

## War Ecology: Can Ukraine's Green Transition Neutralise the Russian Threat?

Article by Martin Vrba

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Russia has exploited Ukraine's centralised, fossil fuel-dependent energy system to weaken Kyiv's defensive capabilities. But while the war continues to devastate public infrastructure, it also provides an opportunity to spur a green transition that will make Ukraine more resilient in the long term.

More than three years into Russia's full-scale invasion of Ukraine, an end is nowhere in sight. At least that is the mindset of German Chancellor Friedrich Merz, who in a recent interview said: "I'm mentally preparing myself for the fact that this war could drag on for a long time." Despite Ukraine fighting an asymmetric war against a stronger enemy, the strength of its resistance, coupled with the weapons' systems it has received from Western allies, has enabled the country to regain large parts of territory occupied since February 2022. However, Russia is again slowly advancing.

To the surprise of many, this conflict has descended into trench warfare, with no significant territorial gains. Despite being the most technologically sophisticated war in history, one that is dominated by drones, both sides are using strategies of attrition to slowly deplete the other's morale, manpower, economy, and political will, as was the case in World War I. But this time, the endgame may look very different.

Under current circumstances, neither a military solution nor a long-lasting peace settlement may be a realistic scenario. In many respects, the war in Ukraine is unprecedented, fusing modern technologies such as drones with traditional military strategies: to maintain an edge in the attritional war, the authoritarian Russian state treats its population as an infinite supply of cannon fodder, as old regimes did. Geopolitically, everyone is watching closely, trying to learn their lessons because the future of warfare is being written on the Ukrainian frontlines.

According to Andriy Zagorodnyuk, a former Ukrainian minister of defence, there may not be a "day after" the war for his country. Regardless of any possible peace settlement and security guarantees, it is expected that Ukraine will live under "constant military pressure" for the foreseeable future. While the conflict may change form over time — from hot to cold, to hybrid warfare and back — the security threat will persist, as will the need to contain it. Zagorodnyuk further argues that when neither a military nor diplomatic solution is viable, Ukraine (and its Western allies) need to shift their efforts towards "strategic neutralisation" of Russia.

One idea he puts forward in pursuit of this is to turn Ukraine into a "steel porcupine" — a heavily defended, militarised, impenetrable fortress that will aim for "functional defeat" of the Russian military. Compared to the attrition strategy that attempts to deplete the enemy, or the conventional military success that follows destruction of the opposing side, functional defeat aims to create a situation "where a military capability is not completely destroyed but rendered irrelevant." In other words, it "ensur[es] that Russia's presence, though intact, yields no strategic gain."

## **The green porcupine**

That has profound implications for Ukraine's approach to climate goals and the green transition. First, acknowledging the likely prolongation of the conflict cannot be postponed indefinitely to a "day after" that may never come. Second, although sustainability and climate ambitions may not feel like the most pressing issues to many Ukrainians, they may surprisingly help to deal with the security threats their country faces. In fact, in many cases, the security and climate issues are intertwined.

Making the environmental and climate agendas relevant for Ukraine means finding ways to integrate them into the "strategic neutralisation" pathway. Rebuilding damaged Ukrainian infrastructure, as well as decarbonising military technologies, can be a vital part of it.

For example, the steel porcupine strategy requires making Ukrainian defences nearly impenetrable. Ukraine's flat topography means that most fighting happens on terrain that lacks natural defences. As a result, defensive structures – trenches, minefields, basements in abandoned villages, or more recently, bogs and marshes – often need to be sought out or artificially created by both sides.

At the beginning of the Russian full-scale invasion in 2022, a dam on the Irpin river north of Kyiv was blown up. As a result, the river basin flooded and the area became a vast plain of muddy terrain that slowed down the advance of Russian heavy machinery.

This tactic has served as an inspiration for wider defensive strategies not just for Ukraine but for NATO's eastern flank, with countries like Poland and Finland reportedly considering the restoration of their dried-up marshes to deter potential Russian invasion. Importantly, bogs and marshes are also great natural carbon sinks, and their restoration would thus play a role in meeting Europe's climate targets.

