



The twin challenges of Ukraine

Keeping the lights on; and post-war rebuilding

- *The fate of Ukraine is of vital strategic self-interest to the liberal democracies.*
- *Its armed forces are receiving substantial hardware so that they can keep fighting.*
- *But national infrastructure, public services, and industry need to continue to function.*
- *Public and private sector providers must continue to function: if not, the war is lost.*
- *Central to this is keeping the electricity system operating.*
- *This requires the urgent supply of funds, together with material and technical support.*
- *Donors need to appreciate that this is a 'make or break' issue for the war's outcome.*
- *They will also wish to know there is a viable long-term plan for Ukraine.*
- *Building such a future will involve many elements and many agencies.*

Keeping the private sector functioning

Ukraine's fate is vital
for the liberal
democracies

1. The fate of Ukraine is of vital importance for the liberal democracies. Were Ukraine to lose the war and fall under Russian thrall, NATO's security strategy would be seriously impaired, Europe's energy security threatened, and various liberal democracies more generally would come under increased threat.

1.1. For more on the force of this point, see the Annex by Lt General (Rtd) Sir Andrew Graham.

Not losing the war
requires the private
sector be kept going

2. The outcome in Ukraine will depend in the first instance on two fundamental elements:

2.1. **Military assistance**, quite possibly in increasing quantity, to enable the country to continue to defend itself; and

2.2. **Financial and practical/material assistance** to enable the economy – both the private and the public sectors – to keep functioning.

- Central in that is maintaining the supply of electricity.

Maintaining the
electricity supply is
essential

3. Judging by the actions to date of Western countries, the need for military assistance is broadly recognised. The need to keep the economy, and hence the electricity system, functioning however is less understood.

4. Since October 10 last year, Russia has launched hundreds of missiles and drones in order to destroy Ukraine's energy sector – not only its electricity generators, but also the grid and the supply chain for electrical equipment.

5. This has caused significant damage to the energy system overall:

5.1. Over half of Ukraine's total generation capacity was unavailable by last December, and further large-scale destruction is continuing.

5.2. 50 substations of different voltage types and 50 high voltage lines were damaged.

5.3. All large wind plants are offline, although most solar plants and hydroelectric stations have (so far) remained online.

Ukraine's energy
system is severely
damaged

6. This has forced Ukraine to stop exporting electricity to the EU, and to introduce rolling energy system blackouts.

7. With Russia attacking not only the electricity generators, but also the grid and the supply chain for electrical equipment, so serious has the problem become that

So serious is the
system's problem ...

maintenance of the power system warrants being put on a 'war footing' – treating 'power as ammunition', and perhaps with a role for NATO, or the delivery and coordinating organisation European Network of Transmission Operators for Electricity (ENTSO-E).

... that maintaining it warrants its being put on a 'war footing'

8. Were the supply of electricity to fail:
 - 8.1. Many public services – water supply, sewerage, heating, telecoms, banking, transport, refrigeration, and more – would be brought to a standstill;
 - 8.2. Ukraine's industry would no longer be able to provide materiel for the war; and
 - 8.3. The armed forces, which depend on electricity in the field, would be weakened to the point of not being able to function.
9. Most fundamentally, the human cost would be immense: the death toll would soar, everyday life would become intolerable and unsustainable, public unity would likely collapse, and determination to continue to stand up to the invader would disintegrate.

Consequences of supply failure would be catastrophic

Urgent needs

10. Vital energy infrastructure equipment, primarily for distribution and generation facilities, electricity generating and reticulation materiel therefore urgently has to be replaced to ensure the immediate restoration of electricity supplies.
11. The range of needs is wide:
 - 11.1. High-voltage equipment for generation infrastructure:
 - Auto transformers, current transformers, voltage transformers, circuit breakers, disconnectors, surge arresters;
 - Engines, generators, power transformers transformer oil, cable, turbines, software.
 - 11.2. Equipment for power grids:
 - Power cells, circuit breakers, current transformers, batteries, bucket trucks, cable joints, mobile substations, cable, cable terminators, power transformers, wire, voltage transformers

The needs are urgent and wide

Unlocking aid

12. Some of these needs can be met in kind; others have to be bought, requiring financial aid.
13. The Energy Community Secretariat is playing a key role in supporting the energy sector of Ukraine.
 - 13.1. First, it managed to set up a mechanism of donor coordination to finance and arrange logistics to cover urgent equipment needs. To date, over EUR 140 m has been channelled by donors via this mechanism.
 - 13.2. Second, it manages to continue support of the energy sector reforms amid war.
 - The Secretariat has recently launched an Observatory which provides transparency in respect of Ukraine's movement towards the EU for the energy sector. The main goal of the Observatory is to prevent using war as a pretext to slow down or hinder reforms.

