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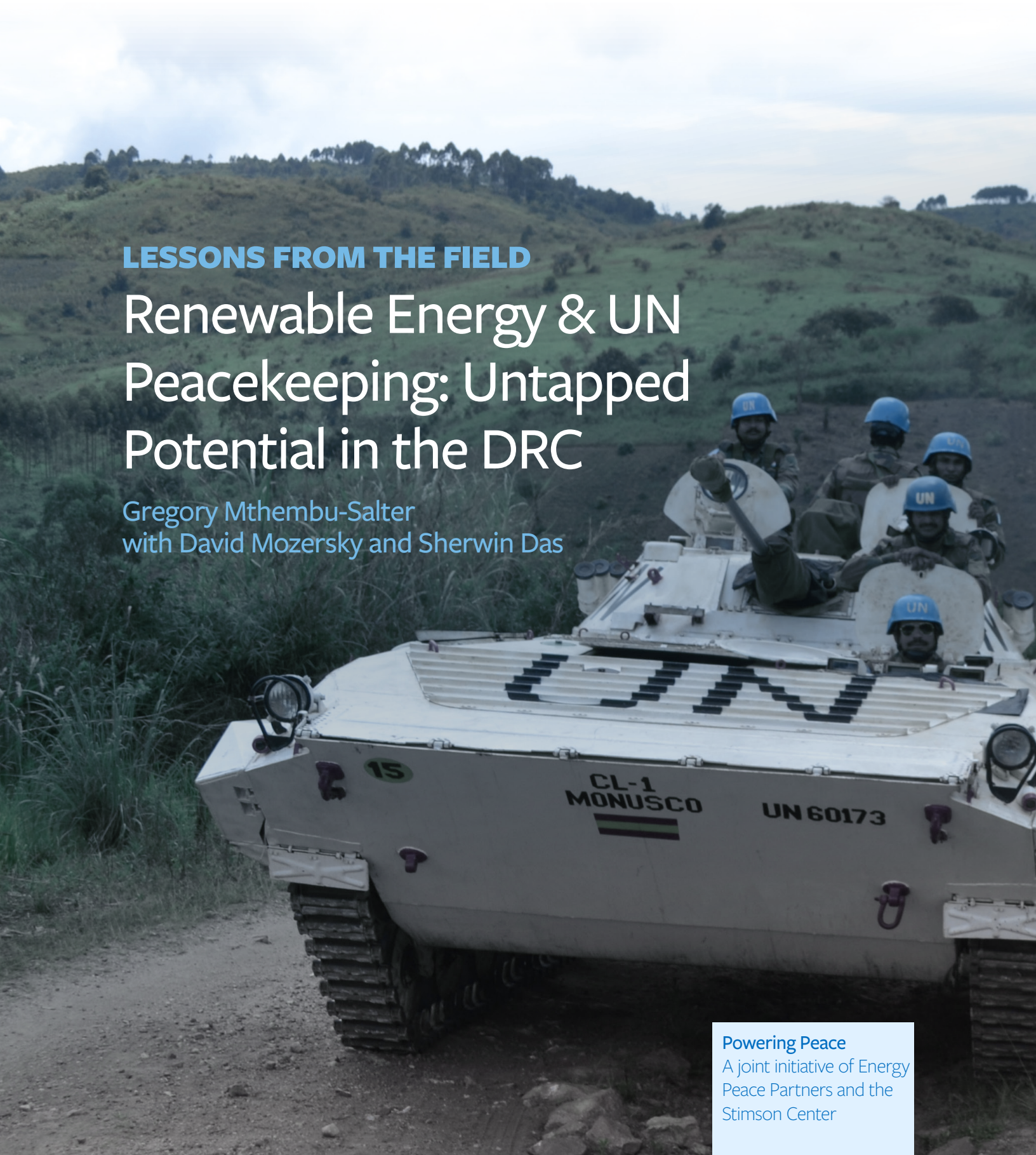

