

Please see response to HCC RFP 4-28 (e).

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
HCC RFP 4-28 Available Transmission Planning Study Reports CONFIDENTIAL.pdf

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-29

QUESTION:

For RM-7: Provide data showing for each 138 kV circuit that will transfer load to the converted circuits:

a. The circuit identity;
b. The circuit capacity;
c. The current peak loading; and
d. The projected peak loading after load transfer to the converted circuits.

ANSWER:

Based on discussions with counsel for HCC, HCC RFP04-28 and 29 seek information for each circuit that CEHE plans to upgrade, and HCC is not requesting information for any circuit that is not planned for an upgrade in RM-7. Accordingly, please see the response to HCC RFP04-28.

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-30

QUESTION:

For RM-7: Show what switching options will be added by this measure and how these options improve resiliency.

ANSWER:

Please see response to OPUC 1-1 (d).

In addition to the response to OPUC 1-1 (d), CenterPoint Houston has a substationally larger 138kV transmission system when compared to the 69kV transmission system which allows CenterPoint Houston to better manage load in the event of transmission circuit outages caused by a resiliency event. CenterPoint Houston's 138kV transmission circuits also generally have higher capacity than 69kV transmission circuits.

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-31

QUESTION:

For RM-7: Provide the priority criteria, assessment methods, and scoring used to prioritize the transmission circuits.

ANSWER:

Please see response to HCC RFP Set 4-24 (b).

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-32

QUESTION:

For RM-7: Provide the load flow analysis for existing load and future load both before and after conversion to 138 kV, including, but not limited to contingencies.

ANSWER:

Please see response and attachment provided for HCC RFP 4-28 (e).

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-33

QUESTION:

For RM-8: Provide the documents containing all reports, memos, and presentations containing, discussing, describing, and analyzing all root cause analyses of S90 towers that previously failed. Also, for each S90 tower that failed, provide:

a. The date of the failure; and
b. The design criteria.

ANSWER:

Please see respose to TIEC 1-12 b.

a.

December 1969.

b.

The National Electric Safety Code (NESC) standards for ice and wind loading design for coastal and inland areas apply to circuits, including structures. Circuits are designed for a given structure span length, wire size, and line angle, among other factors. Actual ratings achieved are dependent on overall circuit design and will, at a minimum, adhere to the latest applicable NESC standards at the time of design. CenterPoint Houston has consistently designed its transmission circuits to the latest applicable NESC standards for ice and wind loading design for coastal and inland areas which are updated every five years. CenterPoint Houston's practice of designing all new transmission lines to utilize Grade B loading requirements applies the highest geographically applicable NESC values for wind and ice loading as well as the highest safety overload factors. However, CenterPoint Houston does not have the original records reflecting the NESC codebook that was used at the time the failed structure was designed.

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-34

QUESTION:

For RM-10: Provide engineering design criteria or protocols for equipment susceptible to water damage located in an underground vault.

ANSWER:

Underground/transformer vaults in CenterPoint Houston's service territory are not substation facilities and not included in RM-10 (Substation Flood Control Resiliency Measure).

For distribution major underground: New customer requested transformer vaults must be built at grade and at least 2' above the 500-year floodplain. Current design standards require the installation of submersible vault type transformers. Transformer vaults with microprocessor-based relays will include the installation of two float switches inside of the vault. The first float switch is located at a height of 6" above grade and it triggers a warning to indicate the presence of liquid in the vault. The second float switch is located at 2' above grade and it triggers a lock-out to safely de-energize the service to the customer. The company provides the building owners with dry contacts for monitoring liquid and high temperature warnings in the company's transformer vaults. The company's supplemental terms and conditions for underground service provides instructions to the customer on how to notify the company in case of a warning light indication. RM-12 (MUCAMS) addresses the company's monitoring of warning light indications in transformer vaults.

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-35

QUESTION:

For RM-10: Provide engineering design criteria or protocols for equipment susceptible to water damage located in an underground vault located in an area with high flood risk.

ANSWER:

Underground/transformer vaults in CenterPoint Houston's service territory are not substation facilities and not included in RM-10 (Substation Flood Control Resiliency Measure).

For distribution major underground: New customer requested transformer vaults must be built at grade and at least 2' above the 500-year floodplain. Current design standards require the installation of submersible vault type transformers. Transformer vaults with microprocessor-based relays will include the installation of two float switches inside of the vault. The first float switch is located at a height of 6" above grade and it triggers a warning to indicate the presence of liquid in the vault. The second float switch is located at 2' above grade and it triggers a lock-out to safely de-energize the service to the customer. The company provides the building owners with dry contacts for monitoring liquid and high temperature warnings in the company's transformer vaults. The company's supplemental terms and conditions for underground service provides instructions to the customer on how to notify the company in case of a warning light indication. RM-12 (MUCAMS) addresses the company's monitoring of warning light indications in transformer vaults.

SPONSOR:
Eric Easton and David Mercado

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-36

QUESTION:

For RM-10: Provide the documents containing all reports, memos, and presentations containing, discussing, describing, and analyzing the relative elevation of the substation locations used to determine at risk locations, investigation of potential mitigation actions, and prioritization.

ANSWER:

Please see attached confidential file.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC-RFP04 36 Confidential Named Flood Report.pdf

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-37

QUESTION:

For RM-10: Provide data supporting the conclusion that the projected impact of flooding and extent of the Company's service area included in the 100-year, 200-year, and 500-year floodplain is expected to increase over time.

ANSWER:

Please see HCC-RFP04-37 Attachemt 1.xls that provides the directional increase in the projected flood depths per county in CEHE service area for various floodplains. This file is a subset (Flood only) of the total export from the Jupiter Intelligence climate forecast acquired for this project which originally included all climate hazards evaluated in CEHE's territory. For the specific floodplains in question (100-year, 200-year and 500-year), please refer to columns AK, AL, AM.

