On the Record
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ELECTRICITY SUPPLY RISKS ARE BREWING

When you sit down for coffee, what do you like to discuss? An unlikely topic is the complexity of processing (from farm to table) the coffee beans, cream, sweetener, or flavors you enjoy - at the perfect temperature and on your schedule. If you appreciate electricity half as much as you do coffee, please continue reading.

Like coffee, several ingredients are needed to provide you with electricity. Here is a cost breakdown.

$^2/_3$ Part: Bulk Power System (BPS) power generation and high voltage transmission

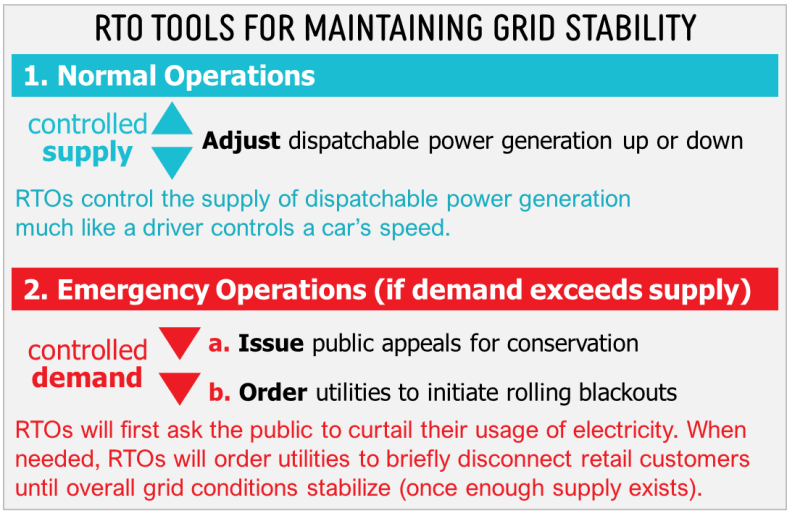
- Dispatchable[1] (controllable) - primarily nuclear, coal, natural gas, and hydroelectric
- Intermittent[2] (weather dependent) - primarily wind and solar

$^1/_3$ Part: Carroll Electric's local distribution, from the BPS to your home or business

Unlike coffee, the mix of power generation ingredients is not a matter of personal taste. A common, yet problematic, misconception is that electricity is stored on the grid, waiting to be used. In fact, the exact moment you turn on your coffee maker, millions of other important variables on the BPS are in motion. Said another way, electricity gets "from farm to table" literally at the speed of light. Regional Transmission Operators (RTOs) continuously assess the **supply** of dispatchable and intermittent power generation to meet the needs of a constantly shifting **demand** for electricity. The process is truly amazing.

Maintaining overall grid stability (see the illustration to the right) also requires system-wide conformance to a precise signal or frequency. Think of this as keeping the "heartbeat of electricity" at the same rate under all conditions. This unforgiving characteristic of electricity requires RTOs to maintain continuous control of the electric grid.

Unfortunately, the need for Emergency Operations to keep the BPS alive is becoming far too common.[3] While some in government are beginning to share these concerns, much work remains.



The Federal Energy Regulatory Commission (FERC) established the North American Electric Reliability Corporation (NERC) as our nation's watchdog for the electric grid. **In recent years, NERC's warnings that reliable energy is in jeopardy have become increasingly alarming**. In a report[4] from July 24, 2023, NERC ranked energy policy as "*Risk Profile #1.*"

> "***A new risk profile*** *has been created this year on* ***Energy Policy****. Given the increased legislation focus and mandates on decarbonization, decentralization, and electrification, the* ***Energy Policy*** *will drive many rapid changes in the energy sector. There is an undeniable need to increase coordination and collaboration among all policy makers and regulators as well as on the owners and operators of the* ***BPS****."* [emphasis added]

