EXPLOSIVE WEAPONS MONITOR

FRAGMENTS

EXPLOSIVE WEAPONS MONITOR QUARTERLY

VOL. 4, ISSUE 1, OCTOBER 2026



The Arms Trade Treaty and Explosive Weapons in Populated Areas

Considerations for Risk Assessment

Laura Boillot, Director, Article 36

Katherine Young, Research and Monitoring Manager, Explosive Weapons Monitor

Methodological Guide

Documenting civilian harm from attacks on energy infrastructure

Patrick Vinck, Co-Founder, Chair and President, Kobo

Jerome Marston, Head of Research, Kobo

Uliana Poltavets, Ukraine Emergency Response Coordinator, Physicians for Human Rights

Katherine Young, Research and Monitoring Manager, Explosive Weapons Monitor

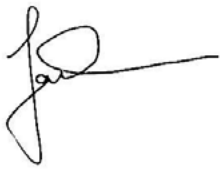
A NOTE FROM THE **EXPLOSIVE WEAPONS MONITOR** AND THE **INTERNATIONAL NETWORK ON EXPLOSIVE WEAPONS**

The humanitarian consequences of the use of explosive weapons in populated areas are well documented, and the same patterns of harm continue to be seen in conflicts throughout the world. This issue of Fragments looks at how that evidence can be put to use: in decisions on arms transfers, and in documenting the harm caused when attacks damage energy infrastructure.

The Arms Trade Treaty and the Political Declaration developed through separate processes, yet 81 States are both Parties or Signatories to the Treaty and endorsers of the Declaration, and both instruments seek to prevent harm to civilians before it occurs. According to US intelligence assessments, Israeli armed forces dropped at least 29,000 explosive munitions on Gaza in the first two months of the conflict alone, nearly half of them unguided. In eastern Democratic Republic of the Congo, Amnesty International recorded more than 150 launches of explosive weapons into densely populated areas in the first seven months of 2024. Patterns like these are evidence of foreseeable risk, and should inform the assessments States must carry out under Article 7 of the Treaty before authorising arms exports. Too often, exports are suspended only after large-scale civilian harm has already occurred.

Attacks on energy infrastructure show how far the effects of explosive weapons reach beyond the point of impact. When power stations and grids are damaged, the consequences extend to hospitals, schools, water supply and livelihoods. Drawing largely on experience in Ukraine, the methodological guide developed by the Explosive Weapons Monitor, Kobo and Physicians for Human Rights sets out indicators for documenting these reverberating effects on physical and mental health, education and livelihoods, and links them to available sources of data. It is intended for researchers and analysts working in humanitarian, human rights and civilian protection, and may also assist justice and accountability bodies.

These impacts on civilians are predictable and preventable. The Political Declaration commits endorsing States to restrict or refrain from the use of explosive weapons in populated areas when civilian harm can be expected, and to collect and share data on the direct and indirect effects of their use. Stronger evidence of civilian harm, used consistently in military and arms transfer decisions, is central to making those commitments a reality.



Júlia Codina Sariols
Global Lead, International Network on Explosive Weapons

FRAGMENTS: EXPLOSIVE WEAPONS MONITOR QUARTERLY SERIES

Fragments is a collection of articles that address topics related to the use of explosive weapons in populated areas and contribute research to or report on developments and news relevant to this issue area. *Fragments* aims to reach a combination of specialised audiences familiar with the issue of explosive weapons in populated areas, including those affected by explosive weapons use, as well as the community of practice working to address the impacts of explosive weapons through the Political Declaration on the Use of Explosive Weapons in Populated Areas.

The Explosive Weapons Monitor is a research initiative of the International Network on Explosive Weapons (INEW). It conducts research and analysis on harms from and practices of explosive weapons use in populated areas and monitors universalisation and implementation of the Political Declaration on the Use of Explosive Weapons in Populated Areas.

WWW.EXPLOSIVEWEAPONSMONITOR.ORG
INFO@EXPLOSIVEWEAPONSMONITOR.ORG
@WEAPONSMONITOR

Cover photo: A destroyed power transformer from Burshtynska thermal power plant displayed in a square in Kyiv. Ukraine no longer produces such transformers, making them difficult to replace. Photo taken by Physicians for Human Rights in September 2024.

This issue was produced and edited by Júlia Codina Sariols of the Explosive Weapons Monitor. Reviews of articles were conducted by the Explosive Weapons Monitor Editorial Board. Art direction and graphic design was provided by Dave Watson of Collected Pros. Images were provided by Getty Images and partners.

© EXPLOSIVE WEAPONS MONITOR

October 2026

Funded by the European Union

This document was produced with the financial assistance of the European Union. The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

CONTENTS

THE ARMS TRADE TREATY AND EXPLOSIVE WEAPONS IN POPULATED AREAS 4

Considerations for Risk Assessment

Laura Boillot, Director, Article 36
Katherine Young, Research and Monitoring Manager, Explosive Weapons Monitor

The Arms Trade Treaty and the Political Declaration on explosive weapons in populated areas developed through separate processes, but they share a preventive aim and much of the same membership: 81 ATT States Parties and Signatories have also endorsed the Declaration. This chapter argues that the well-documented patterns of civilian harm from explosive weapons in towns and cities should inform the risk assessments States must carry out under Article 7 of the Treaty. It also sets out practical steps to bring implementation of the two instruments closer together.

This article was first published as Chapter 1 of the ATT Monitor 2026 report by the Control Arms Secretariat and is reproduced with permission.

METHODOLOGICAL GUIDE 18

Documenting civilian harm from attacks on energy infrastructure

Patrick Vinck, Co-Founder, Chair and President, Kobo
Jerome Marston, Head of Research, Kobo
Uliana Poltavets, Ukraine Emergency Response Coordinator, Physicians for Human Rights
Katherine Young, Research and Monitoring Manager, Explosive Weapons Monitor

Attacks on energy infrastructure harm civilians long after the strike, disrupting health care, education, water and livelihoods. Developed by the Explosive Weapons Monitor, Kobo and Physicians for Human Rights, this guide offers practical tools for documenting that harm. Drawing mainly on examples from Ukraine, it sets out indicators across physical and mental health, education, livelihoods and other areas of civilian life, linked to available data sources, for researchers working in humanitarian, human rights and civilian protection settings.

THE ARMS TRADE TREATY AND EXPLOSIVE WEAPONS IN POPULATED AREAS: CONSIDERATIONS FOR RISK ASSESSMENT

LAURA BOILLOT, DIRECTOR, ARTICLE 36

KATHERINE YOUNG, RESEARCH AND MONITORING MANAGER, EXPLOSIVE WEAPONS MONITOR

The Arms Trade Treaty and the Political Declaration on explosive weapons in populated areas developed through separate processes, but they share a preventive aim and much of the same membership: 81 ATT States Parties and Signatories have also endorsed the Declaration. This chapter argues that the well-documented patterns of civilian harm from explosive weapons in towns and cities should inform the risk assessments States must carry out under Article 7 of the Treaty. It also sets out practical steps to bring implementation of the two instruments closer together.

This article was first published as Chapter 1 of the ATT Monitor 2026 report by the Control Arms Secretariat and is reproduced with permission.

Introduction

The supply of arms has a direct bearing on the means and methods of warfare available to States and other actors when violence escalates. Decisions about which arms are transferred, and to whom, shape the tools available for use in situations of crisis or armed conflict. Patterns of weapon use, and the harm inflicted on civilian populations, are therefore highly relevant indicators for decisions concerning the supply and transfer of weapons. Where particular weapons or practices have been associated with civilian harm, this knowledge should be included in risk assessments that shape decision-making on arms exports.

The use of explosive weapons in populated areas presents distinct and foreseeable humanitarian risks. When explosive weapons are used in these areas, civilians are killed and injured, and civilian infrastructures damaged or destroyed. The reverberating effects stemming from the resulting disruption or collapse of essential services extend well beyond the point of impact and can persist for weeks, months, or even years after a conflict ends. These patterns of harm have been documented across multiple conflicts and are widely recognized as predictable consequences of the use of such weapons in urban environments.[1]

At the international level, however, the regulation of conventional arms transfers and efforts to address the humanitarian consequences arising from the use of explosive weapons in populated areas have largely developed through separate legal and political processes. Arms transfers, export risk assessments and export controls are governed principally through the 2013 Arms Trade Treaty (ATT), while efforts to strengthen the protection of civilians arising from the use and humanitarian impact of explosive weapons in populated areas are pursued through the 2022 Political Declaration on Strengthening the Protection of Civilians from the Humanitarian Consequences Arising from the Use of Explosive Weapons in Populated Areas (EWIPA).



Soldier in tactical gear during military exercises in Argentina.
© Valentin Angel Fernandez

Despite this separation at the global policy level, there is significant overlap in terms of the conventional weapons addressed by both instruments and the shared humanitarian objective of reducing civilian harm.

This chapter examines how coherent implementation of the ATT and the EWIPA Political Declaration can strengthen the protection of civilians in armed conflict. It first identifies the shared humanitarian objectives and complementary nature of the two instruments before examining the documented patterns of civilian harm from the use of explosive weapons in populated areas. It then considers how these patterns, alongside commitments and evidence emerging from implementation of the EWIPA Political Declaration, can inform the prospective risk assessments required under article 7 of the ATT. Finally, it identifies practical opportunities for States to strengthen implementation of both instruments in a mutually reinforcing manner, supporting more responsible transfer decisions and reducing civilian harm.

Setting the stage – Examining the synergies between the ATT AND THE EWIPA Declaration

The ATT was adopted by the United Nations (UN) General Assembly in April 2013 with the aim of establishing the highest standards for regulating the international trade in conventional arms and preventing their illicit trade and diversion. This object is set out with the purpose to contribute to international and regional peace, security and stability; reduce human suffering; and promote cooperation, transparency and responsible action by States Parties in the international trade in conventional arms, thereby building confidence among them.[2]

In November 2022, the EWIPA Political Declaration was developed and endorsed by 83 States as a response to the unprecedented levels of civilian harm arising from the use of explosive weapons in populated areas in contemporary armed conflicts.[3] The Declaration was negotiated in recognition that, despite existing international humanitarian law (IHL), recurring patterns of civilian harm from the use of explosive weapons in populated areas persisted. It therefore establishes shared political commitments aimed at strengthening civilian protection through national policy, military doctrine and operational practice, with a particular focus on preventing foreseeable civilian harm before it occurs. As this use continues to be a major cause of civilian death, injury, displacement and the destruction of homes, infrastructure and livelihoods, the EWIPA Political Declaration seeks to comprehensively address these humanitarian consequences by committing endorsing States to develop national policies and practices to strengthen the protection of civilians.[4]

The EWIPA Political Declaration establishes specific political commitments that endorsing States are expected to implement. Among these, the central normative contribution of the Declaration is the commitment to 'restrict or refrain', as appropriate, from the use of explosive weapons in populated areas, when such use 'may be expected to cause harm to civilians or civilian objects'.[5] Particular concern has been expressed regarding explosive weapons with wide area effects[6] (sometimes referred to as 'heavy explosive weapons'), as extensive evidence demonstrates that these weapons pose the greatest risk of civilian harm when used in populated areas. More broadly, the EWIPA Political Declaration seeks to strengthen the protection of civilians by promoting policies and practices that support more effective implementation of existing obligations under IHL.

The EWIPA Political Declaration also reflects a shared recognition by States of two well-established realities. First, the risk of civilian harm associated with the use of explosive weapons in populated areas is influenced by characteristics such as explosive power, the accuracy of delivery and the number of munitions used. Weapons possessing these characteristics—particularly those capable of producing wide area effects—pose especially severe risks. Second, both the direct and indirect (reverberating) effects of these weapons on civilians and civilian objects have been extensively documented across a wide range of armed conflicts. Together, this recognition means that States can no longer credibly argue that the humanitarian consequences associated with the use of explosive weapons in populated areas are uncertain or unforeseeable. The documentation of these patterns of harm, together with the shared understanding reflected in the EWIPA Political Declaration, provides an important body of evidence concerning foreseeable civilian harm.

The significance of the EWIPA Political Declaration extends beyond the conduct of military operations by endorsing States themselves. Commitment 4.8 requires endorsing States to 'seek adherence' to the EWIPA Political Declaration and to practices consistent with it by all parties to armed conflict, reflecting the Declaration's broader ambition to influence State practice globally.[7] Together with commitment 3.1,[8] which requires endorsing States to implement, review, develop or improve national policies and practices to strengthen the protection of civilians during armed conflict, commitment 4.8 provides a basis for considering responsible arms transfer policy as one means of giving practical effect to the EWIPA Political Declaration. Although the Declaration does not explicitly regulate arms transfers, endorsing States should therefore consider, before authorizing the export of explosive weapons, whether a proposed recipient may reasonably be expected to use those weapons—particularly explosive weapons with wide area effects—in populated areas, taking into account

its past conduct, military doctrine and operational practice. Where there is a foreseeable risk that transferred weapons may be used in ways that are inconsistent with the commitments reflected in the EWIPA Political Declaration, restraint in arms transfers provides one practical means through which States can seek broader adherence to those commitments.

Although the ATT and the EWIPA Political Declaration are distinct—one a legally-binding treaty and the other a politically-binding declaration—both are preventative in orientation, seeking to assess risks of, and prevent harm to civilians from the use of weapons before it occurs. Overlap in these shared goals—as well as purpose and principles, membership, and scope—presents an opportunity for States to adopt policy approaches that strengthen civilian protection and better support implementation of both instruments.

Shared purpose and principles

Despite taking very different regulatory approaches, both instruments are preventative in orientation. The ATT regulates the international transfer of conventional arms by requiring States Parties to assess the risk that exported arms could be used to commit or facilitate serious violations of IHL or international human rights law (IHRL) (Article 7).[9] The EWIPA Political Declaration addresses the use of explosive weapons in populated areas by committing endorsing States to 'restrict or refrain' as appropriate, from such use where it may be expected to cause harm to civilians or civilian objects.[10] Both instruments are grounded in the protection of civilians during armed conflict and seek to influence State behaviour in ways that strengthen respect for IHL and reduce human suffering.

