International Stability Operations Association
White Paper
May, 2024

Sparking Lines:
Energy and Russia's War on Ukraine

By Honorable Sharon E. Burke, President of Ecospherics and Co-Founder of the Ecosecurity Council

Could electricity be the Franz Ferdinand of today's Russo-Ukrainian conflict?

Franz Ferdinand was, of course, the Austrian nobleman (not the indie-rock band) whose assassination catalyzed World War I. Only history will judge whether electricity really did factor into President Vladimir Putin's calculus, but there was certainly a striking correlation. Ukraine disconnected from the Russian electric grid as a prelude to integrating with the European grid on February 24, 2022, the same day that Russia invaded.

In fact, electricity and other forms of energy have been a shaping factor in Russia's war on Ukraine war at all levels of warfare – strategic, operational, and tactical. And while infrastructure has always been a target and enabler in times of war, the Russia-Ukraine conflict is highlighting the elevated role of energy in 21st century warfare, with implications for future conflicts.

The Strategic Context

As one of the world's largest producers of oil, natural gas, coal, and other critical minerals, Russia is a dominant player in the global energy trade. The country has long used its considerable mineral wealth for geopolitical leverage and at times as a weapon, and the war with Ukraine is no exception.

That starts, of course, with Ukraine itself. While Russia's main narrative justifying the war has to do with historical claims to territory, there is no question that Ukraine's energy resources are relevant. In addition to being a key transit point for Russian pipelines, Ukraine has its own oil, gas, coal, and critical mineral wealth, especially in the eastern provinces President Putin has prioritized in his invasion. Greed is an age-old causus belli, though Putin may also be driven by declining productivity in Russia's own energy sector.

It would be hard to overstate the importance of fossil fuels to the Russian economy, and Europe has been the leading customer. Before the 2022 invasion, about half of Russia's oil exports went to the EU; by 2023, that was down to about 8 percent, by mutual action. Of course, the energy relationship cuts both ways, and an international coalition has imposed sanctions on Russia, squeezing the Russian economy. As a liquid, fungible fuel, oil can be shipped elsewhere, and Russia has largely done just that in the face of its own pique and western sanctions, substituting China, India, and Turkey for its erstwhile EU customers. Bewteen the new buyers and higher oil prices, Russia has not seen a huge dent in its oil revenues.

Natural gas is another story, however, given that gas requires costly, fixed infrastructure, such as underground pipelines, compressing or cooling plants, and storage, as well as specialized transport. Before the invasion of Ukraine, Russia supplied about 40 percent of the European Union's natural gas, accounting for 64 percent of Russia's gas exports, which was about to increase with the launch of the Nordstream II pipeline. The dependency varied in scale from nation to nation, with Russia accounting for only 10 percent of Spain's natural gas, for example, but around 65 percent of Germany's. Russia restricted gas exports in the months before the invasion, possibly to run up profits or to soften up its adversaries, and then cut gas flows through the Nordstream I pipeline in June of 2022, before ceasing all flows in September (Germany canceled the 11 billion dollar Nordstream II pipeline before it ever went into use). Some trade through other pipelines and Liquefied Natural Gas has continued, however. And even with gas, Russia has increased the volume flowing to other markets, especially China through LNG shipments and the Power of Siberia pipeline. Russia is allegedly constructing two more pipelines to China.

The growing energy relationship between Russia and China is an unintended geostrategic consequence of the Ukraine war. For China, this is a significant development, given the country's dependence on imports of oil and gas. Moreover, much of the current trade transits the Strait of Malacca, a chokepoint that is only 40 miles across at its narrowest. As long as Russia is a reliable ally, China's energy security is significantly improved, including in any conflict scenario with the United States.

Initially, there were fears in Europe that one effect of weaning the region off Russian oil and gas would be an increase in the use of coal to generate electricity, which would compromise European ambitions to cut greenhouse gas emissions. While European nations have dealt with the shortfall in Russian supply with diversification to other oil and gas suppliers (including the United States), there does not appear to be a rise in either coal consumption or emissions in Europe (though both continue to rise in Asia). The REPowerEU initiative has emphasized measures such as increases in efficiency, reductions in energy demand, and expansion of renewable energy that increase energy security and decrease emissions.

This tension between legacy fuels and future climate goals is also part of the backdrop to the drama surrounding Ukraine's electric grid. Ukraine's nuclear power plants and renewable energy potential are attractive to European countries in meeting ambitious greenhouse gas reduction targets and supply materials for electric vehicle batteries. There were other strategic goals behind the integration of Ukraine (and Moldova) into the European grid, as well. Most

directly, linking the electricity grids supported Ukraine's turn to the West away from Russian dominance. Integration also provided some relief to Russia's influence over regional European and even global energy markets, given that Ukraine had the capacity to be a significant exporter of electricity to Europe.