Considerable aid has been pledged ...

14. Unlocking the international financial institutions ("IFIs") is vital in this context.
 - 14.1. Within that, there is an important issue as to where that funding should go.
 - 14.2. Currently, the cheapest and quickest way to secure urgent power to Ukraine, would be achieved by financing thermal (coal) power plants.
 - 14.3. But this would be contrary to global policy trends to transitioning to green energy.
 - 14.4. IFI's will therefore need to have some form of green-energy transfer guarantee.
15. This is critical to preparing and restoring the electricity generation capacities ahead of the next winter season.
16. Beyond this, considerable financial aid – several billion dollars worth – has been pledged, although not all has yet been made available.
 - 16.1. Unfortunately, the needs are already considerably greater. Prime Minister Denys Shmyhal reportedly said last week that Ukraine will need \$17 billion this year for urgent energy repairs and de-mining and rebuilding some of its critical infrastructure.¹
17. Ultimately much of the rebuilding of Ukraine's shattered industrial capacity and general infrastructure will perforce need to be undertaken by the private sector, and financed by private capital.
18. But until the war is over, a considerable share of the financial risk will have to be assumed or underwritten by donor countries.

... but not all has been delivered ...

... and much more is needed

The cost beyond Ukraine

19. The war in Ukraine has already had large humanitarian and economic costs within the country. It is also having major impacts on countries beyond its borders:
 - 19.1. A burgeoning inflation from surges in the prices of gas, coal, and a range of food items.
 - 19.2. Resulting higher costs of living falling particularly heavily on people on low incomes, leading to increased poverty in pockets of OECD countries, and severe poverty in other parts of the world.
 - 19.3. Substantial increases in interest rates in almost all countries to combat inflation.
 - 19.4. Increases in public sector indebtedness in many countries as governments implement income support packages.
 - 19.5. Substantial military aid commitments by many countries already total nearly €40 bn, and total commitments, including financial and humanitarian aid, already amount to over €108 bn.²
20. These costs however would be dwarfed were Ukraine to lose the war and come under the Russian yoke:
 - 20.1. A refugees and humanitarian crisis in Europe would be inevitable, and
 - 20.2. A food crisis in Europe and indeed beyond would also likely follow.
21. It is therefore in European and broader 'Western' interests to ensure that:
 - 21.1. First, Ukraine wins the war (or at least does not lose it), and

Impacts of the Ukraine war go way beyond its borders ...

... and the costs would be dwarfed were the war to be lost

- 21.2. Second, once the invader has been repelled, Ukraine is not left to fend for itself but is supported in building a democratic open society and a modern economy so as to become a good partner to its neighbours and beyond.

The need for a longer-term plan

A credible plan will be essential for long-term assistance ...

22. The willingness of Western countries to deliver financial assistance near term will be influenced at least in part by donors being confident that, once the war does end, Ukraine will have in place, and will implement, a credible plan for its future.

23. Thus, it will be essential that Ukraine's European neighbours, the United States, and other liberal democracies:

23.1. Agree that Ukraine will need support and should not be left to fend for itself once the invader has been repelled; and

23.2. Agree that Ukraine has feasible plans for the country ultimately becoming a viable political, social, and economic liberal democracy underpinned by stable institutions.

... and would be best agreed sooner rather than later

24. It may seem early to be thinking in such terms. But it is noteworthy that, more than a year in advance of the Second World War ending, the United States and its allies met (at the Bretton Woods conference in July 1944) to agree on a post-war institutional structure that would be capable of ensuring the rebuilding of war-shattered economies, and ensuring their return to economic prosperity.

24.1. In turn, this helped to pave the way for the enactment of the Marshall Plan in 1948 for Europe's reconstruction, which proved highly successful.

Energy is both a short- and long-term issue

25. Materiel destroyed by the war in Ukraine will need to be replaced.

25.1. Energy is both a short- and a long-term issue – both in terms of military strategy and in medium term reconstruction strategy.

25.2. This need opens up considerable opportunities, both to modernise the economy and to replace old 'dirty' technologies with new 'green' ones.

A range of criteria and conditions will need to be met

26. Projects will need to be:

26.1. Economically viable;

26.2. Undertaken in general by the private sector; and

26.3. Financed in large part by private capital, even if donor seed capital and/or guarantees are needed.

27. The requisite capital, both public and private, will doubtless be made conditional throughout on Ukraine's government pursuing sound policies and, where necessary, reform.

