



NERC Lessons Learned

Weathering the Storm-System Hardening

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- The electric system requires additional system hardening in coastal areas to reduce the cost of impact from hurricanes. This is necessary because population growth and infrastructure concentration along the coast has greatly increased the cost of damage from extreme weather events in North America over the last 20 years.

- System hardening efforts greatly increased the speed at which the system recovered from the hurricanes.

Table 1: Hurricane Information		
	Customer Outages in Florida	Time to 95% Restoration in Days
Hurricane Charlie (2004)⁶	600,000	13
Hurricane Wilma (2005)⁷	3,200,000	18
Hurricane Irma (2017)	4,000,000	6
Hurricane Ian (2022)	2,600,000	3.8*

**Restoration was already 2/3 complete by the end of the first day*

- Hardening and resiliency programs that included replacing wood transmission structures with higher wind-speed-rated steel and concrete structures, and burying many distribution lines.
- Staging equipment outside the projected path of the hurricane made the restoration process more effective.
- Leveraging social media enabled the first ever communications with Facebook live and other platforms, providing customers with the most current outage and restoration information.
- Aerial drones were effective in assessing damage, evaluating work conditions, and enabling real-time situational awareness.

- Take opportunities following smaller storm events to provide practical hands-on transmission and distribution restoration training for new personnel, both operations and field. This will translate into skills needed to prepare for large events.
- Keep mutual assistance agreements and emergency supplier contracts up to date to speed recovery. Negotiate agreements with local and geographically remote partners in case of widespread local impacts.
- Apply previous NERC Lessons Learned on substation flooding.

- [LL20230701_Storm_Hardening.pdf \(nerc.com\)](#)

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