Other obligations and commitments of both instruments reflect additional shared principles. Both instruments explicitly recognize the duty of States to respect IHL and IHRL—and, under IHL, the broader duty to ensure respect for it by others. International cooperation, transparency and information sharing are fundamental to both instruments. In this regard, the role of data collection, research and analysis is central to strengthening ATT implementation efforts and improving the transparency of the conventional arms trade. Data collection is likewise essential to progress on implementation of the EWIPA Political Declaration, which facilitates learning and changes to military policy and practice that strengthen the protection of civilians.

Overlap in membership or endorsement

There is considerable overlap between States Parties to the ATT and States that have endorsed the EWIPA Political Declaration, creating opportunities for greater policy coherence without imposing additional obligations or administrative burdens. Seventy-four States are both Parties to the ATT and have also endorsed the EWIPA Political Declaration,[11] and seven Signatories of the ATT have also endorsed the EWIPA Political Declaration.[12]

Even where States are Parties to the ATT but have not endorsed the EWIPA Political Declaration or have endorsed the Declaration without being Parties to the ATT, aligning practice with the shared humanitarian objectives of both can contribute meaningfully to enhanced civilian protection outcomes.

Synergies in scope

Explosive weapons are 'a broad category of weapons that use high explosives to create a zone of blast and fragmentation in the area around the point of a detonation'.[13] Explosive weapons, or explosive weapon systems, include munitions with an explosive payload and their delivery systems.[14]

Heavy explosive weapons, also referred to as explosive weapons with 'wide area effects', are especially problematic when used in populated areas.[15] Explosive weapons with wide area effects will affect an area significantly greater than that of the intended target. There are three characteristics of weapons that create wide area effects, either individually or in combination:

- A substantial blast and fragmentation radius resulting from a large explosive content;
- Inaccuracy of delivery, meaning that explosive munitions may land anywhere in a wider area; and
- The use of multiple warheads or multiple firings, sometimes designed to spread, affecting a wide area.[16]

The range of conventional arms in the scope of the ATT includes many explosive weapons. Those that are prone to wide area effects can be found in the ATT's major conventional arms categories (a)–(g) (see Table 1). Other explosive weapons can be found in the sub-categories of light weapons, including smaller munitions and hand-held or portable delivery systems.

Table 1 – ATT conventional arms and explosive weapons

ATT conventional arms categories[17]	Description including the munitions and delivery systems of explosive weapons[18]
(a) Battle tanks	Armoured fighting vehicles equipped with a direct fire gun of at least 75 millimetres calibre. Tank gun projectiles, including high explosive munitions that fragment on impact and are used to target armoured and unarmoured vehicles, structures or personnel.[19]
(b) Armoured combat vehicles	Vehicles with armoured protection and cross-country capability, either equipped to transport a squad of infantrymen, or armed with a missile launcher or a weapon of at least 12.5 millimetres calibre.
(c) Large-calibre artillery systems	Guns, howitzers, artillery pieces, mortars or multiple launch rocket systems, capable of engaging targets on the ground by indirect fire, with a calibre of 75 millimetres and above. Artillery gun projectiles and mortars are gun-launched, indirect-fire projectiles that are typically unguided,[20] while ground-launched rocket artillery may be fired from a wide range of platforms and can be found in a variety of sizes and capabilities.[21]
(d) Combat aircraft	Manned or unmanned fixed-wing aircraft equipped to employ guided missiles, unguided rockets, bombs, guns, cannons or other weapons. This includes both guided and unguided air-dropped bombs, which compared with other categories of munitions are typically large (up to more than 2,000 kilograms).[22]
(e) Attack helicopters	Manned or unmanned rotary-wing aircraft equipped to engage targets by employing guided or unguided anti-armour, air-to-surface, air-to-subsurface or air-to-air weapons and equipped with an integrated fire control and aiming system for these weapons.
(f) Warships	Vessels or submarines armed for military use and equipped for launching missiles with a range of at least 25 kilometres or torpedoes with similar range. Naval artillery mounted on warships may be used to engage missiles and aircraft, attack other vessels or land-based targets. Most munitions fired by these artillery systems are unguided.[23]
(g) Missiles and missile launchers	Guided or unguided rockets, ballistic or cruise missiles capable of delivering a warhead or weapon of destruction to a range of at least 25 kilometres and means designed or modified specifically for launching such missiles or rockets.
(h) Light weapons	Hand-held under-barrel and mounted grenade launchers; portable anti-tank guns; recoilless rifles; portable launchers of anti-tank missile and rocket systems; and mortars of calibres less than 75mm.

Article 5.3 of the ATT encourages States Parties to go beyond the minimum categories listed in Article 2(1).[24] States Parties can include additional arms not explicitly listed in the ATT's scope in their national control lists and systems. These can include explosive weapons that are directly-emplaced (e.g., anti-vehicle and anti-personnel landmines) rather than fired, launched or delivered.

Though not explicitly mentioned in the scope of the ATT, Article 3 makes clear that States Parties must maintain a national control system to regulate the export of ammunition and munitions fired, launched or delivered by the conventional arms in Article 2(1) and shall apply the provisions of Article 6 ('Prohibitions') and Article 7 ('Export and Export Assessment') prior to authorizing their export.[25] Article 4 establishes similar obligations in relation to parts and components.[26]

EWIPA considerations and ATT risk assessment

In relation to the ATT, the EWIPA Declaration complements the law on arms transfers by strengthening the normative framework for reducing civilian harm. All States are required, at a minimum, to respect and ensure respect for IHL, including when making decisions relating to the transfer of arms. Many States have also accepted more specific obligations through regional export control arrangements and the ATT. Under Article 7 of the ATT, States Parties must assess the potential that exported conventional arms could be used to commit or facilitate serious violations of IHL or IHRL and must not authorize an export where, after considering available mitigation measures, there remains an overriding risk of such consequences.[27] As such it is designed as a forward-looking instrument intended to prevent foreseeable harm by requiring prospective assessments of foreseeable risk before an export is authorized. The shared understanding reflected in the EWIPA Political Declaration, together with the substantial body of evidence concerning the foreseeable humanitarian consequences arising from the use of explosive weapons in populated areas, is directly relevant to the evidence base upon which such prospective risk assessments should be conducted.

Evidence of patterns of harm

For more than a decade, the UN, the International Committee of the Red Cross (ICRC) and civil society have collected and analysed evidence on the civilian impact of explosive weapons in conflict. As a result, the use of explosive weapons in populated areas has been identified as a leading cause of civilian harm in contemporary armed conflicts, and the resulting patterns of harm to civilians are well-documented and recognized in the EWIPA Political Declaration.

Documented civilian impacts of explosive weapons include direct deaths and injuries, and the damage and destruction of civilian infrastructure. They also include reverberating effects, which cause harm to civilians beyond the time of an explosion and location of the immediate blast zone. These effects take numerous forms and can also stem from damaged infrastructure. They include disrupted access to essential services, such as healthcare, sanitation, water and electricity supply, and education. Such impacts also affect the environment, cause widespread displacement, and inflict disability and psycho-social trauma on individuals and communities.[28] The impacts of explosive weapons may also vary among women, men, girls and boys.[29]

The frequency and consistency of these outcomes across different contexts indicate they should not be treated as incidental or context-specific, but as evidence of inherent and foreseeable risk in a number of active armed conflicts throughout the world. Whether through aerial bombardment in Gaza and Ukraine, shelling in Sudan and Myanmar, or the use of rockets and missiles in densely populated areas across the Middle East, the use of explosive weapons has humanitarian consequences and continues to disproportionately impact civilians.

Case studies – foreseeable risk to civilians from explosive weapons

These case studies illustrate situations of armed conflict in which harm to civilians from the use of explosive weapons has been well-documented. They underscore the need for ATT States Parties, when assessing export applications, to proactively examine available information from multiple sources on a recipient's past and current use of explosive weapons. Additionally, States Parties should assess the broader context in relation to any ongoing or risk of armed conflict to determine whether there is a significant risk that exports of explosive weapons could be used in ways that cause serious civilian harm.

These case studies are illustrative rather than exhaustive. They are intended to demonstrate how documented patterns of harm can inform prospective risk assessments under Article 7.

Gaza

Israel's repeated use of explosive weapons in populated areas across successive military operations has generated extensive evidence regarding patterns of use and the resulting humanitarian consequences for civilians.[30] These patterns became particularly acute following the attacks of 7 October 2023, when Hamas and other armed Palestinian groups launched rockets and deployed fighters into southern Israel, killing around 1,200 people. Israeli armed forces responded with a military campaign marked by extensive aerial bombardment together with the use of artillery and other ground- and sea-launched explosive weapons during subsequent ground operations in Gaza.[31]

The impacts of the Israeli armed forces' aerial campaign have been particularly catastrophic for civilians. According to US intelligence, Israeli armed forces dropped at least 29,000 explosive munitions in Gaza during the first two months of the conflict alone, of which nearly half were unguided bombs.[32] Munitions also included 1,000-pound and 2,000-pound satellite-guided bombs, the latter of which has an estimated crater size of 14 meters.[33] A 2,000-pound bomb was used in an airstrike on the Jabalia refugee camp on 31 October 2023, killing at least 126 civilians, including 69 children.[34] Prior to the October 2025 ceasefire, government officials in Gaza estimated that Israeli armed forces dropped approximately 100,000 tonnes of explosives on the Gaza strip over the course of two years.[35] Fighter jets, such as F-35s, were utilized by Israeli armed forces to drop heavy explosive munitions.[36]

As of October 2025, the UN Office for the Coordination of Humanitarian Affairs reported nearly 81 per cent of all structures in Gaza have been damaged or destroyed, including 89 per cent of water, sanitation and hygiene (WASH) assets, and 145 cultural and historical sites. It also reported food insecurity and malnutrition remain long-term issues for civilians on a large scale.[37]

The use of explosive weapons by Israeli armed forces—and the resulting patterns of harm—was not limited to Gaza. In Lebanon, aerial and ground attacks by Israeli armed forces in densely populated areas, in response to rocket fire from Hezbollah after 7 October 2023, caused civilian casualties, damage and destruction of critical civilian infrastructure, displacement and disruption of essential services. Israeli airstrikes during conflict escalation on 23 September 2024 were especially devastating for Lebanese civilians, on a scale akin to the first weeks of Israeli military action in Gaza in 2023.[38] During the 2026 war with Iran, similar attacks in South Lebanon have killed hundreds and displaced hundreds of thousands of people, caused a humanitarian crisis and damaged critical civilian infrastructure such as housing, farmland, transportation links and schools.[39]

Among the different transfers of arms to Israel, in March 2024, the United States authorized the transfer of 1,800 MK84 2,000-pound bombs, 500 MK82 500-pound bombs, and 25 F-35A fighter jets and engines fulfilling previously notified sales.[40] In addition, several ATT States Parties have indirectly provided parts and components of explosive weapons to the Israeli armed forces. For example, a consortium of countries (Australia, Canada, Denmark, Italy, Netherlands, Norway, the United Kingdom and the United States) participate in the production of parts and components for F-35 aircraft as part of the Lockheed Martin F-35 Joint Strike Fighter program. The components are ultimately exported to the United States for integration into the aircraft, of which dozens have been supplied to Israel.[41] Transfers of parts and components are largely managed through general licences and final decisions on exports of complete F-35 aircraft, including to Israel, are taken by the United States.[42]

Democratic Republic of the Congo

Ongoing conflict in the Democratic Republic of the Congo (DRC) can be traced back decades to the 1994 genocide against the Tutsi in Rwanda.[43] The Rwandan-backed March 23 Movement (M23), which formed in 2012, has since clashed periodically with the armed forces of DRC in eastern DRC's towns and cities, most notably Goma. Extensive evidence of human rights violations emerged from these clashes.[44]

At the beginning of 2024, increased use of explosive weapons in populated areas in North and South Kivu, in eastern DRC, exacerbated the humanitarian crisis that developed over decades of conflict. Frequent use of heavy explosive weapons by both the Congolese armed forces and the Rwandan-backed M23 in eastern DRC's towns and cities, and the resulting surge in civilian casualties, marked a new phase of armed conflict in the country. The use of ground-launched unguided rockets, including 122mm Grad rockets, as well as mortars and artillery by both parties to the conflict, has had devastating consequences for civilians and generated evidence of serious human rights violations.[45]

Amnesty International reported that between January and July 2024, explosive weapons were launched more than 150 times into densely populated areas, killing over 100 civilians and wounding hundreds more.[46] In one incident on 3 May 2024, a rocket killed at least 18 civilians, including 15 children, when it hit the 8ème CEPAC internally displaced persons (IDP) camp north-west of the city of Goma. The rocket was likely fired by M23 in response to additional rocket fire by Congolese armed forces that were positioned near the camp. Thirty civilians were also wounded, 28 of whom were women and children.[47]

The ICRC also documented significant civilian harm caused by the use of explosive weapons in eastern DRC since mid-2024. In North Kivu, healthcare facilities reported that 40 per cent of injured civilians seeking care were victims of the use of explosive weapons in populated areas, including shelling and use of other heavy weapons.[48] Hospitals, such as Ndosho hospital in Goma, became overwhelmed and were forced to operate beyond capacity.[49]

In January 2025, M23 attacks intensified in both North and South Kivu, once again compounding the humanitarian crisis and displacing hundreds of thousands of civilians.[50] Physicians for Human Rights reported that M23's takeover of the city of Goma, the provincial capital of North Kivu, resulted in the shelling of the Charité and Virunga hospitals.[51] IDP camps were bombed and civilians were re-displaced, access to humanitarian aid was restricted by closed roads, and shelling forced temporary cessation of healthcare activities in parts of North Kivu.[52]

Reported arms transfers to Rwanda in the last decade include, among others, large-calibre artillery systems, such as the export of RM-70 122mm multiple rocket launchers authorized by Slovakia in 2018 and delivered in 2019, as well as CS/SH-1 122mm truck-mounted self-propelled howitzers authorized by China in 2017 and delivered in 2018.[53] Reported past arms transfers to DRC also include large-calibre artillery systems, such as the export of D-20 152mm towed guns authorized by Bulgaria in 2013 and delivered in 2015, as well as 120mm mortars authorized and delivered by Serbia in 2012.[54] More recently, China authorized the export of nine CH-4B armed drones to the DRC, which were delivered in 2024.[55] These drones can be armed with AR-1 and AR-2 air-to-surface missiles, AKD-10 anti-tank missile, and FT- and GB-series guided bombs.[56]

Incorporating EWIPA considerations into ATT risk assessment

Incorporating analysis on an end user's past and current practices of explosive weapon use into ATT risk assessments can help identify foreseeable risks of civilian harm and strengthen the humanitarian goal of both instruments. Past practice is relevant not simply because it demonstrates previous harmful incidents, but because repeated patterns of use provide evidence of foreseeable future risk. The commitments reflected in the EWIPA Political Declaration, together with the documentation of the humanitarian consequences arising from the use of explosive weapons in populated areas, provide an important body of evidence that can inform the prospective assessments required under Article 7 of the ATT. This, in turn, assists exporting States Parties in determining whether there is an overriding risk that exported arms could be used to commit or facilitate serious violations of IHL.