27.1. It is noteworthy that Marshall Plan disbursements were conditional on European recipient countries making progress in a range of areas, including dismantling trade barriers between them.

28. Ukraine will need to satisfy a range of criteria, in respect of:

28.1. **Democracy**, with free and fair elections and the upholding and promotion of a democratic culture and accountability to the public.

28.2. **Human rights**, with a commitment to protect and promote civil, political, economic, social, and cultural rights.

28.3. **Rule of law**, including an independent, impartial, honest and competent judiciary to protect both individual and property rights.

- 28.4. **Good governance**, ensuring transparency and the rooting out of systemic and systematic corruption.
- 28.5. **Stable monetary and financial system**, capable of providing low inflation while supporting economic growth.
- 28.6. **Open trading system**, providing engagement with world markets.

Roles of countries and institutions

A 'road map' will be needed

- 29. A 'road map', rather than 'pass/fail' approach, will be needed to encourage Ukraine towards meeting those conditions: 'Credits earned' would likely prove most effective at unlocking both incremental funding and support.
- 30. Outside countries giving financial, material, or political support will wish, and should, have a say in shaping the aftermath, whether by advising and giving a view during the negotiations with Russia, or in establishing conditions for the way in which Ukraine reconstructs and builds for the future.
 - 30.1. This has the added incentive of encouraging partnership-working to a shared goal and rewarding behavioural change early.

The EU seems bound to play the primary role ...

- 31. The EU seems bound to have the primary role, not only because of its direct interest, but also because it is uniquely and appropriately equipped.
 - 31.1. Brussels in turn is the appropriate place, not only because the EU should be in the lead, but also because it is the home of NATO, which will inevitably continue to be involved.
 - 31.2. A specialist group to oversee the entire Ukraine reconstruction operation will presumably have to be established.
 - 31.3. For their part, EU leaders have recently acknowledged Kyiv's "*considerable efforts*" to date on reforms. But they have not provided a collective judgment on how much progress Ukraine has made, let alone how far it still has to go.

... with support from other governments and institutions ...

- 32. There will be an important role for other Western governments too, as well as for a range of institutions, to:
 - 32.1. Help Ukraine to establish the above preconditions;
 - 32.2. Set up an appropriate mix of funding methods; and
 - 32.3. Help Ukraine to use its aid effectively.
- 33. **The EBRD**, will need to play a major role, given its expertise in:
 - 33.1. Assessing the viability of investment projects;
 - 33.2. Evaluating and encouraging the appropriateness of macroeconomic policy arrangements and settings; and
 - 33.3. Providing seed capital, such that private sector capital then joins in.
- 34. There will also be key roles for other institutions including, but not limited to:
 - 34.1. The European Investment Bank (**EIB**), World Bank (**WB**), U.S. Agency for International Development (**USAID**), as important sources and conduits of finance;
 - 34.2. The International Monetary Fund (**IMF**) on a range of financial matters; and
 - 34.3. The Organisation for Economic Cooperation and Development (**OECD**) for the promotion of best-practice policies across the whole area of government.

... across the wide
range of needs

35. There may be a need for a coordinator role, perhaps even for an ‘overlord’ or ‘czar’, who could drive and, where necessary, override the project approval process. This coordinator could report to the Brussels group.
36. Energy will need to be a discrete subset of help within such a wider aid framework, given its key role in the economy, and the timescales involved in increasing capacity.
 - 36.1. **An estimate of medium-term capital requirements** for the sector will be needed.
37. **A donor programme** – EU-led but involving others – International Financial Institutions (IFIs), UK, US etc, with loan guarantees as well as grant funding – will need to be set up to deal with energy requirements to c. 2030, on the basis that links with Russian energy remain unavailable over that period.
38. **Separate governance of the energy sector** will also be needed. Again European-led but including representatives of relevant funding bodies and with sufficient political leadership to provide effective delivery of what has been promised. A Ukraine Energy Taskforce, based in Brussels, perhaps with an EBRD or EIB secretariat?
39. **Regular, at least six monthly, reporting** to the donor community and friendly nations on the state of the Ukraine's energy sector, progress against targets, new challenges etc. This will help keep the issue with the political profile needed to deliver its goals. ■

Annex

‘Keeping the lights on’:

