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KYMEA POWER POST

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Winter Storm Elliott 2022

BY MICHELLE HIXON

Winter Storm Elliott 2022 was a powerful winter storm that impacted much of the United States on Christmas weekend. The storm quickly brought heavy snow, sleet, and freezing rain to a vast region from the Midwest to the Northeast, causing widespread travel disruptions, power outages, and property damage.

The storm developed over the Central Plains and rapidly intensified as it moved eastward, bringing blizzard conditions to parts of the Midwest. As the storm continued to intensify, it brought a mix of sleet, snow, and freezing rain to parts of the Mid-Atlantic and the Northeast. The wintry mix caused hazardous travel conditions and made it difficult for utility crews to clear roads and restore power, leaving thousands of homes and businesses without electricity for days.

The impact of the storm was widespread, affecting millions of people across several states causing significant damage to homes and businesses, and power outages due to the heavy snow and ice accumulation. The extensive power outages caused disruptions to water and sewage systems, leading to health and environmental concerns.

In Kentucky, Gov. Andy Beshear confirmed the storm had claimed at least two deaths and warned it was “too dangerous” to be on the roads or outside for long periods of time. Kentucky’s I-71 and I-64 corridors required the assistance of the National Guard during the storm. They cleared the roads and rescued stranded travelers. By Christmas day, temperatures were back in the mid-20s.

Despite the storm's significant impact, emergency management officials, first responders, and the National Guard worked tirelessly to respond to the crisis, provide aid, help clear roads, and restore power lost from the historic storm.

Grid Inertia

BY DOUG BURESH

Greetings,

I would like to examine a little talked about subject outside of engineering circles, but very important topic that must be addressed as the power grid rushes to replace fossil-fuel generation with renewable energy (wind, solar and battery storage).

The need for grid inertia.

A power grid without inertia is one that is unstable, suffers from issues of power quality, and is susceptible to blackouts. The primary mechanism for providing inertia is via the presence of heavy rotating equipment such as steam turbines and gas turbines driving rotating generators.

END USER MOTORS

Look around your home and assess how you use electricity. How many items have a motor? Your HVAC, refrigerator, and washer/dryer have motors that either rotate fans or spin a drum. Your garage door opener, ceiling fan, and hair dryer also have a motor. There are motors everywhere.

How does electricity make your motor spin? The answer is the physical phenomenon of electromagnetic fields where electricity produces attractive and repulsive forces inside the motor. By alternately flipping between attraction and repulsion, using a stator and rotor, the motor converts electricity into mechanical energy or motion energy. The "flipping" is performed with alternating current (AC current).

The AC current of the power grid operates at 60 hertz (Hz) which means the current alternates at a frequency of 60 cycles in a minute or once every second.

ROTATING GENERATORS INERTIA

It cannot be stressed enough that maintaining a supply frequency of 60 Hz is essential to grid stability. If the frequency dips too low, there is not enough supply to meet demand. If the frequency falls below 59.4 Hz for more than nine minutes, protective devices on the power grid begin automatic load shedding in an effort to bring the supply and demand back into balance and raise the frequency to 60 Hz. If the frequency is not corrected, generators will trip offline, and the entire grid will quickly collapse.

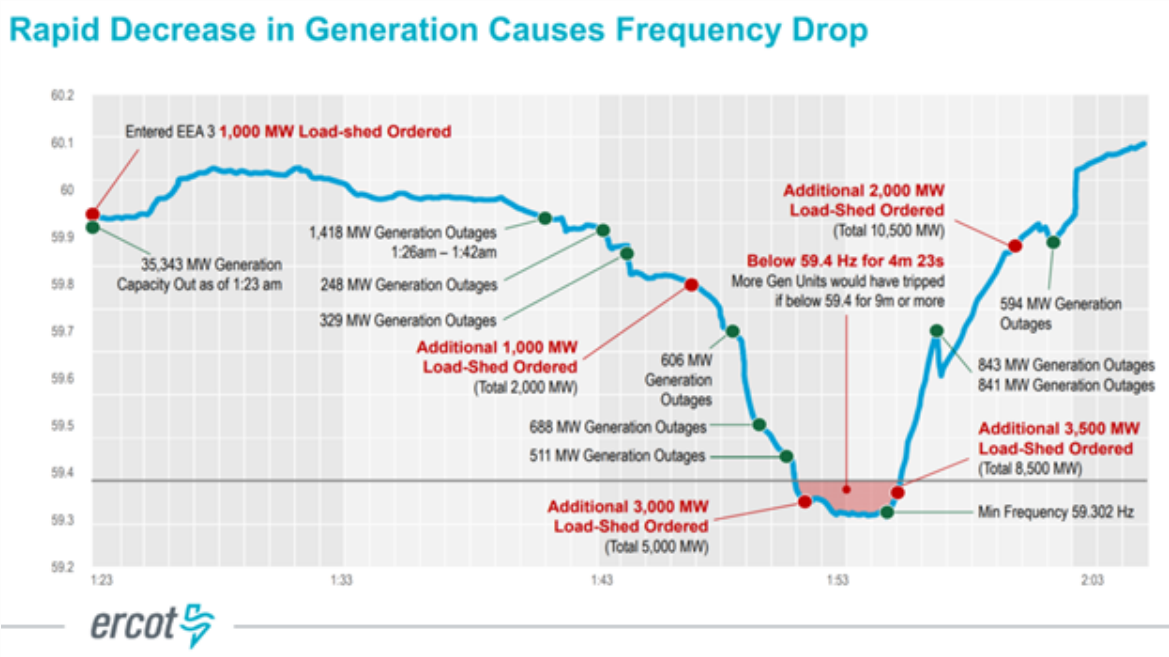
This brings us to the importance of heavy rotating generators. Power system generation from nuclear, coal, hydroelectric, natural gas, and fuel oil uses rotating generators to generate electricity.