SPONSOR:
Eugene Shlatz

RESPONSIVE DOCUMENTS:
HCC RFP04-37 Attachemt 1.xls

County Name	scenario	year	FL_depth	FL_depth2	FL_depth5	FL_depth100yr_mean	FL_depth200yr_mean	FL_depth500yr_mean	FL_depthT	FL_depth1	FL_depth2	FL_depth5	FL_depth1	FL_depth2	FL_depth5	FL_depthTidal_pctarea_mean
Austin County	baseline	1995	1.65	1.75	1.89	2	2.13	2.31		12.61	13.77	15.34	16.58	17.75	19.38	
Austin County	ssp126	2020	1.64	1.74	1.87	1.99	2.11	2.27		12.61	13.75	15.27	16.46	17.59	19.21	
Austin County	ssp126	2025	1.64	1.74	1.87	1.98	2.1	2.26		12.6	13.72	15.25	16.42	17.57	19.2	
Austin County	ssp126	2030	1.64	1.73	1.87	1.98	2.1	2.26		12.58	13.71	15.22	16.37	17.53	19.14	
Austin County	ssp126	2035	1.64	1.73	1.86	1.97	2.09	2.25		12.59	13.71	15.23	16.38	17.53	19.15	
Austin County	ssp126	2040	1.64	1.73	1.86	1.97	2.08	2.24		12.6	13.72	15.24	16.4	17.56	19.19	
Austin County	ssp126	2045	1.63	1.73	1.86	1.96	2.08	2.23		12.61	13.74	15.27	16.43	17.6	19.2	
Austin County	ssp126	2050	1.63	1.73	1.85	1.96	2.07	2.22		12.62	13.75	15.28	16.45	17.62	19.22	
Austin County	ssp245	2020	1.6	1.69	1.81	1.91	2.02	2.17		12.36	13.46	14.94	16.1	17.28	18.85	
Austin County	ssp245	2025	1.61	1.7	1.82	1.92	2.04	2.19		12.46	13.56	15.09	16.27	17.45	19.06	
Austin County	ssp245	2030	1.62	1.71	1.84	1.94	2.05	2.21		12.53	13.65	15.18	16.37	17.53	19.15	
Austin County	ssp245	2035	1.63	1.72	1.85	1.96	2.08	2.23		12.58	13.71	15.24	16.41	17.57	19.2	
Austin County	ssp245	2040	1.64	1.73	1.87	1.98	2.09	2.25		12.64	13.77	15.28	16.45	17.61	19.23	
Austin County	ssp245	2045	1.65	1.74	1.88	1.98	2.11	2.26		12.69	13.83	15.35	16.54	17.66	19.3	
Austin County	ssp245	2050	1.65	1.75	1.88	1.99	2.12	2.27		12.74	13.88	15.41	16.62	17.72	19.32	
Austin County	ssp585	2020	1.68	1.79	1.93	2.05	2.18	2.36		12.88	14.07	15.68	16.91	18.07	19.75	
Austin County	ssp585	2025	1.67	1.77	1.91	2.03	2.16	2.33		12.85	14.03	15.62	16.86	18	19.68	
Austin County	ssp585	2030	1.66	1.76	1.9	2.01	2.14	2.3		12.82	13.98	15.55	16.79	17.92	19.6	
Austin County	ssp585	2035	1.66	1.75	1.89	2	2.12	2.27		12.78	13.94	15.5	16.72	17.83	19.52	
Austin County	ssp585	2040	1.65	1.74	1.88	1.98	2.1	2.25		12.76	13.92	15.46	16.68	17.79	19.45	
Austin County	ssp585	2045	1.65	1.74	1.87	1.97	2.09	2.23		12.75	13.91	15.43	16.66	17.76	19.4	
Austin County	ssp585	2050	1.64	1.73	1.86	1.96	2.07	2.22		12.74	13.89	15.41	16.6	17.74	19.34	
Brazoria County	baseline	1995	0.86	1	1.26	1.63	2.21	3.55	0.37	32.27	36.93	43.27	51.37	58.48	68.62	0.14
Brazoria County	ssp126	2020	0.87	1.03	1.35	1.73	2.33	3.71	0.39	33.02	37.28	45.63	52.34	58.86	69.2	0.36
Brazoria County	ssp126	2025	0.87	1.04	1.36	1.76	2.36	3.76	0.39	33.34	37.4	45.78	52.52	59.32	69.42	0.45
Brazoria County	ssp126	2030	0.88	1.05	1.38	1.79	2.39	3.8	0.39	33.53	37.52	45.95	52.67	59.47	69.66	0.54
Brazoria County	ssp126	2035	0.89	1.06	1.4	1.82	2.43	3.84	0.39	33.66	37.63	46.17	52.87	59.6	69.87	0.66
Brazoria County	ssp126	2040	0.9	1.07	1.41	1.83	2.46	3.87	0.39	33.78	37.73	46.42	53.06	59.72	70.04	0.82
Brazoria County	ssp126	2045	0.91	1.09	1.44	1.84	2.48	3.92	0.39	33.93	38.31	46.67	53.18	59.77	70.3	1.01
Brazoria County	ssp126	2050	0.92	1.1	1.47	1.87	2.53	3.97	0.38	34.04	38.45	46.84	53.36	59.94	70.74	1.28
Brazoria County	ssp245	2020	0.85	1.01	1.29	1.71	2.33	3.7	0.39	32.77	36.71	43.65	51.45	57.58	68.33	0.36
Brazoria County	ssp245	2025	0.86	1.02	1.31	1.74	2.36	3.75	0.39	33.13	36.89	43.9	51.81	58.23	68.68	0.44
Brazoria County	ssp245	2030	0.87	1.03	1.33	1.77	2.39	3.79	0.39	33.32	37.05	44.14	52.05	58.44	68.98	0.54
Brazoria County	ssp245	2035	0.88	1.05	1.38	1.8	2.43	3.84	0.39	33.45	37.2	45.53	52.33	58.64	69.25	0.66
Brazoria County	ssp245	2040	0.89	1.06	1.41	1.82	2.47	3.88	0.39	33.57	37.34	45.84	52.59	58.83	69.47	0.82
Brazoria County	ssp245	2045	0.9	1.08	1.44	1.84	2.5	3.93	0.39	33.73	37.95	46.15	52.8	58.95	69.78	1.04
Brazoria County	ssp245	2050	0.92	1.1	1.47	1.87	2.55	3.99	0.38	33.85	38.12	46.78	53.04	59.18	70.28	1.36
Brazoria County	ssp585	2020	0.86	1.02	1.33	1.72	2.35	3.72	0.39	32.89	36.94	44.67	51.91	57.93	68.55	0.36
Brazoria County	ssp585	2025	0.87	1.03	1.35	1.76	2.37	3.76	0.39	33.29	37.15	44.95	52.2	58.56	68.95	0.46
Brazoria County	ssp585	2030	0.88	1.05	1.37	1.79	2.4	3.8	0.39	33.52	37.35	45.34	52.45	58.84	69.33	0.56
Brazoria County	ssp585	2035	0.89	1.06	1.4	1.82	2.44	3.85	0.39	33.71	37.56	45.99	52.82	59.17	69.7	0.71
Brazoria County	ssp585	2040	0.91	1.08	1.42	1.84	2.48	3.88	0.39	33.91	38.19	46.47	53.1	59.5	70.03	0.93
Brazoria County	ssp585	2045	0.92	1.1	1.46	1.86	2.51	3.94	0.38	34.1	38.46	46.79	53.34	59.7	70.44	1.25
Brazoria County	ssp585	2050	0.94	1.12	1.49	1.9	2.57	4	0.33	34.27	38.7	47.49	53.6	60.01	71.02	2.05
Chambers County	baseline	1995	0.82	1.06	1.63	2.34	3.34	5.33	0.58	47.3	51.02	56.34	61.59	68.6	82.98	4.14
Chambers County	ssp126	2020	0.89	1.17	1.77	2.5	3.47	5.48	0.71	47.89	50.83	56.68	61.51	69.35	83.96	5.07
Chambers County	ssp126	2025	0.91	1.2	1.81	2.54	3.52	5.54	0.73	48.1	50.98	56.93	61.91	69.71	84.33	5.26
Chambers County	ssp126	2030	0.93	1.23	1.85	2.58	3.56	5.6	0.75	48.3	51.16	57.17	62.31	70.1	84.83	5.49
Chambers County	ssp126	2035	0.96	1.26	1.88	2.61	3.61	5.64	0.77	48.44	51.41	57.44	62.74	70.43	85.16	5.74
Chambers County	ssp126	2040	0.98	1.29	1.91	2.65	3.64	5.71	0.79	48.6	51.77	57.65	63.16	70.65	85.63	6.03
Chambers County	ssp126	2045	1.01	1.32	1.96	2.66	3.7	5.76	0.8	48.75	52.03	57.95	63.53	71.04	85.93	6.36
Chambers County	ssp126	2050	1.04	1.34	1.99	2.7	3.74	5.81	0.76	48.92	52.33	58.18	63.81	71.32	86.18	7.22
Chambers County	ssp245	2020	0.89	1.16	1.77	2.5	3.47	5.47	0.7	48.01	51.38	57.09	61.94	69.81	84.25	5.06
Chambers County	ssp245	2025	0.91	1.19	1.81	2.54	3.51	5.53	0.73	48.23	51.52	57.32	62.32	70.14	84.61	5.25
Chambers County	ssp245	2030	0.93	1.22	1.84	2.58	3.55	5.59	0.75	48.42	51.66	57.53	62.66	70.48	85.05	5.46
Chambers County	ssp245	2035	0.96	1.25	1.88	2.61	3.61	5.64	0.77	48.54	51.84	57.76	63.05	70.76	85.34	5.72
Chambers County	ssp245	2040	0.98	1.29	1.91	2.65	3.63	5.71	0.79	48.67	52.05	57.89	63.4	70.92	85.78	6.03
Chambers County	ssp245	2045	1.01	1.32	1.96	2.67	3.7	5.76	0.8	48.81	52.23	58.15	63.63	71.28	86.08	6.42
Chambers County	ssp245	2050	1.04	1.35	2	2.71	3.75	5.82	0.73	48.96	52.46	58.33	63.96	71.53	86.32	7.71
Chambers County	ssp585	2020	0.9	1.17	1.77	2.49	3.47	5.47	0.71	48.22	51.56	57.21	62.32	69.79	84.24	5.07
Chambers County	ssp585	2025	0.92	1.2	1.81	2.53	3.51	5.54	0.73	48.44	51.72	57.47	62.73	70.17	84.62	5.28
Chambers County	ssp585	2030	0.95	1.23	1.85	2.57	3.56	5.6	0.76	48.65	51.89	57.72	63.13	70.56	85.09	5.52
Chambers County	ssp585	2035	0.97	1.27	1.9	2.61	3.62	5.65	0.78	48.83	52.12	57.98	63.62	70.89	85.45	5.84

