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REPORT

FROM RENEWABLE ENERGY TO PEACEBUILDING IN MALI

MINUSMA's Opportunity to Bridge the Gap

By Dirk Druet and Rida Lyammouri with David Mozersky

The Powering Peace Initiative

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COVER
MINUSMA supply convoys on their way to the north of Mali to supply remote UN bases UN Photo/Sylvain Liechti

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TABLE OF CONTENTS

ABOUT POWERING PEACE

Powering Peace is a joint research initiative of the Stimson Center and Energy Peace Partners, which aims to explore cleaner and more efficient energy options for multinational field operations in fragile states. The Stimson Center, a Washington, D.C.-based research and policy center, has led studies and research on peace operations since its founding 30 years ago, and works to protect people, preserve the planet, and promote security and prosperity. Energy Peace Partners is a U.S.-based organization that works to leverage climate finance solutions to support peace in places affected by violent conflict.

The Powering Peace initiative envisions a broad policy shift within the United Nations (UN) system and among its member states to adopt renewable energy in field operations for both short-term and long-term benefits. As part of a shorter-term effort, the initiative aims to help the UN embrace more efficient and cost-saving technologies, and shift to greater use of renewable energy in support of missions. That is more urgent now within the context of the UN Secretariat's 10-year Climate Action Plan to source 80 percent of electricity from renewable energy by 2030. The initiative also seeks to identify impacts of and improvements in current practice, such as reducing the expense or insecurity associated with long fuel convoys or corruption. As part of a longer-term effort, the initiative aims to help the UN better integrate climate solutions in crisis-affected areas as part of the way it does business, an effort that can support peacebuilding and fulfill the organization's ambition to achieve universal global access to energy under the UN's Sustainable Development Goals.

Powering Peace examines the extent to which the footprints of international humanitarian and peace operations can be leveraged to introduce and extend the benefits of renewable energy to communities in fragile states. The project includes the use of reports and case studies as a research tool to identify innovative practices, incentives, and disincentives facing field missions, as well as opportunities for greater efficiency and peacebuilding. Our first report, *Renewable Energy and UN Peacekeeping: Untapped Potential in the Democratic Republic of the Congo*, was published in September 2019. Our second report, *Shifting Power: Transitioning to Renewable Energy in United Nations Peace Operations*, was published in January 2021. Powering Peace is undertaking a series of case studies of energy use by UN missions in conflict-affected countries.

Powering Peace is funded through the generous support of the Schmidt Family Foundation/11th Hour Project and the Carnegie Corporation of New York. The project has also benefited from an anonymous donor, and the expert assistance of the Loomis Council at the Stimson Center. Powering Peace is led by David Mozersky and Sherwin Das of Energy Peace Partners, and Victoria Holt and Alex Hopkins of the Stimson Center.

ABOUT THIS REPORT

This report involved two principal lines of research: a broad conflict analysis of Mali and a review of efforts by the UN peace operation, MINUSMA, to transition to renewable energy. First, the conflict analysis examined the history of the Malian conflict and the evolving roles of geography and climate as core factors in the conflict dynamics. On the basis of a review of energy markets commissioned in select urban centers in the North, supplemented by expert interviews and secondary sources, the authors analyzed the role of diesel and electrification patterns in the political economy of the conflict. The research included conducting a mapping of local, national, and international actors involved in the governance, management, and use of fossil fuels in the country.

Second, the study analyzed MINUSMA's energy practices and efforts to deploy renewable-energy systems. From looking at mission budgetary and planning documents and drawing on interviews with mission personnel and external researchers, the authors describe the mission's energy requirements and operational context for energy generation. The report reviews MINUSMA's solar pilot project and analyzes the mission's planning assumptions and priorities in the context of Mali's conflict dynamics and the mission's mandate and operational parameters.

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EXECUTIVE SUMMARY

Energy plays an important and underrecognized role in the dynamics of climate, security, peace, and conflict in Mali, one of the least electrified countries in the world. There is a vast discrepancy between electrification levels in urban areas of the South and center of the country, where approximately 80 percent of the population have regular access to electricity, and the conflict-affected North, where electrification levels in rural areas are lower than two percent. The discrepancy is a highly visible symbol of the unequal distribution of wealth and development in Mali, which feeds into the history of marginalization and underdevelopment that has driven the country's successive conflicts. The current peace agreement, signed in 2015, sought to address these imbalances by recognizing that increased electrification is critical to the development of the North, and specifically mentioning solar energy as a key deliverable and area for investment. Yet implementation of the peace agreement has been lacking, as has extension of electrification in the North, hampered in part by unstable governance including a coup in late May, the second in a year. Today's energy markets in northern Mali depend on smuggled diesel in order to power generators, and play an important part in the political economy of the region, as fuel supply chains are often controlled by armed groups.

In 2013, the United Nations Multidimensional Integrated Stabilization Mission in Mali (MINUSMA) was deployed to support peace in Mali. MINUSMA is a key actor in the international community's engagement in the conflict in Mali, deployed alongside separate military and diplomatic missions, humanitarian operations, and development initiatives led by the UN Country Team (UNCT) and multilateral development institutions.

With a core United Nations (UN) mandate to support implementation of the 2015 peace agreement, the mission today operates bases in 11 locations across a huge territory. The mission's reliance on diesel to power both generators and vehicles is a fundamental requirement, and informs the design of the mission's presence throughout the country, as well as the frequency and routing of supply convoys. MINUSMA also faces great insecurity. That includes attacks on peacekeepers and convoys, leading it to be the deadliest peacekeeping mission in the world. As a result, a significant proportion of the mission's capabilities is dedicated to force protection and convoy security. While MINUSMA manages its own fuel supplies, its reliance on diesel generators carries enormous costs, including elevated security risks tied to its supply convoys. This undermines the pursuit of MINUSMA's mandate and operations.

This study looks first at the dynamics of energy in Mali, specifically the lack of electrification in the North and the diesel trade in the political economy of northern Mali. It then examines MINUSMA's own diesel-reliant energy practices, the convoy-related security implications, and the options for the mission's transition to renewable energy, in the context of meeting the United Nations' own climate goals. Finally, the report explores opportunities for MINUSMA's renewable-energy transition and options to also unlock new energy projects alongside its field sites, as a new way to deliver on its UN mandate and support the peace agreement.

MINUSMA's choices around its energy practices and transition to renewables could support the wider international strategy for Mali, alongside the UNCT and development institutions. That includes helping to increase energy access and deliver peace dividends to the North, and offering new entry points for projects in regions that have seen limited investment and engagement as a result of the conflict and insecurity. For example, MINUSMA is working on an innovative private-sector financing model for an inside-the-fence solar-energy pilot project in Bamako, with an estimated payback period of three to four years. The pilot project has been slowed by a number of bureaucratic hurdles, even as the mission begins to look toward a larger mission-wide approach to renewable energy.

A greater transition to renewable energy would benefit the mission in several ways. It could reduce security exposure from fuel convoys, increase economic cost savings over time, and offer a dramatic reduction in diesel consumption. A project model that also delivers local energy services offers new opportunities to contribute to peacebuilding and support for peace-process implementation by catalyzing new energy projects in the North. This would also complement the wider international strategy, with the mission providing new entry points to support renewable-energy projects in key northern cities.

These compelling arguments in favor of a MINUSMA-wide shift toward renewable-energy projects benefit both the mission itself and could support local energy access. Examples are emerging in other UN peace operations that have leveraged their role as an anchor client for private-sector power projects that support both the mission and local communities, offering models for MINUSMA to follow. This approach is further bolstered by broader UN goals. The UN has adopted ambitious new climate goals, including an 80 percent renewable-energy use target by 2030 announced by the Secretary General in 2019 and backed by the UN Secretariat Climate Action Plan. Likewise, Phase Two of the UN Department of Operational Support's Environment Strategy for Peace Operations lays out goals to improve fuel efficiency, increase use of renewable energy, and pursue partnerships with the private sector. However, progress has been slow.

The report makes several important findings and actionable recommendations to address MINUSMA's energy use, mission effectiveness and expansion of use of renewable energy for itself and the region.

Findings

First, energy plays an important but nuanced role in the political economy of Mali's conflict, and the implementation of the peace agreement. While Mali is among the least electrified countries, an acute lack of electrification in the North is part of a larger dynamic of chronic underdevelopment that has fueled decades of North-South grievances, and contributed to current and past cycles of conflict.

Second, MINUSMA's current diesel-heavy energy practices carry significant economic, environmental, and security costs for the mission, which depends on long and vulnerable fuel convoys. An increased use of renewable energy could benefit the mission in multiple ways.

Third, even with the UN's ambitious climate goals, lessons from the hurdles faced by MINUSMA's solar pilot project demonstrate both mission-specific and UN-wide challenges that may constrict the expanded adoption of renewable energy in Mali and other field missions. These challenges include:

- *Mission decision-making is siloed across sections, including those working on environmental impact, energy planning, conflict analysis, and mission substantive offices.* The approach is not yet integrated to recognize the synergies across these areas that could maximize mission planning, conflict assessments, and environmental and energy efforts.

- *Ambiguity continues around the roles and responsibilities between and within UN Headquarters and the mission around market research, partnerships, and procurement for new technologies (such as renewable-energy systems) in peacekeeping.*

- *The role of troop- and police-contributing countries (TCCs/PCCs) in the mission's energy footprint runs parallel to UN-owned and -operated energy planning.* Those dual systems complicate the mission's ability to expand and accelerate adoption of mission-wide renewable-energy options. This system must be addressed for the mission to adopt new mechanisms and develop incentives to accrue the full benefits of such a transition to renewable energy.

Fourth, a MINUSMA transition to renewable energy in northern Mali could also strengthen peacebuilding by supporting local energy access. Building on the UN anchor-client and private-sector partnership models emerging in UN peace operations, a MINUSMA renewable-energy project that can also unlock local energy services offers a creative and important new opportunity to support the Algiers peace agreement and MINUSMA's own peacebuilding mandate.

Recommendations

To MINUSMA, the UNCT, international development agencies, and the government of Mali:

- *Support new investment in renewable energy in northern Mali as an under-implemented component of the Algiers peace agreement.* A consistent demand from the non-state signatories to the Algiers agreement is progress in creating the Northern Development Zone, a special development area funded by increased budgetary provisions from Mali's government. Linking the creation of this zone, and specific budgetary funding, to development spending on renewable-energy infrastructure in the Northern Development Zone can help speed up implementation of a key provision of the peace agreement while increasing access to renewable energy in northern Mali.

To MINUSMA and the UN Secretariat:

- *Broaden the decision-making structures around renewable-energy solutions to involve substantive mission personnel in order to integrate conflict analysis and political risks and opportunities as part of decision-making around the mission's solar-energy system.*

To the Secretariat and Member States:

- *Strengthen mission access to renewable-energy options.*

- *Invest in new market research tools and capacities to assist departments and missions in surveying the full breadth of technological/contractual solutions available on the market.*

- *Encourage experimentation and the use of pilot projects and capture lessons learned, while clarifying the design process for pilot projects.* The logic that underlays the design of the MINUSMA solar-energy pilot project — that a small-scale contract with a supplier of a unique technical and financial solution for an emerging, complex requirement would be used to hone requirements and inform the development of a statement of work for the procurement of a larger-scale solution — is both sound and critically important if the UN Secretariat is to keep pace with technological change. The UN Department of Management Strategy, Policy and Compliance should lead an effort to clarify the application of existing UN rules and regulations as they relate to pilot projects, and develop guidance for UN Headquarters and field missions on the design and implementation for expedited, small-scale pilot projects of this type.

- *Further expand the knowledge of TCCs/PCCs about the reimbursement for hybrid renewable energy and more efficient generators.* Member states who champion the UN's Environment Strategy could work with leading TCCs and PCCs to lead a reduction in the use of inefficient generators, and fuel waste, and identify ways to incentivize the use of renewable-energy options by uniformed peacekeepers. In 2022, member states could prepare to review contingent-owned equipment (COE) rules, reimbursement mechanisms, and rates to disincentivize the use of inefficient generators and fuel waste by uniformed units, and incentivize the use of renewable-energy systems. A thematic paper on this subject with appropriate recommendations for changes to the COE manual should be introduced at the next meeting of the COE Working Group.

To MINUSMA and the UNCT:

- *Work together to explore synergies between planned/ongoing development work and MINUSMA's transition to renewable energy*, including around creating the necessary bankability conditions to enable energy project development.

To MINUSMA:

- *Ensure that a mission-wide renewable-energy plan for MINUSMA delivers a peace dividend.* In applying the lessons learned from the solar-energy pilot project and developing a statement of work for the procurement of a mission-wide renewable-energy system, MINUSMA should strongly consider a renewable-energy approach that delivers immediate and long-term energy benefits to the communities around it, building on the anchor-client models from other UN peace operations.

- *Contribute to increasing nighttime lighting infrastructure, especially in urban areas, as part of the mandate to protect civilian populations.* A greater security presence at night in urban areas could help protect energy infrastructure from theft or destruction, making it easier to increase the availability of solar panels and solar-powered lighting, particularly on roads and in public areas.

- *Involve substantive civilian and military personnel in mission-wide planning for a renewable-energy shift;* incorporate the UN's ongoing conflict analysis; partner with local communities where feasible; and proceed in partnership with UNCT efforts — for example, to complement UNCT programming focused on rural-household energy access.