Incorporating these EWIPA-related considerations into ATT risk assessments offers a number of practical benefits. First, such analysis enhances the quality of risk analysis by grounding them in empirical evidence of humanitarian consequences concerning how particular weapons are used in populated areas, while ensuring that export decisions reflect up-to-date information about patterns of harm, operational practice and documented incidents, such as the examples above. Second, identifying these considerations as specific indicators within article 7 risk assessment can promote greater consistency in the application of the ATT by supporting more structured assessments of whether there is an 'overriding risk' that exported arms could be used to commit or facilitate serious violations of IHL. Third, it encourages greater coherence between implementation of the ATT and the EWIPA Political Declaration, enabling States that are Parties to the ATT and have endorsed the EWIPA Political Declaration to give practical effect to the shared humanitarian objectives of the two instruments through existing export control processes.

Explosive weapons are typically held by military or paramilitary forces for use in armed conflict, though they are also used in some contexts of conflict by non-state armed groups. Where a State uses such weapons within its own territory—particularly in populated areas—this should be understood as a warning signal of an escalating crisis. It may indicate a transition from policing to military force, limited State capacity to manage instances of insecurity through law-enforcement means or a breakdown in protection obligations toward civilians. While each situation requires an assessment of its own facts and circumstances, such patterns may provide an early indication of foreseeable risks of further escalation and increasing civilian harm and are therefore relevant considerations in prospective ATT risk assessments.

Indicators of patterns of harm associated with explosive weapons in populated areas

Indicators that reflect the real-world patterns of harm associated with explosive weapons in populated areas may include:[57]

- The conduct of military operations involving explosive weapons in populated areas, particularly the use of explosive weapons with wide area effects including those with large blast and fragmentation radii, and/or those prone to inaccuracy or that fire multiple munitions across an area
- Credible reporting of civilian casualties or damage to essential civilian infrastructure such as hospitals, schools, water systems or energy facilities
- Patterns of weapons use against civilians
- Spikes in displacement
- The absence of credible investigations into alleged violations
- Broader dynamics of escalating armed conflict and rising civilian harm, as indicators of possible future risks for civilians in populated areas.

Linking EWIPA considerations with ATT risk assessment: current practices and possible future developments

Some States and different stakeholders have already begun to incorporate considerations relevant to the EWIPA Political Declaration into arms transfer policy and practice. This section highlights examples of current practice and identifies opportunities for further strengthening coherence between implementation of the ATT and the EWIPA Political Declaration.

Areas of current state policy and practice

State practice in linking civilian harm considerations to arms export decisions can be observed across several areas.

Formal export control policies

Several States have explicit references to IHL compliance and ongoing armed conflict as risk indicators in their export control frameworks.[58] These frameworks provide a logical entry point for developing more explicit policies. Specifically, they allow States to examine an end-user's past and present conduct, assess patterns of civilian harm, and incorporate EWIPA Political Declaration considerations, such as the use of explosive weapons in populated areas, strengthening export assessment criteria ensuring they reflect patterns of harm in current armed conflicts.

New Zealand's export control policy

New Zealand completed the review of its criteria for assessing proposed exports of 'military, dual use and catch-all goods' under its export controls regime in 2023. Under these criteria, the proposed export, its end-user and potential end use, will be assessed against both the legal obligations and non-legally binding commitments New Zealand has undertaken in respect of disarmament, arms control and non-proliferation. In guidance on its assessment criteria, the EWIPA Political Declaration is explicitly listed as an example of the non-legally binding commitments that will be taken into account in the assessment of a proposed export.[59]

Decisions to suspend and deny arms exports

In a number of contexts, States have suspended, denied or revoked exports to parties in armed conflict, including Saudi Arabia in relation to the conflict in Yemen and Israel in relation to the conflict in Gaza.[60]

In several instances, governments have referred to concerns regarding international humanitarian law, the humanitarian situation or the potential use of transferred weapons in military operations in populated areas. For example, in 2024 Canada suspended new arms export permits to Israel following parliamentary debate concerning the humanitarian situation in Gaza,[61] while the United States temporarily paused the export of approximately 3,500 2,000 lb and 500 lb bombs in May 2024 over concerns they could be used during military operations in Rafah.[62] The 500 lb bomb hold was reversed later in the Biden administration; the 2,000 lb hold remained in place until the administration's end and was then reversed. No further official suspensions have followed, though several legislative efforts to block specific transfers have failed to gain sufficient support, and the United States has continued transferring substantial arms to Israel since.[63]

These decisions have not occurred in isolation: they have followed sustained public pressure, findings and recommendations from UN Commissions of Inquiry and Special Rapporteurs, litigation before domestic courts, and provisional measures proceedings before the International Court of Justice concerning Gaza—all of which have kept the question of continued arms transfers under active scrutiny. However, States rarely explain in detail how evidence of civilian harm, legal and political obligations are weighed in individual export decisions. Greater transparency about the reasoning behind a denial would allow States Parties to demonstrate compliance with their ATT obligations and commitment to the EWIPA Political Declaration. In practice, however, States often have limited incentive to do so, since detailed public reasoning can constrain their political flexibility to resume exports to the same recipient once circumstances change. This makes it difficult to assess precisely how documented patterns of civilian harm are incorporated into Article 7 risk assessments or whether the commitments reflected in the EWIPA Political Declaration influence decision-making in practice. One example of good practice is the Netherlands, which reports annually on its strategic export control policy and provides information on export licence denials and the reasons underpinning those decisions.[64] Greater transparency along these lines could support more consistent, preventative application of Article 7, while reinforcing the preventive objectives of the EWIPA Political Declaration.

Risk assessments under Article 7 should be evidence-based, and an export recipient's past conduct legitimately forms part of that basis. However, current practices face critical issues regarding thresholds and timing. In practice, export denials are too often enacted only after sustained or large-scale civilian harm has accumulated in a specific conflict, rather than on the basis of foreseeable risk identifiable at an earlier stage. Documented patterns of harm associated with the use of explosive weapons in populated areas provide precisely the type of evidence that should inform prospective risk assessments, not only retrospective ones. Systematically integrating EWIPA-relevant evidence into export risk assessments could help shift these decisions toward a more consistent and preventative application of the ATT.

Oversight and review bodies

Parliamentary scrutiny, judicial review and litigation have become increasingly important mechanisms through which States' arms export decisions are examined. These processes have highlighted the importance of the humanitarian and civilian harm evidence underpinning export risk assessments, including documented patterns of civilian harm associated with the use of explosive weapons in populated areas. However, this trend is not uniform: in some jurisdictions, oversight of these processes has narrowed rather than expanded.[65] While transparency surrounding export denials and risk assessments remains limited in many jurisdictions, in some cases these oversight mechanisms have helped clarify expectations regarding Article 7 risk assessments and the evidence on which they are based. They may also influence policy and legal developments beyond the jurisdictions in which they operate, contributing to the emergence of more consistent approaches to export risk assessment across States.



Military personnel inspecting a fighter jet on the runway in Rionegro, Colombia.
© Camilo Ospina

Litigation and executive action: The United Kingdom, Italy and the Netherlands

Litigation under the ATT and related national export control frameworks has become an important mechanism for scrutinising government export decisions. Unlike other arms control and disarmament instruments, the ATT has generated sustained judicial review, placing governments on notice that export decisions may face legal challenges.

In the United Kingdom, litigation by the Campaign Against Arms Trade led to a 2019 Court of Appeal judgment on UK arms exports to Saudi Arabia during the Yemen conflict.[66] The court found the government had acted unlawfully in granting licences without properly considering potential IHL breaches, giving particular weight to evidence from UN bodies and non-governmental organizations. The ruling required suspension of new licences, but in July 2020 the UK resumed licensing, concluding the incidents were 'isolated' rather than a pattern.[67] More recently, a separate challenge over the UK's continued export of F-35 components to Israel via the global supply pool—despite a September 2024 partial suspension of other licences—was dismissed by the High Court in June 2025, which held the F-35 'carve-out' was non-justiciable; the Court of Appeal refused permission to appeal in November 2025.[68] These cases show courts can find harm-evidence legally relevant, while still treating the ultimate decision as one for the executive, not the judiciary.

The Italian Parliament adopted a motion in June 2019—explicitly referencing the UK Court of Appeal judgment—calling for restrictions on arms transfers to members of the Saudi-led coalition. The government then suspended the export of aircraft bombs, missiles and their components to Saudi Arabia and the United Arab Emirates for 18 months.[69] In January 2021, those licences were permanently revoked, cancelling an export of more than 12,700 bombs—the first such decision in three decades under Italian Law 185 on Arms Exports.[70]

In the Netherlands, the Court of Appeal of The Hague ordered the government in February 2024 to halt export of F-35 components to Israel, citing a clear risk they could be used in serious IHL violations in Gaza.[71] The government appealed, and in October 2025 the Supreme Court overturned that order, ruling courts must exercise restraint in foreign and security policy and that the Minister has the authority, but is not obliged, to reassess a granted licence.[72] It held, however, that once a government does reassess—as here, following 7 October 2023 and Israel's subsequent operations—it must apply the ATT's and the EU Common Position's mandatory criteria, including refusal where a clear IHL risk exists. The Minister was ordered to reassess within six weeks. In November 2025, the Dutch government wrote to the parliament that the suspension would continue, stating it would be unreasonable to resume the export of F-35 components at this time—meaning the practical effect of the 2024 Court of Appeal order has persisted, achieved through the government's own reassessment rather than a binding judicial prohibition.[73] In June 2026, the Minister of Foreign Affairs reassessed and confirmed this decision.[74]

Recommendations for future developments

Building on current practice, several practical opportunities exist for States to strengthen coherence between implementation of the ATT and the EWIPA Political Declaration. None of these measures would create new legal obligations or additional export criteria. Rather, they would strengthen the evidence base upon which existing Article 7 risk assessments are conducted by drawing more systematically on documented patterns of civilian harm associated with the use of explosive weapons in populated areas.

Opportunities for strengthening risk analysis

Eighty-one States that are States Parties or Signatories of the ATT have also endorsed the EWIPA Political Declaration. This overlap creates an opportunity for more coherent implementation. Exporting States could strengthen prospective risk assessments by drawing more systematically on a recipient's past and current use of explosive weapons in populated areas, patterns of damage to civilian infrastructure, foreseeable reverberating effects, military doctrine and operational practice including those reflected in the EWIPA Political Declaration. Such information provides a stronger evidential basis for assessing foreseeable risk under Article 7.

Strengthening the evidence available to support these assessments is equally important. Integrating specific EWIPA-related considerations into ATT decision-making supports the Treaty's purpose of reducing human suffering, improves legal risk management and reinforces the EWIPA Political Declaration's objective of protecting civilians from the harmful effects of explosive weapons in populated areas. Continued development of civilian harm tracking, investigation mechanisms, lessons-learned processes and public reporting can improve understanding of the humanitarian consequences associated with the use of explosive weapons in populated areas. These mechanisms not only support implementation of the EWIPA Political Declaration by informing military policy and practice but can also improve the quality of ATT risk assessments by generating more systematic evidence concerning patterns of weapons use, civilian harm and the effectiveness of mitigation measures.

Other opportunities for synergies in States' implementation and engagement

Additional opportunities exist to strengthen coherence in implementation at both the national and multilateral levels. At the national level, States that are Parties to the ATT and have endorsed the EWIPA Political Declaration could review export control policies, military doctrine and civilian protection policies together, ensuring that implementation of one instrument informs implementation of the other.

At the multilateral level, States could draw more explicitly on the relationship between these instruments during Conferences of States Parties and Working Group meetings under the ATT, as well as during international conferences and intersessional meetings held under the EWIPA Political Declaration. ATT discussions could examine how documented patterns of civilian harm associated with the use of explosive weapons in populated areas are incorporated into Article 7 risk assessments. Conversely, discussions under the EWIPA Political Declaration could consider responsible arms transfer policy as one practical means through which endorsing States may seek adherence to the Declaration's commitments by all parties to armed conflict, consistent with commitment 4.8. While the EWIPA Political Declaration does not explicitly refer to the transfer of explosive weapons, this commitment and commitment 3.1 to implement, review, develop or improve, national policy and practice on the protection of civilians during armed conflict, can support States in adopting arms transfer policies aimed at avoiding the civilian harm associated with use of explosive weapons in populated areas. In practice, States considering the export of explosive weapons—particularly those with wide-area effects—should assess whether a proposed recipient may reasonably be expected to use them in densely populated areas, including on the basis of the recipient's past conduct. Greater exchange of good practice across these forums would support more coherent implementation of both instruments.

Better coordination between these processes would reinforce the complementary objectives of the ATT and the EWIPA Political Declaration. By ensuring that documented patterns of civilian harm and the evidence generated through EWIPA implementation are more systematically reflected in export risk assessments, States Parties can strengthen both the preventative application of Article 7 and broader efforts to protect civilians from the humanitarian consequences arising from the use of explosive weapons in populated areas.

Conclusion

The ATT and the EWIPA Political Declaration have largely developed through separate legal and political processes. Yet they are complementary instruments that seek, through different means, to reduce human suffering and strengthen the protection of civilians. The ATT regulates the transfer of conventional arms, while the EWIPA Political Declaration establishes political commitments regarding their use. Read together, they provide mutually reinforcing frameworks through which States can strengthen the protection of civilians before harm occurs.