County Name	scenario	year	FL_depth	FL_depth2	FL_depth5	FL_depth100yr_mean	FL_depth200yr_mean	FL_depth500yr_mean	FL_depthT	FL_depth1	FL_depth2	FL_depth5	FL_depth1	FL_depth2	FL_depth5	FL_depthTidal_pctarea_mean
Chambers County	ssp585	2040	1	1.31	1.93	2.66	3.65	5.73	0.8	48.99	52.36	58.16	63.98	71.14	85.92	6.23
Chambers County	ssp585	2045	1.04	1.35	1.99	2.69	3.72	5.79	0.76	49.18	52.64	58.51	64.17	71.56	86.29	7.31
Chambers County	ssp585	2050	1.08	1.39	2.04	2.74	3.78	5.86	0.69	49.38	52.93	58.77	64.43	71.87	86.59	9.12
Colorado County	baseline	1995	1.24	1.33	1.48	1.6	1.74	1.93		13.84	15.54	17.69	19.34	20.99	23.24	
Colorado County	ssp126	2020	1.24	1.33	1.46	1.57	1.69	1.86		13.83	15.4	17.35	18.76	20.19	22.11	
Colorado County	ssp126	2025	1.25	1.33	1.46	1.57	1.69	1.86		13.86	15.43	17.4	18.81	20.26	22.19	
Colorado County	ssp126	2030	1.25	1.33	1.46	1.58	1.7	1.87		13.88	15.45	17.42	18.84	20.3	22.23	
Colorado County	ssp126	2035	1.25	1.33	1.47	1.58	1.7	1.87		13.92	15.5	17.48	18.9	20.36	22.32	
Colorado County	ssp126	2040	1.25	1.33	1.47	1.58	1.7	1.87		13.97	15.55	17.54	18.98	20.44	22.43	
Colorado County	ssp126	2045	1.25	1.33	1.47	1.58	1.7	1.87		14.02	15.61	17.61	19.06	20.52	22.51	
Colorado County	ssp126	2050	1.25	1.33	1.47	1.58	1.71	1.88		14.05	15.63	17.65	19.11	20.57	22.58	
Colorado County	ssp245	2020	1.22	1.3	1.42	1.53	1.65	1.81		13.62	15.19	17.19	18.64	20.09	22.08	
Colorado County	ssp245	2025	1.23	1.3	1.43	1.54	1.66	1.83		13.74	15.32	17.34	18.8	20.26	22.27	
Colorado County	ssp245	2030	1.23	1.31	1.44	1.56	1.68	1.85		13.83	15.42	17.43	18.9	20.36	22.37	
Colorado County	ssp245	2035	1.24	1.32	1.46	1.57	1.7	1.87		13.89	15.48	17.49	18.95	20.43	22.43	
Colorado County	ssp245	2040	1.25	1.33	1.47	1.59	1.71	1.89		13.96	15.56	17.56	19.02	20.51	22.51	
Colorado County	ssp245	2045	1.25	1.34	1.48	1.6	1.73	1.91		14.05	15.64	17.64	19.08	20.58	22.59	
Colorado County	ssp245	2050	1.26	1.35	1.49	1.62	1.74	1.92		14.12	15.71	17.71	19.16	20.66	22.64	
Colorado County	ssp585	2020	1.24	1.32	1.45	1.56	1.68	1.85		13.9	15.54	17.55	19.07	20.6	22.66	
Colorado County	ssp585	2025	1.24	1.33	1.46	1.57	1.69	1.86		13.96	15.58	17.61	19.11	20.64	22.71	
Colorado County	ssp585	2030	1.25	1.33	1.47	1.58	1.71	1.88		14	15.62	17.64	19.14	20.66	22.73	
Colorado County	ssp585	2035	1.25	1.34	1.48	1.59	1.72	1.89		14.06	15.67	17.69	19.18	20.69	22.76	
Colorado County	ssp585	2040	1.25	1.34	1.48	1.6	1.73	1.9		14.12	15.73	17.74	19.24	20.74	22.8	
Colorado County	ssp585	2045	1.26	1.35	1.49	1.61	1.74	1.91		14.18	15.79	17.81	19.28	20.79	22.85	
Colorado County	ssp585	2050	1.26	1.35	1.5	1.62	1.75	1.93		14.23	15.84	17.85	19.31	20.82	22.86	
Fort Bend County	baseline	1995	0.87	0.95	1.07	1.28	1.45	1.72		20.45	23.6	28.09	32.42	35.41	39.55	
Fort Bend County	ssp126	2020	0.86	0.94	1.13	1.28	1.45	1.72		20.61	23.82	29.27	32.54	35.43	39.41	
Fort Bend County	ssp126	2025	0.86	0.94	1.13	1.27	1.44	1.71		20.65	23.85	29.27	32.55	35.42	39.39	
Fort Bend County	ssp126	2030	0.86	0.94	1.13	1.27	1.44	1.7		20.7	23.89	29.29	32.52	35.39	39.37	
Fort Bend County	ssp126	2035	0.86	0.94	1.13	1.26	1.43	1.69		20.74	23.92	29.28	32.51	35.36	39.35	
Fort Bend County	ssp126	2040	0.86	0.94	1.12	1.26	1.42	1.68		20.78	23.95	29.28	32.49	35.34	39.32	
Fort Bend County	ssp126	2045	0.86	0.94	1.12	1.26	1.42	1.67		20.82	23.99	29.28	32.48	35.32	39.29	
Fort Bend County	ssp126	2050	0.86	0.94	1.05	1.25	1.41	1.66		20.86	24.01	28.36	32.46	35.29	39.26	
Fort Bend County	ssp245	2020	0.84	0.91	1.01	1.19	1.33	1.55		20.21	23.17	27.36	31.35	34.31	37.96	
Fort Bend County	ssp245	2025	0.85	0.92	1.02	1.21	1.36	1.58		20.39	23.38	27.63	31.68	34.59	38.38	
Fort Bend County	ssp245	2030	0.85	0.92	1.03	1.22	1.38	1.62		20.53	23.56	27.87	31.93	34.8	38.8	
Fort Bend County	ssp245	2035	0.86	0.93	1.04	1.24	1.4	1.65		20.63	23.72	28.04	32.13	34.98	38.94	
Fort Bend County	ssp245	2040	0.86	0.94	1.12	1.25	1.42	1.67		20.73	23.88	29.16	32.33	35.12	39.05	
Fort Bend County	ssp245	2045	0.87	0.94	1.13	1.27	1.43	1.69		20.84	24.04	29.35	32.5	35.26	39.13	
Fort Bend County	ssp245	2050	0.87	0.94	1.14	1.28	1.45	1.71		20.94	24.19	29.52	32.64	35.38	39.2	
Fort Bend County	ssp585	2020	0.88	0.96	1.16	1.31	1.48	1.76		20.82	24.12	29.6	32.75	35.58	39.35	
Fort Bend County	ssp585	2025	0.88	0.95	1.15	1.3	1.47	1.74		20.87	24.12	29.56	32.71	35.5	39.35	
Fort Bend County	ssp585	2030	0.87	0.95	1.14	1.29	1.45	1.72		20.92	24.14	29.53	32.67	35.43	39.33	
Fort Bend County	ssp585	2035	0.87	0.95	1.14	1.28	1.44	1.7		20.96	24.17	29.52	32.64	35.41	39.32	
Fort Bend County	ssp585	2040	0.87	0.95	1.13	1.27	1.43	1.68		21	24.22	29.5	32.64	35.4	39.33	
Fort Bend County	ssp585	2045	0.87	0.94	1.13	1.26	1.42	1.67		21.06	24.26	29.51	32.63	35.39	39.32	
Fort Bend County	ssp585	2050	0.87	0.94	1.13	1.26	1.42	1.66		21.11	24.3	29.51	32.64	35.38	39.3	
Galveston County	baseline	1995	0.83	1.16	1.79	2.51	3.71	6.48	0.45	46.21	50.9	59	66.27	85.51	97.17	2.87
Galveston County	ssp126	2020	0.94	1.29	1.93	2.67	3.89	6.7	0.52	47.86	52.03	60.13	76.16	86.63	97.77	4.86
Galveston County	ssp126	2025	0.97	1.33	1.97	2.7	3.94	6.79	0.53	48.2	52.4	60.5	76.77	86.99	97.93	5.4
Galveston County	ssp126	2030	1	1.36	2	2.74	3.99	6.88	0.54	48.51	52.75	60.82	77.21	87.35	98.07	5.98
Galveston County	ssp126	2035	1.03	1.39	2.04	2.79	4.05	6.96	0.54	48.81	53.17	61.17	77.66	87.71	98.18	6.7
Galveston County	ssp126	2040	1.06	1.42	2.07	2.83	4.1	7.05	0.54	49.14	53.58	61.43	78	88.12	98.27	7.61
Galveston County	ssp126	2045	1.09	1.45	2.11	2.86	4.13	7.12	0.53	49.44	54.02	61.72	78.35	88.27	98.37	8.79
Galveston County	ssp126	2050	1.13	1.48	2.14	2.89	4.18	7.19	0.48	49.73	54.35	62	78.61	88.61	98.48	11.45
Galveston County	ssp245	2020	0.94	1.29	1.93	2.66	3.88	6.69	0.52	47.83	51.95	59.96	76.06	86.54	97.75	4.83
Galveston County	ssp245	2025	0.97	1.32	1.96	2.7	3.93	6.79	0.53	48.14	52.3	60.31	76.45	86.89	97.92	5.36
Galveston County	ssp245	2030	1	1.35	1.99	2.74	3.98	6.88	0.54	48.45	52.62	60.61	77.08	87.25	98.07	5.92
Galveston County	ssp245	2035	1.03	1.38	2.03	2.78	4.04	6.96	0.54	48.75	53.07	60.96	77.55	87.62	98.18	6.66
Galveston County	ssp245	2040	1.06	1.41	2.06	2.83	4.1	7.05	0.54	49.09	53.49	61.25	77.91	88.05	98.27	7.62
Galveston County	ssp245	2045	1.09	1.45	2.11	2.87	4.14	7.12	0.53	49.42	53.97	61.58	78.29	88.24	98.38	9.03
Galveston County	ssp245	2050	1.13	1.48	2.15	2.9	4.19	7.2	0.46	49.73	54.34	61.93	78.6	88.64	98.5	12.63
Galveston County	ssp585	2020	0.94	1.29	1.93	2.66	3.88	6.7	0.52	47.75	51.87	59.84	76	86.5	97.76	4.87

