EXECUTIVE SUMMARY

Distribution Resiliency Investment Analysis

An Analysis of Florida Utilities Resiliency Investment to Minimize Severe Weather Risks on the Electrical System in the 21st Century

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Core Argument

This report presents findings from an analysis of Florida utility distribution resiliency investment covering the period 2000–2020. The study focused on four major investor-owned utilities (IOUs) in Florida: Florida Power & Light (FPL), Duke Energy Florida, Gulf Power Company, and Tampa Electric Company, using exclusively publicly available financial, reliability, and meteorological data.

The central objective was to develop a more robust value proposition for resiliency investment — one that utilities can present to Public Utility Commissions (PUCs) or Public Service Commissions (PSCs) when seeking funding for infrastructure hardening. The key finding is that each additional minute of storm-attributable SAIDI corresponds to approximately $263,000 in storm restoration expenses, providing a quantifiable link between storm impacts and financial costs.

Background and Objectives

Florida's electrical distribution infrastructure is subject to significant risk from tropical weather systems, including hurricanes, tropical storms, and tropical depressions. The frequency and severity of major storm events — and their associated restoration costs — present an ongoing challenge for utilities seeking regulatory approval for resiliency investments.

This study posed three primary research questions:

- Is there a more robust value proposition for resiliency investment that utilities can reference when seeking funding from Public Utility Commissions?
- Using historical data, can we model the financial impact of major storms on the U.S. electrical distribution grid?
- Can we determine a causation or correlation between major events and needed utility resiliency infrastructure investment?

In practical terms, the goal was to equip utilities with historical evidence to demonstrate to regulators: "Over the past two decades, we have incurred $X in storm costs due to Y storms. Based on climate projections, we anticipate Z future costs — which can be mitigated by investing K dollars in resiliency today."

Study Scope and Approach

Utilities Studied

The study was limited to the four major IOUs operating in Florida during the analysis period:

- **Florida Power & Light (FPL)** — Part of NextEra Energy; over 5 million customers
- **Duke Energy Florida** — Formerly Progress Energy / Florida Power Company; approximately 4.7 million customers
- **Gulf Power Company** — Now part of NextEra Energy, formerly Southern Company; approximately 500,000 customers
- **Tampa Electric Company** — Part of Canadian company Emera; approximately 800,000 customers

Florida was selected for this study for two reasons: the Florida Public Service Commission (FPSC) imposes strong reporting requirements on utilities, enabling access to meaningful data; and Florida is disproportionately impacted by severe tropical weather, providing a rich dataset of storm events.

Analysis Period

The analysis covered 2000 to 2020 inclusive — a 21-year period that captured multiple significant hurricane seasons, including the highly active 2004 and 2005 seasons and the devastating 2017 season.

Data Sources

The study relied entirely on publicly available data from the following sources:

- **NOAA** — Historical hurricane tracking database for Florida, 2000–2020
- **CESER Form OE-417** — Electric Emergency Incident and Disturbance Reports, 2000–2020
- **FERC Form 1** — Distribution O&M and capital expenses, 2000–2020
- **EIA Form 861** — Annual Electric Power Industry Report with distribution reliability indices, 2013–2019
- **Florida PSC** — Reliability reports and storm cost docket filings, 2000–2020
- **SEC 10-K Annual Filings** — For publicly traded utilities or their parent companies, 2000–2020
- **CPI (U.S. Bureau of Labor Statistics)** — Used to normalize all financial figures to 2020 dollars

Major Storm Events: Florida (2000–2020)

The study catalogued all significant tropical weather events affecting Florida during the analysis period. The scope extended beyond Category 1–5 hurricanes to include Tropical Storms (sustained winds 39–73 mph) and Tropical Depressions (sustained winds ≤38 mph), as these systems can cause damage to utility infrastructure comparable to full hurricanes, depending on storm path, duration, and local construction standards.

Key storm years and named events included:

- **2004:** Charley, Frances, Ivan, Jeanne — One of the most damaging seasons in Florida history
- **2005:** Dennis, Katrina, Wilma
- **2016:** Hermine, Matthew
- **2017:** Irma — The costliest single storm in this dataset
- **2018:** Michael
- **2019:** Dorian
- **2020:** Sally, Eta (Tropical Storm)

Data Sources and Analysis

Form OE-417 — Electric Emergency Incident and Disturbance Reports

Utilities are required to file disturbance reports when significant events occur (e.g., more than 50,000 customers without power for one hour or more must be reported within six hours). While conceptually useful, the OE-417 data presented significant quality challenges: inconsistencies in reported values for demand loss and customers affected, date/time discrepancies particularly during large events, and variable availability across the study period. The data was ultimately found to be insufficiently reliable for this analysis.

FERC Form 1 — Financial Data

FERC Form 1 data was collected for all four utilities across the full 2000–2020 period, focusing on two categories:

- **Distribution O&M Expenses** — Accounts 583 (Overhead Line Expenses), 591 (Maintenance of Structures), 593 (Maintenance of Overhead Lines), and 598 (Maintenance of Miscellaneous Distribution Plants)
- **Electric Plant in Service** — Accounts 361 (Structures and Improvements), 364 (Poles, Towers, and Fixtures), 365 (Overhead Conductors and Devices), and 369 (Services)

Visual inspection of annual percentage changes in both O&M and capital expenditures showed little obvious correlation with storm years. Utilities establish internal orders for each storm, aggregate all costs, and initially record them in FERC Account 186 (Miscellaneous Deferred Debits), which are subsequently disbursed to O&M, capital, or below-the-line accounts — making it difficult to isolate storm-related expenses from routine FERC Form 1 data.

