Hurricanes in the Atlantic (Specifically impacting Puerto Rico)

Vortex Energy Group LLC
www.VortexEnergyGroup.com

August 2025

The following information is about hurricanes in the Atlantic, specifically those that have an impact on Puerto Rico. The most recent storm, Hurricane Erin, went from a tropical storm to a category 5 hurricane in less than 24 hours. Even with the eye of the hurricane being 200 miles north of San Juan, Puerto Rico, it left a severe amount of damage, most notably with power outages.

As our team works with numerous government agencies, both federal and local, and subject matter experts, we are offering our solution for Puerto Rico, namely with the deployment of several waste-to-energy (WtE) facilities, built in category 5 hurricane-proof buildings, and buried transmission lines and strengthening, microgrid development (especially near key sites such as hospitals and emergency response), and smart grid construction.

The benefits to the residents in Puerto Rico include sustainable base-load power generation, protection from large storms, energy security, and even lower prices (in most cases more than half of current customer prices). Puerto Rico is 2nd only to Hawaii for having the highest energy costs.

Moreso in Puerto Rico than any other region in the Caribbean Basin, hurricanes aren't the only issue being faced. Puerto Rico receives the greatest volume of sargassum than almost anywhere on the planet. It is the closest island to the Sargasso Sea, as well as the first impact from the sargassum blooms coming from Northern Africa.

As we offer a solution for protection from strong hurricanes, we are also able to offer a solution from the sargassum crisis, as well as with the landfill and garbage crisis that has plagued the island for a long time. We are excited to offer a single concept that can have so many benefits:

- Offer category 5 hurricane-proof buildings to house WtE facilities
- Eliminate the ongoing sargassum crisis
- Eliminate the ongoing landfill and garbage crisis
- Offer consistent and sustainable base-load power generation (no more blackouts)
- Reduce the cost of electricity on the island

For more information, please visit our website: **www.VortexEnergyGroup.com**
or email us at: **Info@VortexEnergyGroup.com**

Hurricane and Sargassum Seasons Calendar

Sargassum Season (Caribbean & Gulf of Mexico)

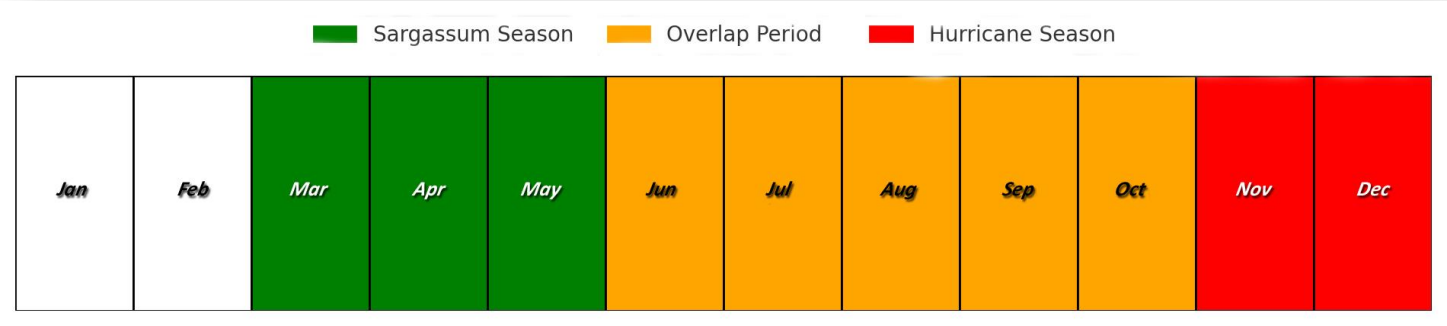
- Dates: March – October (can vary with conditions)
- Peak: May – August

Hurricane Season (Atlantic)

- Dates: June 1 – November 30
- Peak: Mid-August to Late October (around September 10)

Overlap Season

- July – October is when both hurricane and Sargassum seasons are typically active.