County Name	scenario	year	FL_depth	FL_depth2	FL_depth5	FL_depth100yr_mean	FL_depth200yr_mean	FL_depth500yr_mean	FL_depthT	FL_depth1	FL_depth2	FL_depth5	FL_depth1	FL_depth2	FL_depth5	FL_depthTidal_pctarea_mean
Galveston County	ssp585	2025	0.97	1.33	1.97	2.7	3.94	6.79	0.53	48.16	52.34	60.31	76.67	86.9	97.93	5.44
Galveston County	ssp585	2030	1.01	1.36	2	2.75	3.99	6.89	0.54	48.56	52.77	60.73	77.16	87.31	98.08	6.08
Galveston County	ssp585	2035	1.04	1.4	2.05	2.8	4.06	6.98	0.54	48.97	53.34	61.21	77.73	87.76	98.2	7.01
Galveston County	ssp585	2040	1.08	1.43	2.09	2.85	4.12	7.08	0.53	49.41	53.89	61.61	78.19	88.28	98.32	8.3
Galveston County	ssp585	2045	1.12	1.48	2.14	2.9	4.17	7.17	0.47	49.85	54.48	62.04	78.68	88.56	98.44	11.56
Galveston County	ssp585	2050	1.17	1.52	2.18	2.94	4.23	7.26	0.37	50.27	54.98	62.62	79.07	89.11	98.57	20.18
Harris County	baseline	1995	0.82	0.88	0.96	1.05	1.23	1.72	0.47	16.07	18.17	21.31	24.19	27.76	35.04	0.25
Harris County	ssp126	2020	0.82	0.87	0.95	1.04	1.23	1.75	0.54	16.32	18.38	21.48	24.28	27.68	34.9	0.36
Harris County	ssp126	2025	0.82	0.87	0.95	1.04	1.24	1.77	0.56	16.36	18.48	21.61	24.41	27.84	35.14	0.39
Harris County	ssp126	2030	0.82	0.87	0.95	1.05	1.25	1.79	0.59	16.42	18.57	21.72	24.55	28.02	35.39	0.41
Harris County	ssp126	2035	0.82	0.87	0.95	1.05	1.26	1.8	0.6	16.47	18.63	21.79	24.65	28.11	35.57	0.43
Harris County	ssp126	2040	0.82	0.87	0.95	1.06	1.26	1.82	0.62	16.52	18.68	21.87	24.74	28.22	35.75	0.46
Harris County	ssp126	2045	0.82	0.87	0.95	1.06	1.27	1.83	0.64	16.57	18.74	21.96	24.82	28.31	35.88	0.48
Harris County	ssp126	2050	0.82	0.87	0.96	1.07	1.27	1.85	0.66	16.62	18.81	22.03	24.94	28.39	36.12	0.5
Harris County	ssp245	2020	0.82	0.87	0.95	1.05	1.24	1.76	0.54	16.34	18.44	21.63	24.5	27.99	35.39	0.36
Harris County	ssp245	2025	0.82	0.87	0.95	1.05	1.25	1.77	0.56	16.43	18.54	21.75	24.62	28.13	35.59	0.39
Harris County	ssp245	2030	0.82	0.87	0.95	1.06	1.26	1.79	0.58	16.49	18.63	21.86	24.75	28.29	35.8	0.41
Harris County	ssp245	2035	0.82	0.87	0.96	1.06	1.26	1.81	0.6	16.52	18.71	21.95	24.86	28.4	35.98	0.43
Harris County	ssp245	2040	0.82	0.87	0.96	1.07	1.27	1.83	0.62	16.57	18.79	22.05	24.97	28.52	36.14	0.46
Harris County	ssp245	2045	0.82	0.87	0.96	1.07	1.28	1.83	0.64	16.63	18.86	22.13	25.06	28.6	36.26	0.49
Harris County	ssp245	2050	0.82	0.88	0.96	1.07	1.28	1.86	0.67	16.68	18.93	22.22	25.18	28.67	36.47	0.51
Harris County	ssp585	2020	0.84	0.89	0.97	1.07	1.26	1.78	0.55	16.51	18.68	21.91	24.84	28.31	35.55	0.36
Harris County	ssp585	2025	0.83	0.89	0.97	1.07	1.27	1.79	0.56	16.57	18.75	22	24.92	28.41	35.74	0.39
Harris County	ssp585	2030	0.83	0.88	0.97	1.07	1.27	1.81	0.59	16.62	18.82	22.07	24.99	28.52	35.93	0.41
Harris County	ssp585	2035	0.83	0.88	0.97	1.07	1.28	1.82	0.61	16.66	18.88	22.14	25.08	28.61	36.12	0.44
Harris County	ssp585	2040	0.83	0.88	0.97	1.07	1.28	1.83	0.63	16.73	18.95	22.22	25.17	28.7	36.3	0.48
Harris County	ssp585	2045	0.83	0.88	0.96	1.07	1.28	1.84	0.66	16.79	19.03	22.31	25.23	28.76	36.43	0.51
Harris County	ssp585	2050	0.83	0.88	0.96	1.08	1.28	1.86	0.69	16.83	19.1	22.4	25.33	28.81	36.66	0.54
Liberty County	baseline	1995	1.11	1.19	1.34	1.47	1.6	1.86		28.69	32.87	37.65	41.02	44.42	49	
Liberty County	ssp126	2020	1.1	1.19	1.33	1.45	1.58	1.84	0.22	28.78	32.8	37.37	40.59	43.73	48.24	0