In an electric system, the rotational kinetic energy contained in generators at power stations provides inertia as they rotate at the same frequency as the electricity grid. This effectively acts as a buffer against rapid change. If demand for power spikes, the frequency of the grid tends to decrease.

Having the presence of rotating mass on the grid acts like a giant shock absorber and slows the frequency rate of change.

ERCOT GRID NEAR-MISS

Most of the Texas power grid is managed by the ERCOT balancing authority. ERCOT is not connected to the rest of the country, so they cannot rely on grid support outside of ERCOT in times of emergency.



On February 15, 2021, ERCOT, driven by the harsh effects of Winter Storm Uri, experienced massive, forced generation outages coupled with a spike in load demand. As shown in the red area of the nearby graph, ERCOT was 4 minutes and 23 seconds from complete grid collapse as demand far outpaced supply.

Fortunately, the inertia of the large nuclear and fossil-fuel generators provided the ERCOT operators time to shed additional load, raising the frequency and narrowly averting a complete grid collapse.

A complete loss of power over the entire grid is very serious, and requires operators to effectively jump-start the grid with so-called “black start” generators. This involves a complicated balancing act to avoid mismatches between energy generation and consumption, as different sections of the grid are gradually brought back online. It would take weeks to months to reenergize an entire power grid.

RENEWABLE ENERGY DOES NOT PROVIDE INERTIA

Wind and solar generating resources generate power as direct current (DC current) and use DC to AC inverters to convert the DC current to grid-usable AC current. Therefore, replacing conventional generators with inverter-based resources decreases the amount of inertia available on the system as renewable energy can not provide inertia.

The ability to provide sufficient inertia in a world full of inverter-based resources is being studied at think tanks such as the National Renewable Energy Laboratory (NREL). The link below is an excellent NREL short video summarizing the problem.

Link: https://youtu.be/b9JN7kj1tso

ANCILLARY SERVICES

As a member of the Eastern Interconnection AC power grid, KYMEA’s 60 Hz frequency is synchronized with generation and load from the Rocky Mountains to the Atlantic Ocean and from Canada to the Gulf Coast. A key component of a reliable grid is services that facilitate and support the continuous flow of electricity for grid stability and security. These services are referred to as ancillary services.

Ancillary services are increasingly becoming a point of focus and are quickly becoming more valuable. As KYMEA looks to its future portfolio, the Agency will continue to assess the value and importance of ancillary services to ensure a reliable power supply for our Members' customers.

CONGRATULATIONS!

Michelle Hixon

Director, Administrative Services and Communications

Michelle Hixon joined the KYMEA team on March 19, 2018, as the Agency‘s second employee. In those early days, Michelle‘s contributions to standing up KYMEA were immeasurable. As a brand-new organization in 2018, KYMEA needed to quickly hire staff, build out an office space, shop for insurance, and create a website, newsletter, and annual report. The Agency needed an IT/AV specialist, a Human Resources specialist, a Member Communication specialist, and an Administrative specialist. At other organizations, these jobs are handled by multiple people, but Michelle tackles these tasks with excellence and ease. Under Michelle’s direction, KYMEA has already won five (5) APPA communications awards for our website, annual reports, and communication video. KYMEA is very blessed that Michelle is part of our team.