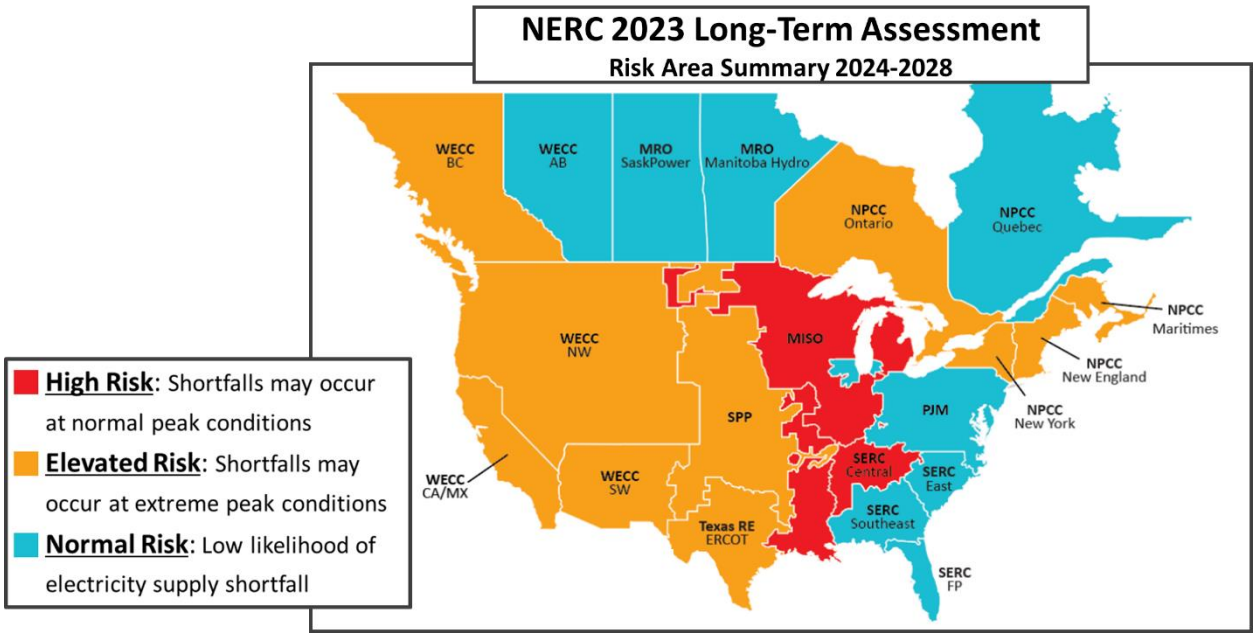
[1] In the context of electricity, the term "dispatchable" refers to a generation technology that can be controlled and scheduled to produce electricity according to demand. Dispatchable power can be adjusted up or down based on the needs of the Bulk Power System (BPS).

[2] "Intermittent power" refers to a power supply or source that is not continuously available but rather operates in a sporadic or irregular manner. This term is often used in the context of renewable energy sources such as solar and wind power, which are characterized by variability and intermittency.

[3] See carrollecc.com/industry-news.

[4] See nerc.com/comm/RISC/Related%20Files%20DL/RISC_ERO_Priorities_Report_2023_Board_Approved_Aug_17_2023.pdf.

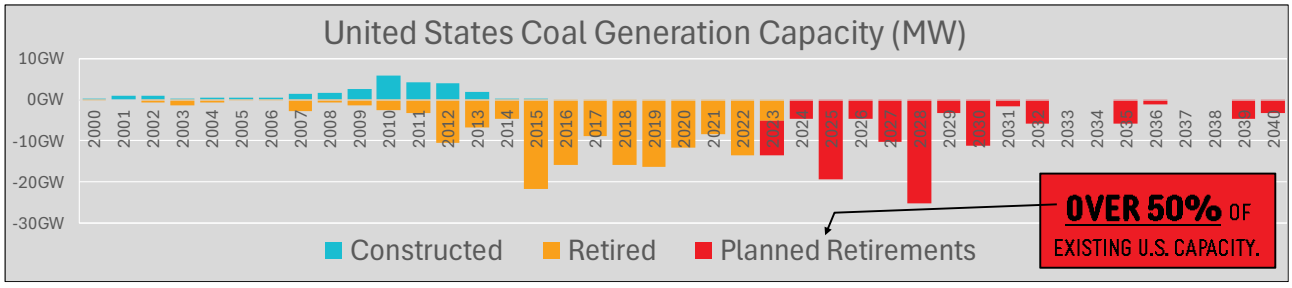
In December 2023, NERC released its Long-Term Reliability Assessment.[5]



January 19, 2024, a few days following Winter Storm Gerri, FERC Commissioner Mark Christie stated:[6]

> *"If the pace of [generation] retirements continues at the pace it is, the numbers just aren't going to add up," Christie said. "This is not a commentary against some form of resources. It is simply stating what NERC has been telling us over and over … that if you don't maintain these dispatchable resources until you have an absolutely adequate replacement, we're not going to have the success we had in the last three or four days."*

▶ Unfortunately, not all the U.S. government shares this view. The Environmental Protection Agency's (EPA) proposed rules insist on carbon dioxide reductions that will force a massive premature closure of dispatchable coal plants. **The EPA closures, if approved, will exceed what is shown below**.[7] The energy policy risk associated with building new coal-powered generation has ended new construction and essentially halted plant improvements that could extend the life of these facilities.



