



When the lights go out: the protection of energy infrastructure in armed conflict

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In armed conflicts across the globe, critical infrastructure enabling the delivery of essential services for the civilian population is subjected to repeated attack, incidental harm and misuse by warring parties, resulting in widespread service disruption. The humanitarian impact of this disturbing trend is immediate and long-term, ranging from mass displacement, hunger and food insecurity, energy insecurity, an increased risk of outbreak and spread of infectious disease, reduced livelihoods, and even death. The grave reverberating effects of essential service disruption are often long-lasting and can transcend borders.

In this post, ICRC Legal Advisers Eirini Giorgou and Abby Zeith take a closer look at the limits imposed by international humanitarian law (IHL) to protect critical infrastructure enabling the delivery of energy to civilians against the danger of hostilities.

ICRC Humanitarian Law & Policy Blog · When the lights go out: the protection of energy infrastructure in armed conflict

Armed conflict takes a heavy toll on civilian lives not only directly, through causing death and injury as a result of use of force, but also indirectly, when essential services on which civilians depend – such as electricity, healthcare, water, food production and distribution, wastewater treatment and solid waste disposal, and education – are disrupted or become inaccessible.

To ensure better protection of civilians in armed conflict, it is important to understand how *essential services work*. An essential service is a system comprising three types of components: hardware (e.g., infrastructure, equipment, etc.), people (operators and maintenance staff) and consumables (material necessary for the functioning of the infrastructure, such as fuel, or for the delivery of the service, such as medicine). Those components that enable the functioning of the service system are referred to as “critical”.

While essential services can be impacted in multiple ways, a common cause is damage or destruction to critical infrastructure which enables their provision during the conduct of hostilities. Such damage can be intentional, for example, when critical infrastructure is targeted – lawfully or unlawfully – by a party to the conflict, or incidental, especially when explosive weapons with a wide impact area are used to attack targets located in the vicinity of such infrastructure. The infrastructure might also be misused by the belligerents as part of a strategy, e.g., by cutting off civilian populations from access to essential services by methods other than attacks in order to put pressure on the adversary.

In this post, we focus on critical infrastructure that enables the provision of energy to civilians, such as networks of electricity-, fuel- and gas-related infrastructure. These networks consist of specific discrete and physically separate pieces of energy infrastructure, such as a building, structure or other object that forms part of an energy system or electricity grid as a whole, for example, a power plant, substation or transformer, cable or other transmission line, generator, dam, water reservoir, penstock, or control centre).

Interdependency of essential services and why energy systems are so important for the civilian population

Services essential for the civilian population and other protected persons during armed conflict are interdependent, which means the disruption of one can have domino effects on others and result in multiple services being disrupted or even collapsing. For instance, electricity supply is needed to ensure the delivery of water and sanitation, solid waste disposal and the cold chain (i.e., the storage, management, and transportation in specific temperatures of essential items such as foodstuffs and medicine). Hospitals and food production and distribution capacities are then dependent on a reliable supply of safe water, sanitation, and electricity.

Lack of *water and sanitation*, food, heating and healthcare can lead to disease and death, and trigger large-scale displacement. Depending on the cause of disruption, repair times range from hours to years – prolonging displacement and civilian suffering. When conflict is protracted, essential service systems may be degraded to the point of collapse. It is those who already face barriers and disadvantages that are the most affected, including women and children, older people and persons with disabilities.

Through its work in protracted conflict across the globe, the ICRC has become *all too familiar* with the severe and cumulative impacts on populations when there is a failure or collapse of electricity supply during armed conflict. Rapid population and economic growth, as well as urbanization, can already put pressure on energy infrastructure pre-conflict to meet increasing demand. The suffering is *exacerbated in regions* with scarce freshwater resources or impacted by extreme weather events (e.g. floods, heat waves, wildfires) and *climate change*.

There are limits to the collective humanitarian response when energy systems collapse

Though energy systems are organized differently in every country, an electricity grid will typically comprise a network of discrete and physically separate pieces of infrastructure key for energy *generation, transmission, distribution and control*. Unfortunately, as the *ICRC and others have noted elsewhere*, many cities in the world have energy infrastructure and services that have been built on a monolithic system design and lack diversified sources of energy production. Too often, a failure in an upstream component (e.g., power plants, high-voltage infrastructure) leads to a failure of all downstream components (e.g., distribution networks) and thus the interruption of the service – and all associated services reliant on it for their energy supply. In times of crisis, this architecture creates a system-wide vulnerability owing to the presence of single points of failure. The vulnerability can be noticed in the infrastructure itself, as well as in the supply chains necessary to ensure its operation.