- *Amend the Statement of Unit Requirements and memoranda of understanding for TCCs/PCCs co-located in UN sites*, in order to shift the primary responsibility of power production to the UN.

- *Accelerate efforts to systematically monitor generator output as part of efforts to increase energy efficiency and to help incentivize TCC/PCC compliance with renewable-energy use, in line with the recommendations of the Special Committee on Peacekeeping Operations in its 2021 report.*[1] To avoid the creation of perverse incentives around COE generator fuel consumption, MINUSMA should require that all COE generators be equipped with digital meters that measure and record energy output and fuel consumption.

To the Government of Mali:

- *Take steps to encourage more investment in the renewable-energy sector, with special interest in the North*, by, for example, establishing easier and more transparent processes for the issuance of power project licenses.

1. INTRODUCTION

Energy is a central issue in the Malian conflict. Understanding the dynamics around the commerce and use of energy — specifically diesel fuel as a main source for millions of people — will help Malian and international actors, and especially the UN, better create sustainable peace in the country. At nearly 20 million people, Mali's population is largely present in the country's southern regions and along the Niger River, along with most of the country's infrastructure, electrical access, and industry.[2] The North, by contrast, has been described as "somewhere else, but not another country either: it is something in-between, a hinterland in limbo between Algeria and Mali."[3] The stark differences in the distribution of resources and services between the North and South, including in levels of electrification, are a core aspect of grievances that have fueled internal conflict for decades.

Mali is among the least electrified countries in the world, with just 50.8 percent of the population having access to electricity.[4] Local populations, private entities, public offices, and humanitarian actors in the North depend on diesel generators, often using fuel smuggled across borders, particularly from Algeria. The illicit trafficking of fuel is a key commodity within the illicit, transnational flows that reinforce logics of violence in the country. Whereas the South's fuel markets are regulated by the government,[5] supplied by multinationals, and guaranteed by state and privately held inventories and tax incentives, the North's markets are subject to fluctuations in road safety, access to contraband, and the quality of fuel available. Energy thus figures directly in the logic of peace in Mali as a material component of equality and inclusion in the country's development.

The UN presence in Mali can play a role in better understanding these dynamics, ensuring that its operations do not reinforce conflict drivers, and ultimately helping to address them. There are practical reasons to do so. Energy is a key requirement for the operations of the UN Multidimensional Integrated Stabilization Mission in Mali (MINUSMA), which operates across a huge territory. The mission's reliance on diesel to power both generators and vehicles is a fundamental planning assumption that informs the design of the mission's presence throughout the country, the frequency and routing of supply lines, and the significant proportion of the mission's capabilities that is dedicated to self-sustainment and force protection. To meet its fuel, food, water, and other logistical demands, MINUSMA relies on regular convoys by road to supply its bases. As a result, MINUSMA peacekeepers have been highly exposed to attacks by non-state armed groups targeting convoys. That has contributed to the mission's status as the most dangerous peacekeeping operation in UN history.

There is growing awareness in some quarters of the linkages between the UN peace operations energy footprint, the safety and security of peacekeepers, the mission's mandate implementation, basic public services, and the peace process. The recognition stems from newly invigorated climate action and climate and security agendas across the UN, and is reflected in MINUSMA's mandate at inception, which, for the first time, asked the mission to consider, and manage, the environmental impact of its operations.[6] In September 2019, the UN Secretariat, which includes deployed peace operations, adopted a new Climate Action Plan in which it committed to an ambitious new set of goals, including to source 80 percent of its energy use from renewable sources by 2030.[7] The Environment Strategy for Peace Operations, launched in 2016 by the Department of Operational Support (DOS), has sought to achieve a vision of "responsible missions that achieve maximum efficiency in their use of natural resources and operate at minimum risk to people, societies, and ecosystems; contributing to a positive impact on these wherever possible."[8] Energy is one of the strategy's five pillars, and increasing the proportion of renewable energy is a key objective. In parallel, MINUSMA has begun to take advantage of the rapid growth of renewable-energy technology worldwide, along with innovative approaches to financing arrangements for renewable-energy infrastructure. The mission is developing a solar-energy pilot project in Bamako intended to generate insights to inform the design of an eventual mission-wide system.

UNPOL and Malian National Guard on joint patrol in Gao UN Photo/Marco Dormino

In this context, in 2020, the Powering Peace Initiative, a collaboration between the Stimson Center and Energy Peace Partners, began a study exploring how MINUSMA might use renewable energy to improve mission effectiveness, reduce costs, and enhance security while mitigating climate change. The study further considered whether these efforts might improve access to electricity in local communities, generating a peace dividend and improving MINUSMA's image and impact. The study also sought to identify challenges and opportunities for the design and rollout of renewable-energy solutions in Mali, and develop recommendations aimed at MINUSMA and the UN Secretariat. This report draws on previous research by Powering Peace, including a similar case study in the Democratic Republic of the Congo[9] and thematic and policy findings contained in its broader institutional report by the initiative, entitled "Shifting Power: Transitioning to Renewable Energy in United Nations Peace Operations."[10]

This report demonstrates the difficulties and risks surrounding fuel supply in northern Mali, as well as the ways in which inequality and lack of infrastructure have for decades nourished discontent and rebellion as well as communal conflict. It also provides recommendations for MINUSMA to transition to sustainable energy sources, highlighting ways in which this shift could generate numerous benefits and co-benefits for the mission as well as for local communities.

2. CLIMATE, INSECURITY, AND GOVERNANCE IN MALI

The Malian Context

The country that is Mali today grew out of a deep and complicated history encompassing centuries of rule by vast empires and kingdoms. These subsequently fractured into smaller political units, followed by decades of French colonial occupation. The country became an independent state in 1960, and early postcolonial governments sought to create a centralized economy with numerous state-owned enterprises, and hardline socialist policies, particularly under the country's first president Modibo Keita.[11] Under this structure, corruption, patronage, and clientelism flourished.[12] An economic recession triggered by successive droughts, resource scarcity, and the mismanagement of state-owned industries battered the country in the 1980s, weakening the regime, and leading to internationally imposed structural adjustment programs. The government was forced to commit to a liberalization of its economy through fiscal and market reforms in exchange for international aid and budget support, dramatically cutting government spending in key areas.[13] A 1991 coup, followed a year later by multiparty elections, ushered in a government that supported decentralizing reforms but fell short of creating the strong democratic institutions necessary to govern the whole of Mali. Weak institutions, mismanagement of resources, and collusion among regional and national elites set the rules of political life in Mali.[14] Moreover, the aforementioned reforms originated in and were driven by the southern regions; communities in the northern regions of Timbuktu, Kidal, and Gao remained on the margins of the Malian state.[15] This situation served to split an already weak country into smaller parts, localizing corruption and further igniting local conflicts in the process across the ethnically diverse state.

In the context of these developments, governance in Mali must juggle the entrenched interests of a multitude of group identities. According to one study,[16] 64 percent of respondents associate more closely with their ethnic backgrounds than their national identity. The country's many subdivisions are divided into two broad categories — those in northern Mali and those in southern Mali — amplified by their respective populations' histories, ethnicities, politics, and languages, among other factors.

Overview of Northern Mali's Crisis

Six years after the signing of the 2015 Agreement on Peace and Reconciliation in Mali between the Malian government and coalitions of northern separatists, only 23 percent of the accord's provisions have been implemented.[17] The accord was signed more than three years after a new Tuareg rebellion began in northern Mali in 2012, the fourth such rebellion since the country's independence in 1960.[18] The limited implementation stems from a lack of political will by signatories and significant disapproval from communities across the country. Given the ongoing stability, security, and development challenges facing northern Mali, there are risks that the lack of progress signals a continuation of a familiar cycle of conflicts that have plagued the region for over 60 years and led to a series of unsustainable peace agreements over the last three decades.

The fourth rebellion for an independent northern Mali — also called the Azawad region by some northern nationalists and proponents of independence — began in January 2012 with an attack on a military post in the Ménaka region.[19] The group leading the rebellion, the National Movement for the Liberation of Azawad (MNLA), consisted of Arabs, Tuaregs and other northern communities. While the MNLA was focused on fighting for the independence of the Azawad, jihadist groups affiliated with al-Qaida sought to implement religious fundamentalist views and their interpretation of Islamic law across the North. The chaos triggered political turmoil in the South and led to a military coup in March 2012.[20] The coup was in part a response to the government's perceived inability to quell multiple rebellions, including the nearly back-to-back rebellions of 2007-09[21] and 2012. Aggrieved officers felt marginalized, but also unwilling to risk their lives fighting against northerners and Tuaregs. These

officers were supported by strong public opinion in the South against northern separatism.[22] Amid the confusion created by the military coup in Bamako and the jihadists' control of key northern cities, the MNLA declared the Azawad region an independent state.

More than two years after French forces drove jihadist fighters out of northern Mali's main cities, the Malian government and the two main armed groups negotiated a peace agreement under heavy international pressure. However, jihadist groups continued to carry out violent attacks, undermining stability. Armed groups and separatists split into multiple alliances vying for political and security influence through negotiations with Mali's government, which eventually agreed to further decentralize power and allow greater autonomy for the North. This was an effort to disentangle the issue of political independence — pursued by some armed groups — from the security threat posed by the Islamist groups, and to identify parties with whom the government could negotiate. The international community backed the agreement as a way to separate Tuareg rebels from the Islamist extremists, and help Bamako to extend its state authority and services. Decentralization and security provisions proved harder to implement than anticipated, however, as a lack of political will, along with deep-seated ethnic tensions and distrust, persisted among the Malian security forces, the pro-Malian-government northern coalition of armed groups known as the Platform,[23] and separatist groups known as the Coordination of Movements of Azawad (CMA).[24]

Although diesel theft is not the primary reason behind the targeting of MINUSMA convoys, the increased number of convoys required for fuel resupply, and movement along the poor and dangerous roads in the north, expose peacekeepers to jihadist groups trying to undermine stabilization efforts.

Past peace agreements between the government and northern Mali separatists had recognized a special status for northern Mali, supported northerners' inclusion in political and security structures, encouraged economic development, and committed to a reduced state military presence.[25] However, those past accords fell short on inclusivity and representativeness, a weakness that was repeated again in the 2015 peace agreement.[26] Focused primarily on the insecurity caused by the latest rebellion of 2012, the negotiations for the 2015 accord lacked representation from all parties to the conflict, most notably civil society, women, and youth.[27] The 2015 agreement calls for medium- and long-term economic development, improvements and investment in basic social services, food security, agricultural and livestock activities, infrastructure, and increasing employment opportunities, among others.[28] Increased electrification is critical to the development of the North. The peace agreement specifically mentions solar energy as a key deliverable and an area for investment. Implementation of the peace accord has struggled to adequately invest in political decentralization processes or meaningfully integrate CMA fighters into national-level security forces. These failings further stoked distrust and encouraged political and security decision-making to occur at the local level by non-state armed groups instead of relying on local government authorities. The poor progress in implementing the peace agreement has further marginalized northern communities and made the country more vulnerable to additional conflicts.

The northern region, historically known for its trade routes and a symbol of wealth and scholarship throughout the Islamic world, has now become a region marked by human trafficking and the smuggling of weapons, drugs, and contraband. The lack of financial or political investment in economic development in northern Mali — one

of the key components of the 2015 peace agreement — has incentivized the continued growth of these illicit economic activities. Increasingly, they constitute a fundamental dimension of the logic of violence.[29] The discovery of gold in northern Mali helped buffer decades of poor economic development, and assisted with the demobilization of combatants chasing profits from gold mining — though this is a temporary fix.[30] These gold mines are mostly informal and open to all gold prospectors, but this could change at any time, potentially undercutting the livelihoods of many families if the mines get taken over by private or state-owned companies. The opening of drug routes has increased the presence of bandits and traffickers — some of whom are linked to armed groups — which in turn results in greater levels of violence and insecurity for northern residents. The fighting has impeded market access, foreign and private-sector investment, and degraded infrastructure. Mass displacements have further contributed to a general decrease in economic activities, reflected by a high cost of basic goods. Although many of these economic challenges existed prior to the 2012 rebellion, they were intensified by the new conflict.

Mali is currently host to a variety of interethnic conflicts in the context of a weak state. Multiple international initiatives have sought to support the government to reestablish security and authority in the troubled central and northern territories. In addition to MINUSMA, the G5 Sahel joint force, and France's pan-Sahelian military initiative Opération Barkhane, are aimed at stopping the Islamist groups' advancements.

Simultaneously, the Malian government has been under pressure from its citizens to solve some of the underlying systemic issues of poverty, human rights, and ethnic clashes. The results have been modest to poor. A combination of the government's failure to improve the situation, poor management of the insurgency in the North, allegations of government corruption, and a crumbling economy led to popular protests in June 2020, culminating in a coup d'état on August 18, 2020. A civilian transitional government was established five weeks later, with agreement to rule until elections could be held.[31] On May 24, 2021, military personnel arrested the transitional president and prime minister, following a government reshuffle that led to the removal of two powerful military figures. Col. Assima Goïta, who led the August 2020 coup, was appointed as interim president, despite international pressure to see a rapid appointment of a new civilian-led government.[32] Goïta subsequently appointed an opposition leader, Choguel Maiga, as prime minister.[33]

A sustainable peace will require significant investment in economic development as part of any demobilization process. Such a process is delicate and must consider the potential harm if certain communities or regions are perceived as unequally favored through development initiatives, potentially seeding new conflict. This level of investment by the central government is unlikely unless all Malians redouble their efforts to advance the implementation of the peace agreement, beginning with proper political representation and national budget allocation for the North.