The EWIPA Political Declaration does not create new legal obligations governing arms transfers, nor does it alter the legal standard established by Article 7 of the ATT. Rather, it strengthens the evidence base available for prospective risk assessments by reflecting States' shared recognition of the foreseeable humanitarian consequences arising from the use of explosive weapons in populated areas and by promoting policies and practices that improve understanding of civilian harm. That evidence is directly relevant to the prospective assessment of foreseeable risk required under Article 7.

The relationship between the two instruments is also reciprocal. The ATT provides one practical means through which endorsing States can give effect to their commitments under the EWIPA Political Declaration. Where States have recognised, through the Declaration, the foreseeable humanitarian consequences associated with the use of explosive weapons in populated areas and have committed to restrict or refrain from such use, to strengthen national civilian protection policies and to seek adherence to those commitments by all parties to armed conflict, those commitments should inform how they assess the export of explosive weapons under Article 7 of the ATT.

Accordingly, where States that have endorsed the EWIPA Political Declaration fail to take account of the evidence and commitments reflected in the Declaration when conducting ATT risk assessments, questions arise not only as to whether Article 7 assessments have fully reflected foreseeable risk, but also as to whether those States are giving practical effect to the commitments they have undertaken under the EWIPA Political Declaration. Conversely, by systematically incorporating this evidence into export risk assessments, strengthening transparency surrounding export decisions and continuing to improve civilian harm tracking and analysis, States can reinforce implementation of both instruments in a mutually reinforcing manner and strengthen the protection of civilians in armed conflict.

1. See, for instance: Explosive Weapons Monitor (2025). 'Explosive Weapons Monitor 2024'. May 2025. tinyurl.com/mtww68vr; ICRC (2022). 'Explosive Weapons with Wide Area Effects: A Deadly Choice in Populated Areas'. January 2022. tinyurl.com/22eykpmn; and Wille, C. and Malaret Baldo, A. (2021). 'Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas'. UNIDIR. 23 February 2021. tinyurl.com/3yhfjff2.
2. Arms Trade Treaty, Article 1 (adopted 2 April 2013, entered into force 24 December 2014). tinyurl.com/23vvaafu.
3. Explosive Weapons Monitor (2025). 'Explosive Weapons Monitor 2024'. May 2025. tinyurl.com/mtww68vr, p. 6.
4. Political Declaration on Strengthening the Protection of Civilians from the Humanitarian Consequences Arising from the Use of Explosive Weapons in Populated Areas (adopted 18 November 2022). tinyurl.com/bdhdjbbd.
5. Ibid., para 3.3.
6. See ICRC (2022). 'Explosive Weapons with Wide Area Effects: A Deadly Choice in Populated Areas'. January 2022. tinyurl.com/22eykpmn; and Boillot, L. (2025), 'Avoiding Civilian Harm by Restricting or Refraining from the Use of Explosive Weapons in Populated Areas'. Policy Briefing. May 2025. tinyurl.com/mr976hsh.
7. Political Declaration on Strengthening the Protection of Civilians from the Humanitarian Consequences Arising from the Use of Explosive Weapons in Populated Areas (adopted 18 November 2022). tinyurl.com/bdhdjbbd, para 4.8.
8. Center for Civilians in Conflict (CIVIC) (2026), 'Civilian Harm and Arms Transfers: A Primer on International Law and Policy'. June 2026. tinyurl.com/6u7dfdte.
9. International Committee of the Red Cross (ICRC). 'Arms Trade Treaty, 2 April 2013'. International Humanitarian Law (IHL) Databases. tinyurl.com/vjpmenzn. See also: Arms Trade Treaty, Articles 6 and 7 (adopted 2 April 2013, entered into force 24 December 2014). tinyurl.com/23vvaafu.
10. Political Declaration on Strengthening the Protection of Civilians from the Humanitarian Consequences Arising from the Use of Explosive Weapons in Populated Areas (adopted 18 November 2022). tinyurl.com/bdhdjbbd.
11. ATT States Parties that have also endorsed the EWIPA Political Declaration, as of 31 May 2026, are Albania, Andorra, Argentina, Australia, Austria, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Cabo Verde, Canada, Central African Republic, Chile, Colombia, Costa Rica, Côte d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, El Salvador, Finland, France, Georgia, Germany, Greece, Guatemala, Guyana, Honduras, Hungary, Iceland, Ireland, Italy, Japan, Lesotho, Liberia, Liechtenstein, Luxembourg, Madagascar, Malawi, Maldives, Malta, Mexico, Monaco, Montenegro, Netherlands, New Zealand, Nigeria, Norway, Palau, Peru, Philippines, Portugal, Republic of Korea, Republic of Moldova, Republic of North Macedonia, Romania, Saint Kitts and Nevis, Saint Vincent and the Grenadines, San Marino, Senegal, Serbia, Sierra Leone, Slovakia, Slovenia, Spain, State of Palestine, Sweden, Switzerland, Togo, United Kingdom of Great Britain and Northern Ireland and Uruguay.
12. ATT Signatory States that have also endorsed the EWIPA Political Declaration are Cambodia, Comoros, Kiribati, Malaysia, Thailand, Türkiye and the United States of America. The United States has signed the ATT but no longer intends to become a State Party.
13. Explosive Weapons Monitor (2023). '2021-2022: Two Years of Global Harm to Civilians from the Use of Explosive Weapons'. April 2023. tinyurl.com/yece52zp, p. 4.
14. International Committee of the Red Cross (ICRC) (2022). 'Explosive Weapons with Wide Area Effects: A Deadly Choice in Populated Areas'. Geneva. January 2022. tinyurl.com/22eykpmn, p. 64.
15. See, for example, the International Committee of the Red Cross (ICRC) (2022). 'Explosive Weapons: Civilians in Populated Areas Must Be Protected'. 26 January 2022. tinyurl.com/mvk4a69s.
16. Article 36 and PAX (2020). 'Explosive Weapons with Wide Area Effects and Risk to Civilians'. Background Note. February 2020. tinyurl.com/45n5xhnp.
17. Arms Trade Treaty, Article 2.1 (adopted 2 April 2013, entered into force 24 December 2014). tinyurl.com/23vvaafu.
18. Definitions of categories of major conventional arms are from the United Nations Register of Conventional Arms (UNROCA). 'Categories of Major Conventional Arms'. tinyurl.com/4xpxynkd. Examples of arms included in the ATT's light weapons sub-categories are from the Working Group on Transparency and Reporting (WGTR) (2022). 'Reporting Authorized or Actual Exports and Imports of Conventional Arms under the ATT. Questions & Answers'. ATT/CSP8.WGTR/2022/CHAIR/734/Conf.Rep. 22 July 2022. tinyurl.com/8zwhyj3e, p. 29.
19. Open Source Munitions Portal (n.d.). 'Tank Gun Projectiles'. tinyurl.com/y9mf696h.
20. Open Source Munitions Portal (n.d.). 'Artillery Gun Projectiles'. tinyurl.com/ynyt5fdu; and Open Source Munitions Portal (n.d.). 'Mortar Projectiles'. tinyurl.com/bu4me8kf.
21. Open Source Munitions Portal (n.d.). 'Rockets and Missiles'. tinyurl.com/4aspstw8.
22. Open Source Munitions Portal (n.d.). 'Air-delivered Bombs'. tinyurl.com/fyy8ktmf.
23. Dullum, O. S., et al. (2017). 'Indirect Fire: A Technical Analysis of the Employment, Accuracy, and Effects of Indirect-fire Artillery Weapons'. Armament Research Services (ARES). January 2017. tinyurl.com/5n6hevsk, pp. 35-36.
24. Arms Trade Treaty, Article 5(3) (adopted 2 April 2013, entered into force 24 December 2014). tinyurl.com/23vvaafu.
25. Arms Trade Treaty, Article 3 (adopted 2 April 2013, entered into force 24 December 2014). tinyurl.com/23vvaafu.
26. Arms Trade Treaty, Article 4 (adopted 2 April 2013, entered into force 24 December 2014). tinyurl.com/23vvaafu.
27. Arms Trade Treaty, Article 7.3 (adopted 2 April 2013, entered into force 24 December 2014). tinyurl.com/23vvaafu.
28. Morais Figueiredo, B. and Young, K. (2024). 'Understanding Civilian Harm from the Indirect or Reverberating Effects of the Use of Explosive Weapons in Populated Areas: Strengthening Data Collection to Implement the Political Declaration'. Workshop Report. UNIDIR and Explosive Weapons Monitor. March 2024. tinyurl.com/tfyhpff7.
29. For more information on the gendered impacts of explosive weapons, see United Nations Institute for Disarmament Research (UNIDIR) (2024). 'Gendered Impacts of the Use of Explosive Weapons in Populated Areas'. tinyurl.com/mu2432bd.
30. Young, K. (2023). 'Unprecedented Harm to Civilians in Gaza: Death and Injury from the Use of Air-Dropped Explosive Weapons in Densely-Populated Gaza'. Fragments: Explosive Weapons Monitor Quarterly Series, Vol. 1, Issue 2. December 2023. tinyurl.com/yef39khx.
31. For examples of incidents in which ground- or sea-launched explosive weapons were allegedly used by Israeli armed forces in Gaza, see: Airwars. 'Civilian Casualty Archive'. Accessed on 26 May 2026. Archive. tinyurl.com/2tb638ys.
32. Bertrand, N. and Bo Lillis, K. (2023). 'Exclusive: Nearly Half of the Israeli Munitions Dropped on Gaza Are Imprecise 'Dumb Bombs,' US Intelligence Assessment Finds'. CNN Politics. 14 December 2023. tinyurl.com/yc74znxa.
33. Pax and Article 36 (2016). 'Areas of Harm: Understanding Explosive Weapons with Wide Area Effects'. October 2016. tinyurl.com/495tefhp, p. 11.
34. Young, K. (2023). 'Unprecedented Harm to Civilians in Gaza: Death and Injury from the Use of Air-Dropped Explosive Weapons in Densely-Populated Gaza'. Fragments: Explosive Weapons Monitor Quarterly Series, Vol. 1, Issue 2. December 2023. tinyurl.com/yef39khx.
35. Aladam, M. (2025). 'Death Toll in Gaza Rises as Ceasefire Allows Rescuers to Search Rubble'. Middle East Eye. 22 January 2025. tinyurl.com/5n95ua55.
36. Amnesty International (2025). 'Over 230 Global Organizations Demand Governments Producing F-35 Jets to Stop Arming Israel'. 21 February 2025. tinyurl.com/mr35c45e.
37. United Nations Office for the Coordination of Humanitarian Affairs (OCHA) (2026). 'Reported Impact Snapshot | Gaza Strip (8 April 2026)'. 10 April 2026. tinyurl.com/uf5wyuer.
38. Young, K. (2025). 'Escalation of Explosive Weapons Use in Lebanon: Humanitarian Consequences on Civilians and Civilian Infrastructure'. Fragments: Explosive Weapons Monitor Quarterly Series, Vol. 3, Issue 1. March 2025. tinyurl.com/5cdckuk8.

