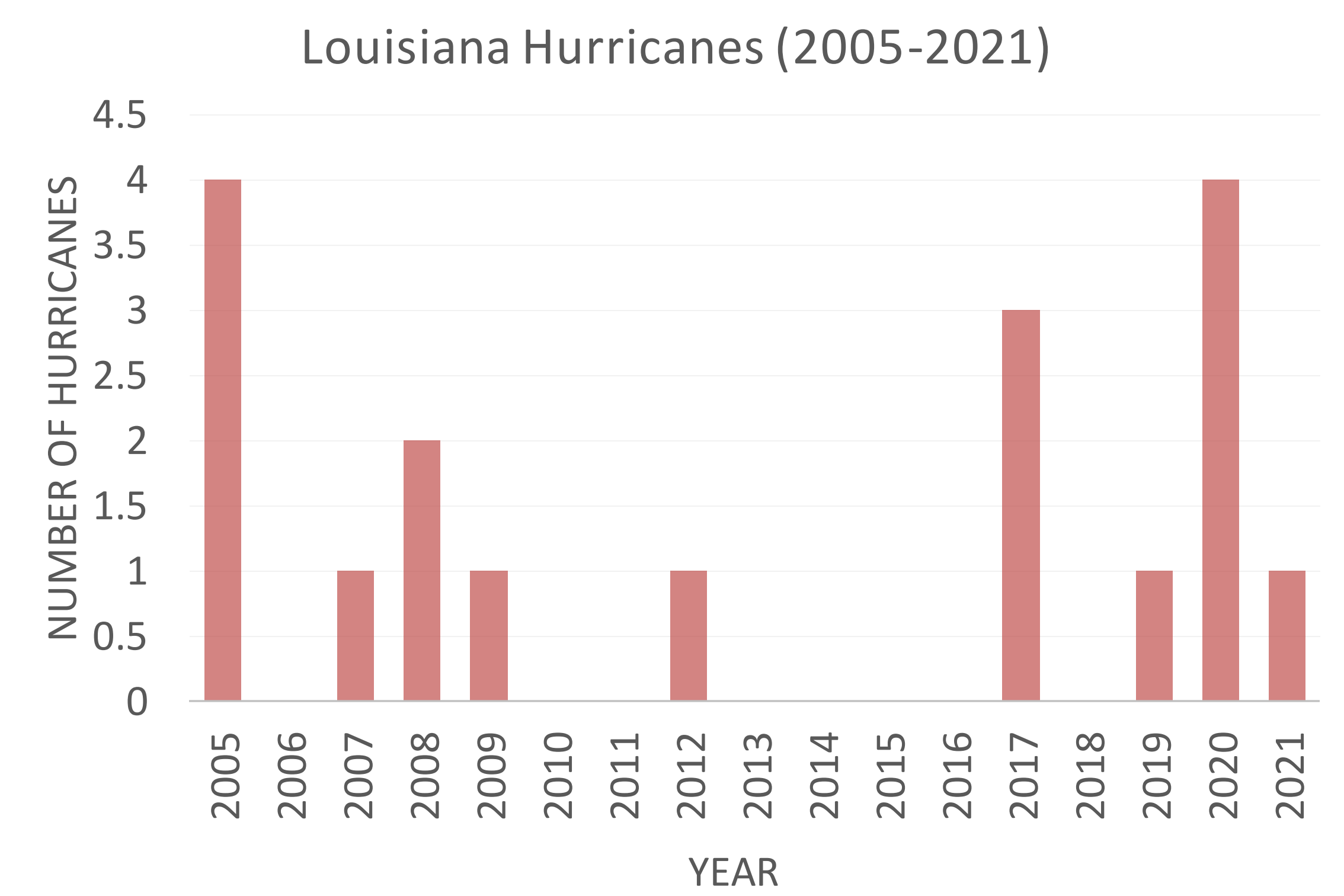


Mobilizing Energy for Disaster Management

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Abstract:

In the modern world, many critical industries, such as communications, water, food, transportation, and healthcare, rely on the electrical grid for nonstop power to perform day-to-day operations. Natural disasters cause widespread outages. Louisiana often experiences hurricanes and outages that result from them. Unexpected outages that last for extended periods of time have disastrous effects. Many infrastructures, such as healthcare and food services, have refrigerated stock that is unusable once it dips below a certain temperature. Also, hospitals have equipment that needs power to remain functional. Therefore, thousands of dollars could be lost from spoiled goods as well as lack in business, and lives could be at risk if power is not supplied to those who have electric medical equipment. Because of the importance of the electric grid, there has been much research into using transportable energy storage systems to increase grid resilience when there is risk of an outage. Mobile resources can include truck mounted batteries and power conversion systems as well as repairmen sent out to fix the damaged grid. These mobile resources could be sent out to areas affected by severe weather and supply emergency power until the grid is usable again, saving lives and profits in the process. Mobile generative sources are cleaner and quieter than stationary generators and can be transported to areas of need.