Electrification in Mali: Inequality and Impacts on Development

Mali has extremely low levels of electrification, with roughly 50 percent of its population having access to electricity.[34] This number drops to 25 percent among rural populations. The vast discrepancy between electrification levels in urban centers of the South and center of the country, where, according to UN Country Team (UNCT) personnel, approximately 80 percent of the population have regular access to electricity, and the conflict-affected North, where electrification levels in rural areas are lower than 2 percent, is a highly visible symbol of the unequal distribution of wealth and development in the country. Responsibility for electricity distribution in cities lies with the national energy company Energie du Mali (EDM-SA). Access to electricity is often uneven and inconsistent, with EDM-SA reporting an average of 41 major power outages per year, and Mali ranking 161st of 190 countries in the category of "getting electricity" in the 2020 World Bank Doing Business Report.[35] The EDM-SA delivers electricity in the country through three different and separate grids: an interconnected grid around Bamako, a connected grid from Cote d'Ivoire that also supplies Bamako, and stand-

alone grids in isolated population centers around the country.[36] The largest is the grid surrounding Bamako, connected to multiple power plants.[37] It has a capacity of slightly below 2,000 gigawatt-hours (GWh), or about 228 megawatts (MW) of generation capacity. This should be sufficient to power more than 100,000 homes per year; however, with regular power outages and irregular supply from Cote d'Ivoire, many in the capital rely on diesel generators for backup.

For instance, while the Cote d'Ivoire grid in the South should supply a minimum of 50 MW under the contract, it was reported in April 2021 that the Ivorian partner was experiencing temporary difficulties on its national network, and therefore began restricting its energy exports to Mali to between 30 and 50 MW, compared to 100 MW in 2020.[38] This coincided with increased demand for electricity because of high temperatures, causing a significant production deficit on the national grid and leading to increased interruptions in electricity supply. The grids in the isolated centers run mainly on diesel generators or hybrid systems (Diesel/photovoltaic panels), generating about 90 MW. This generation carries an average cost of 128.1 FCFA (~$0.23)/kilowatt-hour (kWh) and an average sale price of 96.5 FCFA (~$0.18)/kWh for low and medium voltage, implying a net deficit for the government. With such a deficit, a lack of investment in the sector, costly maintenance, and a ten percent yearly increase in electricity demand, exploring other venues for the production of electricity is a necessity.

Given Mali's size and limited resources, grid extension into rural areas is limited, and the government is unable to meaningfully invest in grids to reach isolated villages. This has resulted in considerable disparities between urban and rural areas, most notably in the less developed and accessible northern regions. Much of the rural population relies on local energy providers using diesel generators or hybrid systems; about 45 percent of electricity production in Mali relies on diesel, while the remaining 55 percent is hydroelectric.[39] Efforts to address rural electrification have exacerbated grievances regarding continued underdevelopment in the North; for instance, recent efforts by the Malian government and its international partners to improve access to electricity through investment in new solar plants was focused on the southern region of the country.[40] The lack of public services in the North has fueled grievances and a sentiment of being neglected among the northern population. This view has lent insurgents greater legitimacy and support while further entrenching local power brokers and armed groups who could provide some of those services as well as, at times, access to basic forms of justice and governance.

The stark disparities in development between the North and the South have led many aid agencies and nongovernmental organizations to invest in development programs specifically for the northern region of the country in an attempt to bridge the divide.[41] These programs are complex and attempt to deal with the many underlying issues dividing Mali, such as conflict prevention and reconciliation, the reconstruction and development of public infrastructure, boosting the local economy, and avoiding further conflict. However, these programs have not always been successful in dealing with all these issues, especially within a context of ongoing conflict and violence. The northern regions, where negative sentiment toward the central government persists, poses challenges for improving public services since the local context makes it difficult for the Malian government to operate. Armed group signatories of the peace accord are trying to fill that gap and govern those regions, although their efforts have had limited impact so far as a result of a lack of resources and a lack of access to development funding from international organizations.

Electrification in Northern Urban Areas

Whereas sourthern Mali boasts an infrastructure and relative stability that enables a better, though still inconsistent, supply of both electricity and fuel, the northern regions suffer from a lack of infrastructure and stability. The South's fuel markets are regulated by the Office National des Produits Pétroliers (ONAP),[42] supplied by multinationals, and guaranteed by state and privately held inventories and tax incentives. The

Solar panels in Ménaka Consultant/Sahel MeMo

Diesel for sale in the streets of Ménaka Consultant/Sahel MeMo

North's markets are not run this way, and are subject to fluctuations due to road safety, access to contraband, and the quality of available fuel. Communities and organizations in the northern regions, located far away from the central electrical grid, must thus rely heavily on diesel generators, including to support the large energy footprints of the UN and other international actors deployed on the ground. Although diesel theft is not the primary reason behind the targeting of MINUSMA convoys, the increased number of convoys required for fuel resupply, and movement along the poor and dangerous roads in the north, expose peacekeepers to jihadist groups trying to undermine stabilization efforts. Many attacks on fuel convoys have been orchestrated by jihadist groups in order to hinder state or foreign operations on the ground.

Most of northern Mali is not connected to a state electricity grid. Only in the densest urban areas of northern Mali, such as Ménaka, Kidal, Gao, or Timbuktu, are households connected to the grid through a prepaid ISAGO meter with electricity produced by major generators. This meter is installed by EDM-SA and refilled through the available mobile phone companies, Orange and Malitel. Access to electricity through centralized grid infrastructure does not extend to much of the periphery or many of the newly constructed building zones, primarily because of the prohibitive costs of connection to the grid.[43] Access depends on households' purchasing power, with monthly bills averaging between 1,000 FCFA (~$1.85) for those without many electrical appliances to 7,000 FCFA (~$12.93), or more, for others. This poses a challenge for the average household in Mali, which in 2019 earned $193 per month,[44] with the average significantly lower in the North.

Public lighting is limited in Gao, Ménaka, Kidal, Ansongo, and Timbuktu. Streetlamps are scarce, limited to the main streets, and poorly maintained. Some solar-powered streetlamps, funded by MINUSMA through specific projects, can be found along smaller streets; however, many of these lights have been stolen. The lack of lights and inadequate nighttime security further facilitates vandalism and theft, and contributes to insecurity at night.

While electricity is provided by EDM-SA's diesel power plants in these urban areas, they do not provide sufficient output for continuous access, or sufficient generation to meet the towns' demand. As in the South, the northern grids are frequently shut down in the hot season or when the generators fail, leaving the population without electricity for hours or days at a time. In Gao, electricity shifts between neighborhoods,

Solar-Powered Streetlamp in Gao Consultant/Sahel MeMo

Diesel supply in Timbuktu Consultant/Sahel MeMo

with some receiving it during the day and others at night, in order to prioritize continuous electricity access for the public administration. In Timbuktu, electricity is often provided just four out of seven days in the hot season (January-June), with blackouts during the rainy season (July-November). This chronic instability in electricity provision has drawn frequent protests by frustrated residents in both the North and the South. Furthermore, the instability of the electricity supply generates significant economic costs, which hinder economic development and contribute to instability and widening inequalities. Individual households in northern cities have turned to diesel generators and solar panels as an alternative to central power supplies, but only a limited number of families have the means to afford these. Solar panels fluctuate in price between the three towns, ranging between 60,000 FCFA to 150,000 FCFA (~$110.80 to $277.10) for panels ranging from 70 watts (W) to 270 W. Prices are more expensive in Ménaka than Gao.

3. THE POLITICAL ECONOMY OF DIESEL IN MALI

Access to Fuel in Mali

The State

With scarce access to electricity and 45 percent of energy production in the country dependent on diesel, it is no surprise that diesel is a crucial commodity in Mali. Landlocked and devoid of crude oil production or refinery capacities, the country meets all of its diesel-fuel needs through imports, with transit from neighboring countries' ports. The port of Abidjan in Côte d'Ivoire is the closest, at about 800 miles from Bamako, though the port of Dakar in Senegal accounts for about two-thirds of total imports.[45] EDM-SA's reliance on these long and difficult diesel supply chains leads to difficulties in providing electricity to remote rural areas and in providing consistent electricity to the mining sector through its main grid. EDM supplies 22 remote urban centers through an independent network using diesel generators and the Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER), which authorizes local private energy producers to supply the market through their own generators and solar grids.[46] As a result of the country's weak energy infrastructure, mines and other industries often supply their own energy, mainly through on-site diesel generators. This reliance on diesel for power also extends to humanitarian organizations, French military operations, and UN actors on the ground.

The import of fuel has been fully liberalized, allowing decentralized access to fuel supply. Around 60 companies, including multinationals, import and transport fuel from coastal ports to Mali and distribute it domestically. Additional domestic companies are involved in the distribution process, delivering fuel along roads in tanker trucks.[47] Prices are set by the ONAP on a monthly basis, taking supply prices, taxes, margins, and transport costs into consideration.[48] These are adjusted with lower taxes for more distant ports to ensure a diverse supply of diesel, avoiding events like the 2002 Côte d'Ivoire crisis — when supply lines had to be diverted — from impacting the fuel supply line to Mali.[49] Also of note, the Malian government had initiated oil exploration in northern Mali through the Autorité de la Recherche Pétrolière in the Ministry of Mines, though this was cut short by the 2012 conflict.[50]

Key Local Players

Since the AMADER framework allows for local private energy producers to provide energy directly in their local markets, there is considerable opportunity for decentralized, localized investment in new energy production that could potentially be stimulated by elevated government pricing structures to create a more attractive market for suppliers. Local energy producers mostly rely on diesel generators, with the cost of industrial grade generators in northern Mali starting at around 5.5 million FCFA (~$10,160). Benefiting from generous tariff schemes for those involved in supplying diesel to the market, a diverse array of companies are involved in diesel import and distribution. In Ménaka, for instance, there are three main suppliers of diesel: Entreprise de Construction pour le Développement du Sahel, Geco Sarl, and Hadaba Sarl. These companies import the fuel from Niger and Algeria primarily to supply the main consumers in town, including development and humanitarian offices.[51] Small consumers and street vendors depend on transporters bringing subsidized fuel from Algeria. With the absence of gas stations, the local population must buy diesel through informal street vendors and resellers.

In Timbuktu, a different set of local suppliers deliver diesel, including Oil Mali, Station Taoudenit, and Hama Ould Ahmed.[52] Similar to Ménaka, while some gas stations may be operational, street resellers remain heavily involved in the lucrative resale trade, with prices oscillating between 600 FCFA and 1,000 FCFA (~$1.10 and $1.84) for a liter of diesel. Gao also has a number of local companies involved in both the inventory management of diesel and diesel imports. In terms of inventory management, a number of individuals maintain private inventories. This is mostly used to supply different existing businesses, offices, and street vendors. Several companies import diesel from Niger for formal distribution to gas stations, managing both transportation and distribution, notably SONEF,

Société Tilemsi service, Société Ali Badi et fils, Gareka et fils, and Nour service.[53] When the flow across the borders is hindered, these actors and smaller suppliers may resort to contraband to fulfill the demand.

Alongside these companies, an informal network of diesel transportation and supply exists for the whole northern region. The lack of electricity infrastructure and a weak formal economy creates a strong black market for diesel, which members of various armed groups are able to exploit. For example, armed groups rely on weekly markets to sell contraband fuel at steep prices, as much as 2,000 FCFA (~$3.70) per liter in remote areas. Timbuktu is also supplied informally by local suppliers, with fuel coming from Algeria or Mauritania.[54] This is done in collusion with customs officers, necessitated by a market failing to sufficiently address the demand for fuel. It is difficult to quantify the profits generated by different armed groups from the diesel trade in particular, and the informal economy more generally. The dysfunction and weakness of the state in the North has allowed an informal economy to flourish, which ignores market rules and state legal, fiscal, and regulatory frameworks. Reliance on the informal economy has become an established and widespread practice in the North and is a barrier to efforts to restore a formal economy.

> The Security Council has cited the failure of the Malian government to adequately distribute resources across the whole of the country. That approach includes 'energy access' as a factor in the 'security and stability of Mali,' and encourages both the government and UN entities to understand and mitigate risks arising from this factor, among others.

The main players involved in fuel supply are local businessmen, known and respected within their communities. This is primarily because of higher risks of insecurity for outsiders, as well as an implicit agreement with the local power brokers, driven by economic interests. In northern Mali it is common for local influential political and economic actors to strike business deals with illicit actors, often along ethnic lines.[55] That said, it is also challenging for investors from outside northern Mali looking to engage in economic development efforts to infiltrate a market lacking in transparency and marked by endemic corruption. While such practices are perceived as illegal and unacceptable by the international community, they are perceived by northern communities as a key source for livelihoods and survival.