39. Christou, W. (2026). 'Vision of Destruction: Israel's Assault on Southern Lebanon in Video, Maps and Charts'. The Guardian. 11 May 2026. tinyurl.com/4bn7stw6; Saifi, Z. et al. (2026). 'The Gaza Playbook: Satellite Images Reveal Scale of Israeli Destruction in Lebanon'. CNN. 24 April 2026. tinyurl.com/mwet6hsk; and Ward, E. (2026). 'Nearly 700,000 Displaced by War in Lebanon, U.N. Says'. The New York Times. 10 March 2026. tinyurl.com/2y89teyj.
40. Hudson, J. (2024). 'U.S. Signs Off on More Bombs, Warplanes for Israel'. Washington Post. 29 March 2024. tinyurl.com/2hh5caac. For a list of arms transfers to Israel, see Stockholm International Peace Research Institute (SIPRI). 'SIPRI Arms Transfers Database'. Accessed on 26 March 2026. tinyurl.com/yc3bdttt.
41. Hudson, J. (2024). 'U.S. Signs Off on More Bombs, Warplanes for Israel'. Washington Post. 29 March 2024. tinyurl.com/2hh5caac.
42. See for instance: Control Arms Secretariat (2025). 'ATT Monitor Report 2025'. Geneva. 25 August 2025. tinyurl.com/yyhtbn2p, pp. 28-30; Gallagher, K. (2025). 'Global Production of the Israeli F-35I Joint Strike Fighter'. Project Ploughshares. January 2025. tinyurl.com/3sahay2e; and Hussain, Z. (2025). 'How Top Arms Exporters Have Responded to the War in Gaza: 2025 Update'. Stockholm International Peace Research Institute (SIPRI). 3 October 2025. tinyurl.com/mrx2828v.
43. United Nations (2026). 'Use of Explosive Weapons 'Must Stop' in Eastern DR Congo: Türk'. 9 July 2026. tinyurl.com/ckjnumc2.
44. Human Rights Watch (2022). 'DR Congo: Resurgent M23 Rebels Target Civilians'. 25 July 2022. tinyurl.com/zhcjwf3n.
45. Global Centre for the Responsibility to Protect (2026). 'Democratic Republic of Congo'. Populations at Risk. 16 March 2026. tinyurl.com/mry44s5a; and Amnesty International (2025). 'DR Congo: Rwandan-backed Armed Group and Congolese Army Must Stop Using Explosive Weapons in Densely Populated Areas'. 19 January 2025. tinyurl.com/mtv9dwad.
46. Amnesty International (2025). 'DR Congo: Rwandan-backed Armed Group and Congolese Army Must Stop Using Explosive Weapons in Densely Populated Areas'. 19 January 2025. tinyurl.com/mtv9dwad.
47. Ibid.
48. International Committee of the Red Cross (ICRC). 'DR Congo: Civilians in the Firing Line as Use of Heavy Weapons Signals Alarming New Phase of Armed Conflict in the East'. 6 March 2024. tinyurl.com/2yx5apx9.
49. Ibid.
50. International Organization for Migration (IOM) (2025). 'Democratic Republic of the Congo'. Displacement Tracking Matrix. April 2025. tinyurl.com/4ydwazza.
51. Geneva Academy of International Humanitarian Law and Human Rights (2026). 'War Watch: IHL in Focus Report – 1 July 2024 to 31 December 2025'. February 2026. tinyurl.com/47yw7hcz, p. 126.
52. United Nations Office of the High Commissioner for Refugees (UNHCR) (2025). 'UNHCR Gravely Concerned by Worsening Violence and Humanitarian Crisis in Eastern DR Congo'. Briefing notes. 24 January 2025. tinyurl.com/3snrxyp8.
53. Stockholm International Peace Research Institute (SIPRI). 'SIPRI Arms Transfers Database'. Accessed on 26 March 2026. tinyurl.com/yc3bdttt.
54. Ibid.
55. Ibid.
56. Army Recognition (2023). 'Congo Armed Forces Receive 9 Chinese CASC CH-4 Rainbow Combat Drones'. 4 July 2023. tinyurl.com/3mfvkyu3.
57. See Moyes, R. (2012). 'State Use of Explosive Weapons: An Indicator of Crisis'. Article 36. January 2012. tinyurl.com/25cadrw5.
58. Explosive Weapons Monitor (2025). 'An Assessment of Implementation of the Political Declaration on Explosive Weapons in Populated Areas'. Briefing Paper. November 2025. tinyurl.com/yy7mda9c.
59. New Zealand Ministry of Foreign Affairs and Trade (n.d.). 'Assessment Criterion 1' tinyurl.com/4uy3j548.
60. See, for example, Knolle, K. and Alkousaa, R. (2025). 'Germany Halts Arms Exports that Israel Can Use in Gaza'. Reuters. 8 August 2025. tinyurl.com/5ecc5rs3; and Muresan, R. (2021). 'Renewed Hope for Yemen as More Countries Halt Arms Transfers to Saudi-led Coalition'. Control Arms. 3 February 2021. tinyurl.com/2mh3vv8t.
61. Cecco, L. (2024). 'Canada to Halt Arms Sales to Israel after Non-Binding Vote in House of Commons'. The Guardian. 19 March 2024. tinyurl.com/2ukbp965.
62. Flaherty, A. and Boccia, C. (2024). 'US Withheld Bomb Shipment to Israel Out of Fears It Could Be Used in Rafah'. ABC News. 8 May 2024. tinyurl.com/y3u7y3tz.
63. Forum on the Arms Trade (n.d.). 'Biden Administration Arms Sales and Transfers to Israel'. Last updated February 2025. tinyurl.com/jf64bkmh; and Forum on the Arms Trade (n.d.). 'Trump Administration Arms Transfers and Sales to Israel'. tinyurl.com/3rft4ksn.
64. Government of the Netherlands (n.d.). 'Reporting Practices with Regard to Military and Dual-use Goods'. tinyurl.com/y5h3yy5y; and Minister for Foreign Trade and the Minister of Foreign Affairs. (2025). 'Dutch Export Policy on Strategic Goods in 2024'. tinyurl.com/4uecfp3f.
65. In the United Kingdom, the Committees on Arms Export Controls—the dedicated cross-committee body scrutinising strategic export licensing, drawing on the Defence, Foreign Affairs, Business and Trade, and International Development Committees—ceased to operate from January 2024, when responsibility was folded into the Business and Trade Committee's wider remit. Brooke-Holland, L. (2024). 'An Introduction to UK Arms Exports'. House of Commons Library (CBP-8312, 24 January 2024). tinyurl.com/mt3f5k9r; and Brooke-Holland, L. (2025). 'UK Arms Exports to Israel'. House of Commons Library (CBP-9964, 8 January 2025). tinyurl.com/3ujjhmxa. In the United States, annual public reporting on Direct Commercial Sales and Foreign Military Sales has shifted to more aggregated figures in recent years, reducing visibility into those sales; a similar trend is documented in the Department of Defense's budget justifications for military aid programmes. Yousif, E. (2024). 'Diminishing Transparency in the US Arms Trade'. Stimson Center. 9 July 2024. tinyurl.com/ye8jrxta.
66. Courts and Tribunal Judiciary (2019). 'Campaign Against Arms Trade v Secretary of State for International Trade'. [2019] EWCA Civ 1020. 20 June 2019. tinyurl.com/sez4pcsp. See also Campaign Against Arms Trade (2025). 'CAAT's Legal Challenge'. 8 September 2025. tinyurl.com/3kwyey49.
67. UK Secretary of State for International Trade (2020). 'Trade Update'. Statement UIN HCWS339, 7 July 2020. tinyurl.com/32vvj56x.
68. Courts and Tribunal Judiciary (2025). '(Al-Haq) v Secretary of State for Business and Trade'. [2025] EWHC 1615 (Admin). 30 June 2025. tinyurl.com/2kbt8sdt; and Courts and Tribunal Judiciary (2025). 'Al-Haq -v- Secretary of State for Business and Trade'. [2025] EWCA Civ 1433. 12 November 2025. tinyurl.com/466dae52.
69. Camera dei Deputati [Chamber of Deputies - Italy] (2019). Mozione 1/00204 [Motion 1/00204]. 24 June 2019. tinyurl.com/dpkzfuhk.
70. See: European Center for Constitutional and Human Rights (ECCHR) (2021). 'The Italian Government Revokes Bomb Export Licenses to Saudi Arabia and the United Arab Emirates: Civil Society Organizations Welcome the Decision'. 29 January 2021. tinyurl.com/ydp6u9vu.
71. Court of Appeal of The Hague, State of the Netherlands v. Oxfam Novib et al., judgment of 12 February 2024, ordering the Netherlands to cease the export and transit of F-35 parts destined for Israel because of a clear risk of serious violations of international humanitarian law in Gaza. See: Court of Appeal in The Hague (2024). 'ECLI:NL:GHDHA:2024:191' (Unofficial translation). 12 February 2024. tinyurl.com/27s2hdy9.
72. Hoge Raad (Dutch Supreme Court), case no. 24/01340, judgment of 3 October 2025, ECLI:NL:HR:2025:1435 tinyurl.com/4mhvwt7h, overturning the Court of Appeal's order and ruling that the Minister must perform the reassessment of the F-35 export licence again, applying the criterion of whether granting the licence poses a clear risk of serious violations of international humanitarian law. See: Hoge Raad Der Nederlanden (2025). 'Supreme Court: Minister Must Perform Reassessment of Licence to Export F-35 Parts to Israel Again'. 3 October 2025. tinyurl.com/2k2ys9z2.
73. PAX (2025). 'Crucial Victory: Export of F-35 Parts to Israel Remains Prohibited'. 14 November 2025. tinyurl.com/5a9bh57h.
74. PAX (n.d.). 'Rechtszaak Tegen Nederlandse Staat: Stop Levering Voor F-35's' [Lawsuit Against Dutch State: Halt Delivery of F-35s]. tinyurl.com/452wtcc.

METHODOLOGICAL GUIDE DOCUMENTING CIVILIAN HARM FROM ATTACKS ON ENERGY INFRASTRUCTURE

PATRICK VINCK, CO-FOUNDER, CHAIR AND PRESIDENT, KOBO

JEROME MARSTON, HEAD OF RESEARCH, KOBO

ULIANA POLTAVETS, UKRAINE EMERGENCY RESPONSE COORDINATOR, PHYSICIANS FOR HUMAN RIGHTS

KATHERINE YOUNG, RESEARCH AND MONITORING MANAGER, EXPLOSIVE WEAPONS MONITOR

Attacks on energy infrastructure harm civilians long after the strike, disrupting health care, education, water and livelihoods. Developed by the Explosive Weapons Monitor, Kobo and Physicians for Human Rights, this guide offers practical tools for documenting that harm. Drawing mainly on examples from Ukraine, it sets out indicators across physical and mental health, education, livelihoods and other areas of civilian life, linked to available data sources, for researchers working in humanitarian, human rights and civilian protection settings.

About this guide

The aim of this publication is to provide practical guidance and tools for documenting civilian harm from attacks on energy infrastructure. The focus is on measuring the impacts of attacks on energy infrastructure through indicators related to civilians' physical health, mental health, education, and livelihoods, among other aspects of civilian life. This guide provides an overview of data sources and methodologies for documenting attacks on energy infrastructure. However, the focus is on what to measure, rather than how to carry out the research.

The intended audience for this guide is researchers, information management officers, academics, and data analysts working in humanitarian relief, human rights, civilian protection, and similar fields. It assumes a basic familiarity with research design and data collection, analysis, and management. This document may be best suited for researchers at organizations planning to actively collect data about attacks on energy infrastructure, though organizations with systems designed to passively receive reports of attacks may also find relevant information. Users can apply the guide to structure their documentation efforts by identifying relevant domains of harm, selecting appropriate indicators, and linking them to available sources of data for analysis, advocacy, and response. Investigators at justice and accountability bodies might also find this guide useful for identifying relevant categories of civilian harm and data that may inform legal analysis, including proportionality assessments.[1] However, this guide does not provide a methodology for attributing specific attacks to perpetrators or for conducting a pattern analysis required to establish individual criminal responsibility.

Although methodology for documenting incidents of attacks on energy infrastructure is included, this guide is most relevant for investigating the impacts of attacks on civilians. This includes immediate effects, including death, injury, and damage to facilities, as well as reverberating or knock-on effects, including on civilians' health, education, and livelihoods.[2]

This methodological guide draws on the experience of the Explosive Weapons Monitor (EWM), Kobo, and Physicians for Human Rights (PHR). The EWM uses incident-level data on attacks against civilians and civilian infrastructure to report on harm from the use of explosive weapons, including disruptions to critical civilian services such as health care, education, humanitarian aid, food, and water. Kobo conducts large-scale surveys to document attacks on civilians and civilian infrastructure, including the impacts of attacks on energy infrastructure on civilians' physical and mental health, education, and livelihoods. Finally, PHR documents attacks on health, their patterns, and impacts, including attacks on energy infrastructure impacting health and health care.

This guide focuses on electricity infrastructure; however, given the interdependent nature of energy systems, other critical utilities like fuel and gas are also referenced. Although this document draws heavily on examples from Ukraine and attacks involving explosive weapons, it also holds relevance for other contexts and other forms of attack, such as arson or small arms fire. The authors relied on resources from across several adjacent fields to develop this guide and have included them as references.

The need for data on civilian harm from attacks on energy

Rich data about attacks on energy infrastructure and their impacts are crucial for understanding the scale and nature of civilian harm. Thousands of attacks and other conflict-related disruptions affecting energy systems occur each year in armed conflicts around the world, leading to immediate harm, damage, and death, as well as longer-lasting effects on civilians' well-being. In some contexts, energy infrastructure has been damaged by direct strikes; in others, civilian harm has resulted from a combination of bombardment, siege-like restrictions, fuel shortages, damaged distribution networks, cyber operations, occupation, or obstruction of repair and maintenance.

Despite media coverage of attacks on energy facilities and disruptions affecting energy systems in contexts such as Ukraine, Iran, and Gaza, the full impact of attacks, including on civilians' health, education, and livelihoods, is not well documented or understood. Yet high-quality data collection and analyses are critical for advocacy, prevention, response, compliance with international law, and accountability initiatives to limit these attacks.

Introduction

Attacks on energy infrastructure have been documented in multiple recent armed conflicts.[3] These attacks involve airstrikes, shelling, and ground assaults on power plants, substations, and distribution grids. Military occupation, looting, and arson attacks have also been documented.[4] Damage to energy infrastructure disrupts critical civilian services, including health care, education, and water and sanitation, producing grave humanitarian consequences and violating fundamental rights.[5] Disruptions to the power grid also hamstring the local economy. In recent years, attacks on energy infrastructure have occurred in diverse contexts, including Gaza, Iran, Myanmar, Sudan, Ukraine, and Yemen.[6]

Several advances have been made in documenting and analyzing attacks on civilian infrastructure. Organizations including the Global Coalition to Protect Education from Attack (GCPEA), Insecurity Insight, and the United Nations Institute for Disarmament Research (UNIDIR) have developed frameworks and toolkits to monitor attacks on schools, hospitals, and other civilian infrastructure, which can be applied to the energy sector. Adapting these approaches is crucial for improving the global community's understanding of attacks on energy infrastructure and for bolstering evidence-based advocacy, accountability, and prevention and response.

Attacks on energy facilities, as civilian infrastructure, are generally prohibited under international humanitarian law. The principles of distinction, proportionality, and precautions are important in determining the legitimacy of targets and ensuring civilian suffering is limited.[7] Relevant initiatives have been taken to prevent and respond to attacks on civilian infrastructure, particularly among nongovernmental organizations (NGOs) and United Nations (UN) agencies working to limit the use of explosive weapons in towns and cities. In particular, a 2022 political declaration set international standards for addressing the civilian harm caused by the use of explosive weapons in populated areas.[8]

International law and attacks on energy infrastructure

Civilian energy infrastructure is protected under international humanitarian law.[9] Even where a component of an energy system may qualify as a military objective, parties to the conflict must comply with the principles of distinction, proportionality, and precautions in attack.[10] In assessing expected civilian harm, parties to the conflict must consider not only immediate death, injury, and physical damage, but also reasonably foreseeable consequences for civilians, particularly in relation to the assessment of proportionality and precautions in attack.[11]

The rights to health, education, water and sanitation, and to an adequate standard of living[12]—as contained in the International Covenant on Economic, Social and Cultural Rights as well as other human rights instruments—require at their core that states refrain from restricting access to essential services such as health care, sanitation, safe drinking water, food, and schools, in territory under their control, in particular to marginalized groups.[13]

Documentation of attacks on energy infrastructure should therefore preserve information relevant to legal analysis, including about impacts on physical and mental health and infringements on the rights to education, water and sanitation, and an adequate standard of living. Where appropriate, such documentation can support accountability efforts by helping investigators assess whether parties to a conflict adhered to distinction, proportionality, and precautions, and assess the cumulative or widespread character of attacks. Doing so can also factor into the legal analysis of what is or is not permissible in future targeting and operational decisions.

Background on civilian infrastructure and services

Electricity, water, telecommunications, and other infrastructure and services are essential for sustaining the daily lives of civilian populations. According to Zeitoun and Talhami, services consist of three interdependent components: "people (e.g. service provider staff, private sector contractors and entrepreneurs), consumables (e.g. fuel, chlorine, medicines), and hardware (e.g. equipment, heavy machinery, infrastructure)."[14] In the case of electricity, these might be seen as operations staff and consumers, a water source to power production, and an electrical power plant.

