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A Plan to Future-Proof the Texas Power Grid

The state's massive blackouts are the result of a failure to insure against extreme weather.

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As the power crisis in Texas stretches into its fifth day, the blame game is well underway.

Frozen wind turbines, unsubstantiated allegations of nefarious power plant outages, the state's libertarian approach to electricity markets and its deliberately isolated power grid have all been targets of pundits and politicians quick on the takes but light on the facts.

The truth is, there is plenty of blame to go around. That gives easy fodder for instant experts trying to confirm their priors. But the failure to prepare for this extreme cold is systemic, and the millions of Texans enduring deadly cold and extreme discomfort deserve a closer look at what went wrong, and what to do about it. The lessons can help Americans prepare for the range of extreme weather that a changing climate will bring.

Texans aren't accustomed to temperatures in the teens. Neither is the state's energy infrastructure, which failed this week as record-breaking cold drove skyrocketing heating demand and widespread failures of power plants, gas pipelines and wells.

Homes and buildings in Texas are built to stay cool during summer heat, not to weather an Arctic freeze, which means they have less insulation than buildings in colder climates. The result: As temperatures fall, Texas' energy demand rises more quickly than in some other states.

On Sunday, demand for electricity hit a winter record, at 69,150 megawatts, and by Monday morning, more than 30,000 megawatts of power went offline. These plant outages represented twice the level that the Electric Reliability Council of Texas, or ERCOT, considers an "extreme generator outage" in its scenario planning.

Faced with greater demand and diminished generation capacity, the grid operator ordered transmission utilities to start disconnecting millions of customers. Days later, many of them have yet to regain power.

Texas is unique among states for having its own electrical grid. The grid operator, ERCOT, must balance supply and demand for electricity. If demand exceeds supply, generators strain to meet the greater load and plants automatically disconnect to avoid damaging overworked generators, triggering a cascade of shutdowns that can blackout the entire state. A grid operator's primary job is to avoid this outcome.

What caused so many power plants to fail? The same frigid temperatures that sent demand soaring.

Every source of power generation — wind turbines, natural gas plants and nuclear reactors — has been hammered by the winter storm. But Texans rely on natural gas for two-thirds of their winter electricity supply, and failures across Texas' natural gas system are the biggest cause of current outages.

While pundits and politicians pounced on early reports of wind turbines icing up, renewable energy outages are the least significant factor in the blackouts, according to a senior director for the Texas grid operator. Wind and solar provide valuable energy throughout the year. But grid operators know not to count on these resources for much output during tough conditions, and these energy sources represent just 11 percent of Texas' winter capacity needs. In short, wind and solar are reliably unreliable.

Two-fifths of the generating capacity of Texas' thermal plants (a category that includes natural gas, coal and nuclear plants) has been offline since Sunday night, accounting for the bulk of supply shortfalls. Texans were counting on these plants to be there, and they failed.

The problems start out in the Permian Basin, where gas wells and gathering lines have frozen, and pumps that are used to lift gas from the ground lack electricity to operate; this has cut gas field production in half. At least one nuclear reactor near Houston also went offline Monday when a safety sensor froze; it was restarted Tuesday night.

It is possible to weatherize energy infrastructure to protect against these outcomes. After all, more extreme weather conditions are a regular part of life in many parts of the Midwest and New England.

Pipelines can be buried deeper to insulate against the ground's cold surface. When gas supplies are disrupted, dual fuel power plants can switch from gas to petroleum stored on site. Wind turbines can be equipped with heaters to keep blades free of ice. Sensors, valves and coolant intakes can be protected against freezing. Long-distance power lines can connect to other regions' power systems and draw from their supplies during times of need.

All of this is possible but costly.

Preparing for extreme events is like buying home or health insurance: it costs you every year and you hope you'll never use it. But when a crisis strikes, paying the premiums can look like the perfect decision in hindsight.

The problem, of course, is that we have to use foresight, not hindsight, to identify the kinds of crises that we wish to protect against.

Texas is well prepared for peaks in demand driven by summer heat waves. These happen often enough that it's obviously worth investing to mitigate the risks. Planning for rarer events is more difficult.

The calculus should come down to both the frequency of such events and, when they do occur, the severity of their impacts. A once-in-a-decade cold snap that causes a few hours of rolling blackouts, as occurred in 2011, may be tolerable. But several days without heat during below-freezing temperatures are not.

When the power returns, a thorough inquiry can determine what steps could have been taken to protect Texas' electric and gas systems from such failures. Texans will have to determine just how much insurance is worth taking out.

Texas' crisis also raises important questions for energy system operators and infrastructure planners across the country, as extreme cold is not the only weather threat we face. While scientists are still analyzing whether these polar vortex cold snaps are related to climate change, we do know that climate change increases the frequency of extreme heat waves, droughts, wildfires, rain and coastal flooding. Those extreme events test our systems to the breaking point, as they have in Texas this week.

The changing climate means the past is no longer a guide to the future. The entire country must get much better at preparing for — and insuring against — the unexpected.

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