Why preventing the collapse of Ukraine’s electricity grid matters

By Lt-General (Rtd) Sir Andrew Graham CB CBE

Introduction

1. Ukraine is engaged in a war of national survival. Whether or not the current war is a particularly violent and disruptive symptom of a much broader geo-strategic struggle for power and influence is not a matter for this paper.
2. If it is a symptom, as may well be the case, then Ukraine’s ability to win, or at least to not lose and thereby have some negotiating ‘capital’, is of critical importance to any future western European and NATO security strategy.³ Were Ukraine to fall into Russia’s ambit then Western Europe’s strategic economic and security options would be significantly impaired.
3. Coverage of wars tend to focus on the battles being waged on the ground, in the air, at sea, and (increasingly in the 21st Century), in the Information and Space domains, on the territory gained or lost, on the losses sustained and the damage and disruption caused in the fighting.
4. We should remind ourselves that ‘war is the continuation of politics by the admixture of other means’. The Armed Forces (the ‘other means’) conduct campaigns and fight battles to achieve political objectives, but waging war is a national effort which touches every aspect of national life and stretches every political, economic, social, information, infrastructure, and military sinew to its limit.
5. If any element of any of those sinews is stretched beyond its recoverable limit, or snaps, then the nation’s overall ability to wage war is diminished and the chances of a favourable if negotiated outcome are reduced. A dependable supply of electrical power to where it is needed when it is needed is one such element, and the grid is under sustained attack, threatening Ukraine’s ability to ‘Keep the Lights On’. The collapse of Ukraine’s power grid would have strategic consequences not only for Ukraine but also for Europe.

Bottom line up front

6. Failing to ‘Keep the Lights On’ would undermine Ukraine’s capability to wage war and defend both its territory and its right to self-determination.
7. In the longer term, were the war to be lost as a consequence the strategic defence and security, especially energy security, aspirations of western Europe would be significantly impeded.

Russia

8. Russia’s failure to seize its primary objectives and its cumulative losses of men and materiel on the battlefield have prompted it to attack a crucial element of Ukraine’s national civilian infrastructure, the electrical power grid. Its efforts appear to have been executed both competently and effectively.
9. The Russians have had 8 years to prepare for this war; their intelligence homework will have been comprehensive. Clearly the Russians recognise that power is increasingly crucial to the effective functioning of modern states. They therefore believe that the systematic taking down of the Ukraine’s electricity grid by destroying transformers and power plants will improve its chances of succeeding in its overall objectives.
10. By targeting the electricity grid for destruction Russia seeks to diminish Ukraine’s capacity and will to wage war by bringing public services to a standstill, weakening Ukraine’s overall industrial capacity in general and its military-industrial capacity in particular, and eroding public trust, unity and determination. Russia’s actions have made the electricity grid as vital a target to be protected as any government or military headquarters, position, formation, or storage depot.

11. Maintaining a sufficiently viable power grid through a combination of determined repair on the ground, the ready provision of finance and components from allies, innovation to confront the compatibility⁴ and other challenges, enhanced cyber, air and ground defence, and electricity conservation measures including rolling blackouts and prioritisation, would nullify the enemy's chosen line of attack.
12. Thus 'Keeping the Lights On' represents a victory of its own. There is opportunity here for Ukraine to gain advantage in the waging of this war.

Ukraine defence capability perspective

Front line dependency and demand

13. It is difficult to assess the scale of the demand for electricity from the grid that so-called 'Warfare in the Information Age' imposes. Conventional ground force equipment such as tanks, artillery pieces, armoured vehicles, trucks and plant require traditional fuels and lubricants. On the other hand communication systems, computers, drones and other ISTAR capabilities are powered by electricity drawn from the grid or from batteries which themselves draw from the grid.
14. It may be that the demand on the grid from the front line is relatively small and can be met with generators and supplies from abroad as obvious work-arounds.
15. However, if the dependency is significant and the availability and continuity of supply is crucial for sustaining the capability of those engaged in the fighting, then failing to 'Keep the Lights On' risks becoming a key liability to achieving battlefield dominance and success.

Defence industry

16. Sustainability is a Principle of War. The notion of sustainability tends to focus on maintaining adequate equipment and materiel sustainability to win today's battle and be prepared for tomorrow's.
17. In contemporary warfare we should consider sustainability more broadly and extend the definition to include support activities in a country's national and international depth: in rear areas (infrastructure, storage, movement, supply etc); in society (people, training, 'home fires burning' support etc); in politics (funding, sanctions etc); and in industry (equipment, manufacture, innovation, technical support and repair etc).
18. A feature of the first year of the war has been the adaptability and innovation shown by the Ukrainian Armed Forces using off-the-shelf civilian technology for tactical effect. The ability to maintain and reinforce that adaptability and innovation depends in great part on protecting the capacity and output of Ukraine's Defence-Industrial base, including the private sector SMEs and 'non-traditional industries' being drawn into the Defence and Security space⁵. 'Keeping the Lights On' means minimising the impact of power shortages on the capacity of Ukraine's Defence-Industrial base as an important aspect of ensuring that the front line is sustained effectively.