Liberty County	ssp126	2025	1.11	1.19	1.33	1.45	1.58	1.84	0.26	28.83	32.82	37.4	40.6	43.75	48.26	0
Liberty County	ssp126	2030	1.11	1.19	1.34	1.46	1.58	1.85	0.31	28.91	32.87	37.43	40.7	43.78	48.3	0
Liberty County	ssp126	2035	1.11	1.2	1.34	1.46	1.58	1.85	0.36	28.98	32.91	37.46	40.72	43.79	48.32	0
Liberty County	ssp126	2040	1.11	1.2	1.34	1.46	1.58	1.86	0.41	29.05	32.96	37.49	40.74	43.81	48.36	0
Liberty County	ssp126	2045	1.11	1.2	1.34	1.46	1.58	1.87	0.34	29.09	33	37.52	40.76	43.83	48.39	0
Liberty County	ssp126	2050	1.11	1.2	1.34	1.46	1.58	1.87	0.28	29.15	33.05	37.54	40.78	43.86	48.42	0
Liberty County	ssp245	2020	1.1	1.19	1.34	1.47	1.6	1.87	0.21	28.93	33.14	37.89	41.27	44.61	49.11	0
Liberty County	ssp245	2025	1.1	1.19	1.34	1.47	1.6	1.87	0.26	29.02	33.2	37.92	41.33	44.58	49.12	0
Liberty County	ssp245	2030	1.1	1.19	1.34	1.47	1.6	1.88	0.31	29.11	33.22	37.92	41.32	44.54	49.07	0
Liberty County	ssp245	2035	1.11	1.2	1.35	1.47	1.6	1.88	0.36	29.14	33.21	37.91	41.29	44.49	49.04	0
Liberty County	ssp245	2040	1.11	1.2	1.35	1.47	1.6	1.89	0.41	29.19	33.23	37.9	41.26	44.46	49.03	0
Liberty County	ssp245	2045	1.11	1.2	1.35	1.47	1.6	1.89	0.35	29.22	33.24	37.89	41.24	44.42	49	0
Liberty County	ssp245	2050	1.12	1.21	1.35	1.47	1.6	1.89	0.29	29.25	33.25	37.88	41.22	44.38	48.96	0
Liberty County	ssp585	2020	1.12	1.21	1.36	1.48	1.61	1.87	0.22	29.19	33.31	37.92	41.26	44.46	48.93	0
Liberty County	ssp585	2025	1.12	1.21	1.36	1.48	1.61	1.87	0.27	29.29	33.38	37.95	41.28	44.46	48.92	0
Liberty County	ssp585	2030	1.12	1.21	1.36	1.48	1.61	1.87	0.32	29.37	33.4	37.96	41.28	44.44	48.91	0
Liberty County	ssp585	2035	1.12	1.21	1.36	1.48	1.6	1.87	0.38	29.41	33.41	37.96	41.26	44.41	48.89	0
Liberty County	ssp585	2040	1.12	1.21	1.35	1.47	1.6	1.88	0.44	29.44	33.41	37.96	41.24	44.38	48.87	0
Liberty County	ssp585	2045	1.12	1.21	1.35	1.47	1.59	1.88	0.28	29.46	33.4	37.93	41.2	44.31	48.83	0
Liberty County	ssp585	2050	1.12	1.21	1.35	1.46	1.58	1.87	0.32	29.45	33.38	37.9	41.14	44.24	48.76	0
Matagorda County	baseline	1995	0.88	0.99	1.16	1.34	1.58	2.01	0.25	31.05	35.61	41.92	47.93	53.44	59.78	0.94
Matagorda County	ssp126	2020	0.88	0.99	1.19	1.37	1.62	2.06	0.37	31.31	36.06	42.08	48.63	53.62	59.97	2.67
Matagorda County	ssp126	2025	0.88	1	1.19	1.38	1.63	2.08	0.41	31.7	36.21	42.25	48.79	53.81	60.11	2.86
Matagorda County	ssp126	2030	0.89	1	1.2	1.39	1.63	2.09	0.44	31.89	36.36	42.4	48.91	53.89	60.16	3.06
Matagorda County	ssp126	2035	0.9	1.01	1.21	1.4	1.65	2.09	0.48	32.07	36.51	42.57	49.05	53.98	60.22	3.26
Matagorda County	ssp126	2040	0.9	1.02	1.22	1.41	1.66	2.11	0.52	32.26	36.68	42.75	49.17	54.06	60.32	3.46
Matagorda County	ssp126	2045	0.91	1.03	1.23	1.41	1.67	2.12	0.55	32.44	36.87	42.96	49.25	54.15	60.33	3.69
Matagorda County	ssp126	2050	0.92	1.03	1.24	1.43	1.69	2.13	0.58	32.6	37.01	43.14	49.39	54.21	60.38	3.94
Matagorda County	ssp245	2020	0.87	0.97	1.16	1.33	1.58	2.02	0.36	30.99	35.56	41.22	47.22	52.33	58.57	2.66
Matagorda County	ssp245	2025	0.87	0.98	1.17	1.35	1.59	2.03	0.4	31.45	35.76	41.5	47.85	52.63	58.86	2.84
Matagorda County	ssp245	2030	0.88	0.99	1.18	1.37	1.6	2.05	0.44	31.66	35.92	41.68	48.06	52.77	58.98	3.04
Matagorda County	ssp245	2035	0.89	1	1.19	1.38	1.62	2.06	0.48	31.83	36.08	41.88	48.25	52.92	59.08	3.25
Matagorda County	ssp245	2040	0.9	1.01	1.21	1.39	1.64	2.08	0.52	32.03	36.27	42.09	48.43	53.1	59.28	3.47