The path of service distribution is often broken into three elements, based on their distance and level in the production and delivery of a service: upstream, midstream, and downstream. For energy, these divisions might be into electrical power plants (upstream), substations and transmission lines (midstream), and electrical transformers that serve consumers (downstream). Upstream infrastructure serves the most people and has the widest reach, while downstream infrastructure serves a limited number of consumers in a smaller area. Since they serve the most people over the widest area, attacks on upstream infrastructure typically have the greatest impact on service provision.[15]

The interdependent nature of civilian infrastructure and services means that the damage or destruction of one often impacts another. For instance, an attack on an electrical grid may produce power cuts in hospitals or schools.[16]

The severity of damage from attacks also depends on how centralized the energy infrastructure is. Compared to decentralized or localized systems, centralized energy systems, where electricity is generated at large-scale facilities removed from end users, tend to be more vulnerable to cascading grid failures due to physical and cyberattacks.[17]

Definition of attacks on energy infrastructure and personnel

Attacks on energy infrastructure and personnel are any physical or threatened violence or digital obstruction carried out by a military force, non-state armed group, or other armed actor against the facilities or staff involved in the extraction, production, transmission, or distribution of energy supplies.[18] Although this definition encompasses attacks against both energy infrastructure and personnel, this guide focuses on infrastructure-related damage, disruption, and civilian harm. Attacks on energy personnel are included where they constitute direct harm or affect the operation, repair, or restoration of energy systems.

Attacks on energy infrastructure may include nuclear power plants, oil refineries, and water reservoirs, since these are often used to generate electricity or produce the fuels to power the grid. Damage to such infrastructure merits particular attention since it can result in the release of airborne contaminants, hazardous waste, flooding, toxic spills and fires, and other immediate and reverberating effects for civilians and the environment.

Electricity infrastructure

Electricity infrastructure is the facilities, equipment, and services needed to move electrical energy from the point of generation (e.g., hydroelectric dams, fossil fuel refineries, nuclear or wind power plants) to the end user. This infrastructure includes power plants, substations, transmission towers and lines, and transformers for the transmission (high-voltage) and distribution (low-voltage) of energy.[19] According to Hoicka and MacArthur, "Electricity infrastructure...is made up of power generation that travels long distances over transmission and distribution to demand centers, such as cities, buildings, and industries, for electrical use. The infrastructure that moves generated power along these points is collectively known as 'the grid.'"[20]

Documenting civilian harm from attacks on energy infrastructure

Attacks on energy infrastructure often result in direct damage to the facility and can cause the injury or death of energy workers. For instance, a suicide bombing attack on a state-run power plant in Iraq in September 2017 resulted in damage to the facility and the death of seven employees.[21] Although less frequent, attacks may also affect energy personnel only, not facilities; in Gaza, for example, two electricity technicians were killed in an airstrike while on their way to repair previously damaged transmission lines.[22] Beyond direct damage and harm, these attacks can have far-reaching impacts due to the interconnectedness and interdependencies among energy and other civilian systems. Attacks on the energy grid can affect civilian well-being across a range of factors, including health, mental health, education, access to safe drinking water, and income.[23]

The destruction of energy infrastructure produces grave consequences for the health care sector. Power cuts compromise both a health facility's internal capacity to provide care and the facility's service delivery to the surrounding population. Hospitals cannot function without access to water, heating, and ventilation, which often depend on electricity. Proper lighting is essential for surgeries and diagnostic procedures, such as magnetic resonance imaging (MRI) and computer tomography (CT) scans, cannot be performed without stable electricity. Emergency services also suffer when communications go down and life support systems dependent on electricity are nonfunctional.[24] In Ukraine, for example, power outages have forced surgeons to operate by flashlight, interrupted or delayed critical surgeries, and led to failures in life-support systems. Around 66 percent of Ukrainian health care workers surveyed in 2024 reported that power outages resulting from attacks on energy infrastructure affected medical procedures.[25]

Disruptions to electricity also severely impact access to education. Schools rely on electricity for heating, lighting, preparing meals, computers, and remote learning platforms, among other educational needs. Prolonged power outages interrupt learning since many schools do not have backup generators, meaning students must stay home during power outages. Remote learning is also impacted by power outages, affecting students displaced by conflict or those who were forced to study online after their schools were damaged by direct attacks. Combined, the effects of power cuts have exacerbated learning loss in Ukraine, Sudan, and Myanmar.[26]

Moreover, water and sanitation are affected by energy disruptions, since water pumping stations, treatment plants, and wastewater systems require stable electricity to function. Power outages have led to widespread interruptions in access to safe drinking water and adequate sanitation in Ukraine, Gaza, and Sudan.[27] Meanwhile, damage to energy infrastructure resulting in a lack of access to clean water increases the risk of waterborne diseases.[28] For instance, drone attacks on a power plant in Atbara city, Sudan, in May 2025 caused power outages that prevented a local water treatment plant from operating at full capacity, putting local communities at risk of cholera and other waterborne diseases.[29]

Among other impacts on civilians' day-to-day lives, energy outages also affect their ability to earn wages. Energy outages often translate to missed work, business and banking interruptions, store closures, and reduced productivity due to unreliable electricity, lighting, and internet. For instance, in Ukraine, around one-quarter of households surveyed in 2025 reported lost income or work linked to power outages, with higher percentages among households experiencing frequent and prolonged outages.[30] Meanwhile, bakeries in Gaza had to cease or limit their operations in 2023 due to a lack of electricity, fuel, or other means of energy production for use by generators.[31]

In all cases, the most vulnerable populations are most at risk from power outages. Older persons and persons with disabilities, pregnant and postpartum women, infants, children, and people with chronic illnesses are differentially impacted by power outages. For instance, these groups may be more susceptible to waterborne diseases or more impacted by extreme temperatures or prolonged gaps in health services.[32] Research also shows that the impacts on vulnerable populations do not exist in isolation but are cumulative, and each additional risk factor increases overall vulnerability exponentially. They interact, overlap, and mutually reinforce one another, creating more complex patterns of vulnerability than the individual factors alone. For example, in Ukraine, disruptions to the usability of in-home medical devices, treatment routines, and basic services often combined with water and heating outages, leading to heightened and compounding risks for people with chronic illness or disabilities and for older adults.[33]

Conceptualizing the impacts of attacks on energy infrastructure

Energy infrastructure enables the provision of many essential services across a wide geography, often powering devices for the majority of a population. Electrified schools, for instance, allow for technology in the classroom and learning at more times of the day; electricity is also associated with improved educational outcomes.[34] Reliable energy sources also enable pumping and filtration for clean drinking water and sanitation.[35] Beyond that, energy infrastructure creates job opportunities, facilitates banking, and connects communities.

The distinct nature of energy infrastructure must be taken into account when conceptualizing the impacts of attacks. In contexts where energy infrastructure is in place, it is generally networked, has broad geographic coverage, and touches most segments of a population–traits that make the service unique. Energy infrastructure also enables the provision of other services; as such, it is typically prioritized for repair after attacks, to the extent possible. Although other services, such as health care and education, share these traits to some extent, they are typically less networked, more geographically isolated, and do not touch as many segments of society on a daily basis. Water, sanitation, and transportation, on the other hand, may be closer to energy infrastructure along several of these axes.

Measuring the impacts of attacks on energy infrastructure

Measuring the impacts of attacks on energy infrastructure requires novel indicators, since this infrastructure and service is unique. Around much of the world, energy infrastructure touches all segments of a population, enables the provision of other services, runs on a networked grid, and has a wide geographic spread.[36] An attack on a power plant means not only the loss of electricity for grid-connected households, but also the potential loss of health care and education in far-off communities connected to that grid.

Due to this interconnectedness, disruptions to other services should be assessed when documenting the impacts of attacks on energy infrastructure. For this reason, the indicators developed below include numerous sectors. Relatedly, impacts far from the attack should be considered, and the effects of energy outages on all demographic groups should be taken into account. As such, multiple domains and data sources are relevant and included below.

Immediate and reverberating effects of attacks and cumulative and compounding harm

The impacts of an attack are often divided into immediate effects and reverberating effects on the relevant civilians, infrastructure, and services. Immediate effects include the initial attack, often resulting in death, injury, and damage to energy facilities. Reverberating effects, on the other hand, are the consequences of the former spread further across time, geography, and communities impacted, and may include harms from loss of services, spread of communicable diseases, psychological trauma, and other knock-on effects.[37]

Attacks on energy infrastructure may produce cumulative and compounding harm. Cumulative harm arises when repeated or prolonged attacks and outages create successive losses over time, including the depletion of household resources, deterioration of infrastructure and services, and reduced capacity to cope with future disruptions. Compounding harm occurs when multiple effects, such as loss of electricity, water, heating, health care, communications, education, or income interact and intensify one another, producing consequences that may be more severe than the effect of any single disruption.

The indicators below for assessing the civilian impacts from attacks on energy infrastructure encompass both immediate and reverberating effects, and are sufficiently flexible to track cumulative and compounding harm.

Domains, key components, and data sources for documenting civilian harm

Unique domains, components, and data must be considered for documenting harm caused by attacks, due to the distinct nature of energy infrastructure. Different actors undertake this documentation for a variety of purposes. For example, documenting civilian harm from attacks on energy infrastructure can inform operational and humanitarian responses, such as victim assistance, preparedness, and reconstruction. This documentation also supports increased understanding of the reverberating effects of attacks, including how civilians' needs might shift over time, as well as accountability efforts. Actors with varied mandates may draw on a range of different domains, components, and data.[38]

Incident-based methodologies collect open- and closed-source data that can be linked to specific attacks, with information recorded in a standardized manner that may identify locations, dates, weapons categories, damage, and other vital information. Although verified methodologies have been developed, an incident-level, open-source monitor dedicated to global attacks on energy infrastructure does not yet exist.[39] Impact-based methodologies, which employ qualitative, quantitative, and field research methods to understand patterns of harm that extend beyond an attack, include surveys, interviews, and field data collection about the short- and long-term impacts on the lives and well-being of civilians.[40]

Indicators to measure the impacts of attacks on energy infrastructure

This guide introduces indicators for measuring the impacts of attacks on energy infrastructure. Some of these indicators incorporate measures from other sectors, given the interdependence between energy and other civilian systems. Another set of indicators are unique to energy infrastructure. The table is broken into immediate and reverberating effects. Data types are also included at a high level; specific examples of open-source investigations and surveys are available in the resources listed at the end of the guide.

Table 1: Domain, components, and data sources to document civilian harm caused by attacks on energy infrastructure

Domain	Key components	Data sources
Attacks	Extent of damage to infrastructure or harm to personnel, perpetrator, weapon type, whether targeted, and connection with critical infrastructure	News reports, databases of violent incidents, NGO databases, satellite imagery, forensic assessments of damage, and technical documentation (e.g., grid operational logs)
Power cuts[41]	Duration of disruption, number of consumers affected, number of consumers for which electricity supply was restored	Reports from transmission and distribution system operators, news reports, remote sensing data, NGO databases, and technical documentation (e.g., grid operational logs)
Service provision (e.g. health care facilities, water treatment plants, communication networks)	Description of services that were disrupted, duration of disruption, impact on critical services, humanitarian harm caused (e.g., health crises, disease outbreaks, food safety)	Government data on number of facilities functioning, survey with service providers (e.g., health care facilities, municipal water authorities) and humanitarian organizations, administrative records analysis (e.g., mortality), public health surveillance data (e.g., outbreaks, nutrition status)
Civilian experience	Experiences of disruption, harm, adaptation and coping, and stress and anxiety	Population-based surveys, focus groups, testimonies from affected individuals, social media content monitoring

Guidance for using the indicators

Researchers should begin by considering the level of effects (immediate or reverberating) and the sector or sectors relevant for their analysis. The next step is identifying the indicator or indicators most relevant for measuring the civilian impact of interest. In selecting the indicators for testing, researchers should consider the types of data available to them; possible data sources are provided in non-exhaustive lists in Table 2.

Civilian harm may be documented at several related levels: the individual or household; the facility or service provider; the community or population; and the energy system as a whole. Researchers should specify the unit of analysis for each indicator and avoid inferring individual harm solely from aggregate service disruption, or collective harm solely by aggregating individual outcomes. Relatedly, where relevant, researchers should define "collective harm." For example, whether this form of harm refers to widespread or community-level deprivation, harm to a particular group, or degradation of a system on which a population depends.

Establishing a link between a power outage and civilian harm is distinct from determining how the outage was caused. In the indicators, references to harm occurring "due to" or "as a result of" a power outage relay the self-reported relationship between the disruption of electricity and the civilian impact. They do not, by themselves, establish whether the outage was due to an attack rather than maintenance or another cause, confirm that the energy infrastructure was deliberately targeted, identify the actor responsible, or support a legal determination regarding the attack.[42]

Given the interconnectedness of energy infrastructure and the compounding nature of harm, simultaneous impacts across services should be considered in most analyses. Likewise, the cumulative harm of attacks means that documentation should consider the frequency, duration, and sequencing of outages; previous exposure to attacks or disruption; pre-existing vulnerabilities; and changes in the ability of individuals, households, facilities, and communities to cope and recover.

In many cases, cross-sectional data is appropriate, since indicators measure civilian impact at one point in time. For instance, this might be the number of students without access to online learning due to outages during a particular month. In other cases, longitudinal data may be ideal, particularly for indicators that compare pre-conflict conditions to current ones, or if shifts in an indicator are measured over time to show cumulative harm.

Where possible and appropriate, indicators should be disaggregated by location, gender, age, disability, and other characteristics relevant to the sector to facilitate the identification of places and groups differentially impacted by attacks on energy infrastructure.[43]

Data types for the indicators below include information from government ministries and population surveys. Such data may not be available in some contexts, for instance where a government lacks the capacity to gather information, manipulates statistics, or is the perpetrator of attacks. Additionally, the collection of such data may not be feasible due to resource or security constraints. Data may also be available but not sufficiently fine-grained to analyze the differential impacts of attacks by relevant groups. Finally, repeated data collection over time or drawing comparisons with pre-conflict data may not be feasible in some contexts. Information from the United Nations, humanitarian cluster system, NGOs, news reports, violence monitors, and other public sources is sufficient to measure some indicators; however, for other indicators, researchers may be limited by data availability and related constraints.