Carroll joined hundreds of electric cooperatives and other stakeholders in comments opposing EPA's proposed rules.[8] NRECA, which represents electric cooperatives across the United States, is also advocating for legislation to address the implications of EPA's proposed rules.[9] If these rules become final, this challenge will move to the courts.

▶ Dispatchable nuclear power generation does NOT produce carbon dioxide emissions. Despite an energy policy that values carbon-free power above all else, the schedule and budget uncertainties associated with

[5] See nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2023.pdf

[6] See utilitydive.com/news/extreme-weather-shows-need-for-transmission-FERC-commissioners/704990/

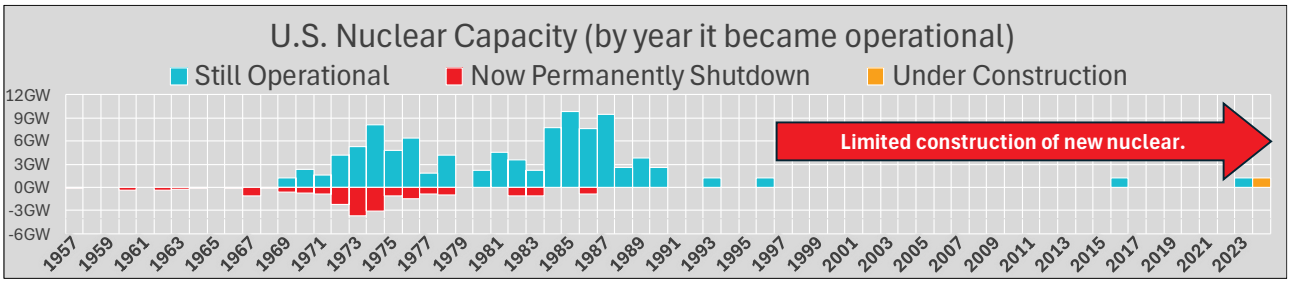
[7] Compiled with data (through June 2023) from Global Energy Monitor, see globalenergymonitor.org/creative-commons-public-license/.

[8] See carrollecc.com/upload/Public_Comments.pdf.

[9] See nreca.informz.net/NRECA/data/images/CE_InteriorLetter.pdf.

permitting and construction bring unbearable investment risk. If the trend[10] below continues, the U.S. will no longer be the world leader in nuclear power.

New nuclear units coming online in 2016, 2023, and expected in 2024 took 17-25 years from planning to commercial operations. The 2023/2024 units, originally budgeted at $14 billion, are now over $35 billion and growing. Several other projects have suffered cancellation and bankruptcy.



Headlines about small modular nuclear reactors often sound promising.[11] However, the same risks[12] of regulatory approvals, successful demonstration of commercial operations, unknown costs, and likely construction delays provide little hope of new nuclear construction in a timely fashion.

Fortunately, a 2022 nuclear closure[13] is being reconsidered. However, nuclear cannot possibly solve the dispatchable problem until regulatory uncertainties (e.g., cost and construction timelines) are addressed.

▶ Partially dispatchable hydroelectric, understandably, is not something that is easy to construct. Because of the land mass needed and concerns for wildlife, 98% of U.S. hydroelectric capacity was constructed before 1991 (33 years ago). In terms of scalability, the U.S. would have to double the current hydroelectric capacity (and have ideal water conditions) to merely replace the closing of coal-powered generation scheduled over the next nine years. Hydroelectric is not a feasible solution to fill the dispatchable void.

In fact, recent developments indicate that carbon-free hydroelectric power generation is also vulnerable[14] to premature closure. NRECA's President, Jim Matheson, recently spoke to Congress about the very harmful potential closing of Snake River Dams.

▶ Dispatchable natural gas has an important role in fueling the BPS. However, it also falls within the carbon dioxide reduction targets of EPA's proposed rules. Pipeline congestion and competing needs for natural gas (especially in the winter) are also critical concerns. **Further, natural gas prices are extremely volatile**. It is neither feasible nor wise for natural gas to be our only option for dispatchable power. And it remains to be seen if even natural gas-powered generation will survive EPA rulemaking.

At best, only one dispatchable choice will remain. At worst, Emergency Operations will become the norm.

▶ Other dispatchable power generation technologies (e.g., petroleum, wood products, geothermal, and landfill gases) also exist. For various reasons, none of these technologies can presently scale to meet the immediate dispatchable needs of the BPS.