Practical Implications of a Complex Situation: The Case of Humanitarian Actors and Northern Mali's Fuel Economy

The international community has a significant engagement in the conflict in Mali, including in the form of international peace and security actors like MINUSMA, the G-5 Sahel and Operation Barkhan, and internationally supported humanitarian operations,[56] and development initiatives led by the UNCT and multilateral development institutions. Humanitarian actors play an important role in the fuel economy in northern Mali, and represent a significant portion of the demand side of the economy. For instance, Action Contre la Faim (ACF), Agence d'Aide à la Coopération Technique et au Développement (ACTED), the International Rescue Committee (IRC), and the German Development Agency (GIZ) spend $300 to $600 on monthly electricity bills for their offices in Gao and Ménaka.[57] Individual agencies can use up to 2,000 liters of diesel monthly, and their fuel expenditures can

View of a UN ambulance damaged during a deadly attack in Aguelhoc, Mali UN Photo/Marco

reach millions of FCFA (more than $1,800) during periods of high activity. Based on interviews conducted in Gao, Timbuktu, and Ménaka, this section explores how humanitarian nongovernmental organizations (NGOs) secure and acquire the fuel for their operations in the three key urban centers of the North. While small grids exist in most urban centers in northern Mali, the electricity supply remains insufficient to cover the demand of the local population and NGOs present in the towns.

Continuous access to electricity is crucial for these NGOs and humanitarian operations. In Ménaka, Gao, Timbuktu, Kidal, and other urban locations, energy is required for sustaining internet access for everyday operations, lighting for offices and security, and basic amenities for staff. Power outages are frequent, and thus all NGOs supplement their unstable grid connections with diesel generators for their operations. In the event of a spike in demand, major NGOs often issue a tender, and a supplier is chosen based on ability to supply volume, availability of fuel, and, most importantly, fuel quality. Lower quality fuel can yield reduced energy outputs and damage generators or vehicles. The makeup of fuel in most northern towns likely contains a mix of licit and illicit fuel supplies. Mechanisms do not seem to be in place to reliably discern between the two to avoid fuel contraband. This is due to three main factors. First, the failure of legally imported fuel supplies to meet demand in northern towns. Second, the inability of the state to put in place and enforce a control system guaranteeing legality or ongoing accessibility. Third, international borders are often not recognized by communities in northern Mali, where many communities survive based on cross-border commerce (both licit and illicit) and where members of diverse communities often hold dual nationality in neighboring states. Furthermore, corruption in the customs systems at these international borders undermines any efforts to deter these practices.

In Gao,[58] access to diesel is easier for NGOs thanks to the town's proximity to Niger and the presence of several companies supplying the local market through imports. However, contraband fuel is still present. Some of the

larger NGOs active in the city include the ACF Danish Refugee Council, GIZ, the International Committee of the Red Cross (ICRC), Médecins du Monde (MDM), the Norwegian Refugee Council (NRC), and Save the Children. These organizations work through local wholesalers, who provide the quantity and quality of fuel they require. As a matter of standard practice, the administrative paperwork of the sellers is checked to avoid ties with terrorist organizations. While GIZ, the NRC, and Save the Children issue calls for tenders for fuel, other NGOs rely on their own supply-chain manager to establish a contract with a supplier. Regular purchase orders for fuel are typically settled on a monthly basis, limiting the amount of fuel inventory NGOs must maintain but putting them at the mercy of price fluctuations. A liter of fuel currently sells for roughly 650 FCFA (~$1.20) at the station. Here too, NGOs rely on generators to secure electricity in case of power outages.

The situation in Ménaka[59] seems to be more prone to uncertainty. With no gas stations in town, fuel prices tend to be both higher and more volatile. This has led several NGOs to purchase larger amounts of fuel on the market when prices are lower, and to store this inventory for when needed. NGOs operating in Ménaka include ACTED, Développement Durable de Ménaka the IRC, MDM-Be (Médecins du Monde Belgique), and the NRC. All rely on diesel generators in case of power outages on the local grid. Some small solar systems are also used in Ménaka, mostly to guarantee stable internet. The IRC, for example, manages its diesel supplies by issuing calls for tender. Other NGOs prefer buying directly from the market, particularly for smaller quantities, which is sourced from Niger, Algeria, and even the city of Gao in some cases. An informal system, and absence of control, have made it impossible to know which is which.

In the context of Mali's diesel-fuel political economy, it seems clear that increasing access to renewable-energy infrastructure could provide peace dividends and unlock multiple benefits. For northern communities, cleaner, more consistent, and cheaper access to energy could help improve the environment and overcome regular electricity shortages and outages. If supported and effectively managed by Mali's government, a greater use of renewables could help instill confidence in the government, reduce the reliance on long and difficult fuel supply lines, and more effectively link northern communities to Mali's government. International support for a shift toward renewable energy could help international humanitarian and development actors operate more easily and efficiently and help to mitigate the unintentional deepening of communal conflict while advancing the implementation of the Algiers peace agreement.

4. THE ROLE OF ENERGY IN MINUSMA

While not the focus of MINUSMA's mission, the role of energy in the peace process and for the mission's own operations is central. This section looks at the mandate and deployment requirements, describing the role of energy in the substantive objectives of the mission and its operational profile. It then describes the mission's present energy profile, identifying the administrative and support conditions that influence energy production in its camps. It describes various motivations for a shift toward renewable energy production in MINUSMA that, to varying extents, have been taken into consideration by the mission in its energy planning, and explores the implications of these considerations for the mission's efforts to deploy a solar-energy pilot project.

Mandate and Deployment

Against the background of Mali's conflict history, MINUSMA's central mandate is to support the political process for implementation of the 2015 Algiers peace agreement. This mandate for MINUSMA, strengthened by the UN Security Council in 2020, aims to help address the historic inequities between the North and the South, and establish the fundamental functions of the state in the North. In its resolutions on Mali, the Security Council has cited the failure of the Malian government to adequately distribute resources across the whole of the country. That approach includes "energy access" as a factor in the "security and stability of Mali," and encourages both the government and UN entities to understand and mitigate risks arising from this factor, among others.[60] Mechanisms to address these challenges foreseen under the peace agreement include the operationalization of a Northern Development Zone for intensifying government and international development support for the North, "with a view to swiftly delivering peace dividends to the population."[61]

The primary strategic objective of MINUSMA, spelled out in its mandate from the Security Council (and renewed in Resolution 2531 of 29 June 2020), is to support the parties to the peace agreement in implementing their commitments. Its second priority is to support the more recent, and related, Stabilization Strategy for the Center of Mali, which foresees, among other things, the establishment of state authority in the region and the provision of basic services. Following the coup d'état of August 2020 and subsequent establishment of transitional arrangements, the Security Council also requested that the mission provide support to the transition process.[62]

To execute these tasks, MINUSMA's mandate implementation directly interacts with the political economy of energy in three ways: peacebuilding, mission logistics and security, and environmental stewardship. First, in providing support to the parties in implementing the agreement, the mission's roles range from the broad security guarantee provided by its physical presence and efforts to maintain stability and protect civilians as the agreement is progressively implemented, to more specific tasks such as providing support for the effective functioning of interim administrations in the North of Mali that are responsible for delivering development results. This work requires a detailed knowledge of the political and economic operating environment in which MINUSMA is deployed, and a dynamic understanding of conflict drivers, threat profiles, and opportunities across the country. MINUSMA hosts a number of peacekeeping-intelligence capacities to enhance its conflict analysis and improve situational awareness. These include both tactical sensors to identify immediate threats and more strategic tools to help the mission analyze population movements, economic trends, and ecological phenomena and the effects of global warming. This heightened understanding of the operating environment helps to inform efforts to design and target political and programmatic support to interim administrations in the North managed through the mission's Stabilization and Recovery Section. The section marshals financial assistance from the international community toward strategic projects that support peacebuilding objectives, as well as activities funded through assessed funding for the mission and managed under several substantive sections of the mission. These include, for example, community violence reduction projects implemented by the Disarmament, Demobilization and Reintegration/Security Sector Reform (DDR/SSR) section.

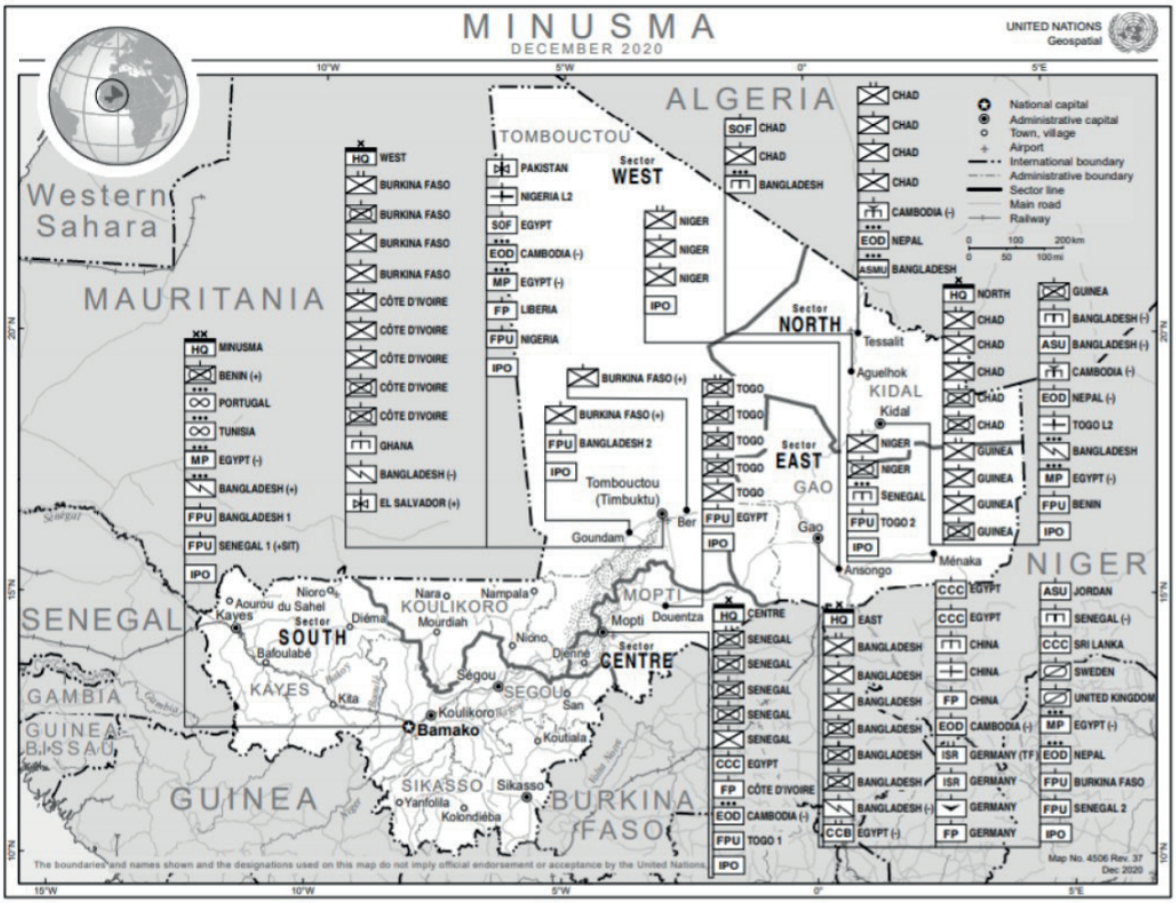

Figure 1. MINUSMA deployment map[63]

Second, MINUSMA has a challenging supply chain with serious security risks. In light of the targeted attacks it has faced in the past, the mission is tasked with "improving logistics in mission, in particular by taking all necessary measures to secure MINUSMA's logistical supply routes …" As discussed in greater length below, MINUSMA's efforts to secure its supply lines to date have consisted of a combination of strategies to increase the uniformed security capacities that accompany its convoys. The convoys have been the target of frequent attacks over the mission's lifespan, and the mission has made efforts to reduce the size and frequency and increase the speed of the convoys themselves.

Finally, MINUSMA is engaged in strengthening its environmental practice. The Security Council has requested that the mission "consider the environmental impacts of its operations when fulfilling its mandated tasks and, in this context, manage them as appropriate and in accordance with applicable and relevant General Assembly resolutions and United Nations rules and regulations."[64] In practice, this task spans a wide range of mission operations, from waste management to sustainable water sourcing, transportation, and energy efficiency and production, described in the 2009 Environmental Policy of the Department of Peacekeeping Operations and the Department of Field Support.[65] This part of the mandate has existed since MINUSMA's inception in 2013.[66]

MINUSMA currently has a long-term presence in 11 principal and secondary cities and towns throughout Mali, divided by the mission's military component into sectors that align closely with Mali's administrative divisions at the time of the mission's inception, and that align with the concentrations of international and national

development actors' operations in the country. The mission's headquarters is located in Bamako, where it has multiple physical presences, including Sector South Headquarters. Sector Centre is headquartered in Mopti, with a secondary location in Douentza. Sector East is headquartered in Gao, with secondary locations in Ménaka and Ansongo. Sector West is headquartered in Timbuktu, with secondary locations in Ber and Goundam. Finally, Sector North is headquartered in Kidal, with secondary locations in Tessalit and Aguelhok.[67] Figure 1 shows the mission's deployment across the territory of Mali, including the national contingents deployed to each mission location.