Important Dates

April

27th Board Meeting
27th AR Project Committee Meeting

May

19th Board Meeting

June

22nd BROC Committee Meeting
22nd Board Meeting

Effective Forecasting

BY ROB LEESMAN

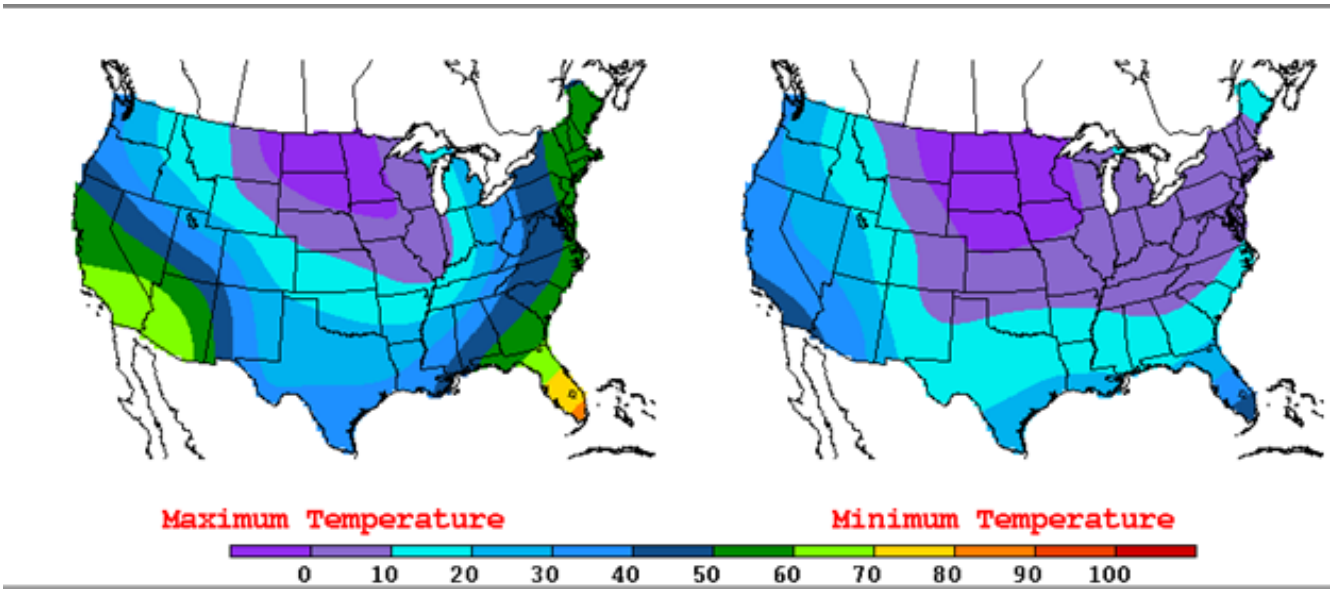
Forecasting load is the foundation for making planning/business decisions about utilities' resources and serves as a gauge to assess the overall health of the grid. Weather, of course, is the most significant variable related to usage and human behaviors. Still, weather is also a huge variable as it relates to resource performance. As part of the North American Electric Reliability Corporation's (NERC) MOD-032-1 standard, functional entities are required to submit peak forecasts for the upcoming seasons and the next ten years. Submittal forecasts of both 50/50 probability as well 90/10 probability are required for varying seasons of the year. The purpose, according to NERC, is as follows: "To establish consistent modeling data requirements and reporting procedures for development of planning horizon cases necessary to support analysis of the reliability of the interconnected transmission system." As nine of KYMEA's transmission members reside within the LG&E/KU balancing authority, KYMEA must also submit summer and winter assessments annually for the Southeastern Electric Reliability Council (SERC). These assessments look at peaks and energies and dive into potential reliability issues, operational challenges, and demand and resource scenarios.

Accurate load and supply forecasting has become increasingly more complex and critical for reliable operations due to the increased penetrations of renewable resources, distributed energy resources (DERs), and electric vehicles (EVs). Of course, utilities have the ability to collect more granular data with the adoption and expansion of advanced metering infrastructure (AMI). However, even with extensive data collection and planning preparations (both short-term and long-term), things that can alter those plans will and do happen. There is no clearer example of this than the recent events that gripped most of the United States during Winter Storm Elliott 2022, at the center of last year's holiday season.