While humanitarian organizations are adept at directing assistance towards the most vulnerable and some, including the ICRC, have developed expertise to support the provision of some essential services during armed conflict in a systematic manner, the risk that an entire population could be in need if interconnected and interdependent essential service systems fail is *alarming*. There are limits to the collective humanitarian response in stemming the rate of service decline during armed conflicts, especially when faced with *sanctions, counterterrorism and other restrictive measures* inhibiting the import of materials and items necessary to ensure service continuity.

Notably, in terms of energy systems the technical complexity, scale, and financial cost of generation, distribution, and transmission are such that when energy systems fail, the scale of the consequences far exceed that which can be addressed by humanitarian action alone. The ICRC, together with the World Bank and UNICEF, have developed a series of joint recommendations for systemic change in a report titled “*Joining Forces to Combat Protracted Crises*” which details *inter alia* how the failure or collapse of energy supply impacts upon the provision of water and sanitation during armed conflict.

However, preventing the damage and destruction of energy infrastructure in the first place is paramount to protect civilians. IHL provides crucial safeguards aimed at ensuring essential services can continue to be accessible for civilians during armed conflict.

Not only do these rules protect energy infrastructure that enables service delivery, but they also protect the civilian personnel who operate, maintain and repair that infrastructure, as well as the service provider stocks. Similarly, IHL contains important rules on *starvation and on relief operations* to ensure that civilians are not made to starve nor deprived of supplies essential to their survival, as well as rules for the protection of the *natural environment*. While of utmost importance for the protection of civilians, these latter rules exceed the scope of this post and will therefore not be addressed in the following.

How does IHL protect energy infrastructure?

Pieces of energy infrastructure that form part of an energy system enabling the provision of essential services to civilians are in principle civilian objects, and as such are protected against *direct attack* and *reprisals* as well as incidental harm. Insofar as they are normally dedicated to civilian purposes, they

benefit from a presumption of civilian status. This means that *in case of doubt* whether a piece of infrastructure is being used to make an effective contribution to military action, that object must be presumed to be civilian.

Beyond attacks, the obligation of parties to armed conflict to take *constant care* to spare the civilian population, civilians and civilian objects in all military operations is of particular importance when it comes to the protection of energy infrastructure. Parties need to exercise heightened caution when conducting troop movements, maneuvers, and other military activities and when taking up positions in the vicinity of such objects. This requires, e.g., doing everything feasible to understand how different essential systems are interconnected and to identify the most vulnerable pieces of energy infrastructure (at ground, above and below ground level), in order to avoid damaging or putting these at risk.

Under what circumstances would a piece of energy infrastructure become a military objective?

A *cumulative two-prong test* will determine whether a particular piece of energy infrastructure qualifies as a military objective under IHL. One should not assume that just because it fulfills the first prong of the definition, it automatically fulfills the second prong. Concretely, this means that:

(1) by its nature, location, purpose (intended future use) or use the piece of energy infrastructure must make an effective contribution to *military action*; and

(2) its total or partial destruction, capture or neutralization, *in the circumstances ruling at the time*, must offer a definite military advantage.

The phrase “effective contribution to military action” in the first prong is crucial for any discussion on the targetability of energy infrastructure. In effect, for such a piece of infrastructure to qualify as a military objective, there must be a close connection – or “proximate nexus” – between the infrastructure and the fighting itself (*Gisel*, pp139–150).

This nexus will typically relate to tactical or operational level activities undertaken for the purpose of military operations during armed conflict. For example, a power station that provides electricity to a military barracks, military headquarters or military command, control, and communication systems. In certain circumstances, there might be a nexus to strategic-level military activities, such as those aimed at producing direct military effects (e.g., targeting a piece of energy infrastructure that provides electricity to air-defense radars to deny the adversary’s air-defense capabilities) or impacting upon war production (e.g., targeting a piece of infrastructure that supplies electricity to a munition factory).

As for the second prong, there must be a concrete and perceptible advantage that will benefit the armed forces seeking to attack a piece of energy infrastructure in view of the circumstances ruling at the time, rather than at some hypothetical future time (*International Law Association*, 330–1, 342–3). In other words, sweeping or anticipatory classification of the entire electricity grid of a country or area under enemy control as a military objective is prohibited, and any subsequent attacks based on such broad classification would most likely be indiscriminate. Any anticipated advantage that is solely economic, financial, political, psychological, social or moral is irrelevant (*Bothe, Partsch and Solf*, 367).