## **Rebuilding from debris**

At the same time, there are many damaged sectors of the Ukrainian economy and society for whom the green transformation would also mean improving their resilience in wartime. Among the many broken things that need to be repaired — from energy infrastructure to public utilities — are the very buildings to live in.

According to the Low Carbon Ukraine initiative, residential buildings have suffered more than 54 billion euros' worth of damage since the beginning of the Russian full-scale invasion. Whole villages and cities have been flattened and turned from once flourishing centres to piles of rubble.

But this war debris can be upcycled and reused in reconstruction efforts, thus making it a sustainable building material. This is the goal of the Safe, Sustainable, and Swift Reconstruction of Ukraine project. Transforming war debris into a building material for future use helps to mitigate the impacts of Russian aggression while at the same time providing the foundation for sustainable and resilient construction practices.

The war has also exacerbated Ukraine's energy insecurity, reinforcing the case for energy-efficient buildings in place of energy-intensive Soviet-era buildings. In this context, green reconstruction becomes a matter of pragmatic policymaking: apart from reducing reliance on fossil fuels and enhancing energy resilience, it can provide improved living conditions for Ukrainians displaced by war, by reducing their energy poverty and their reliance on centralised, vulnerable energy systems.

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In a country devastated by war and economic decline, fighting energy poverty is of crucial importance. Poor insulation, high energy prices and outdated heating systems are among the key challenges here. The combination of better insulation that reduces heat loss, energy-efficient windows and doors that prevent drafts, and smart heating controls optimising energy use can significantly help to lower energy bills for Ukrainians.

There are many promising examples already, such as the energy-saving renovations in the cities of Zaporizhia, Kamianske and Lutsk, funded by the European Investment Bank. Or the reconstruction of a multi-family building in Trostanyets powered by geothermal and solar energy, as well as heat pumps. Similarly, a project funded by Finland through the Green Recovery Programme for Ukraine rebuilt several war-damaged schools as nearly-zero energy buildings.

Such thermal modernisation of Ukrainian buildings, combined with their integration into renewable energy infrastructure, also supports Ukraine's accession to the European Union and integration into the European energy grid. It aligns with key EU building legislation such as the Energy Efficiency Directive (EED) and the Energy Performance of Buildings Directive (EPBD). This is also confirmed by last year's approval of Ukraine's Building Thermal Modernisation Strategy 2050, developed by the Ministry for Communities, Territories and Infrastructure Development.

## **Resilient renewables**

Another vulnerability of Ukraine is its fossil fuel energy infrastructure, which is centralised and hard to defend against attacks, the consequences of which are significant (Russia suffers from this vulnerability too). The shift from centralised fossil fuels to a decentralised power grid based on renewables would provide Ukraine with not only clean energy but also the resilience to withstand continuous military pressure.

There are already promising examples. The collaboration between UK-based Octopus Energy Group and Ukrainian energy company DTEK seeks to raise 100 million euros to fund up to 100 solar and battery projects in Ukraine. These technologies are also important in a decentralised grid, powering key infrastructure such as hospitals or schools. Here, the Ray of Hope project, where solar energy powers hospitals in Kyiv, serves as another example of building energy resilience through decentralisation.

Last but not least, making local communities more self-sufficient through new energy infrastructure and less vulnerable to missile attacks, sabotage, or cyberattacks through improved defence capabilities could give Ukraine a strategic advantage over Russia, whose centralised energy system, largely reliant on gas power plants, is an easy target for Ukrainian deep strikes and sabotage.

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## **Challenges on the path**

Needless to say, Ukraine faces specific challenges to make such a transformation a reality. The shortage of skilled workers is a severe issue, given that a significant part of the country's workforce has either been drafted into the military or has left the country. As a result, the construction sector currently lacks adequately trained professionals specialising in energy-efficient technologies and sustainable building materials. While educational programs and retraining may help in the long run, it is increasingly obvious that Ukraine can't make it without foreign assistance, investment, and skilled workers.