Table 2: Indicators to measure the impacts of attacks on energy infrastructure

Level of effects	Sector	Indicators	Data types
Immediate effects	Energy	Number or proportion of energy facilities (substations, powerlines, etc.) damaged, destroyed, or where supply is obstructed[44]	NGO reports, news reports, and other incident-level data; energy ministry press releases or records of total facilities; needs assessments
		Number of energy infrastructure personnel deaths and injuries	NGO and news reports; energy ministry press release
		Number of energy facilities occupied or used by armed forces or groups that damage facilities, harm personnel, or obstruct power generation or transmission	NGO and news reports; energy ministry press release
Reverberating effects	Energy	Number or proportion of energy facilities rendered inoperable or with degraded capacity for service delivery[45]	NGO and news reports; energy ministry data (e.g., grid operational logs)
		Electricity generation capacity lost (in gigawatts) or percentage of demand not served, relative to pre-conflict capability	Energy ministry data (e.g., grid operational logs)
		Average number of hours per day with electricity or number of outages, compared to pre-conflict[46]	Energy ministry data (pre- and postconflict); population survey data (preand post-conflict); NGO and news reports
		Proportion of the population (or households) experiencing disruption of energy services and their geographic distribution	Population survey data; energy ministry data; energy transmission system operator and distribution system operator data
	Cross-sector	Number or proportion of schools, businesses, health, water and sanitation, or other civilian facilities experiencing power disruption	NGO and news reports; data from relevant ministries or facilities
		Number or proportion of schools, businesses, health, water and sanitation, or other civilian facilities forced to reduce, suspend, or relocate services due to power disruption	NGO and news reports; data from relevant ministries or facilities
		Duration and frequency of power cuts at schools, businesses, health, water and sanitation, or other civilian facilities due to power disruption[47]	NGO and news reports; data from relevant ministries or facilities; surveys or interviews with staff of civilian facilities
	Health[48]	Number or proportion of the population able to receive routine or emergency medical care during power outages[49]	Population survey data (representative of a region or the country); needs assessment data; ministry of health or health service provider data
		Number or proportion of the population able to obtain, use, or properly store prescribed medications during power outages[50]	Population survey data, surveys or interviews with health service providers or patients

Level of effects	Sector	Indicators	Data types
		Number or proportion of the population able to operate medical devices that are needed for care at home during power outages	Population survey data; interviews with health service providers, humanitarian and NGO workers, and patients; emergency service reports, ministry of health or health service provider data
		Number or proportion of the population with injuries, illnesses linked to coping strategies, malnutrition, or worsening chronic conditions during power outages (e.g., falls, accidents, burns or carbon monoxide poisoning due to unsafe heating)	Population survey data, police and emergency services reports; ministry of health or health service provider data; public health surveillance data
		Proportion of the population that experienced lack of heating or cooling due to power outages	Population survey data; needs assessment data
		Number or proportion of the population with missed or complicated maternal, newborn, or infant care due to power outages[51]	Population survey data; needs assessment data; surveys or interviews with health providers or patients; ministry of health and hospital administrative data
		Incidents of disrupted, damaged, broken, or malfunctioning medical equipment due to power outages	Surveys or interviews with health care providers; ministry of health or local health authority data; hospital administrative data
		Incidents of disruptions in storage of medications, vaccines, or biological samples in health care facilities due to power outages	Surveys or interviews with health care providers; ministry of health or local health authority data; hospital administrative data
		Incidents of disrupted hospital functionality, communications, or data losses affecting medical care during power outages[52]	Surveys or interviews with health care providers; ministry of health or local health authority data; hospital administrative data
		Number of emergency, routine, or elective procedures delayed, interrupted, cancelled, or completed under degraded conditions due to power disruption[53]	Surveys or interviews with health care providers; ministry of health or local health authority data; hospital administrative data
		Number or proportion of patients referred elsewhere, discharged early, or unable to be admitted due to power disruption, or who experienced delays in diagnosis or treatment due to unavailable imaging, laboratory testing, or electronic records	Surveys or interviews with health care providers; ministry of health or local health authority data; hospital administrative data
		Disease outbreaks related to power disruption (e.g., respiratory infections linked to heating or crowding, hospital-acquired infections linked to disruption of sterilization)	Public health surveillance data; ministry of health data (e.g., outbreaks); hospital records
		Number of permanent health harms and deaths reported as plausibly linked to power disruption, or excess morbidity and mortality associated with periods of power disruption	Health ministry data; representative population survey with surviving family members

Level of effects	Sector	Indicators	Data types
	Mental health	Proportion of the population with new or deteriorating mental health symptoms linked to power disruption	Population survey data (pre- and post-conflict); surveys or interviews with mental health service providers; NGO reports
		Number or proportion of health workers reporting increased workload, stress, burnout, moral distress, or fear linked to power disruption	Surveys of clinicians, interviews with mental health providers; NGO reports
	Education	Number of days of virtual or in-person schooling lost due to power disruption	School or education ministry data; interviews with education staff; population survey data
		Proportion of students (or households with students) unable to participate in remote/online classes or complete homework due to power outages	Population survey data; school or education ministry data
	Water and sanitation	Number or proportion of population affected by the disruption of water and sanitation due to power outages	Relevant ministry data (health, environmental protection, etc.); population survey data (representative of a region or the country)
		Proportion of the population experiencing water-borne diseases or infections due to limited sanitation related to power outages	Relevant ministry data (health, environmental protection, etc.); population survey data (representative); needs assessment data
	Food security	Number or proportion of population who skipped meals or ate spoiled food due to power outages	Population survey data; needs assessment data; public health surveillance data (e.g., nutrition status)
		Number or proportion of markets, bakeries, food warehouses, or other food distribution points that stopped or limited operations due to power outages	NGO and news reports; data from relevant ministries or facilities
	Humanitarian aid	Number or proportion of internally displaced persons (IDPs) or refugees affected by power outages	International and local NGO data; data from relevant ministries or facilities; population survey data (representative); needs assessment data
		Number or proportion of humanitarian facilities, offices, distribution points, or IDP/refugee camps that stopped or limited the provision of aid due to power outages	International and local NGO data; news reports; data from relevant ministries or facilities
	Income	Number or proportion of the population who lost income, work, or access to banking due to power outages	Population survey data; needs assessment data
		Amount or percentage of income lost due to power outages	Population survey data; needs assessment data; central bank data
	Cultural heritage	Number or proportion of cultural artifacts (e.g., art, archives, sites) damaged due to power outages[54]	NGO and news reports; museum and other cultural heritage site inventory logs; national cultural heritage registries

Level of effects	Sector	Indicators	Data types
	Environment	Square mileage of agricultural, forest, or developed land flooded by a reservoir breach (e.g., damage to a hydroelectric dam)	NGO and news reports; ministry of agriculture land use data
		Hazardous waste as a proportion of all debris produced (e.g., damage to a nuclear power plant)	Ministry of environment pollution data
		Number or proportion of illnesses or deaths reported attributable to the spread of radioactive contaminants (e.g., damage to a nuclear power plant)[55]	Ministry of health data
	Resilience and coping strategies	Number or proportion of population that used a coping strategy (e.g., storing extra food) during power outages	NGO and news reports; population survey data
		Number or proportion of the population with back-up generators or renewable energy sources (or schools, businesses, health, water and sanitation, or other civilian facilities with the same)	NGO and news reports; population survey data; data from relevant ministries or facilities
		Number or proportion of population that reports the ability to cope with future power outages (e.g., have supplies or are otherwise prepared to remain in their home for more than one week)	Population survey data
		Number or proportion of the population that temporarily relocated, evacuated, or was displaced during power outages	NGO and news reports; population survey data; government or customs data

Ethical and security considerations

Documentation of attacks on energy infrastructure should be planned and conducted in accordance with standard ethical and do-no-harm principles. Where primary data collection involves individuals, researchers should obtain voluntary and informed consent, minimize the risk of distress or retraumatization, and clearly explain how information will be used, stored, shared, and protected.[56] For all forms of data collection, particular care should be taken with names, contact details, precise location details (e.g., geolocation), staffing patterns, repair routes, facility vulnerabilities, and other information that could expose respondents, energy workers, service providers, or infrastructure to retaliation, surveillance, or further attack. Researchers should collect only the information necessary for the stated purpose, use secure data-management procedures, and anonymize or aggregate data where possible. Decisions to collect or publish sensitive information should be based on an assessment of whether its evidentiary or operational value outweighs the foreseeable risks to individuals and communities.

Resources for ethical human subjects research

- Institutional Review Boards (IRBs) or ethics committees at universities and hospitals
- The Belmont Report (guiding principles for research with human subjects)
- The Common Rule (U.S. regulations for the protection of human subjects)
- Office for Human Research Protections guidance
- Professional association ethics codes
- Collaborative Institutional Training Initiative (CITI) modules for research, ethics, compliance, and safety
- Global Code of Conduct for Gathering and Using Information about Systematic and Conflict-Related Sexual Violence (Murad Code) provides principles and resources for survivor-centered research approaches and informed consent

Relevant resources

Significant work has been undertaken by human rights and humanitarian organizations, UN agencies, academics, and legal experts to document the impacts of attacks on civilians and civilian infrastructure. Although developed for sectors adjacent to energy infrastructure, many of these indicators, toolkits, interactive maps, and other resources are relevant for measuring the impact of attacks on energy infrastructure. These resources are included below.

Resources for data collection

Reports and tools related to the impacts of attacks on energy infrastructure

Impacts of attacks on energy infrastructure on civilian health, mental health, education, and livelihoods:

- Kobo, TJET, and Rating Group, Ukraine: Household survey of effects of attacks on energy infrastructure (2020-2025)
  - Survey instrument (English, Ukrainian, Russian)
- PHR and Truth Hounds, Health Care in the Dark: The Impacts of Russian Attacks on Energy in Ukraine
  - Survey instrument (English, Ukrainian)
- UN Human Rights Monitoring Mission in Ukraine, Attacks on Ukraine's Energy Infrastructure: Harm to the Civilian Population

Guides, reports, and tools from adjacent sectors with relevance for attacks on energy infrastructure

Explosive weapons:

- UNIDIR, Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas
- UNIDIR, Second Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas
- UNIDIR and EWM, Understanding Civilian Harm from the Indirect or Reverberating Effects of the Use of Explosive Weapons in Populated Areas
- EWM, Explosive Weapons Monitor

Education:

- GCPEA, Toolkit for Collecting and Analyzing Data on Attacks on Education
- GCPEA, Education under Attack report series
- TRACE Data Portal, a collaboration between Kobo, GCPEA, Insecurity Insight, and the Education Above All Foundation
- UNICEF, Monitoring of Attacks on Education
- UN Monitoring and Reporting Mechanism, Guidelines and Field Manual
- Education Clusters, Monitoring of Attacks on Education
- Kobo, "Learning under Fire": Attacks on Education in Colombia, 2020-2025
- Kobo, Methodological Guide for Documenting Attacks on Education: Lessons from Colombia

Health:

- PHR, Truth Hounds, and partners, Map of Attacks on Health Care in Ukraine
- Safeguarding Health in Conflict Coalition (SHCC), Attacked and Threatened: Health Care at Risk map
- SHCC and partners, Toolkit: Evidence that Protects Health Care
- Researching the Impact of Attacks on Healthcare, Resources

Humanitarian aid:

- Insecurity Insight, Aid in Danger

Environment:

- Conflict and Environment Observatory, Ukraine conflict environmental briefing (Fossil fuel infrastructure)
- PAX, Environment, Peace and Security programme, Risks and impacts from attacks on energy infrastructure in Ukraine

Cultural heritage:

- International Centre for the Study of the Preservation and Restoration of Cultural Property, First Aid to Cultural Heritage in Times of Crisis - Handbook
- UNESCO, Learning on Culture in Emergencies
- Human Rights Watch, Destroying Cultural Heritage: Explosive Weapons' Effects in Armed Conflict and Measures to Strengthen Protection

Cumulative harm:

- Essex, Oxford, Georgetown, and Duke Universities, Cumulative Civilian Harm Project examining the legal and policy parameters for taking into account the aggregated harm to the civilian environment over time
- Hathaway, Khan, Revkin, "The Dangerous Rise of Dual-Use Objects in War", Duke Law School Public Law & Legal Theory Series

Accountability:

- International Criminal Court, Guidance for documenting international crimes for accountability purposes

Cyber attacks:

- International Group of Experts at the Invitation of the NATO Cooperative Cyber Defence Centre of Excellence, Tallinn Manual on the International Law Applicable to Cyber Warfare