Infrastructure perspective

19. From an Infrastructure perspective the systematic destruction of transformers and power plants is a determined effort by Russia to restrict Ukraine's ability to shift electricity from one region to another. The first order consequences are apparent – blackouts and power outages. The second order consequences are potentially more serious and strategically debilitating – water and sewage systems shut down, transport at a standstill and infrastructure shut down and at risk of not reopening, and heavy industry such as the ArcelorMittal steel plant in Kryvyi Rih wrecked.
20. The short-term impact on Ukraine's ability to continue to wage war effectively could possibly, and it would be the worst case, precipitate a lessening of public and political support for continuing the fight at the same time as industrial output (which declined an estimated 38% between September 2021 and September 2022)⁶ slumps irrevocably, with economic and political collapse ensuing and the war being lost even while the front line holds. In the longer term, and assuming that Ukraine retains its independence, the costs of reconstruction would be increased significantly.

Economic perspective

21. Others will speak to the current state of Ukraine's economy, its ability to pay for what it needs and to adjust the terms of loan and other agreements, and the thus-far-declared commitment, capacity and will of allies to fund or to provide in kind what is required.
22. There is an immediate and short-term price to be paid for supporting Ukraine in all its efforts to prevent its energy grid from collapsing, and thus sustain its ability to wage war in order to maintain its independence. The strategic question that allies and supporters must answer is this:

*Is failing to pay that price worth the strategic pain for those same allies and supporters of potentially losing Ukraine as a long-term democratic partner, a free market supplier of agricultural produce, energy and other goods into the European market, and an important actor in the 'decarbonisation of Europe's energy' capable of 'making a significant contribution to Europe's post-war energy security system'?*⁷

Looking to the future

23. On 25th October 2022 delegates from the G7 and other nations gathered in Berlin for a conference on how to structure aid for the future reconstruction of Ukraine.
24. Discussing process and mechanisms on the presumption of a favourable outcome is important, but risks being complacent since that outcome is by no means a given. If western allies wish to avoid the situation where the reconstruction effort is for a Ukraine that has fallen by force under Russian hegemony then the first order issue for this paper remains.
25. Given that a robust and resilient power grid is an important element in reinforcing the state of Ukraine's capacity and ability to wage war, which is a national endeavour, then preventing the grid from collapsing and wreaking further damage to the country's military capability, its infrastructure, its industrial capacity and its people seems a very wise and important investment to make at some haste.
26. Failure to do so risks undermining Ukraine's capability to wage war and defend both its territory and its right to self-determination. The harsh reality for Europe and western allies is this: were Ukraine to become much closer to Russia as an outcome of the war then the strategic defence and security, especially energy security, aspirations of western Europe risk being significantly impeded.

This paper was written by Dr John Llewellyn, Preston Llewellyn, and Sir Andrew Graham. Important contributions were made by Steve Cutts, Sir Martin Donnelly, Lord Stephen Green, Silja Sepping, and other Associates of *Independent Economics* in discussion of an earlier draft.

Endnotes

- ¹ See: [External backers pour billions into Ukraine to counter war damage | Reuters](#)
- ² Data as of 24 November 2022. See: [Ukraine Support Tracker.xlsx \(live.com\)](#)
- ³ Such a strategy would combine coherent and integrated defence and security strengthening, forward deployment, and effective deterrence with political and economic determination to weaken the Russian economy, reduce reliance on Russian resources, and disrupt and diminish Russian influence and interference in other nations' affairs.
- ⁴ Compatibility. Much of Ukraine's grid uses the old Soviet 5 step system to step the power down from the high voltage from power stations to the voltage households can use. Western European systems use different voltages so transformers built for western European system cannot replace older Ukrainian transformers. Many central and eastern European states formerly used the Soviet system. Ukraine has asked those countries to go through their stockpiles and see what they still have in store, including non-functional units that can be cannibalised. *Economist*; 24 October; *Ukraine races to stop Russia destroying its power grid*.
- ⁵ RUSI discussion with representatives of Ukroboronprom, 6 February 2023.
- ⁶ Ukraine Industrial Capacity –State Statistics of Ukraine. Trading Economics.com
- ⁷ Maksym Timchenko, DTEK CEO, speaking at a Davos roundtable in January 2023.

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