Status of mobile resources:

Mobile resources are a juvenile technology, so there are not many cases of them being used for natural disaster strategy. However, there have been many studies in mobile resources over the past few years. There are many forms of mobile resources being considered in these studies, such as large battery storage, renewable energy sources, microgrids and EV connections. There are a few companies that are selling mobile resources. Power Edison, for example, offers a battery trailer and a power conversion system trailer. There are also some local governments that are looking into mobile resources as a response to natural disasters. For example, the Louisiana Energy and Power Authority (LEPA) consists of Louisiana cities that work towards providing stable sources of power at a low cost. Mobile resources are a viable choice for that kind of program.



Source: Power Edison

Mobile Energy Storage

- no pollution during operation
- quiet
- can be relocated as needed



Source: Generac

Stationary Fuel Generators

- creates CO2 emissions
- noisy
- cannot be moved

Technical analysis:

An ideal electric grid is constantly supplying power to consumers, but this is nearly impossible during severe weather events. Therefore, the grid must have increased resilience to operate as fully as possible when affected by a natural disaster. One option is to harden the grid itself, but due to the low frequency of these events, temporary options, such as mobile resources, are more feasible. A mobile resource such as a large-scale battery could supply loads to available areas on the grid until it is drained. Once drained, the power supply would need to be recharged either via renewables, at an EV charging station, or at a point in the grid where there is still power. This mitigates the affect of the outage on residents and businesses by providing backup power in the absence of a fully operational grid.

Challenges:

- Since this energy solution is mobile, repair crews as well as any trucks holding energy storage must be transported to affected areas. Hazardous road conditions could affect their route.
- Between the cost of fuel, large trucks, and very large batteries, mobile resources are expensive.
- It is possible that the batteries run out of power if the grid is down for too long.
- It is impossible to connect to any point of the grid.
- It is unethical to provide energy solutions for those with more money during a natural disaster rather than helping those in need. Many residents that are wealthy already own stationary generators.



Map of Louisiana: Red Stars Indicate Where Cities in LEPA are located

Solutions:

- Some companies offering mobile resources have off-road trucks, which would be helpful in uncertain road conditions.
- Government funding is a possibility if state or local governments could see the economic benefit of the technology.
- Renewable energy sources, namely solar or wind, could be used to recharge batteries as needed. Priority switching could be implemented to save power. This process involves supplying power to more critical loads while cutting power to loads that are not currently needed.
- Mobile resources could be prepositioned in grid-accessible areas, so that a successful connection could be made, and repairmen could safely get to the grid to make repairs.
- With the help of government-run programs such as LEPA, mobile storage systems could be sent to places such as shelters, libraries, or recreational centers, so that multiple families within a community could have power. This could be targeted towards lower-income communities.

Economics:

Natural disasters are the leading cause of widespread grid outages. These outages cost commercial industries billions of dollars due to spoiled inventory, delayed production, inconvenience, and grid repairs. These resources could also benefit those who are considered low-income. For example, in Lafayette, Louisiana, low-income for a two-person household is considered to be around \$4,000 a month. Stationary generators start around \$3,000 and can cost up to \$20,000. Therefore, when taking to account the additional costs of a house note, groceries, and utilities, it is next to impossible for those considered low-income to be able to afford a stationary generator. As was previously mentioned, a viable alternative is government programs that could place mobile energy systems at large public places that could fit several families. This way, lower income families have access to the same power that wealthier families do in times of emergency, helping combat power inequity. This being said, the economic benefits of mobile power resources are two-fold: allowing low-income residents access to power without costing them thousands and saving businesses profits that could be lost by mitigating the effects of outages on productivity.

Forecasting:

As was previously mentioned, mobile resources are a fairly new technology especially in natural disaster relief. However, with its growth in the research field, there could be an increase in popularity. Mobile resources have the potential to save businesses profit during an outage, and the possibility to help low-income communities that do not have access to alternate forms of power. By allocating mobile energy storage systems to public buildings with available connections and nearby recharging stations, mobile solutions become a viable tool in disaster recovery. Mobile resources also mitigate the impact of affected areas by supplying power to businesses and hospitals, so there is a large market for the technology.