While the Ukrainian government first started talking to its European neighbors about connecting to the European grid almost two decades ago, the conversation didn't shift into high gear until after the Euromaidan Revolution in 2013, Russian annexation of Crimea in 2014, and subsequent Russian cyber attacks on the Ukrainian electric grid in 2015. Once the Russians invaded in 2022, there was no question of Ukraine reconnecting to Russia's grid, so the country remained islanded. About a month later, Ukraine successfully connected to 35 other European countries, resulting in the largest synchronous electrical grid in the world. This linkage, a year ahead of schedule, was a remarkable technical feat, taking place with unprecedented speed and extensive technical support from the EU and the United States.

At first, Ukraine was exporting electricity to Europe. Then in September of 2022, the Russians captured Ukraine's Zaporizhzhia nuclear generating station. This was no accident; while the capture of Zaporizhzhia was important to denying Ukraine a significant source of power for both the civilian and military end users, it also denied the EU grid access to the largest nuclear plant in Europe. At that point, Ukraine became an importer of European electricity, which puts pressure on European energy supplies, but is crucial to Ukraine's ability to withstand Russian pressure.

Ukraine is far from the only country where energy is something of an Achilles heel. Key U.S. allies and partners across the Indo-Pacific, including Japan, South Korea, Singapore, and the Philippines, are highly dependent on imported energy. This has the potential to be an especially acute vulnerability for Taiwan, which also has an electric grid open to attack. Russia has also opened the door to targeting of civilian nuclear plants as a strategic objective in war.

The Operational Context

Unfortunately, Russia has also targeted electricity at the operational or national level. Using missiles, artillery, and drones (including long-range attritable Shahed drones), Russia has systematically hit and destroyed power lines, transformers, power plants, dams, and other critical infrastructure. The *Kyiv Independent* reports that Russia has attacked the Ukrainian power grid five times in 2024 alone, including strikes on 106 facilities on May 12th. In March, a Russian assault cut power to half of the country. Indeed, power outages have been common throughout the conflict, especially in the winter months, as the Russians have specifically attempted to use cold weather to amplify the effects of their grid attacks. The EU and the United States have engaged in heroic missions to assist Ukraine in repairing and replacing its grid, including large pieces of equipment, such as transformers. This combat repair would be challenging no matter what, but it's particularly challenging in a country such as Ukraine, where much of the grid system may date to the Soviet era and is no longer manufactured.

While Ukraine has followed suit and targeted Russian energy facilities, there is a qualitative and quantitative difference in the targets – qualitative in that Ukrainian strikes seem to be focused on clearly military or strategic targets.

Electric grids and energy infrastructure more broadly are something of a gray area in the laws of war, since they can be a legitimate target if they support military operations or facilities. The Russians may have de facto lowered the bar with their systematic attacks, though the International Criminal Court in March 2024 did issue arrest warrants for two Russian military officials for war crimes, in part because of their responsibility for missile strikes on Ukraine's electric grid system. Even if the ICC's judgment is enforced, which seems unlikely, it is reasonable to expect that electric grids will be a major target in any future conflict, regardless of whether they serve civilian populations. First, industrial nations are now highly and increasingly electrified, and that power is often inherently dual use; in the United States, for example, almost all military bases are on the civilian grid. And then, it's just an effective target: hitting electricity undermines civilian morale and potentially support for war, while also damaging economic activity and military operations and industrial facilities. The United States and its partners and allies in the Indo-Pacific and around the world should expect electric grids and other energy infrastructure to be targeted, including remotely through cyber means. And while Russia has uncommonly good knowledge of Ukraine's Soviet-era grid, information about electric grids is often in the public domain.

For the United States and NATO allies, this targeting of critical infrastructure is an immediate concern beyond Ukraine's borders, as well. First, Russia continues to supply natural gas to Europe and is a major player in global markets for coal, oil, and non-fuel minerals. It still has significant energy leverage to exercise. Even more alarming, recent news reports suggest that Russia is planning to sabotage critical infrastructure across Europe.