Of particular concern is the tendency by some parties to armed conflict to adopt overly broad interpretations of the *military objective definition* to justify operations against energy infrastructure, not for the purpose of degrading an adversary’s military capabilities, but rather for political or economic reasons. To be clear, IHL forbids attacks against pieces of energy infrastructure if the sole purpose is to degrade an adversary’s economic capacity, even if they are indirectly sustaining their war-fighting capability (e.g. *Dinstein*, pp126–7), to force the adversary to the negotiating table, to influence the will of the population, or to intimidate political leaders. As has been argued *elsewhere*, if the intention to directly influence an enemy population’s determination to fight were recognized as a legitimate objective for military force, then no limit to warfare would remain. Similarly, attacks against pieces of energy infrastructure launched for the primary purpose of spreading terror among the civilian population are also prohibited. Such purpose may, depending on the circumstances, be inferred from the nature of the attack; for example, state practice and the jurisprudence of international courts and tribunals indicate that the targeting of civilians or civilian objects and indiscriminate attacks carried out in a protracted manner or on a large scale have at times been considered as acts of terror (see *ICRC CIHL Study*).

Can a piece of energy infrastructure be attacked merely because it qualifies as a military objective?

The answer to this question is: no.

IHL affords special (heightened) protection to certain types of energy infrastructure, notably objects indispensable to the survival of the civilian population, as well as works and installations containing dangerous forces. This special protection applies even in the case where such pieces of energy infrastructure constitute military objectives.

Objects indispensable to the survival of the civilian population

As a corollary to the *prohibition on starvation of civilians* as a method of warfare, it is specifically prohibited to attack, destroy, remove or otherwise render useless *objects indispensable to the survival of the civilian population*. Such objects include but are not limited to foodstuffs, agricultural areas for food production, crops, livestock, drinking water installations and supplies, and irrigation works. It extends to pieces of energy infrastructure critical to the effective operation of other indispensable objects (see *ICRC API Commentary* [2103] but also *Dinstein* p. 289, *Schue and Wippman*, p 573, *Schmitt*, and *Dannenbaum*). However, consideration of this important and *complex* rule is beyond the scope of this post.

Objects containing dangerous forces, namely dams, dykes and nuclear power plants

As we have *explained previously*, the protection of *works and installations containing dangerous forces*, namely dams, dykes and nuclear electrical generating stations, does not cease merely because they become *military objectives*. IHL establishes a detailed system of protection, the gist of which is very simple: to

avoid that these works and installations become battlegrounds or are incidentally damaged by the fighting.

In any case, even when a piece of energy infrastructure does not benefit from heightened protection under IHL, all other customary and treaty IHL rules protecting the civilian population from the effects of hostilities, as well as the *natural environment*, continue to apply. This also includes, for example, prohibitions on *indiscriminate* and *disproportionate attacks*, as well as the several rules on *precautions in attack* and *against the effects of attacks*.

Why is it problematic to target energy infrastructure during armed conflict?

Even though energy infrastructure has often been targeted in armed conflicts, it is an especially problematic target set.

First, energy infrastructure is often used for military and civilian purposes simultaneously. For example, a power station may provide electricity to both military barracks and the rest of the city. If its use for military purposes renders a specific piece of energy infrastructure a military objective, it will become a lawful target. In light of today's modern, integrated electrical grid network facilities, it is very difficult to limit the effects of an attack to those portions of the service being used by the armed forces (*Jachec-Neale, p73-74; Dinstein, p140-1*). Notwithstanding these challenges, the prevailing view, shared by the ICRC, is that the principles of proportionality and precautions remain relevant, not only with regard to the incidental harm directly caused to civilians and other civilian objects (such as those in the vicinity of energy infrastructure), but also in terms of the consequences of impairing the civilian use or functionality of the energy infrastructure itself, including the indirect civilian harm that results from such impairment.

Secondly, there can be a tendency to overestimate the direct and concrete military advantage anticipated from attacking certain pieces of energy infrastructure. This may be due to a lack of appropriate intelligence or speculation about, for example, the extent to which it is making an "effective contribution" to the adversary's military action or the military effects of targeting such infrastructure, or even a failure to anticipate how their adversary might reasonably react in response to mitigate the impact of such attacks. In fact, some *suggest* that while targeting pieces of energy infrastructure might in certain circumstances provide short-term military advantage, the long-term strategic and operational military advantages remain questionable and, in any event, are likely outweighed by the serious *reverberating effects* of such attacks on the civilian population (which are examined below). This is especially the case when militaries are generally priority users during armed conflict and, as such, are likely to be allocated any residual electricity capacity for their operations when pieces of energy infrastructure are subject to attack (*Waxman, p 20*), because this simultaneously reduces the concrete military advantage anticipated and increases the civilian harm.