MINUSMA's Energy Supply and Implications

The overwhelming majority of MINUSMA's energy requirements are met through diesel generators. Over half of the mission's diesel usage is dedicated to electricity generation, while 30 percent is used by mission vehicles. The mission makes heavy use of sheet-metal-clad, insulation-foamed, panel prefabricated structures that require large amounts of energy to keep cool, representing a major source of power consumption.[68] For the 2020-2021 budgetary year, MINUSMA anticipated using 55.8 million liters of fuel, of which 29.2 million liters, or 52 percent, were used for generators — an increase of 3.7 million liters, or 13 percent, from the previous year.[69]

Outside of Mali's capital city Bamako, MINUSMA's field presences are almost exclusively consolidated into large, multiuse camps that house the mission's regional office, the military and police component's sector or subsector headquarters, individual military units, mission support services, and infrastructure. In Gao, Mopti, Ménaka, and Kidal, camps include civilian offices and housing. The Timbuktu regional office is adjacent to the Sector West super camp but supplied from the same internal grid. Energy for these four Sector Headquarters camps comes exclusively from one of two sources operated by the UN and its troop- and police-contributing countries (TCCs/PCCs), neither of which are connected to Mali's electricity infrastructure: either 1) a UN-owned equipment (UNOE) grid, or 2) contingent-owned equipment (COE) minigrids. For the UNOE grid, 337 UN-owned diesel-power generators supply energy for low- or medium-tension grids that power UN-owned facilities like offices, mission telecommunications, civilian housing, and camp security systems in 11 mission locations.[70] For the COE minigrids, each military unit and formed police unit stationed in the sector maintains a subcamp within the super camp, providing power through their own equipment.

That self-generation approach is laid out between the UN and each TCC/PCC through the statement of unit requirement, and the subsequent major equipment deployed by the TCC/PCC within an established memorandum of understanding is reimbursed by the UN, through a "wet lease"[71] arrangement. Since 2017, TCCs and PCCs may bring a variety of types of generators as part of this arrangement — including hybrid solar-diesel generators — which are reimbursed by the UN. Despite a higher rate of reimbursement for these types of generators, the power-generation infrastructure currently deployed by TCCs/PCCs in MINUSMA consists solely of diesel generators. Collectively, they account for more than 50 percent of the mission's total use of fuel for energy generation.[72] The types and features of COE generators vary widely: some are equipped with digital meters that measure energy output and efficiency, while the output of others can only be estimated by the amount of fuel they are reported to use.

For the MINUSMA mission structure and operating environment, this UNOE and COE setup is highly inefficient and environmentally harmful.[73] The requirement that contingents supply their own energy-generation capacities is one aspect of the long-standing principle of self-sustainment that enables individual units and subunits to be deployed flexibly throughout a peacekeeping mission's area of operations. Units, for example, may be sent to establish and maintain a company operating base far away from Sector Headquarters. While such a capability for mobility remains necessary for peacekeeping missions and some units, most of the military components are deployed in super camps. As such, their energy needs would be better met through a single, centralized grid for each camp. In turn, that approach could unlock opportunities for larger, more efficient, and greener energy

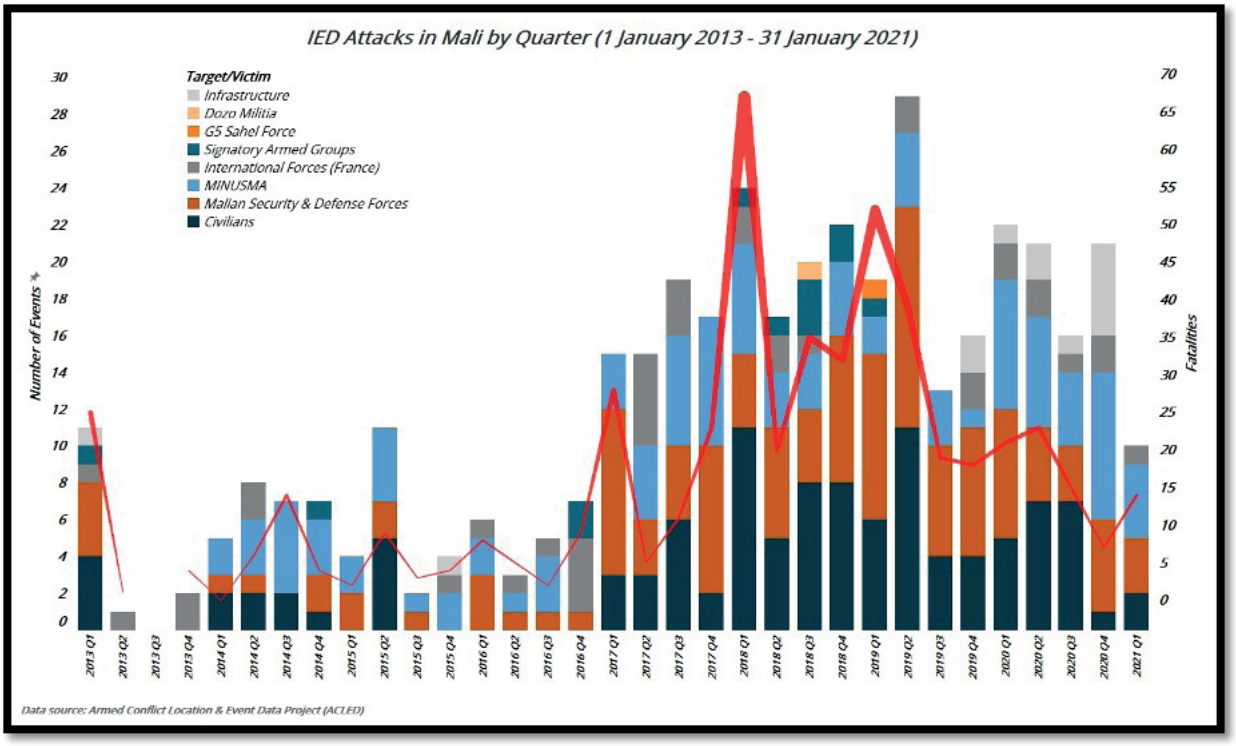

Figure 2: IED Attacks in Mali from January 2013 to February 2021

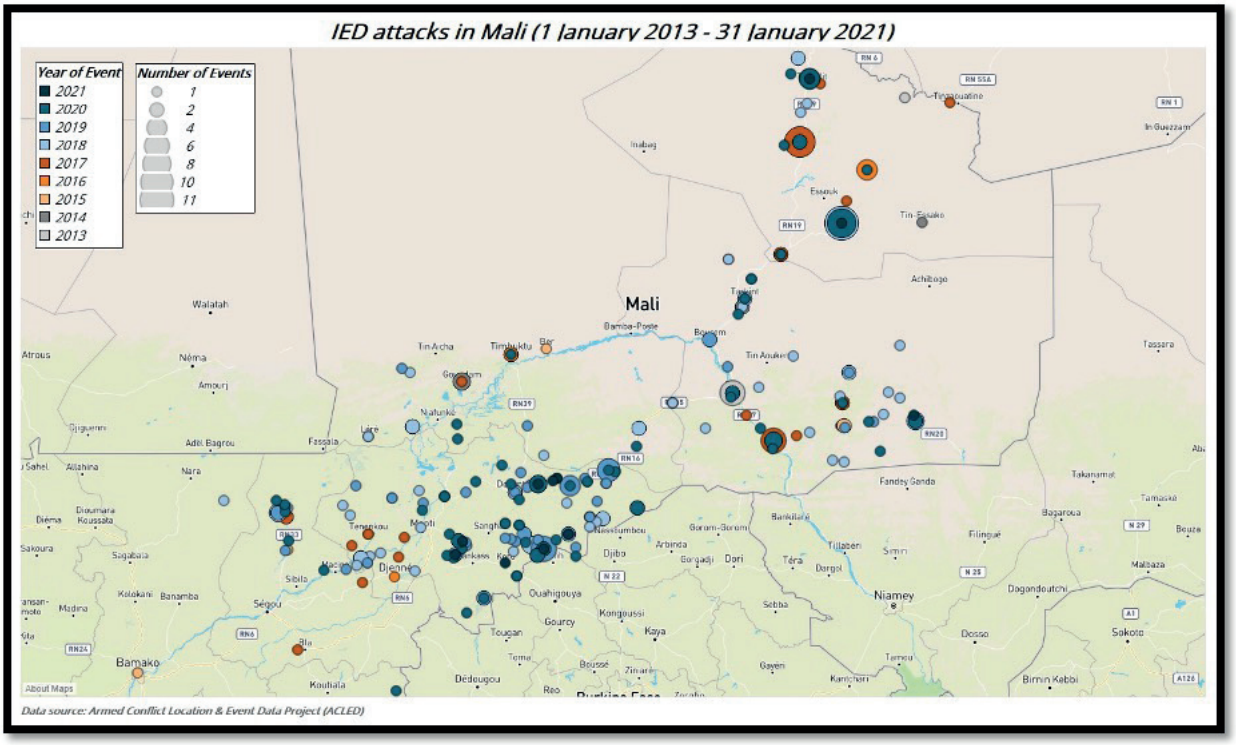

Figure 3: Mapping of IEDs throughout Mali from January 2013 to February 2021

systems for missions, while reducing emissions and the environmental risks from fuel spillage and seepage that are common to any large-scale operation.

Fuel for both UNOE and COE generators in MINUSMA's field locations is supplied by the mission support component. The provision of diesel fuel makes up an important segment of the mission's supply requirements. The mission's fuel sources are secured through turnkey contracts with multinational companies that deliver diesel from Abidjan to fuel storage facilities in Bamako or, in some cases, are delivered directly to field locations from Cotonou via Mali's western border. For fuel transported from Bamako, contracted tanker services join mission supply convoys that deliver the fuel to 13 storage and distribution points[74] in super camps and more distant locations, except in the rainy season when river barges are used instead.[75] Fuel comprises between one-third to one-half of standard resupply convoys to field sites, the majority of which is for electricity generation, in addition to jet fuel for aviation and diesel fuel used for transport.[76] The convoys also include fresh and preserved food, COE equipment and parts, and UNOE equipment and facilities. While it is the food resupply that commonly dictates the frequency and schedule of the convoys, the large diesel-for-power requirements contribute to the size and speed of the convoys, exposing them to greater risk as dozens of large, slow-moving tankers lumber along poor roadways.

> Outside of Mali's capital city Bamako, MINUSMA's field presences are almost exclusively consolidated into large, multiuse camps that house the mission's regional office, the military and police component's sector or subsector headquarters, individual military units, mission support services, and infrastructure.

Mission officials estimated that introducing renewable energy could reduce the fuel component of the convoys significantly. In turn, this could reduce the size of convoys by one-third to one-half. These smaller convoys would make transport easier and faster, and reduce the risk of breakdowns and delays. Smaller, faster convoys would be easier to protect against attack, thereby reducing the proportion of the mission's military capabilities that need to be dedicated to logistics instead of substantive tasks.[77]

Addressing Insecurity and Reducing the Carbon Footprint: Rationales for Renewable Energy in MINUSMA

For MINUSMA mission support personnel, the rationale for a move to solar energy is clear and necessary given the gravity of the security and support requirements of the current system. Since the mission's opening, at least 138 peacekeepers have been killed by malicious acts, many of them during attacks on supply convoys.[78] While this figure represents the highest fatality rate for uniformed peacekeepers in any peacekeeping mission, the United Nations data fails to report on the frequency of these attacks and the extent of injuries and nonpeacekeeper fatalities sustained during these attacks. There is generalized data from other sources, including reports to the Security Council. In a typical three-month period in 2019, for example, the Secretary-General reported to the Security Council that three violent attacks had taken place against MINUSMA logistics convoys. The first attack, on 26 July, occurred in the Bambara-Maoudé area of the Timbuktu region and resulted in the injury of six peacekeepers, when an armoured personnel carrier escorting a convoy hit an improvised explosive device (IED). A second IED attack, on 16 August in the Ménaka district, killed a civilian logistics

contractor and injured two others. A third IED attack on a mine-protected vehicle escorting a convoy near Kidal on 20 August wounded seven peacekeepers, one seriously.[79]

Pressure for the UN to address these incidents grew in 2017, when Lt. Gen. Alberto dos Santos Cruz, former force commander of the UN Organization Stabilization Mission in the Democratic Republic of the Congo (MONUSCO), led an analysis of safety and security in UN missions. His report found that frequent, long, and slow supply convoys accounted for a major source of security exposure for missions. Across all peacekeeping operations between 2013 and 2017, attacks on convoys, patrols, and escorts accounted for 98 peacekeeper fatalities, more than any other type of threat. Cruz found that in addition to the security risks associated with these convoys, missions dedicate as much as 90 percent of their operation capacity to escorts and convoy protection, radically reducing their capacity to perform substantive tasks such as the protection of civilians. Cruz argues that "logistically, we need to know why our presence has to be so big. Do we need to be economical with our presence to reduce the need for heavy convoys?"[80] The findings and recommendations of the Cruz report featured heavily in the debates leading to the UN's 2018 Action for Peacekeeping agenda, which serves as the framework for efforts to reform and strengthen peacekeeping, and which prioritizes safety and security as one of its eight priority commitment areas.[81] As part of these efforts, MINUSMA has generated and deployed four specialized combat convoy companies dedicated exclusively to securing logistics convoys.[82] However, IED attacks against MINUSMA convoys and other actors have continued, albeit at lower levels (see figures 2 and 3), and are likely to continue.