County Name	scenario	year	FL_depth	FL_depth2	FL_depth5	FL_depth100yr_mean	FL_depth200yr_mean	FL_depth500yr_mean	FL_depthT	FL_depth1	FL_depth2	FL_depth5	FL_depth1	FL_depth2	FL_depth5	FL_depthTidal_pctarea_mean
Matagorda County	ssp245	2045	0.91	1.02	1.22	1.4	1.66	2.1	0.55	32.2	36.45	42.36	48.56	53.27	59.42	3.73
Matagorda County	ssp245	2050	0.92	1.04	1.23	1.42	1.68	2.12	0.58	32.37	36.61	42.58	48.77	53.43	59.53	4.01
Matagorda County	ssp585	2020	0.88	0.98	1.17	1.34	1.58	2.02	0.37	31.09	35.66	41.37	47.73	52.5	58.7	2.67
Matagorda County	ssp585	2025	0.88	0.99	1.18	1.36	1.6	2.04	0.41	31.59	35.91	41.7	48.07	52.87	59.08	2.87
Matagorda County	ssp585	2030	0.89	1	1.19	1.38	1.61	2.06	0.45	31.84	36.15	41.97	48.35	53.12	59.32	3.08
Matagorda County	ssp585	2035	0.9	1.01	1.2	1.4	1.64	2.07	0.49	32.09	36.4	42.28	48.63	53.38	59.56	3.33
Matagorda County	ssp585	2040	0.91	1.02	1.22	1.41	1.66	2.1	0.53	32.32	36.66	42.59	48.88	53.65	59.87	3.59
Matagorda County	ssp585	2045	0.92	1.04	1.23	1.42	1.67	2.12	0.57	32.57	36.92	42.98	49.15	53.98	60.16	3.92
Matagorda County	ssp585	2050	0.93	1.05	1.25	1.44	1.7	2.14	0.61	32.8	37.16	43.29	49.46	54.28	60.41	4.28
Montgomery Count	baseline	1995	1.37	1.46	1.58	1.67	1.75	1.88		13.67	14.71	16.11	17.17	18.29	19.74	
Montgomery Count	ssp126	2020	1.36	1.45	1.55	1.64	1.72	1.83		13.74	14.75	16.15	17.17	18.19	19.56	
Montgomery Count	ssp126	2025	1.36	1.45	1.55	1.63	1.72	1.83		13.74	14.75	16.16	17.19	18.21	19.58	
Montgomery Count	ssp126	2030	1.37	1.45	1.55	1.63	1.71	1.83		13.75	14.76	16.18	17.21	18.23	19.59	
Montgomery Count	ssp126	2035	1.37	1.45	1.55	1.63	1.71	1.82		13.77	14.78	16.19	17.21	18.23	19.59	
Montgomery Count	ssp126	2040	1.37	1.45	1.55	1.63	1.71	1.82		13.79	14.8	16.2	17.21	18.23	19.59	
Montgomery Count	ssp126	2045	1.36	1.45	1.55	1.63	1.7	1.81		13.81	14.82	16.21	17.22	18.23	19.58	
Montgomery Count	ssp126	2050	1.36	1.45	1.55	1.62	1.7	1.81		13.82	14.83	16.21	17.22	18.23	19.57	
Montgomery Count	ssp245	2020	1.35	1.44	1.55	1.64	1.72	1.84		13.72	14.74	16.16	17.21	18.3	19.73	
Montgomery Count	ssp245	2025	1.36	1.44	1.55	1.64	1.72	1.84		13.76	14.79	16.21	17.26	18.34	19.77	
Montgomery Count	ssp245	2030	1.36	1.45	1.56	1.64	1.73	1.85		13.79	14.83	16.24	17.3	18.37	19.8	
Montgomery Count	ssp245	2035	1.36	1.45	1.56	1.64	1.73	1.84		13.8	14.84	16.28	17.34	18.4	19.83	
Montgomery Count	ssp245	2040	1.37	1.46	1.56	1.64	1.73	1.84		13.81	14.86	16.31	17.38	18.43	19.86	
Montgomery Count	ssp245	2045	1.37	1.46	1.56	1.64	1.73	1.84		13.83	14.89	16.34	17.41	18.46	19.88	
Montgomery Count	ssp245	2050	1.38	1.46	1.56	1.64	1.73	1.84		13.85	14.91	16.37	17.43	18.48	19.89	
Montgomery Count	ssp585	2020	1.41	1.5	1.62	1.71	1.81	1.94		13.95	15.02	16.52	17.61	18.72	20.19	
Montgomery Count	ssp585	2025	1.4	1.49	1.61	1.7	1.79	1.92		13.95	15.02	16.5	17.57	18.67	20.12	
Montgomery Count	ssp585	2030	1.39	1.49	1.6	1.69	1.77	1.9		13.94	15.01	16.47	17.54	18.62	20.06	
Montgomery Count	ssp585	2035	1.39	1.48	1.59	1.67	1.76	1.88		13.93	14.99	16.45	17.51	18.58	20	
Montgomery Count	ssp585	2040	1.38	1.47	1.58	1.66	1.74	1.86		13.92	14.97	16.42	17.47	18.53	19.94	
Montgomery Count	ssp585	2045	1.38	1.46	1.56	1.64	1.73	1.84		13.91	14.96	16.39	17.44	18.49	19.88	
Montgomery Count	ssp585	2050	1.37	1.45	1.55	1.63	1.71	1.82		13.9	14.94	16.36	17.41	18.44	19.82	
Waller County	baseline	1995	1.62	1.72	1.87	2	2.15	2.41		14.03	16	18.64	20.59	22.53	24.67	
Waller County	ssp126	2020	1.62	1.73	1.89	2.01	2.16	2.4		14.01	15.89	18.23	20.21	22.09	24.21	
Waller County	ssp126	2025	1.62	1.73	1.89	2.01	2.15	2.39		14.01	15.89	18.26	20.21	22.08	24.21	
Waller County	ssp126	2030	1.62	1.72	1.88	2.01	2.15	2.39		14.02	15.9	18.28	20.21	22.08	24.18	
Waller County	ssp126	2035	1.62	1.72	1.88	2	2.14	2.37		14.05	15.93	18.32	20.22	22.09	24.19	
Waller County	ssp126	2040	1.62	1.72	1.87	1.99	2.13	2.36		14.08	15.97	18.36	20.25	22.1	24.2	
Waller County	ssp126	2045	1.62	1.71	1.86	1.99	2.12	2.35		14.11	16	18.39	20.27	22.13	24.22	
Waller County	ssp126	2050	1.62	1.71	1.86	1.98	2.11	2.34		14.13	16.02	18.42	20.29	22.14	24.23	
Waller County	ssp245	2020	1.57	1.65	1.8	1.9	2.04	2.26		13.72	15.59	17.92	19.94	21.73	23.94	
Waller County	ssp245	2025	1.58	1.67	1.82	1.93	2.06	2.28		13.84	15.73	18.11	20.09	21.93	24.11	
Waller County	ssp245	2030	1.59	1.68	1.83	1.95	2.08	2.31		13.94	15.83	18.28	20.21	22.05	24.2	
Waller County	ssp245	2035	1.61	1.7	1.85	1.97	2.11	2.34		14.01	15.89	18.35	20.25	22.11	24.25	
Waller County	ssp245	2040	1.62	1.72	1.86	1.99	2.13	2.36		14.08	15.97	18.43	20.33	22.19	24.29	
Waller County	ssp245	2045	1.63	1.73	1.88	2	2.14	2.38		14.16	16.06	18.51	20.41	22.26	24.34	
Waller County	ssp245	2050	1.64	1.74	1.89	2.01	2.16	2.39		14.23	16.12	18.57	20.49	22.33	24.38	
Waller County	ssp585	2020	1.65	1.77	1.92	2.06	2.21	2.48		14.53	16.39	19.03	20.96	22.85	24.86	
Waller County	ssp585	2025	1.65	1.76	1.9	2.04	2.18	2.44		14.39	16.31	18.94	20.83	22.72	24.74	
Waller County	ssp585	2030	1.64	1.74	1.89	2.02	2.16	2.4		14.34	16.26	18.82	20.7	22.58	24.64	
Waller County	ssp585	2035	1.63	1.73	1.87	2	2.14	2.37		14.28	16.2	18.73	20.57	22.44	24.52	
Waller County	ssp585	2040	1.63	1.72	1.86	1.99	2.12	2.35		14.25	16.16	18.66	20.48	22.32	24.42	
Waller County	ssp585	2045	1.62	1.71	1.85	1.97	2.11	2.32		14.23	16.14	18.6	20.41	22.23	24.34	
Waller County	ssp585	2050	1.62	1.71	1.85	1.96	2.09	2.3		14.21	16.1	18.53	20.35	22.15	24.26	
Wharton County	baseline	1995	0.86	0.92	1.01	1.09	1.18	1.33		18.78	21.6	25.53	28.65	31.81	35.85	
Wharton County	ssp126	2020	0.85	0.9	0.98	1.06	1.14	1.28		18.5	21.13	24.85	27.78	30.69	34.36	
Wharton County	ssp126	2025	0.85	0.91	0.99	1.06	1.15	1.29		18.58	21.21	24.93	27.86	30.77	34.43	
Wharton County	ssp126	2030	0.86	0.91	0.99	1.06	1.15	1.29		18.63	21.27	24.99	27.94	30.82	34.48	
Wharton County	ssp126	2035	0.86	0.91	0.99	1.07	1.16	1.29		18.7	21.35	25.07	28.01	30.88	34.55	
Wharton County	ssp126	2040	0.86	0.91	0.99	1.07	1.16	1.3		18.78	21.43	25.16	28.1	30.96	34.63	
Wharton County	ssp126	2045	0.86	0.91	0.99	1.07	1.16	1.3		18.85	21.52	25.24	28.17	31.02	34.67	
Wharton County	ssp126	2050	0.86	0.91	1	1.07	1.16	1.3		18.89	21.57	25.28	28.23	31.05	34.71	
Wharton County	ssp245	2020	0.85	0.89	0.97	1.04	1.12	1.25		18.3	20.85	24.42	27.19	30.04	33.68	
Wharton County	ssp245	2025	0.85	0.9	0.97	1.04	1.13	1.26		18.42	20.99	24.61	27.39	30.22	33.84	