It is critical that armed forces do not make assumptions or generalizations about energy infrastructure, as others have also cautioned against (*Henderson, 139-141*). Those planning and deciding upon attacks need to make their decisions with respect to target selection, verification, proportionality and precautions in attack on the basis of robust multidisciplinary intelligence assessments which comprehensively map, for example, power production, consumption, backup systems and, notably, the projected effects of disrupting electricity on the adversary's military capabilities (*Griffith, pp45-46*), but also considering the impact on the provision of essential services to the civilian population. While this type of information may be difficult to acquire, it certainly does not negate the legal requirement to take all feasible measures to obtain it when planning and deciding upon an attack on a specific piece of energy infrastructure.

What are the reverberating effects of targeting energy infrastructure?

Incidental civilian harm is not limited to the damage, destruction or loss of functionality of the targeted piece of energy infrastructure and the death or injury of civilians located in or at its vicinity that is directly caused by the attack. It includes all reasonably foreseeable indirect or "reverberating" effects from the impact on such infrastructure that amount to "loss of civilian life, injury to civilians and damage to civilian objects or a combination thereof". For example:

- The damage caused to electrical power plants or supply lines might disrupt water distribution, health care, power supply and sanitation, which is likely to result in significant harm affecting a large part of the civilian population beyond the weapon's impact area and for a period well beyond the immediate aftermath of the attack. Such harm is relevant for both *proportionality* and *precautions in attack* insofar as it has a causal link to the attack and is reasonably foreseeable at the time of the attack, though what should be considered reasonably foreseeable in practice is a vexed question.
- *Environmental damage* caused by the release of harmful substances because of damaged pieces of energy infrastructure also constitutes civilian harm relevant for proportionality. Take, for example, when a water-purification station ceases to function because the electricity supply lines indispensable for its operation are damaged, or when an attack damages a *nuclear power plant* causing the release and spread of lethal radioactive material in the air, soil and watercourses.
- "Injury" includes *illness and disease* triggered by, for example, inadequate or insufficient water provision caused by an attack on or incidentally harming a water purification station, a water pump or the electricity grid. While not per se considered as incidental civilian harm, displacement due to unavailability of essential services is relevant for proportionality and precautions in attack, insofar as it may lead to disease or deaths among the displaced population, as well as more generally in the "weight" to be given to the damage to a piece of energy infrastructure when assessing incidental harm under the principles of proportionality and precautions (*ICRC, pp. 18-19*).

Precautions to prevent and reduce incidental civilian harm from targeting energy infrastructure

Parties to a conflict must do everything feasible not only to verify that a piece of energy infrastructure fulfils both criteria for being designated as a military objective, i.e., a lawful target – something by no means easy – but also to assess whether an attack against it will comply with the rule of proportionality. In the ICRC's view, this entails an obligation to do everything feasible to obtain information that will allow for a meaningful assessment of the foreseeable incidental effects, on civilians and civilian objects, of an attack.

As previously mentioned, this will call for a comprehensive and multidisciplinary intelligence assessment which includes the likelihood and magnitude of the reverberating effects on the civilian population due to the disruption to essential services. What is reasonably foreseeable by a commander in each case

should be informed by past experience and lessons learnt from their armed forces. It should also draw on the ever-growing experience gathered from other conflicts which involved the targeting of energy infrastructure. This can include, for example, data and evidence from publicly available studies and other sources, as well as from urban engineers, public health specialists, humanitarian organizations, development agencies and local authorities assessing and/or responding to the impact of the conflict. Information obtained using enhanced stand-off recognition (e.g., *remote sensing techniques and satellite imagery*) and, when feasible, from local authorities can also ensure more robust incidental harm assessments.

The precautions that may be deemed feasible expand commensurately with improvement in the information, expertise, and tools available to commanders to anticipate the reverberating effects of an attack.

In addition, those planning and deciding upon attacks against pieces of energy infrastructure must do everything feasible to avoid or at least minimize all incidental civilian harm that is foreseeable in the circumstances based on information reasonably available to them from all sources.

This refers first and foremost to the *choice of targeted pieces of infrastructure*. For example, if the intent of an attack is to deny electricity supply to the adversary, then, an attack on either the power generation station or the distribution network (e.g. transformers or powerlines) might be equally as effective in achieving that goal (e.g., *Henderson*, p 189). However, attacking the latter (or parts thereof) may lessen impact on civilians to an extent.