While the U.S. homeland could also be a target, especially with cyber attacks, there is an immediate concern about U.S. military bases – there are around 80 in Europe, not counting expeditionary positions in Poland and Romania – which depend on host nations for energy, water, and other supporting infrastructure. Any disruption to energy supplies in Europe would affect these bases, too. The vulnerability would be especially problematic for locations such as Ramstein Air Force Base, which plays an important part in global drone operations, according to press accounts, as well as being a key node for the U.S. Space Force. Congress directed the Department of Defense to study the vulnerabilities and resilience of European bases to energy disruptions, including natural gas from Russia. Though the report has not yet been finalized, the Brown University Climate Solutions Lab mapped US military energy dependencies in Europe last year based on publicly-available materials.

Almost all U.S. bases depend on civilian infrastructure, including in the Indo-Pacific region, where key allies such as South Korea and Japan are highly reliant on imported energy supplies. Resilience to energy disruptions – such as on-site energy storage and microgrids –at bases outside the United States is generally limited.

The Tactical Context

Finally, at the tactical level, there have been some energy surprises, right alongside echoes of the past.

Perhaps the prevalence of uncrewed systems in the Russo-Ukraine war is not truly a surprise, given that every fighting force from violent non-state actors to militaries in about three dozen countries have armed drones in their arsenals. But the extensive use of these platforms in Ukraine, from cheap hand-launched machines to long-range, attritable platforms, including in coordination with missile, cyber, air, ground, and maritime operations, has signaled a new era in warfare. In addition to generally being cheaper than the manned platforms they replace or augment, drones also use less energy and have more energy flexibility. For example, liquid fuels from a variety of feedstocks, batteries, fuel cells, solar, and liquid hydrogen are some of the options now in development or in use for powering uncrewed systems. In some cases, alternatives to petroleum fuels may have co-benefits, such as lower noise and heat signatures and longer range and loiter time. Also, the Ukrainians have pioneered the use of 3D printed drones; printing equipment at the point of use, rather than flying, shipping, or trucking equipment to the battlefield could significantly decrease overall fuel demand.

At the same time, the fight for Ukraine has served as a reminder that old-fashioned fuel logistics can still be a limiting factor on the battlefield. In ancient times, that fuel may have been food and fodder and it may someday be electricity, but today, it's still all about petroleum-based fuels. Russia's abundant oil supplies at home were moot in the early days of the war when insufficient fuel logistics left entire convoys stranded, a tactical setback that contributed to an initial strategic failure.

NATO forces are not off the fuel logistics hook, either. According to a recent report from the Center for Strategic and International Studies, Europe lacks the military fueling infrastructure to support current positions in eastern Europe and is already relying on commercial trucking to move fuel to NATO frontline positions even at the current non-combat tempo. While NATO and Poland, in particular, have taken steps to mitigate this infrastructure shortfall, the insufficient fuel distribution networks could swiftly become a serious challenge and potentially a limiting factor should Russia's war escalate beyond Ukraine.

These insights from Ukraine about both uncrewed systems and fuel logistics will certainly apply to other theaters of operation. This is especially true in the Indo-Pacific theater, given the distances involved. Power and energy solutions for long-range platforms are even more important, and there are already questions about the adequacy of U.S. military fueling infrastructure in the Indo-Pacific.

Conclusion

The global economy remains overwhelmingly dependent on fossil fuels, even as the effects of climate change are intensifying and possibly accelerating. European nations have a strong commitment to the clean energy transition as a national and collective priority, but Russia's aggression may force them to face difficult tradeoffs about whether to invest in legacy fuel supply and distribution to protect their security today, or in clean energy and electrification to advance the digital economy and the future. The United States and its allies and partners, including in the Indo-Pacific region, face similar hard choices.

Beyond energy security, other geopolitical advantages to Russia of a Ukrainian defeat—control over energy and critical minerals, food supply and trade routes, and maritime dominance in the Black Sea—are closely related to energy supply, consumption, and trade. These calculations will not really change as the global economy shifts in the energy transition; control over renewable energy supply chains will yield the same sorts of geopolitical returns that control over fossil fuels has for more than a century.

Energy is likely to remain critical in future conflicts, as well, and as the first high-intensity conflict of the clean energy transition, the Russo-Ukrainian war provides valuable insights on how the role of energy is evolving. First, beyond the tough tradeoffs between legacy and future energy systems, the geopolitics of energy will be a factor in any future conflict, no matter the theater of operations. Second, uncrewed systems – air, ground, and maritime – will be pervasive on global battlefields, and the power and energy for these platforms will be key enablers. Third, energy logistics will generally be crucial in any future conflicts, and current U.S. and allied capabilities are insufficient. Finally, while electricity may not have caused Russia to invade Ukraine, the conflict there is previewing the ways in which electricity, as a center of gravity in modern Digital Age economies and militaries, will be driver, a target, and collateral damage in future conflicts, too.