1. Under international humanitarian law, all three principles of distinction, precautions and the duty of constant care, and proportionality work together to minimize civilian harm in war. The duty of constant care, in particular, provides important affirmative obligations on parties to a conflict throughout operations: "(i)n the conduct of military operations constant care shall be taken to spare the civilian population, civilians and civilian objects." AP I art. 57(1) and a general principle under customary international law. Furthermore, a proportionality assessment is the process of weighing expected incidental civilian harm against the anticipated military advantage of an attack. If the incidental harm—such as civilian casualties or damage to civilian objects—is excessive in relation to the direct and concrete military advantage anticipated, then that attack is prohibited AP I 57 2(b).. For more information see: ICRC, Customary International Humanitarian Law, Rule 14: Proportionality in Attack, International Humanitarian Law Database.
2. Reverberating effects are defined as harms "that are not directly and immediately caused by the attack, but are nevertheless the product thereof." Although the term is often associated with explosive weapons in monitoring frameworks or proportionality assessments under international humanitarian law, this guide uses the terminology regardless of weapon type or legal connotation. In this document, "reverberating effects" is interchangeable with "knock-on effects." For more see: Isabel Robinson and Ellen Nohle, "Proportionality and precautions in attack: The reverberating effects of using explosive weapons in populated areas," International Review of the Red Cross, 2016, 98 (1), 107–145; and Alfredo Malaret Baldo and Francesca Batault, Second Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas, UNIDIR, 2022.
3. ICRC, "ICRC president: War on essential infrastructure is war on civilians; every effort to de-escalate is critical", Presidential Statement, March 23, 2026.
4. Truth Hounds, "Seizing Power: Rosatom's Complicity in Occupation, Torture, and Nuclear Safety Breaches at the Zaporizhzhia NPP," September 24, 2025; "Central Darfur: Sabotage attacks in Zalingei target power and water lines," Radio Tamazuj, February 11, 2024; Priam Nepomuceno, "AFP condemns NPA attack on Mindoro power plant," Philippine News Agency, February 26, 2019; Philip Acuña, "ELN guerillas allegedly attack Ecopetrol supply caravan," Colombia Reports, April 28, 2014; WB, EU, UN, Gaza Strip: Rapid Damage and Needs Assessment, April 2026.
5. Explosive Weapons Monitor, Explosive Weapons Monitor 2024, May 2025; OHCHR, "Attacks on Ukraine's Energy Infrastructure: Harm to the Civilian Population," Bulletin, UN Human Rights Monitoring Mission in Ukraine, September 2024;
6. Human Rights Watch, "Israel, Iran: Unlawful March Attacks on Energy Infrastructure," April 22, 2026; "Power-line attack plunges Yemen into darkness," Al Jazeera, June 11, 2014; United Nations, "Report: Gaza Strip Rapid Damage and Needs Assessment – European Union, United Nations and World Bank," April 20, 2026, p. 30; Safeguarding Health in Conflict and Insecurity Insight, "Care in the Crosshairs: Violence Against Health Care in Conflict," 2025, p. 17; Mohamed Elnourani, Hamid Suliman Hamid Elhag, Waleed Isameldin Alasad, and Mohamed Nasr Bashier, "Khartoum War's echoes in oil and energy sectors: Economic and environmental implications for Sudan and South Sudan," Heliyon, July 2024, 23;10(15):e34739; ICRC, "Sudan: Attacks on critical civilian infrastructure surge amid escalating fighting," January 27, 2025.
7. Commentary of 1987 on Additional Protocol I, note 3(b) to Article 52
8. The full name is the Political Declaration on Strengthening the Protection of Civilians from the Humanitarian Consequences Arising from the Use of Explosive Weapons in Populated Areas. More details can be found at EWIPA.org.
9. Article 54(2) of Additional Protocol I.
10. Customary International Humanitarian Law Database, Rule 10; Customary International Humanitarian Law Database, Rule 14; Article 48 of Additional Protocol I to the 1949 Geneva Conventions (AP I); Article 52(1) of AP I.
11. Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I) (adopted 8 June 1977, entered into force 7 December 1979) 1125 UNTS 3, art. 51(5)(b); Report on Violations of International Humanitarian and Human Rights Law, War Crimes and Crimes against Humanity Committed in Ukraine since 24 February 2022, Organization for Security and Cooperation in Europe, April 22, 2022, p. 29; Isabel Robinson and Ellen Nohle, "Proportionality and precautions in attack: The reverberating effects of using explosive weapons in populated areas," International Review of the Red Cross, 2016, 98 (1), 107–145; Eirini Giorgou and Abby Zeith, "When the lights go out: the protection of energy infrastructure in armed conflict," ICRC Humanitarian Law & Policy Blog, April 20, 2023.
12. The applicability of these rights in conditions of conflict varies, as does the degrees of obligations on the Parties to a conflict (e.g., attacking vs. invading vs. occupying States).
13. United Nations General Assembly. "International Covenant on Economic, Social and Cultural Rights," December 16, 1966, United Nations, Treaty Series, Vol. 993, p. 3.
14. Mark Zeitoun and Michael Talhami, "The impact of explosive weapons on urban services: Direct and reverberating effects across space and time," International Review of the Red Cross, 2016, 98 (1), 53–70.
15. Mark Zeitoun and Michael Talhami, "The impact of explosive weapons on urban services: Direct and reverberating effects across space and time," International Review of the Red Cross, 2016, 98 (1), 53–70.
16. Mark Zeitoun and Michael Talhami, "The impact of explosive weapons on urban services: Direct and reverberating effects across space and time," International Review of the Red Cross, 2016, 98 (1), 53–70. Diakonia International Humanitarian Law Centre, Protection of Civilian Infrastructure in Armed Conflict: Q&A, 2023.
17. United States Environmental Protection Agency, "Centralized Generation of Electricity and its Impacts on the Environment," December 23, 2005; François Bouffard and Daniel S. Kirschen, "Centralised and distributed electricity systems," Energy Policy, Vol. 36, Issue 12, 2008, pp. 4504-4508.
18. This definition adapts established definitions used to monitor attacks on civilians and civilian infrastructure from other sectors, while also drawing on academic and technical descriptions of energy infrastructure. For more, see: WHO, "Surveillance system for attacks on health care," WHO/WHE/EMO/2019.2/BRO, December, 2018; Office of the Special Representative of the Secretary-General for Children and Armed Conflict (OSRSG-CAAC), United Nations Children's Fund (UNICEF) and United Nations Department of Peacekeeping Operations (DPKO), "Field Manual: Monitoring and Reporting Mechanism (MRM) on Grave Violations Against Children in situations of Armed Conflict," June 2014; GCPEA, Toolkit for Collecting and Analyzing Data on Attacks on Education, January 2023, ICRC, "International Humanitarian Law and Cyber Operations during Armed Conflicts," position paper, 2019; Mark Zeitoun and Michael Talhami, "The impact of explosive weapons on urban services: Direct and reverberating effects across space and time," International Review of the Red Cross, 2016, 98 (1), 53–70; Christina Hoicka and Julie MacArthur, "The Infrastructure of Electricity," The Oxford Handbook of Energy Politics, 2021.
19. "Brief Overview of the Electricity Infrastructure Sector," International Trade Administration webpage, accessed June 13, 2025.
20. Christina Hoicka and Julie MacArthur, "The Infrastructure of Electricity," The Oxford Handbook of Energy Politics, 2021.
21. Radio Free Europe/Radio Liberty, "Iraqi Officials Say Seven Killed In Suicide Attack On Power Plant," September 2, 2017.
22. UNICEF, "State of Palestine: Humanitarian Situation Report – UNICEF update," August 28, 2014.
23. Eirini Giorgou and Abby Zeith, "When the lights go out: the protection of energy infrastructure in armed conflict," ICRC Humanitarian Law & Policy Blog, April 20, 2023.
24. Mohammad Reza Farzanegan and Reza Majdzadeh, "When electricity infrastructure is targeted, health is targeted too," BMJ, April 30, 2026, 393:s831.
25. PHR and Truth Hounds, Health Care in the Dark: The Impacts of Russian Attacks on Energy in Ukraine, December 2024.
26. UNICEF, "Effect of Power Outages on Education in Ukraine [Presentation]," July 2024; GCPEA, "Attacks on Education and Military Use of Education Facilities in Ukraine in 2022," February 2023; Save the Children, "I want a peaceful sky": Education and children's wellbeing in wartime Ukraine," 2024; Esra Abdallah Abdalwahed Mahgoub, Amna Khairy, Samar Osman, Musab Babiker Haga, Sarah Hashim Mohammed Osman, Abubker Mohammed Abbu Hassan, Hala Kamal, and Ayia Babiker, "War and education: the attacks on medical schools amidst ongoing armed conflict, Sudan 2023," Conflict and Health, March 29, 2024 ;18(1):23, p. 7; Mizzima News, "Myanmar youth struggle for education amidst coup-triggered power outages," April 17, 2024.
27. UN Human Rights Monitoring Mission in Ukraine, "Attacks on Ukraine's Energy Infrastructure: Harm to the Civilian Population," September 2024; UNICEF, "'Barely a drop to drink': children in the Gaza Strip do not access 90 per cent of their normal water use," UNICEF press release, December 20, 2023; MSF Sudan, "Sudan: Drone Attacks on Power Plant Threaten Lives and Health Services in River Nile State."

28. UNICEF, "Ukraine Humanitarian Situation Report," December 2022.
29. MSF Sudan, "Sudan: Drone Attacks on Power Plant Threaten Lives and Health Services in River Nile State," May 7, 2025.
30. Vinck P, Mysiv L, Marston J, Pham PN. 2026. "Household Survey of Effects of Attacks on Energy Infrastructure (2022-2025)," 2026. Kobo.
31. Abdelhakim Abu Riash, "Gaza bakeries targeted and destroyed by Israeli air attacks," Al Jazeera, November 2, 2023.
32. UNICEF, "Water under Fire," 2019. ACAPS, "Ukraine: Energy infrastructure attacks - Updated outlook and impact during the 2024–2025 cold season."
33. PHR, "Attacks on Health in Ukraine Continue to Escalate Four Years into Russia's Full-Scale Invasion," February 12, 2025.
34. UNDESA, Electricity and education: The benefits, barriers, and recommendations for achieving the electrification of primary and secondary schools, 2014.
35. UNESCO, United Nations World Water Development Report, Water and Energy, 2014.
36. Mark Zeitoun and Michael Talhami, "The impact of explosive weapons on urban services: Direct and reverberating effects across space and time," International Review of the Red Cross, 2016, 98 (1), 53–70.
37. Mark Zeitoun and Michael Talhami, "The impact of explosive weapons on urban services: Direct and reverberating effects across space and time," International Review of the Red Cross, 2016, 98 (1), 53–70. Christina Wille and Alfredo Malaret Baldo, Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas, UNIDIR, 2020. Bárbara Morais Figueiredo and Katherine Young, Understanding Civilian Harm from the Indirect or Reverberating Effects of the Use of Explosive Weapons in Populated Areas, UNIDIR and EWM, 2024.
38. Bárbara Morais Figueiredo and Katherine Young, Understanding Civilian Harm from the Indirect or Reverberating Effects of the Use of Explosive Weapons in Populated Areas, UNIDIR and EWM, 2024.
39. To the authors' knowledge. Exceptions are emerging, however: Insecurity Insight has developed the methodologies for open-source monitoring of attacks on energy infrastructure, including through social media scraping using natural language processing (NLP); ACAPS monitors incident-level attacks on energy infrastructure in select countries; and the Armed Conflict Location & Event Data (ACLED) project tracks events that target or damage infrastructure in Ukraine, including energy, using automated NLP tags. For more, see: "Recorded facility damages," Ukraine Interactive Dashboard, ACAPS; and ACLED, "ACLED's methodology on Ukraine civilian infrastructure automated tags," February 20, 2026.
40. Bárbara Morais Figueiredo and Katherine Young, Understanding Civilian Harm from the Indirect or Reverberating Effects of the Use of Explosive Weapons in Populated Areas, UNIDIR and EWM, 2024.
41. Power cuts are included as a separate domain, since not all attacks on energy infrastructure result in power cuts and not all power cuts are the result of attacks. This domain is a bridge between the attack and knock-on effects for services and civilians.
42. Where possible, researchers should separately document whether the infrastructure appears to have been directly targeted, damaged during an attack on another objective, or affected in circumstances that remain unclear, along with the alleged responsible actor and the evidentiary basis for that attribution, and the strength of the causal link between the incident, the power outage, the disruption of services, and the resulting civilian harm.
43. Where possible, indicators should be disaggregated to capture differences in exposure, access, vulnerability, and severity of harm. Relevant disaggregation will vary by sector and indicator. Disaggregation is particularly important for identifying which groups and services are most affected and comparing impacts across locations or periods.
44. For instance, the following report assesses the number of power plants damaged across seven governorates in Iraq in 2017, alongside residents' access to electricity in nine cities. World Bank, Iraq: Damage and Needs Assessment of Affected Governorates, 2018.
45. Adapted from: Alfredo Malaret Baldo and Francesca Batault, Second Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas, UNIDIR, 2022.
46. Adapted from: Alfredo Malaret Baldo and Francesca Batault, Second Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas, UNIDIR, 2022.
47. Could also include: time to restore power at civilian facilities, availability and reliability of backup power, and incidents of generator failure or delayed generator activation
48. For health indicators, data should be disaggregated where possible by type of care or service affected, including routine, urgent, emergency, surgical, laboratory, imaging, pharmacy, maternity, newborn, rehabilitation, mental health, ambulance, referral, and home-based care.
49. In the case of health facilities, this could include for instance urgent care, maternal and newborn care, chronic disease care, disability-related care, and medication access.
50. Specifically, number or proportion of health facilities or patients able to refrigerate medicines, insulin, vaccines, blood products, or other temperature-sensitive medical items.
51. For instance, numbers of deliveries, pre-term deliveries, ante and postnatal complications, C-sections, neonatal interventions, or obstetric emergencies
52. Disruptions of hospital functionality could include lighting; elevators; heating/cooling/ventilation; water; sanitation; sterilization/infection prevention; oxygen systems; internal transport; back-up power generation. Disruptions in communications could include delays/errors in patient identification, emergency dispatch, ambulance coordination, referral pathways, delays in prescription dispatching, telemedicine, and patient contact systems.
53. For instance, dialysis, chemotherapy, radiotherapy, intensive care unit (ICU), neonatal intensive care unit (NICU), emergency, surgical, trauma, or oxygen-dependent treatments affected.
54. The loss of electricity can cause failures to climate control, fire suppression, and security systems, which are needed to preserve and secure cultural heritage; For more, see: Human Rights Watch, Destroying Cultural Heritage: Explosive Weapons' Effects in Armed Conflict and Measures to Strengthen Protection, April 2024; International Centre for the Study of the Preservation and Restoration of Cultural Property's First Aid to Cultural Heritage in Times of Crisis - Handbook, 2018.
55. The indicators concerning flooding, hazardous waste, and radioactive contaminants are adapted from environmental degradation indicators found in: Alfredo Malaret Baldo and Francesca Batault, Second Menu of Indicators to Measure the Reverberating Effects on Civilians from the Use of Explosive Weapons in Populated Areas, UNIDIR, 2022.
56. For more details on interviewee and team safety, see: Office of the High Commissioner for Human Rights, "Interviewing," Manual on human rights monitoring (HR/P/PT/7/Rev. 1), 2011.

EXPLOSIVE WEAPONS MONITOR

The Explosive Weapons Monitor is a research initiative of the International Network on Explosive Weapons (INEW). It conducts research and analysis on harms from and practices of explosive weapons use in populated areas and monitors universalisation and implementation of the Political Declaration on the Use of Explosive Weapons in Populated Areas.

WWW.EXPLOSIVEWEAPONSMONITOR.ORG
@WEAPONSMONITOR

© EXPLOSIVE WEAPONS MONITOR
October 2026