Further, all feasible precautions must be taken regarding the choice of weapons and tactics. This might include disrupting the adversary's electricity supply by using means and methods that disable power generation or distribution facilities temporarily rather than destroying them entirely. For example, *in previous conflicts*, BLU-114 cruise missiles have showered energy infrastructure with carbon fibre filaments to short-circuit transformers and other high voltage equipment upon contact (e.g. *Schmitt*). The intended purpose of such means is to minimize incidental harm by ensuring a shorter recovery time than in the case of destroying other pieces of energy infrastructure such as those involved in energy generation (e.g., power plants). Precautions such as these are however unlikely to eliminate the risk of incidental civilian harm entirely. For example, instant short-circuiting of material *reportedly* ignited affected power lines and structures on some occasions, resulting in long-term – and often permanent – damage (e.g. *Jachec-Neale*, p134;).

As such, it must be stressed that attacks against energy infrastructure will be unlawful if the expected incidental civilian harm is excessive in relation to the concrete and direct military advantage anticipated despite having taken all feasible precautions to minimize such harm.

Other necessary precautions to protect energy infrastructure against the dangers of military operations

Aside from obligations upon those seeking to target pieces of energy infrastructure, parties to armed conflict must also take all feasible measures to protect civilians and civilian objects (inc. energy infrastructure) under their control against the direct and reverberating *effects of attacks* by an adversary. Such measures might include:

- Preventing pieces of energy infrastructure enabling the delivery of essential services to civilians from becoming a military objective by avoiding the use of such infrastructure for military purposes.
- Clearly separating the parts of the electricity system used for military purposes from the parts dedicated to civilian use (e.g. by marking them or by other means). Where not possible, doing everything feasible to mitigate risk of disruption to the essential civilian service(s) the infrastructure enables and consequent civilian impact, for example by ensuring alternative supplies of energy, for instance generators and sufficient fuel enabling hospitals, water and sanitation, food production and distribution, to continue working even if the provision of electricity is reduced or cut off.
- Removing civilians and civilian objects from the vicinity of pieces of energy infrastructure that have become military objectives.
- Avoiding the placement of military objectives (troops, weapons, etc.) in or at the vicinity of such infrastructure.
- Taking appropriate measures to strengthen the resilience of energy systems against the effects of attacks including by building redundancies into the systems, and within pieces of energy infrastructure themselves, to ensure the infrastructure continues to operate at capacity to maintain a sufficient quality of service delivery to civilians at the very least.
- Ensuring service providers and/or humanitarian actors have safe and sustained access to maintain and as necessary repair critical infrastructure and the service it enables and stem the rate of further service decline.
- Providing warnings to civilians to prepare for essential service scarcity or disruption, whether by leaving the area or by finding alternative means of sustenance.
- Reaching agreement between the parties to the conflict to establish protected zones to enhance protection of particularly vulnerable pieces of energy infrastructure. Prioritization of designated areas could be based on the severity of consequences if infrastructure is damaged or destroyed, the size of the population likely to be affected, and the availability and effectiveness of coping mechanisms to mitigate harm. For such zones to be effective, it would call for a recognition of such zones by all the parties concerned (notably through written agreement), a complete demilitarization, clear and visible marking of the area by the party in control of the area, safety from weapon contamination to enable safe access for maintenance, the issuing of clear direction to military personnel that such areas are to be respected (i.e., not to be used for military purposes and not to be attacked), the establishment, if possible, of a supervisory mechanism – as foreseen, for instance, in the draft agreements contained in the annexes I of the *GCI* and *GCIV* – and, of course, a minimum level of respect of IHL rules.

Conclusion

Energy infrastructure indispensable for providing electricity, heating, water and sanitation, and health care, and for food production and distribution to civilians must be preserved to the maximum extent during armed conflict. Such infrastructure must in principle not be attacked, nor misused by the parties, and must be protected against incidental effects of hostilities. Particular care must be taken when designating specific pieces of infrastructure forming part of energy systems as targets during military operations, as the necessary IHL requirements are less likely to be met than one might think.

The attacking party must do everything feasible to anticipate the direct and indirect/reverberating effects the attack against specific pieces of energy infrastructure will have on civilians, notably as a result of disruption of one or more essential services, and to ensure that these are not excessive in relation to the concrete and direct military advantage anticipated. Considering the severe and often long-lasting impact of the disruption of essential services due to attacks against pieces of energy infrastructure, ensuring the proportionality of such attacks is likely to be difficult. So, too, is compliance with the more stringent protections afforded to objects indispensable to the survival of the civilian population, as well as work and installations containing dangerous forces.

Short of keeping conflict away from energy infrastructure altogether, robust active and passive precautions and other mitigation measures are essential to ensure that civilians have access to a quality of essential services necessary to preserve their lives, security, physical and moral integrity, and dignity even in the midst of fighting.

See also

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