Hurricanes in the Atlantic: Categories, Impacts, and Resilience Strategies

🌪️ CHART: Atlantic Hurricane Categories (Saffir-Simpson Hurricane Wind Scale)

Category	Wind Speed (mph)	Damage Level	Typical Effects
Tropical Storm	39–73	Minimal	Branch breakage, isolated flooding
Category 1	74–95	Very Dangerous	Minor roof damage, power outages
Category 2	96–110	Extensive	Major roof and siding damage, trees uprooted
Category 3 (Major)	111–129	Devastating	Severe damage to homes, widespread outages
Category 4 (Major)	130–156	Catastrophic	Structural failure of small buildings, long-term power outages
Category 5 (Major)	157+	Catastrophic+	Total roof failure and collapse of many buildings, large areas uninhabitable for weeks or months

---

📈 Category 5 Hurricanes and Puerto Rico

Historical Frequency:

Hurricane	Year	Category at Landfall or Closest Approach
San Felipe II (Okeechobee)**	1928	Category 5 (approaching)
Hurricane Allen	1980	Cat 5 (passed south of island)
Hurricane Hugo	1989	Cat 4 when it affected Puerto Rico
Hurricane Maria	2017	Category 4 at landfall, but Cat 5 in open Atlantic
Hurricane Irma	2017	Cat 5 — passed just north of island

Recurrence Pattern:

- **Direct Cat 5 landfalls are rare** (every ~75–100 years)
- **Close brushes with Cat 5 storms** occur every **10–15 years**
- Warming seas and climate change are **increasing frequency and severity**

🏗️ Hurricane-Resistant Construction for Category 5 Storms

To withstand a Category 5 hurricane, buildings in hurricane-prone regions like Puerto Rico should adhere to **FEMA P-361** and **ASCE 7** standards and consider the following:

Key Design Principles:

- **Reinforced Concrete or Steel Frame**: Essential for resisting extreme wind loads.
- **Hurricane-Strapped Roofs**: Use hurricane straps and clips to secure the roof to walls.
- **Impact-Resistant Windows and Doors**: Laminated glass or storm shutters required.
- **Aerodynamic Roofing**: Sloped, hip roofs perform better than flat or gable designs.
- **Elevated Foundations**: Especially in flood-prone coastal areas.
- **Minimal Overhangs and Appendages**: Reduces vulnerability to wind uplift.

Example Technologies:

- **ICF (Insulated Concrete Forms)** for walls
- **Steel roofing systems** with 150+ mph wind ratings
- **Ballistic or hurricane-rated doors** for essential infrastructure

---

🔌 Protecting Electrical Infrastructure from Cat 5 Hurricanes

Challenges:

- Extreme winds (157+ mph)
- Flying debris impact
- Flooding and saltwater corrosion

Solutions:

Solution	Description
Underground Power Lines	Reduces exposure to wind and debris. Very effective but expensive and harder to access for repairs.
Hardened Poles	Use of **composite or steel poles** instead of wood. Wind-tested for >150 mph.
Smart Grid Systems	Allows rapid detection and isolation of faults. Minimizes blackout duration.
Microgrids	Local power generation to reduce reliance on the main grid. Critical for hospitals, shelters, and emergency centers.
Guy Wire Anchoring	For transmission towers — reinforced with deeper concrete footings and angled guy wires for wind resistance.
Vegetation Management	Maintain buffer zones free of tall trees and branches along power lines.

Cost Estimator for Category 5 Hurricane-Proof Buildings

Key Cost Factors for Category 5 Hurricane-Proof Construction

Component	Cost Impact
Structural Frame	Reinforced concrete or steel adds 10–25% over standard framing
Impact-Resistant Openings	Windows & doors can cost 2–3× more than standard
Roofing System	Hip roof + hurricane straps = 20–30% premium over standard
Elevated Foundation	Can add $20–$60/sq ft depending on elevation needs
Design & Engineering	Custom structural engineering increases soft costs by 5–10%
Location Factors (e.g. Puerto Rico)	Shipping + labor premiums may add 15–35%

Typical Cost Ranges (2025 Estimates)

Building Type	Standard Construction	Hurricane-Resistant Estimate
Single-Family Home	$150–$200/sq ft	$250–$350/sq ft
Essential Facility (Clinic, Shelter)	$300–$400/sq ft	$400–$600/sq ft
Warehouse / Utility Bunker	$120–$160/sq ft	$180–$250/sq ft

 Example: A 2,000 sq ft hurricane-proof home in Puerto Rico may cost $500,000–$700,000, depending on terrain, local codes, and supply chain.

Special Considerations for Puerto Rico

- **Labor & Materials**: Costs are higher due to transport and skilled labor shortages.
- **Code Compliance**: PR uses International Building Code (IBC) + special wind zones.
- **Permits & Inspections**: Delays and compliance with hazard mitigation requirements.
- **Federal Grants**: FEMA, HUD-CDBG-DR, and local incentives can offset costs for public or community-use buildings.