County Name	scenario	year	FL_depth	FL_depth2	FL_depth5	FL_depth100yr_mean	FL_depth200yr_mean	FL_depth500yr_mean	FL_depthT	FL_depth1	FL_depth2	FL_depth5	FL_depth1	FL_depth2	FL_depth5	FL_depthTidal_pctarea_mean
Wharton County	ssp245	2030	0.85	0.9	0.98	1.05	1.14	1.27		18.5	21.09	24.71	27.54	30.32	33.91	
Wharton County	ssp245	2035	0.85	0.9	0.98	1.06	1.15	1.28		18.56	21.16	24.79	27.63	30.38	33.95	
Wharton County	ssp245	2040	0.86	0.91	0.99	1.06	1.15	1.29		18.64	21.25	24.9	27.74	30.46	34	
Wharton County	ssp245	2045	0.86	0.91	0.99	1.07	1.16	1.3		18.72	21.32	24.96	27.81	30.52	34.02	
Wharton County	ssp245	2050	0.86	0.91	1	1.08	1.17	1.31		18.78	21.39	25.04	27.86	30.54	34.03	
Wharton County	ssp585	2020	0.86	0.91	0.99	1.06	1.14	1.27		18.55	21.17	24.81	27.65	30.55	34.21	
Wharton County	ssp585	2025	0.86	0.91	0.99	1.06	1.15	1.28		18.65	21.28	24.92	27.8	30.68	34.33	
Wharton County	ssp585	2030	0.86	0.91	0.99	1.06	1.15	1.29		18.73	21.37	25.02	27.91	30.76	34.4	
Wharton County	ssp585	2035	0.86	0.91	1	1.07	1.16	1.29		18.82	21.46	25.12	28.01	30.84	34.47	
Wharton County	ssp585	2040	0.86	0.91	1	1.07	1.16	1.3		18.89	21.55	25.23	28.13	30.92	34.55	
Wharton County	ssp585	2045	0.86	0.92	1	1.08	1.17	1.31		18.97	21.63	25.32	28.23	31.01	34.62	
Wharton County	ssp585	2050	0.86	0.92	1	1.08	1.18	1.31		19.03	21.69	25.39	28.27	31.05	34.64	