When reviewing the winter 22/23 reliability assessment from NERC, they did identify the following: Winter weather conditions that exceed projections could expose power system generation and fuel delivery infrastructure vulnerabilities. Increased demand caused by frigid temperatures, coupled with higher than anticipated generator forced outages and derates, could result in energy deficiencies that require system operators to take emergency operating actions, up to and including firm load shedding. SERC and the neighboring Pennsylvania, New Jersey, Maryland (PJM) RTO did not identify any emerging or potential reliability issues for the winter 22/23 season.The Midcontinent Independent System Operator (MISO), representing 57% of KYMEA's capacity, identified risks in a high-generation outage and high-load scenario.

From December 21, 2022, through December 26, 2022, a historic bomb cyclone created winter storm conditions, including blizzards, high winds, snowfall, and record-cold temperatures across most of the U.S. and Canada. The figure below shows the highest and lowest temperatures on Saturday, December 24, 2022.

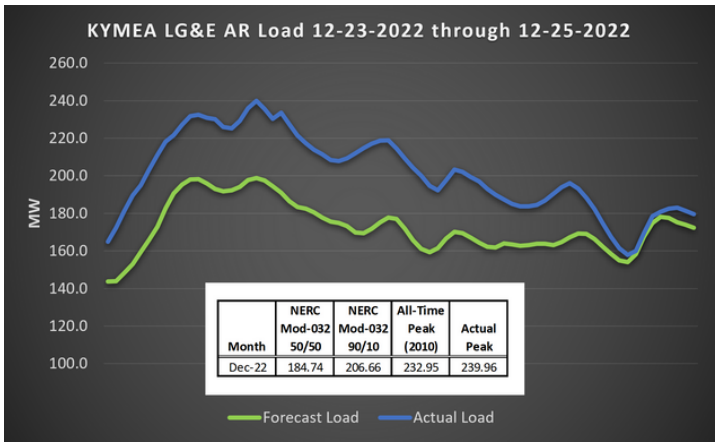
What culminated from this storm was that more than 1.5 million homes and businesses were without power. Tennessee Valley Authority (TVA) issued rolling blackouts on both Friday the 23rd and Saturday the 24th. LG&E/KU implemented rolling blackouts on Friday, the 23rd. PJM entered maximum generation emergency action status during the 23rd and the 24th for the first time in their 80



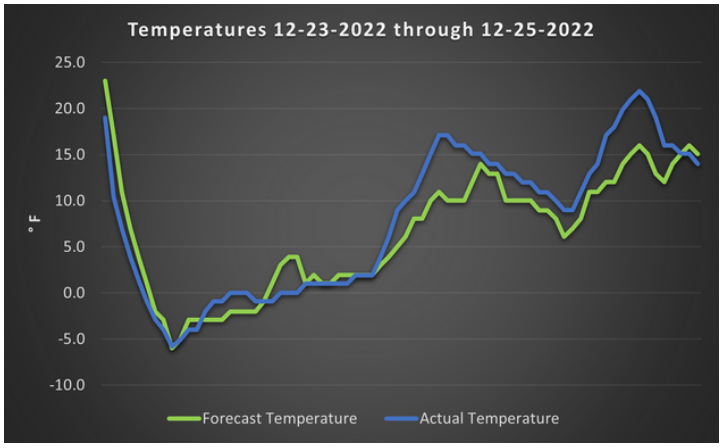
year history, while MISO entered this state on the 23rd. The reason behind the outages was due to much higher load than was initially forecasted, a much larger volume of forced outages, and transmission constraints. PJM had 46 GW of total forced outages and derates occur on the 24th, representing more than 23% of their total capacity, and their load came in 10% over forecast. MISO had 19 GW of total forced outages and derates occur on the 23rd and 24th, while their load came in 5 GW higher than planned. As mentioned before, a good amount of KYMEA's energy comes from MISO, and given where MISO reserve capacity stood versus demand, if conditions had worsened, exports would have been curtailed.

KYMEA was able to make it through the storm without any curtailment directives, even as a portion of our energy supply was reduced due to operational issues. Even with all the preparedness, events like these occur and will continue to occur. The hope is that we learn from these events to prepare better and lessen the impact when future events do happen.

The charts to the right illustrate how uncertain load forecasting can be when faced with extreme weather conditions. The top graph shows KYMEA expected a peak of around 200 MW (green line). The actual peak came in at 240 MW (blue line). The 20% surge in additional customer usage was driven by heat pumps and space heaters working overtime to keep the KYMEA customers warm from the brutally cold temperatures.



Month	NERC Mod-032 50/50	NERC Mod-032 90/10	All-Time Peak (2010)	Actual Peak
Dec-22	184.74	206.66	232.95	239.96



Legislative Update - 2023

BY CHARLIE MUSSON

The Kentucky General Assembly heads toward adjournment with its focus on sports wagering and medical marijuana. Those pieces of legislation have garnered the most attention in this year's session and heated debate is certain before the fate of the final tally of either bill is known.