▶ Some argue that utility-scale battery storage can make intermittent resources dispatchable. While this is, in a sense, true (for the 4-hour window of discharge), it is inaccurate to believe batteries can address the continuous needs of the BPS. To discover the practical limitations of using battery storage, see carrollecc.com/upload/files/why-not-batteries.pdf.

Maintaining electric grid stability without a dispatchable source is as challenging as brewing coffee without coffee beans. Considering policies advocating for electric vehicles and appliances; the growth of

[10] Data source: International Atomic Energy Agency, see pris.iaea.org/PRIS/CountryStatistics/CountryDetails.aspx?current=US.

[11] See utilitydive.com/news/ferc-nerc-joint-meeting-smr-nuclear-black-start/705708/.

[12] See reuters.com/business/energy/cancelled-nuscale-contract-weighs-heavy-new-nuclear-2024-01-10/.

[13] See thehill.com/opinion/energy-environment/3503142-another-nuclear-plant-closes-get-ready-for-electricity-shortages/

[14] See video at electric.coop/matheson-to-congress-snake-river-dams-are-vital-to-power-supply-in-northwest.

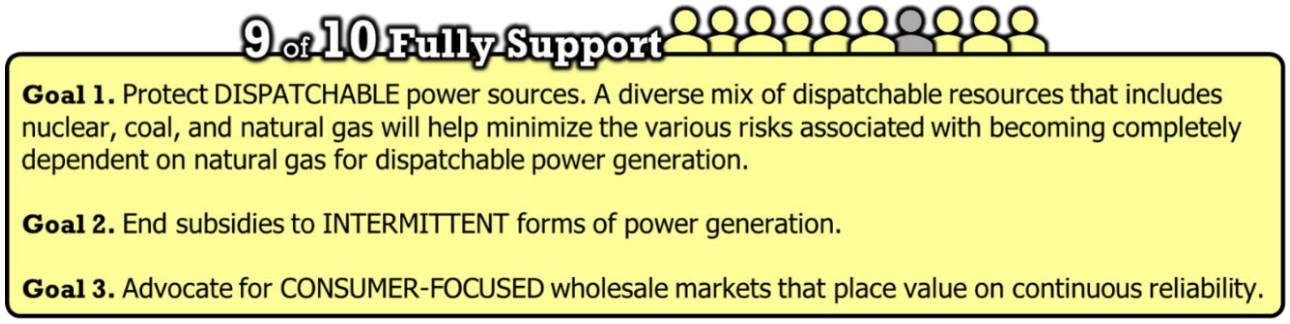
data centers for cryptocurrency, artificial intelligence, and other functions; cannabis cultivation; and population growth, **we need <u>more</u> dispatchable power generation**, not less.

U.S. energy policy is failing the citizens it ultimately serves. It is important to recognize that while some recent policies are accelerating the problem, decades of short-sighted policymaking have set the stage for these failures. Even as more government leaders fully recognize this dilemma, it will still take years to reverse course.

When RTOs issue public calls for conservation or order Carroll Electric to initiate rolling blackouts, we are prepared. Even though Emergency Operations only last for short periods, these necessary safeguards should not be viewed as an acceptable energy policy. Until a more orderly grid transformation is contemplated, <u>it is important that you be prepared to restrict your electricity consumption when needed</u>.

This publication is not without good news! The level of awareness[15] in both government and industry has increased significantly since Issue 1 of **On the Record** was released in March of 2021. **<u>Your support will continue to be shared with government and industry leaders</u>.**

On the Record's purpose has always been to inform you and policymakers of the risks ahead (see carrollecc.com/on-the-record). Before Carroll Electric publicly expressed our concerns in Issue 1, we felt obligated to offer practical solutions. We continue to believe these goals remain a fundamental part of the solution. Of the 13,632 members responding to Issues 1-3 of **On the Record**, 91% (12,472 members) fully support the following goals:



PLEASE RESPOND TO ISSUE 4 – Please scan the QR code (above) **<u>or</u>** respond by mail (attached).

As we continue to build on this grassroots support, we have developed tools to activate your voice in policymaking decisions if and when it is productive. Nothing speaks louder to government leaders than hearing directly from the people they represent.

Admittedly, the current political division within our federal government remains a significant obstacle. Despite this, electric cooperative leaders across the nation are pressing hard for solutions. When Carroll Electric triggers a call to action, please be prepared to answer that call.

If you have additional questions, concerns, or interest in this topic, please visit our website or Arkansas Electric Cooperative Corp. (Carroll Electric's wholesale provider) at aecc.com/balance-of-power, or NRECA's advocacy electric.coop/issues-and-policy/reliability-and-affordability.

[15] See carrollecc.com/industry-news.