In addition to mission requirements and security driving UN operations to explore the use of renewable energy, peacekeeping operations are also interested in reducing their emissions. In 2020, UN peace operations accounted for 42 percent of the UN system's carbon footprint, and peace operations are coming under increased pressure to reduce their own emissions.[83] In 2019, the UN Secretariat Climate Action Plan (UNSCAP) brought new urgency to these efforts. Through this plan, the Secretary-General committed the UN Secretariat to achieve absolute and per capita emission reductions of 25 percent by 2025 and 45 percent by 2030, and to shift to renewable-energy sources, with a goal of 45 percent renewable-energy usage by 2025 and 80 percent by 2030. Significant progress in UN missions will be required to meet these targets.[84]

The DOS Environment Strategy for Peace Operations, which came into effect in 2017, focuses on energy as one of its five pillars. Phase One of the strategy (2017-2020) focused primarily on reducing energy demand. It required each field operation to develop an Energy Infrastructure Management Plan (EIMP) that established a baseline of its energy demand and production, to be used in developing specific energy infrastructure project plans.[85] MINUSMA has undertaken several initiatives aimed at reducing energy demand and consumption, ranging from communication campaigns, usage monitoring, generator synchronization, installation of energy-efficient appliances, and generator size-requirement reviews. The EIMP and the Mission Environmental Action Plan contain performance and process indicators against which progress can be measured, although the mission is still in the process of establishing baseline data.[86]

Phase Two of the Environment Strategy (July 2020 to June 2023), formally launched in March 2021, will continue to emphasize efficiencies in the use and consumption of energy, and will pursue "innovative solutions to increase the use of renewables" through outsourcing, partnership, leasing, and other options.[87] In its updated Phase Two strategy document, the DOS identifies the main system-level constraint hindering the deployment of renewable energy as the current high installed-unit cost of solar photovoltaic (PV) systems purchased through global systems contracts. The DOS also notes that the UN's current contract model is unable to keep pace with renewable-energy technology advancement, thus not allowing the UN to capture advances in the market. To respond to these constraints, the Environment Strategy establishes core objectives to accelerate the deployment of renewable energy, including obtaining competitive prices, leveraging economies of scale, reducing risk and liabilities, and accelerating project execution. Phase Two also forecasts an increased willingness to pursue

outsourced, "outside-of-the-fence" initiatives to reduce missions' costs for energy and capital expenditures, while also mitigating issues missions face during drawdown. According to the DOS, these types of projects have the "secondary benefit of anchoring renewable energy capacity that could be sustained after the departure of the mission," and could be "combined with projects that provide local communities with an immediate sustainable source of energy and/or leave a positive legacy."[88] Finally, the Environment Strategy emphasizes the need for the UN to extend central power supply to TCCs/PCCs that are co-located in, for example, super camps, while maintaining the operational autonomy of individual contingents and units through backup generators. Regardless of the source of this energy, such a measure should cut down significantly on the use of small COE generators.

A Missing Factor in MINUSMA's Renewable-Energy Planning: The Climate and Security Agenda

There are strong arguments in favor of MINUSMA embracing a strategic shift to renewable energy — including safety and security, institutional climate goals, and the challenges related to energy poverty in northern Mali. However, there is little evidence of exchange between MINUSMA personnel involved in renewable-energy efforts and those that might be best placed to consider how these initiatives might affect, facilitate, support, or hinder the mission's broader mandated tasks and objectives, including the stabilization of the country, the advancement of the peace process, and the protection of civilians. This seems largely due to the organizational setting for efforts related to renewable energy in MINUSMA, which fall squarely under the Director of Mission Support and have been delegated to the Office of Service Delivery. There appears to be little interaction between these efforts and, for example, the work of the Civil Affairs Division, the Joint Mission Analysis Centre, or the Integrated Office of the Deputy Special Representative of the Secretary-General/UN Resident Coordinator/Humanitarian Coordinator, who is responsible for coordination between the mission and the development and humanitarian agencies in the country.

At the UN Headquarters level, however, there is an increased understanding of the linkages among climate change; human development indicators, such as energy access; environmental footprints of peacekeeping operations; and stability. These issues have come to feature more prominently in Secretariat policy and Security Council debates in recent years. In addition to the Secretary-General's commitments to deliver on the increased use of renewable energy and on carbon neutrality, a number of policy debates in the Security Council referencing the issue of climate security have impacted these understandings. First is the emphasis placed on the environmental consequences of armed conflict and the implications of environmental degradation on the livelihoods of conflict-affected populations, which dates to the end of the Cold War and led to the General Assembly's designation of 6 November as the International Day for Preventing the Exploitation of the Environment in War and Armed Conflict in 2001.[89] This discussion continues to feature on the Security Council's agenda, including in an Arria-Formula meeting on the topic convened jointly by four non-permanent members in December 2019.[90]

Similarly, a "climate change and security" agenda has gained momentum over the last decade, part of which the Security Council has increasingly acknowledged, and the Security Council has also responded to the impact of climate change on international peace and security. In practice, this has often meant ensuring a fuller understanding of how climate-related issues affect communities and populations, and this in turn affects conflict dynamics. The inclusion of references to climate-related conflict drivers in Security Council documents is now common for the Council's engagement on several regions, including the Lake Chad Basin, Sudan and South Sudan, and the Horn of Africa.[91] Indeed, since 2011, the Security Council has specifically requested that the Secretary-General's report contain analysis on climate-related issues that have a bearing on peace and security.[92] For Mali, the Council has emphasized "the need for adequate risk assessment and risk management strategies, by the Government of Mali and the United Nations, of ecological changes, natural disasters, drought, desertification, land degradation, food insecurity, energy access, climate change, among other factors, on the security and stability

of Mali."[93] These factors have been analyzed in detail in a 2021 report by the Stockholm International Peace Research Institute, which traces the links between climate change, livelihoods and security dynamics; for example, the recruitment into armed group and criminal organizations. The report also details the direct effects of climate trends on MINUSMA's own operations and peacebuilding efforts, including logistical and supply challenges cause by extreme weather and the weakening of local conflict-resolution mechanisms that serve as an important interface for the mission.[94]

An increasingly important line of debate within the climate and security discourse relates to the roles that adaptation and resilience play in mitigating conflict dynamics and preventing violence. At a high-level open debate of the Security Council on the theme of "addressing climate-related security risks to international peace and security through mitigation and resilience building" in February 2021, the United Kingdom, which held the presidency of the Council that month, asked members to consider how efforts to build resilience and support adaptation to the effects of climate change could also play a role in preventing conflict and promoting peacebuilding and stability.[95] As noted above, this notion has been internalized in the 2015 Agreement on Peace and Reconciliation in Mali. At the time, Mongi Hamdi, then-Special Representative of the Secretary-General (SRSG) of MINUSMA, described the agreement as a "political, institutional, security, humanitarian, and development compromise," declaring that, "concretely, the people of Mali, particularly those of the northern regions, are for only one thing: security and the return of basic social services …"[96] The World Bank has arrived at a similar analysis, concluding that "making more effective use of budgetary resources for electricity and agriculture is critical for delivering better services at the local level. Improved access and delivery of services should contribute to the stability of the country and address some of the drivers of fragility."[97]

With this relatively institutionalized understanding of the linkages between climate change, electrification, security, and stability in northern Mali, this analysis is not yet what guides the offices responsible for designing the mission's energy infrastructure. As discussed in the following section, without that broader approach driving plans, missions will be more limited in their approach to energy options. This would result in a relatively narrow scope for the planning of the mission's renewable-energy pilot project, which may have missed opportunities to contribute to the mission's substantive objectives.

5. TOWARD A RENEWABLE-ENERGY FUTURE FOR MINUSMA

In the context of the challenges and motivations discussed in the previous section, in 2017 MINSUMA's mission support component began designing a solar-energy pilot project that would inform the eventual rollout of a mission-wide renewable-energy system. This section discusses the institutional arrangements governing the introduction of new technologies in peacekeeping missions, and analyzes the planning process and technical and financial specifications of the pilot process. It then highlights several considerations for any expansion of a future system to cover the entire mission.

Designing and Deploying Technology Solutions in UN Field Missions

The use of new technologies, including renewable-energy systems, in UN peacekeeping operations is decentralized and loosely governed. The process is managed through a combination of Headquarters-driven and systemwide tools, targeted initiatives led by different parts of UN Headquarters, and innovation and experimentation by individual missions. At Headquarters, new technology solutions for MINUSMA have originated in a variety of places. These include the deployment of new surveillance technologies at the initiative of the Office of Military Affairs, the development of digital situational awareness by the UN Operations and Crisis Center, and the deployment of new forensics technologies through the support of the Police Division. More centralized, the Office of Information Communications and Technology (OICT), which backstops mission-level Field Technology Sections (FTS), manages the rollout of new enterprise tools. The OICT also regularly undertakes targeted initiatives to deploy new tools for specific purposes in individual missions, and often supports the development and deployment of new initiatives managed by other parts of UN Headquarters for peacekeeping.

While subject to the same UN procurement rules and regulations as UN Headquarters, missions have considerable leeway in identifying needs, developing statements of requirements, and seeking new solutions on the market or through partnerships with troop- and police-contributing countries. In such cases, the OICT can play a facilitating role, advising the Director of Mission Support to Chiefs of FTS to accurately describe technology requirements, building on experiences and good practices from other missions, and connecting field technology staff with suppliers of new technologies. To this end, in 2015 the predecessor of the OICT began convening periodic technology fairs in member-state capitals where mission staff could discuss common challenges, share good practices, and meet technology experts and suppliers from member states and the private sector.

The MINUSMA Solar Pilot Project

The origins and technology of MINUSMA's solar pilot project are unique to the mission. At a technology fair organized by the OICT and the UN's Procurement Division in Valencia in October 2017, MINUSMA's mission support component identified and selected a solar energy system from a vendor attending the fair. The manager of the pilot project, who was a participant at the technology fair, told the authors of this report that the approximately 90 vendors at the fair had been pre-cleared from a procurement perspective for partnerships on new technology pilot projects.[98] In fact, vendors at the fair had no such formal pre-clearance or special status with the Secretariat's procurement system. Nevertheless, the mission entered into a single-source procurement contract with the supplier. The contract took almost three years to negotiate and receive approval from the UN Headquarters Committee on Contracts, which ultimately approved it with the understanding that the information learned from the single-source pilot project would be used to develop a statement of work for a mission-wide solar-energy solution that would go to the global market and could serve as a model for other UN field missions. The misperception on the parameters of the technology fair vendors points to the larger need for clarity in the roles and responsibilities across peacekeeping missions and the UN Secretariat for identifying technology requirements, market research, and risk management in new technology partnerships and procurement.

Mission support staff explained that, as they sought out a renewable-energy system, they had three basic requirements in addition to delivering the required energy output: the system had to be mobile, environmentally friendly, and come at no additional upfront cost for the mission. The option identified at the technology fair, provided by a small Danish startup company, met these three requirements. The company offered a scalable package of industry-standard solar panels, which delivers energy into a vanadium redox liquid-storage system (commonly known as a redox flow battery) that, according to the mission, is reputed to be one of the most environmentally friendly battery systems over a 25-year lifespan. The system is modular, and will be delivered (and can be repackaged) in containers that could be flexibly moved if necessary. Most storage systems for off-grid solar projects use lithium-ion or lead-acid batteries. Redox flow batteries are not yet a common battery technology for off-grid solar projects or more generally. This is believed to be the first-ever deployment of a redox flow battery in a UN mission, and among the first such batteries to be deployed with a solar project in Africa beyond a handful for mining sites in South Africa.

The pilot is still under development. When completed, the solar and battery system is to be deployed in the main MINUSMA operational base in Bamako. The system will have a capacity of 3,000 kWh, requiring 18,000 square meters of space within the camp to deploy. The mission support team elected to take advantage of the large, unused space around all MINUSMA bases created by the standoff distance between the inhabited portion of the bases and their outer perimeter, and required by security precautions. The solar panels placed in these spaces will be linked to two storage locations that will feed into the camp's centralized grid infrastructure.[99]

The financing model of the MINUSMA energy pilot project is critical to its viability. Traditionally, the one-year mandate and budget cycles of peacekeeping missions have made it difficult for the UN General Assembly to approve upfront investment in capital expenditures that would pay off over multiple years, even when a mission was highly likely to remain in place for years. As with renewable-energy projects recently introduced in South Sudan and Somalia,[100] MINUSMA's pilot project addresses this constraint by placing the burden for financing on the supplier, who is responsible for acquiring, installing, and, in the initial amortization phase, maintaining and operating the equipment. Energy produced by the system is sold to the mission at an agreed rate per kilowatt-hour. The pilot project's amortization phase, or payback period, will continue until the capital and production costs and agreed profit margin are met — estimated to take three to four years — at which point ownership and responsibility for maintenance and operation will pass to MINUSMA. It is anticipated that during this period, the supplier will help train mission personnel to operate and maintain the system, thereby building this skillset into the UN international and national human resources pool.[101] While no formal thought had been given to the use of the system after the end of the mission's deployment, mission support staff suggested that individual modules of the system could be provided to local organizations through the mission's Quick Impact Projects (QIPs) program, or handed over to the host government as part of the mission's liquidation at its closure.[102]

To arrive at an agreed rate of payment for energy generated during the amortization period — and to justify this rate to the Headquarters Committee on Contracts — the mission had to calculate the all-in price for energy consumed in the mission, incorporating the full set of costs associated with energy provision. While mission personnel were unwilling to share the calculations, they reported that the rate agreed on with the contractor was between $0.84 and $0.87 per kWh, based on an estimate of the true cost of energy consumed by the mission's most remote field location, in Tessalit.[103] In addition to the cost of purchasing the fuel itself, this high figure likely includes some combination of the cost of contracted transport services to deliver the fuel by road; the costs of mission security details, aerial reconnaissance and deterrence, and emergency-response capacities mobilized to protect convoys; payments to national security services escorting MINUSMA convoys; and, when security conditions were nonpermissive or the requirement for fuel was urgent, the cost of delivering diesel by helicopter. Strictly speaking, since the pilot project is based in Bamako and not in Tessalit where these additional costs are incurred, the mission will be heavily overpaying for energy consumed in Bamako during the amortization period.