Though not as captivating as those two pieces of legislation, a few bills relating to electric utilities were filed, and though the majority will not see the casting of votes, some may end up in the approved "hopper" at the typical frenzied end of the legislative session.

Three bills have little to no chance of being considered at this session; however, they may receive consideration by the General Assembly in a future session. Beware HB 552 that provides that no agency or instrumentality of the state or local government shall engage in "solar geoengineering" or "weather modification". Solar geoengineering means any attempt to reflect sunlight into space with the goal of reducing global temperatures, and weather modification means any attempt to deliberately manipulate natural processes of weather patterns if the goal is to impact the climate. HB 552 appears to have stalled in committee, so rest assured that sending messages by reflecting handheld mirrors or building campfires at a campsite remain safe for another year.

HB 422 requires electric utilities, including municipal electrics, to have a vegetation management plan to prune, cut, trim, treat or mow trees and vegetation in utility rights-of-ways and facilities to prevent facility damage, promote worker safety and maintain reliability of the electrical system. If adopted, HB 422, with its public notification provisions, report preparation, and timely responses to a landowner's objections, would be a bureaucratic nightmare for electric utilities. Luckily, HB 422 is unlikely to be reported out of committee.

Likewise, HB 532 is languishing in committee with little hope during this session to be reported to the full House. HB 532 would amend KRS Chapter 96 to require any municipality that furnishes electric power to establish an independent utility commission, separate from the city legislative body, to approve rates and conduct the utility's business. Pursuant to HB 532, revenues from electric rates charged to customers could only be used to cover maintenance of utility assets and purchase power for utility customers. HB 532 would prohibit utility funds from being used for any general governmental service of the municipality.

Finally, two pieces of legislation have received approval from the Senate and have been reported to the House for consideration. KRS 45A.625, adopted approximately ten years ago, required the state to develop a strategy to replace 50% of the state passenger vehicles and light-duty trucks with hybrid/alternative fuel vehicles. SB 281, which passed the Senate on a 35-0 vote, will require the state to implement the plan by January 1, 2026. SB 281 has been received and given a first reading by the House.

The Senate also adopted SB 4 by a vote of 25-8. SB 4 provides that prior to retiring an electric generating unit, the owner shall apply to the Public Service Commission for approval. SB 4 states that it is the intent of the legislation to provide a rebuttable presumption against the retirement of a fossil fuel-fired electric generating unit, and that the Commission will not approve the retirement of such a unit unless such presumption is rebutted by evidence sufficient for the Commission to find that (i) the reliability of the grid will not be compromised, (ii) that a retirement of the unit will not adversely affect the transmission system of any Independent System Operator or a RTO thereby increasing the potential for forced curtailments, (iii) that a retirement will not adversely impact the reliability of electric service to customers, and (iv) that the retirement will not increase short term capacity additions thereby increasing customers rates. SB 4 has been received by the House and was sent to the Natural Resources & Energy Committee. It has been reported out by the Natural Resources Committee and has received two readings before the House. The House is expected to vote on SB 4 before the session ends.

CITY OF FALMOUTH

KYMEA's Faces of Public Power

Belinda Stephens

Belinda has served the City of Falmouth since 2016 and serves as a liaison between the utility customers and the City. Her duties include, but are not limited to, the billing and receiving of payments for utility services that include electric. Belinda has worked closely with the Maintenance Department who reads both electric and water meters, some of which are auto reads and some are manual. She maintains the account information in Falmouth's billing program of approximately 1300 customers. Falmouth is blessed to have such dedicated person!

Gary Lea

Gary Lea has been an employee of the City of Falmouth for 42 years, having been hired in May of 1980 right out of high school. He moved to the role of City Supervisor in 2005.Gary has worn many hats over the years, but his electric expertise has been invaluable to the City. Falmouth rarely experiences power outages, but when it does happen, Gary is quick to narrow down the affected grid and restore power within hours, not days. He has vast knowledge of the transmission lines, the transformers, and is currently in the process of working to upgrade Falmouth's existing service lines. We appreciate you!

Kentucky Municipal Energy Agency
1700 Eastpoint Pkwy. Ste. 220
Louisville, KY 40223

DISCOVER THE POWER OF ENERGY OPTIONS

#PUBLICPOWERFORKENTUCKY

If you have ideas for the next Power Post, please email Michelle Hixon at mhixon@kymea.org.