EIA Form 861 — Reliability Indices

Form EIA-861 provided SAIDI, SAIFI, and CAIDI reliability indices for each utility, reported both with and without Major Event Days (MED), for the period 2013–2019. The delta between with-MED and without-MED values was used to isolate storm-attributable reliability impacts. This proved to be among the most analytically useful data sources in the study.

Correlation Analysis: FERC vs. EIA-861

Statistical correlations were run between various FERC Form 1 financial accounts and EIA-861 SAIDI data (storm component). Results are shown below (Pearson correlation coefficients):

Utility	2000–2020	2006–2020	2013–2019
Florida Power & Light	0.965	0.967	0.975
Duke Energy – Florida	0.252	0.204	-0.003
Gulf Power Company	0.435	0.418	0.443
Tampa Electric Company	0.453	-0.009	0.219

Note: Although FPL appeared to show strong correlation, removing the anomalous 2017 booking of $1.4 billion in miscellaneous distribution plant expenses caused the correlation to drop to -0.039. No meaningful correlations were found across utilities using FERC financial data alone.

FPSC and SEC Filings — Storm Cost Data

The most reliable storm cost data was assembled from FPSC docket filings, FPSC reliability reports, and SEC 10-K annual filings. All figures were adjusted to 2020 dollars using the CPI. The table below presents storm restoration costs by utility and event:

Year	Named Storm(s)	FPL	Duke Energy FL	Gulf Power	Tampa Electric
2002	Edouard	$27.0M	—	—	—
2003	Henri	$25.0M	—	—	—
2004	Charley, Frances, Ivan, Jeanne	$1,219.4M	$366.3M	$193.9M	$102.1M
2005	Dennis, Katrina, Wilma	$1,201.2M	$69.7M	—	—
2008	Fay (TS)	$1.9M	—	—	—
2016	Hermine	$319.1M	—	—	$10.8M
2017	Irma	$1,372.6M	$541.7M	—	$107.7M
2018	Michael	$3.1M	$159.9M	—	—
2019	Dorian	$233.4M	$155.8M	—	$8.1M
2020	Sally, Eta (TS)	—	$18.8M	$186.0M	—

Key observations:

- **2004 hurricane season:** Total costs of approximately $1.88 billion — driven heavily by the sequence of four named storms
- **2005 season:** Approximately $1.27 billion, led by FPL's $1.20 billion
- **2017 (Hurricane Irma):** The single costliest storm year at over $2.02 billion total; FPL incurred $1.37 billion and Duke Energy Florida $542 million
- **Storm costs are concentrated in FPL and Duke Energy Florida**, reflecting their larger service territories and customer bases

Key Finding: SAIDI as a Predictor of Storm Costs

By plotting storm restoration cost data from FPSC/SEC filings against storm-attributable SAIDI values from EIA-861 (for the overlapping 2013–2019 period), a statistically meaningful relationship was identified.

A linear regression analysis produced a Pearson correlation coefficient of approximately 0.8 — a strong positive correlation between storm-caused SAIDI minutes and restoration expenses. The regression model yields the following central finding:

> **Each additional minute of storm-attributable SAIDI corresponds to approximately $263,000 in storm restoration expenses.**

This relationship — expressed as a cost-per-SAIDI-minute metric — provides a quantifiable, data-driven tool for utilities to present to regulators. If a utility can estimate the SAIDI reduction achievable through a proposed resiliency investment, it can translate that directly into avoided restoration cost, forming the basis of a financial value proposition.

Important caveats accompany this finding:

- **Limited dataset:** Only 12 data points (four utilities over the 2013–2019 EIA-861 window), which constrains statistical power
- **Multi-year cost reporting:** Utilities report final storm costs incrementally as allowances and disallowances are processed by the FPSC
- **Outlier risk:** FPL's 2017 figure ($1.4 billion) may be skewing the exponential curve fit; a polynomial (2nd order) regression is likely a more appropriate model
- **Over-fitting risk:** Present with more complex regression forms given the small dataset

Conclusions and Next Steps

Data Source Assessment

The study identified strengths and weaknesses across the data sources used:

Challenges encountered:

- **FERC Form 1** — Storm costs are not directly traceable; they are routed through internal orders and Account 186 before disbursement, obscuring the storm signal in O&M and capital accounts
- **OE-417 Disturbance Reports** — Data quality was inconsistent, with missing or unreliable values for demand loss, customer counts, and timing, particularly during large events

Promising data sources:

- **EIA Form 861** — Provides clean, utility-reported reliability indices with and without major event days; available for 2013–2019
- **FPSC Docket Filings and SEC 10-K Reports** — Detailed storm cost data is available but requires significant research effort to compile across multiple filings and years

Recommended Next Steps

- **Expand geographic scope** — Replicate the analysis for utilities in other storm-prone states to increase the dataset size and improve statistical confidence
- **Seek additional storm cost data** — Pursue other publicly available financial filings and regulatory reporting in states with strong PUC disclosure requirements

- **Refine regression modeling** — With a larger dataset, move beyond linear regression to polynomial or other appropriate curve-fitting approaches
- **Develop a standardized framework** — Use the SAIDI-to-cost metric as the foundation for a replicable regulatory toolkit that utilities can adapt to their specific service territories and storm exposure profiles