Atul Khare, Under-Secretary-General for Operational Support, speaks to staff serving with the UN Multidimensional Integrated Stabilization Mission in Mali (MINUSMA) during a launch ceremony of the new supply chain management system for all UN field offices. UN Photo/Sylvain Liecht

However, this higher rate will shorten the payback period. Further understanding of the mission's approach to calculating its all-in energy costs would be valuable in analyzing the cost-benefit analysis and generating recommendations for other field missions.

The current reliance on diesel convoys redirects scarce mission resources away from substantive mandated tasks, including the protection of civilians, and carries costs including the injuries or deaths of peacekeepers during attacks on mission supply convoys. These are reportedly not included in the calculation of the cost-benefit analysis for transitioning to a renewable-energy solution. The indirect benefits from achievement of the mission's mandate to a shift to renewable energy are significant, however. Further still, as one MINUSMA staff member noted, "every time you lose a fuel truck, you know this fuel will go towards attacking you."[104]

At the same time, a renewable-energy system will come with logistical and security implications, particularly as it is being tested for the first time. Implications include the costs of protecting the systems from attack or theft, and, following the completion of the payback period, the cost of replacing any parts of the system that might be damaged during an attack. There may be additional costs for maintaining business continuity in the event the system is inoperable for an extended period of time. Since the pilot project is to be located in Bamako, the varied costs and savings associated with a future system deployed in mission field locations will be directly measurable through the pilot.

In addition to the mission's efforts to deploy large-scale solar systems, MINUSMA and the UNCT in Mali have collaborated to reduce the impact of staff residential accommodations. A smaller, innovative, and highly promising pilot project started in 2019, when the UN Security Management Team (which includes all heads of UN presences in the country and is chaired by the SRSG, who is also the "designated official" under the UN Security Management System) approved a pilot project aimed at making small-scale renewable-energy systems for UN personnel. The decision amended arrangements under the country's Residential Security Measures, whereby staff could be reimbursed for installing solar systems sourced on the local market instead of receiving the traditional reimbursements for generators and fuel.[105] Staff members who voluntarily opted for this measure in Bamako and Mopti reported high levels of satisfaction with the systems and their reduced emissions and noise pollution, as well as the business continuity provided during COVID-19 lockdown measures that forced many to work from their residences.[106] As the socioeconomic and environmental impacts of peacekeepers on their host communities become better understood, the Residential Security Measures solar pilot is an important first step with the potential to be scaled across UN field operations worldwide.

This pilot is also an example of effective cooperation on environmental impact reduction across the mission and the UNCT, which could be scaled up as part of MINUSMA's rollout of a mission-wide renewable-energy system. In addition, the Department of Management Strategy, Policy and Compliance should lead an effort to clarify the application of existing UN rules and regulations as they relate to pilot projects, and develop guidance for Headquarters and field missions on the design and implementation for expedited, small-scale pilot projects of the type MINUSMA is developing.

The COE Barrier to Scaling a Mission-wide Solar System

As MINUSMA's solar-energy pilot project is implemented, and as the mission prepares to deploy a mission-wide renewable-energy solution to all or most of its bases, there are several factors to consider that could enhance or hinder the solution's impact on emissions, cost savings, convoy security, and its ultimate mandate: to help support peace in Mali. Above all, a mission-wide system will need to contend with uniformed contingents' use of diesel to power small COE generators. While these generators are unlikely to be rendered obsolete by a solar-power system — they will still be required as backups — as long as the system is running, contingents would presumably only need to operate them in the event of a failure of the primary system or if energy needs were to surpass its capacity. This assumes, however, that all contingents would be willing to connect to the central grid for their energy needs and use generators only when necessary.[107] This approach will need testing. Some contingents may prefer to use their own energy sources to power sensitive equipment, while others may see the current system of COE reimbursement as being financially advantageous.

6. OPPORTUNITIES FOR PEACE AND DEVELOPMENT DIVIDENDS IN A MISSION-WIDE SOLAR-ENERGY SOLUTION

As this anlysis has shown, MINUSMA's planning around renewable-energy concepts for the mission is largely tied to the design of the solar technology system identified at the 2017 technology fair. The managers of the pilot project took several factors into consideration: the mission's environmental footprint (reduced carbon emissions and the environmental impact of the system itself); convoy security, in terms of the potential benefits to sites outside Bamako of shorter, faster supply convoys that, lacking fuel tankers, would present less attractive targets to armed groups; cost efficiency, in terms of the savings offered by a renewable system and the financing structure of the solution; and operational considerations, in terms of how the system would be maintained and how it could be moved from place to place. On its own, this approach places MINUSMA as among the more forward-leaning UN peacekeeping missions with regard to renewable-energy considerations.

The pilot project has focused exclusively on a UN-only, behind-the-fence solution, however. As such, the concept for the pilot did not consider broader political, security, and mandate-related questions. These questions include how the energy solution could contribute to mission confidence-building and strategic communications objectives by delivering a peace dividend for local communities; how the project could contribute to development objectives by helping to build the domestic renewable-energy market, particularly in the underdeveloped North; and how the mission could leverage its financial and operational capacities to support and extend local energy services. These factors have the potential to leverage a shift to renewable power to contribute to broader stabilization and development objectives detailed in the mission's mandate, including the electrification and renewable-energy-related aspects of the 2015 Agreement on Peace and Reconciliation in Mali and complementarity with the UNCT.[108]

Generating Peace Dividends

Based on an examination of existing practice in other missions, the structure of the energy sector in Mali, and the analysis and programming of UN agencies, funds, and programs in the country, MINUSMA has a significant opportunity to advance many of its goals through its energy transformation. This includes improving the permissibility of its operating environment and contributing to the achievement of the UNSCAP, which calls on UN entities to embrace "sustainable development co-benefits" by contributing to "climate smart infrastructure and other sustainable development benefits to local communities."[109] To do that, however, MINUSMA's current approach will need to be expanded and supported.

The potential of solar energy as a means of expanding electrification and, in turn, delivering peace dividends that contribute to long-term stability has been well understood by the parties to the 2015 peace agreement as a core area of opportunity for strategies to stabilize northern Mali and the broader Sahel region. As noted in the UN Integrated Strategy for the Sahel, the region boasts unparalleled solar generation capacity.[110] Moreover, the diversity in scale and output of solar technologies provides for a blended approach of smaller distributed solar systems and larger grid-based systems that are well suited to the diffuse geography of the North. This logic underlies the theory of change for the World Bank's considerable interventions in the energy sector in Mali, which posits that a combination of intensive distribution of minigrids throughout the country, combined with large-scale energy generation and import through regional initiatives will bring about broad-based, sustainable, and relatively affordable energy to all primary and secondary cities in Mali, as well as rural areas where a national gird is not feasible in the near future.[111]

MINUSMA's Stabilization and Recovery Section (SRS) coordinates several efforts across the humanitarian, development, and peacebuilding spectrum through projects for inclusive dialogue, the restoration of state authority, and the return of basic social services at the community level, particularly in northern Mali. It pursues these efforts through two programmatic mechanisms. First, the mission implements QIPs, which are small-scale, short-term projects aimed at "meeting priority needs of the population and [...] building confidence towards the peace process, the Mission and its mandate."[112] Between 2013 and 2020, MINUSMA implemented over 600 QIPs. Of these, 13 percent supported the development of public facilities and spaces and 8 percent helped to build local economies, both of which included the installation of small-scale solar energy technologies.[113] Second, the SRS coordinates the substantive implementation of the Trust Fund for Peace and Security in Mali, a multidonor trust fund with a budget approaching $100 million in international donor contributions. Since its establishment in 2013, the trust fund has executed multiple renewable-energy projects linked directly to peace consolidation objectives. These include initiatives to distribute thousands of solar home systems to households in Kidal, Timbuktu, and Goundam, among other locations, linked to mediation efforts in these areas; and the installation of solar lighting in public spaces in Aguelhok, Tessalit, and Ménaka, among others.[114] Other mechanisms delivering renewable-energy programming include the UN Peacebuilding Fund's investments in the Sahel, which follow the approach of the UN Integrated Strategy for the Sahel, aiming at cross-border projects that address transnational root causes of conflict.[115] Between 2017-19, the Peacebuilding Fund financed projects worth more than $8 million with objectives including security, social cohesion, community dialogue, and peace consolidation.[116]

Strengthening the Local Energy Market

The Malian energy sector is severely lacking, particularly in the most conflict-affected parts of the country, and the renewable-energy sector is in its infancy.[117] A review of the local energy-technology market conducted as part of the Residential Security Measures solar pilot project found that, while there are some distributors of high-quality solar systems in the country, all possess minimal operating capital and thus focus primarily on short-term, low-risk projects. None would be capable on their own of securing the upfront financing for a system of the scale and time frames required by the peacekeeping mission. Moreover, MINUSMA personnel highlighted the concern that a paucity of skilled maintenance capacity on the local market would present serious liabilities for any system procured without accompanying operating and maintenance services, especially in the initial phases of the initiative.[118]

Nevertheless, the energy market in Mali has seen recent growth in entrepreneurial activity, and the regulatory environment is conducive to rapid growth. Energy companies are permitted to negotiate 15-year concessional agreements to provide power across a set geographic grid area, with the cost of power fixed on the basis of an agreed analysis of costs and risks. If MINUSMA was willing to procure energy from a local project and serve as an anchor client, the financing needs could certainly be overcome, given growing international and continental investment in renewable-energy projects in Africa.[119] Once the challenges of financing are overcome, the expansion of renewable-energy supply could be explosive and quickly become highly competitive.[120] While building the local private sector is beyond the scope of the mission's mandate, an expansion of the national capacity to meet existing energy needs with renewable energy rather than fossil fuels could constitute a significant "sustainable development co-benefit" of MINUSMA's investment in renewable-energy infrastructure, as envisioned in the UNSCAP.[121]

The UN as an Anchor Client

A source of catalytic, transformational financing for the Malian renewable-energy market may lie in the presence of a large, financially reliable, stable source of energy demand. The recent agreement between the UN Support Office in Somalia (UNSOS) and a private solar company, which in turn had an agreement with the government of the Southwest State in Somalia to build a solar-energy system in Baidoa, demonstrates the value of the guaranteed demand and financial stability offered by a UN field presence and shows how this can catalyze new renewable-energy projects in fragile settings. The Baidoa deal will see a private-sector company build a renewable-energy power plant including solar PV and energy storage, and establish a local distribution system in order to sell power both to the UN and African Union missions, as well as other local customers. The UNSOS commitment to purchase energy made the project economically viable, and the availability of other local customers guarantees project sustainability and long-term de-risking. Moreover, after 15 years, the ownership of the system will be handed over to the local government.

This type of commitment is a rare phenomenon in such an unstable environment, where regulation and contract enforcement are weak but offer a highly attractive basis for private-sector financing and renewable-energy developers required to deploy large renewable-energy projects in communities that would otherwise not be priorities — such as the cities hosting MINUSMA bases in northern Mali. This same model could be applied across Mali, contributing new energy solutions to communities in central and northern Mali at the heart of the country's conflicts. Such an approach would require further analysis to that conducted by the mission so far; for example, an analysis of space requirements and whether such a system could be accommodated within the security parameters envisioned by the current pilot protection. In the medium term, realizing the full benefits of such an approach might also invoke secondary work by the mission or the UNCT, for example in helping to build the regional or national regulatory and institutional frameworks.

While these hurdles are not insignificant, rolling out a renewable-energy system in partnership with local administrations would have the immediate effect of further reducing the environmental footprint of energy production in the country, building the capacity of local administration to manage utilities, increasing local electrification, and improving the livelihoods of those newly benefiting from electrification.