Here, the legislative framework for green (re)construction is crucial for attracting international financial institutions as well as private investors. Key institutions such as the European Bank for Reconstruction and Development (EBRD) and the World Bank have already expressed interest in supporting green construction initiatives and aligning their goals with the Paris Agreement.

According to the think-tank BPIE, which is focused on the energy performance of buildings, if Ukraine is to build back better (and greener), it needs multilateral investment in its green reconstruction efforts. There are positive examples in European countries like Germany, Italy, and Croatia, which rebuilt damaged buildings in a sustainable way in the aftermath of major natural disasters, thus speeding up their energy transition and decarbonisation.

And there are already promising examples of sustainable construction in Ukraine. The Energy Map project, a data resource developed by Ukrainian and international partners, provides valuable insights into the energy performance of buildings across the country.

Among many others, a pioneering project that can pave the way for Ukrainian green resilience is the invention of "post-frame construction", which dramatically reduces the use of very carbon-intensive brick and cement materials, and emphasises wooden materials. According to Transform Ukraine, such buildings can also serve as carbon capture and storage technology (CCS) if the wood used for them is harvested sustainably.

## **Greening the military?**

Of course, reconciliation between ecology and defence will not always be easy. Militaries are still among the largest consumers of fossil fuels, while their emissions are largely exempt from international climate reporting (it has been estimated that military activities account for almost 5.5 per cent of annual greenhouse gas emissions globally). The best way to decarbonise the army is by downscaling – and that will not happen anytime soon.

Instead, as a response to the Russian threat, NATO is moving rapidly in the opposite direction. In June this year, NATO countries declared their commitment to increasing their spending on defence to 5 per cent by 2035. Some 3.5 per cent is reserved for core defence (such as troops, weapons and overall readiness), and 1.5 per cent for defence infrastructure and resilience.

That leaves the project of military decarbonisation with two options: technological transformation and carbon offsetting. The use of both is the most likely scenario for now: to evolve military technologies into their low-carbon alternatives wherever possible, and to seek ways to offset the remaining emissions for areas such as military aviation or heavy machinery.

And there is no other place in the world where military technologies are evolving more rapidly than on the Ukrainian battlefield. Here, the electrification of military technologies (for instance, Ukrainian drones are connected to operators via fibre optic cables, meaning Russia is unable to sabotage drone capabilities via the jamming of radio frequencies) is happening alongside the expansion of drone usage, which is radically transforming the character of modern war. However, in its current form, it also leaves Ukrainian land covered with tangled cobwebs of cables, leading to significant plastic pollution and long-term threats to wildlife.

Needless to say, there is no war that is not damaging to the environment. In fact, destroying the environment is oftentimes part of military tactics, which has led to initiatives calling for legal recognition of the crime of ecocide. Although it may sound absurd to demand decarbonisation of warfare rather than to simply stop warfare altogether, the geopolitical situation does not seem to be in favour of peaceful disarmament anytime soon.

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## **War ecology of Ukraine**

Ukraine may pursue a path that is a variation of what French philosopher Pierre Charbonnier labelled as “war ecology”. Here, the green transformation does not compete with defence spending over a constrained state budget. Instead, it plays a vital role in achieving defensive resilience and making one’s country impenetrable to enemy forces.

Decentralising the energy grid through renewables, upcycling of debris, low-energy buildings, electrification of warfare or restoration of marshes are just some examples of how a state can pursue war ecology as its defensive strategy, and in the process gain an advantage over an aggressive petrostate.

The war has already reshaped Ukraine’s energy and economic landscape, forcing a rethink of its development trajectory. If supported with green investments and policies, its reconstruction could set a precedent — well beyond its borders — by demonstrating how security and sustainability go hand in hand.

Out of the ashes of war, a new, green Ukraine has the potential to rise — one that not only rebuilds what was lost but lays the foundation for the new and better life that Ukrainians deserve: green, European and safe.



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