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-38

QUESTION:

For RM-12: Provide documentation detailing the underground failures due to resiliency events.

ANSWER:

Please refer to confidential attachment HCC RFP 04 38 Confidential MUCAMS Underground Failures.pdf for underground equipment that is planned to be monitored by MUCAMS that failed during a Resiliency Event from 2020 to 2024. To provide proper context for this resiliency measure, the Company is also providing information on water damage during Hurricane Harvey in 2017.

Not all underground failures will result in customer outages. The Company's engineering design criteria for dedicated underground areas requires the installation of at least two feeders at each point of service.

MUCAMS is a monitoring system intended to provide the company real-time information about the state of the underground distribution system in certain areas of Houston. It allows the company to deploy operations personnel more effectively to improve our restoration time and prevent potential damage the company's and customer's electrical infrastructure. It should be noted that MUCAMS will also be utilized to monitor failures of underground equipment outside of a resiliency event as well. There were 37 failures outside of resiliency events from 2020 to 2024.

SPONSOR:
Eric Easton and Randy Pryor

RESPONSIVE DOCUMENTS:
HCC RFP 04 38 Confidential MUCAMS Underground Failures.pdf

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-39

QUESTION:

For RM-12: Provide data showing the existing age, type, and condition of infrastructure at each location proposed to utilize this measure.

ANSWER:

**HCC Set 4 Discovery Agreement - Updated question: The program is replacing an older copper communication system. What is the approximate age of the system and type of communication conductor being used?

The system has been in service for approximately 20 years. Site to site communication is over single-mode fiber cable. Communication between equipment within each site is primarily over copper wire ethernet, serial or twisted pair.

SPONSOR:
Eric Easton and Randy Pryor

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-40

QUESTION:

For RM-15: Provide data showing the existing age, type, and condition of infrastructure at each location proposed to utilize this measure if it is replacing existing infrastructure.

ANSWER:

Load Shed IGSD locations are not known at this time and will be determined on an annual basis based on circuit segmentation studies performed.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-42

QUESTION:

For PP-1:

a. Provide any draft or referenced microgrid Request for Approval ("RFP") CEHE has used or created in considering the pilot microgrids.

b. Provide the documents containing all reports, memos, and presentations containing, discussing, describing, and analyzing the studies which were used to determine priorities areas and devices to include in the microgrid pilot.

ANSWER:

a. There is currently no draft RFP as the Company is awaiting the PUCT's approval of this program. Once approved, the RFP will be developed and released.

b. Locations will be determined from the RFP responses and, as such, there are no current documents showing this information.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-43

QUESTION:

For RM-16: Provide a copy of the most recent distribution system capacity study or similar study evidencing the need for capacity upgrades at substations and distribution lines.

ANSWER:

Please see attached file named HCC-RFP04 43 Confidential capacity study.pdf.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
HCC-RFP04 43 Confidential capacity study

CENTERPOINT ENERGY HOUSTON ELECTRIC, LLC
PUC DOCKET NO. 57579
SOAH DOCKET NO. 473-25-11558

HOUSTON COALITION OF CITIES
REQUEST NO.: HCC-RFP04-44

QUESTION:

Please provide the documents containing all reports, memos, and presentations containing, discussing, describing, and analyzing the studies that were used to determine priorities for deployment of the following measures:

a. RM-26:

b. RM-27; and

c. RM-16.

ANSWER:

a. RM-26: Please reference HCC-RFP04-01j

b. RM-27; Please reference HCC-RFP01-07

c. RM-16.Please reference HCC-RFP04-43 for this information.

SPONSOR:
Eric Easton

RESPONSIVE DOCUMENTS:
None

CERTIFICATE OF SERVICE

I hereby certify that on March 24, 2025, notice of the filing of this document was provided to all parties of record via electronic mail in accordance with the Second Order Suspending Rules, filed in Project No. 50664.

Michael Burleson

The following files are not convertible:

HCC RFI 4-72 IGSD Historical Costs and Benefits.xlsx
HCC RFI 4-75 Pole Cost Comparison.xlsx
HCC RFP 4-20 Hazard Tree Budget.xlsx
HCC RFP04-37 Attachment 1.xlsx
HCC-RFI04-77 - VM Major Event Analysis.xlsx
HCC-RFP04-22 VM Outages Outside of Easement.xlsx

Please see the ZIP file for this Filing on the PUC Interchange in order to access these files.

Contact centralrecords@puc.texas.gov if you have any questions.