7. FINDINGS AND RECOMMENDATIONS

The links between climate and security are increasingly recognized in Mali and the Sahel, and more broadly around the world. Energy plays an important and o role in this equation. This study looked first at the dynamics of energy in Mali, and specifically the lack of electrification and diesel trade in the political economy of northern Mali. It then examined MINUSMA's own diesel-heavy energy practices, and the convoy-related security implications, as well as options for its transition to renewable energy in the context of meeting the UN's own climate goals. Finally, the report explored opportunities for MINUSMA's renewable-energy transition to also unlock new energy projects alongside its field sites as a way to deliver on its mandate and support the peace agreement. We find that this approach offers a valuable strategic opportunity for MINUSMA to bolster its ongoing efforts to support the implementation of a fragile peace agreement and help address long-standing grievances among local populations in the North, thereby advancing the achievement of the mission mandate.

Northern Mali's meager electrification levels are part of the chronic underdevelopment and marginalization that has fueled decades of North-South grievances and cycles of conflict. Although renewable energy is a leading global climate solution, and while investments in solar power were promised as part of the 2015 peace agreement, in reality northern Mali has yet to meaningfully benefit from new renewable-energy systems at a significant scale. Instead, energy markets still depend on smuggled diesel to power generators, which plays an important part in the political economy of the conflict.

MINUSMA represents a key component of the international community's engagement in the conflict in Mali, alongside humanitarian operations and development initiatives led by the UNCT and multilateral development institutions. New UN-focused climate goals are slowly orienting field operations toward a greater embrace of renewable energy. MINUSMA is at the forefront of this transition, with its initial inside-the-fence solar pilot project at mission headquarters in Bamako emerging as another proof of concept for a private-sector infrastructure-financing model with enormous potential for UN peace operations. While the initiative is laudable, it is still under development, and has been slowed by bureaucratic hurdles, inadequate Secretariat tools for mission staff to engage with new technology options, and a siloed approach within the mission to the management of the project. These factors have constrained the pilot project's planning parameters both technically and substantively. Changes to the concept will be required if the mission is to maximize the benefit of a mission-wide transition to solar.

MINUSMA's choices around its energy practices and transition to renewables have the potential to complement and support the wider international strategy to help increase energy access in Mali and deliver peace dividends to the North. There are compelling arguments in favor of a MINUSMA-wide shift toward renewable-energy projects that not only focus on the mission but also can support local energy access, thereby building on the emerging examples of other UN peace operations that have leveraged their role as an anchor client for private-sector projects that power both the missions and local communities. A transition to renewable energy can deliver multiple benefits to the mission, including reduced security exposure for convoys, economic cost savings over time, and a dramatic reduction in diesel consumption. Along the way, these efforts will contribute significantly to the achievement of the UNSCAP goals and Phase Two of the DOS Environment Strategy.

In addition, a project approach that allows for local energy co-benefits offers new opportunities to contribute to peacebuilding and support for the peace process in Mali by catalyzing new energy projects in the North. This peacebuilding lens should be integrated into the rollout of a mission-wide renewable-energy transition. This would also complement the wider international strategy of the UNCT and multilateral development institutions, with the mission providing new entry points to support renewable-energy projects in key northern cities.

The following findings and recommendations are intended to help assist with such a transition, maximize the impact, and strengthen the UN Secretariat's support for peace operations in making the shift to renewable energy in ways that can maximize peace impacts.

Findings

First, energy plays an important but nuanced role in the political economy of Mali's conflict, and the implementation of the peace agreement. An acute lack of electrification in the North is part of a larger dynamic of chronic underdevelopment that has fueled decades of North-South grievances, and contributed to current and past cycles of conflict. Solar energy was highlighted in the peace agreement as a peace and development dividend for the North, but this has not been implemented. Instead, northern energy markets are largely dependent on smuggled fuel supplies, which run through illicit supply chains often controlled by armed groups. The discrepancies in electrification in different parts of Mali, most notably between the North and urban centers in the South and center of the country, can act as drivers of conflict.

Second, MINUSMA's current diesel-heavy energy practices carry significant economic, environmental, and security costs for the mission, which depend on long and vulnerable fuel convoys. An increased use of renewable energy could benefit the mission in multiple ways. Long, slow fuel and resupply convoys expose the mission to security vulnerabilities that have helped make MINUSMA the deadliest peacekeeping mission in the world. Transitioning to renewable energy would greatly reduce the required fuel component of these convoys, and allow them to be shorter, faster, and easier to defend. The associated reduction in diesel usage would further provide economic cost savings and environmental benefits, while freeing up more of the mission's uniformed resources to perform substantive tasks, such as the protection of civilians.

Third, even with the UN's ambitious climate goals, lessons from hurdles faced by MINUSMA's solar pilot project demonstrate both mission-specific and UN-wide challenges that may constrict the expanded adoption of renewable energy in Mali and other field missions. System change is required for the UN to enable a renewable-energy transition at scale in order to meet its climate and environmental goals. The experience of MINUSMA's solar pilot project highlights some of the mission-specific and UN-wide challenges that still need to be addressed for a larger transition to succeed. These include:

- *Mission decision-making is siloed across sections, including those working on environmental impact, energy planning, conflict analysis, and mission substantive offices.* The approach is not yet integrated to recognize the synergies across these areas that could maximize mission planning, conflict assessments, and environmental and energy efforts. The design, procurement, and implementation of MINUSMA's solar pilot project by the mission support component had little engagement with substantive aspects of mission management. As such, the project planning goals were limited, and missed important considerations such as the implementation of its political, stabilization, and capacity-building mandates; the management of strategic communications and perceptions of the mission; and coordination with and facilitation of the work of the UNCT and humanitarian team. The resulting scope of the project has been unnecessarily narrow, to the detriment of the mission's strategic interests. Furthermore, any efforts by MINUSMA, and the UNCT, to expand access to electricity in the urban centers in which its bases are located should be sensitive to these dynamics, empower local ownership and decentralized decision-making, and be balanced with other efforts targeted at rural communities where the government utility is unlikely to extend grid access in the near future.

- *Ambiguity continues around the roles and responsibilities between and within UN Headquarters and the mission around market research, partnerships, and procurement for new technologies (such as renewable-energy systems) in peacekeeping.* Mission staff lack ready access to industry professionals, detailed awareness of technological innovations in a given area, or detailed knowledge of partnership modalities, which inhibits access to information to help make decisions around new technologies. Periodic technology fairs have sought to address this, although a lack of clarity on the status of participating vendors and pilot-project design processes risks limiting the breadth of technological innovation and unnecessarily constraining market research in peacekeeping. In the case of the MINUSMA solar pilot project, mission staff's understanding of the parameters for pilot-project design artificially narrowed mission planning and technical parameters, such that valid alternatives were ignored, contributing to long and unforeseen procurement approval lag times.[122]

- *The role of TCCs/PCCs in the mission's energy footprint, which runs parallel to UN-owned and -operated energy planning, complicates mission-wide renewable-energy transition planning.* This must be addressed, and new mechanisms and incentives developed, in order to accrue the full benefits of such a transition. Achieving the full environmental, cost-efficiency, and security benefits of a mission-wide renewable-energy transition will require MINUSMA to provide uniformed units with access to bases' central grids as their primary source of energy, and ensure that COE generators are used only as backups. Until then, perverse incentives created by fuel distribution practices, COE reimbursement regimes, and operational security considerations may inhibit this practice.

Fourth, a wider MINUSMA transition to renewable energy in northern Mali could also support local peacebuilding by supporting increased energy access. Building on the UN-anchor-client and private-sector partnership models emerging in UN peace operations, a MINUSMA renewable-energy project that can also unlock local energy services offers a creative and important new opportunity to support the Algiers peace agreement and MINUSMA's own peacebuilding mandate. MINUSMA's scale, energy requirements, and purchasing power would allow it to serve as an anchor client for new renewable-energy projects that leverage private-sector solutions in the cities and towns throughout Mali where the mission is deployed. These projects can be designed to meet MINUSMA's energy, self-sufficiency, and business-continuity needs, while providing power to the local community. The same financing model used for the MINUSMA solar-energy pilot project and the UNSOS project in Baidoa, Somalia, could be used to deliver such a solution, at no additional financial cost or liability to the mission.[123] This approach would leverage the MINUSMA footprint to support the peace agreements and provide local peace dividends, in concert with the UNCT.

Recommendations

To MINUSMA, the UNCT, international development agencies, and the government of Mali:

- *Support new investment in renewable energy in northern Mali as an underimplemented component of the Algiers peace agreement.* A consistent demand from the non-state signatories to the Algiers agreement is progress in creating the Northern Development Zone, a special development area funded by increased budgetary provisions from Mali's government. Linking the creation of this zone, and specific budgetary funding, to development spending on renewable-energy infrastructure in the Northern Development Zone can help speed up implementation of a key provision of the peace agreement while increasing access to renewable energy in northern Mali.

To MINUSMA and the UN Secretariat:

- *Broaden the decision-making structures around renewable-energy solutions to involve substantive mission personnel in order to integrate conflict analysis and political risks and opportunities as part of decision-making around the mission's solar-energy system.*

To the Secretariat and Member States:

- *Strengthen mission access to renewable-energy options.*

- *Invest in new market research tools and capacities to assist departments and missions in surveying the full breadth of technological/contractual solutions available on the market.*

- *Encourage experimentation and the use of pilot projects and capture lessons learned, while clarifying the design process for pilot projects.* The logic that underlays the design of the MINUSMA solar-energy pilot project — that a small-scale contract with a supplier of a unique technical and financial solution for an emerging, complex requirement would be used to hone requirements and inform the development of a statement of work for the procurement of a larger-scale solution — is both sound and critically important if the UN Secretariat is to keep pace with technological change. The UN Department of Management Strategy, Policy and Compliance should lead an effort to clarify the application of existing UN rules and regulations as they relate to pilot projects, and develop guidance for UN Headquarters and field missions on the design and implementation for expedited, small-scale pilot projects of this type.

- *Further expand the knowledge of TCCs/PCCs about the reimbursement for hybrid renewable energy and more efficient generators.* Member states who champion the Environment Strategy could work with leading TCCs and PCCs to lead a reduction in the use of inefficient generators and fuel waste, and identify ways to incentivize the use of renewable-energy options by uniformed peacekeepers. In 2022, prepare to review COE rules, reimbursement mechanisms, and rates to disincentivize the use of inefficient generators and fuel waste by uniformed units, and incentivize the use of renewable-energy systems. A thematic paper on this subject with appropriate recommendations for changes to the COE manual should be introduced at the next meeting of the COE Working Group.

To MINUSMA and the UNCT:

- *Work together to explore synergies between planned/ongoing development work and MINUSMA's transition to renewable energy,* including around creating the necessary bankability conditions to enable energy project development.

To MINUSMA:

- *Ensure that a mission-wide renewable-energy transition for MINUSMA delivers a peace dividend.* In applying the lessons learned from the solar-energy pilot project and developing a statement of work for the procurement of a mission-wide renewable-energy system, MINUSMA should strongly consider a renewable-energy solution that delivers immediate and long-term development energy benefits to the communities around it, building on the anchor-client models from other UN peace operations.

- *Contribute to increasing nighttime lighting infrastructure, especially in urban areas, as part of the mandate to protect civilian populations.* A greater security presence at night in urban areas could help protect energy infrastructure from theft or destruction, making it easier to increase the availability of solar panels and solar-powered lighting, particularly on roads and in public areas.

- *Planning for a mission-wide renewable-energy transition should involve substantive civilian and military personnel;* incorporate ongoing conflict analysis, in partnership with local communities where feasible; and proceed in partnership with UNCT efforts — for example, to complement UNCT programming focused on rural household energy access.

- *Amend the Statement of Unit Requirements and memoranda of understanding for TCCs/PCCs co-located in UN sites*, in order to shift the primary responsibility of power production to the UN.

- *Accelerate efforts to systematically monitor generator output as part of efforts to increase energy efficiency and to help incentivize TCC/PCC compliance with renewable-energy use, in line with the recommendations of the Special Committee on Peacekeeping Operations in its 2021 report.*[124] To avoid the creation of perverse incentives around COE generator fuel consumption, MINUSMA should require that all COE generators be equipped with digital meters that measure and record energy output and fuel consumption.

To the government of Mali:

- *Take steps to encourage more investment in the renewable-energy sector, with special interest in the North*, by, for example, establishing easier and more transparent processes for the issuance of power project licenses.

FUTURE RESEARCH

This report points to areas where efforts to meet strategic goals of supporting peace, increasing access to energy, and improving UN peacekeeping mission security can be strengthened through an increased use of renewable energy. In researching this report, the authors have identified areas where additional work could yield useful analysis of how to make that connection stronger.

First, there are additional questions about northern Mali's energy sector that go beyond what was explored here. For example, a deeper analysis of diesel-fuel supply chains in different parts of northern Mali, and the viability of local private-sector-led renewable-energy projects in the North, could help illuminate future areas of focus.

Second, the report raises questions of how to better connect mission-specific renewable-energy planning with broader UNCT efforts, international development institutions, and host-government energy planning. A series of case studies and/or workshops could further explore these options on a country-by-country basis.

Third, the research identified a lack of awareness within the mission of examples and models of renewable-energy projects from other UN peace operations. Additional case studies and/or workshops between missions and UN Headquarters could help missions to better understand their options, including opportunities for whether and how to support national energy goals.

Finally, more work is needed to understand and strengthen UN Secretariat policies and practices around the identification and deployment of new technologies, including renewable energy.

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BACK COVER
MINUSMA peacekeepers on patrol between villages outside of Mopti.
UN Photo/Gema Cortes