LESSONS FROM THE FIELD

Renewable Energy & UN Peacekeeping: Untapped Potential in the DRC

Gregory Mthembu-Salter
with David Mozersky and Sherwin Das

Powering Peace
A joint initiative of Energy Peace Partners and the Stimson Center

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Renewable Energy and UN Peacekeeping

Untapped Potential in the Democratic Republic of the Congo

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An initiative of: Energy Peace Partners

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ABOUT POWERING PEACE

Powering Peace is a joint research initiative of Energy Peace Partners and the Stimson Center to explore cleaner and more efficient energy options for multinational field operations in fragile states. Energy Peace Partners is a U.S.-based organization that works to leverage climate and finance solutions to support peace in places affected by violent conflict. The Stimson Center is a Washington, DC-based research and policy center that works to protect people, preserve the planet, and promote security and prosperity.

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 United Nations meet its goals of being carbon-neutral by 2020, of embracing more efficient and cost-saving technologies, and of shifting to greater use of renewable energy, as laid out by UN leaders for more than a decade. The initiative also seeks to identify impacts and improve on 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 United Nations 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 Sustainable Development Goals. Powering Peace seeks to examine the extent to which the footprints of existing international humanitarian and peace operations can be leveraged to introduce and extend the benefits of renewable energy to communities in fragile states. It aims to use 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.

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 the expert assistance of the Loomis Council at the Stimson Center.

Powering Peace thanks Gregory Mthembu-Salter of Phuzumoya Consulting for his expertise and creativity and for taking on this research project. Nigel Quinney and his colleagues at The Editorial Group expertly managed the editing, design, and layout of this report.

ABOUT THIS REPORT

This study of the Democratic Republic of the Congo (DRC) is the first in a series of reports commissioned and led by the Powering Peace initiative that examines the electricity practices of United Nations (UN) operations and the impact of accelerated renewable energy transitions in fragile contexts. It considers the role of electricity generation and consumption in the DRC's political and conflict dynamics, with a particular focus on the United Nations and its peacekeeping mission, the UN Organization Stabilization Mission in the DRC (MONUSCO). The report's goal is to identify opportunities for and obstacles to renewable energy use and to explore ways in which UN field missions could transition to greater use of renewable energy sources; the report proposes that this transition will save the United Nations money and benefit the planet, as well as potentially boost local economies and contribute to peacebuilding. This country-based study builds on a 2018 report that tackles these ideas in South Sudan.[1]

Gregory Mthembu-Salter of Phuzumoya Consulting, a South Africa–based consultancy specializing in African political economy research, led and conducted the research for this report in Goma, DRC, and Kigali, Rwanda, during March and April 2019. He also developed and served as the lead author on this report. Mthembu-Salter has researched and written extensively on Central and Southern African political economy for more than 20 years, and he is a former member of the UN Group of Experts on the DRC. Phuzumoya Consulting research associate Nadine Lusi provided invaluable assistance with the Goma fieldwork. Contributing author David Mozersky is president of Energy Peace Partners (EPP). He has been involved in conflict prevention work since 2001, and he is founding director of the Program on Conflict, Climate Change and Green Development at the University of California, Berkeley. He has worked with the International Crisis Group, the African Union, and Humanity United, among others. Sherwin Das is managing director of EPP. He has a background in UN peace operations, specializing in mediation and conflict prevention. He has served in UN missions in the Balkans, Eastern Europe, and Central Africa and has worked on strengthening peacekeeping and peacemaking practice at the UN Secretariat.

1. David Mozersky and Dan Kammen, "South Sudan's Renewable Energy Potential: A Building Block for Peace," Special Report no. 418, United States Institute of Peace, January 4, 2018, https://www.usip.org/publications/2018/01/south-sudans-renewable-energy-potential.

Additional support, analysis, and editing was provided by Victoria K. Holt, managing director of the Stimson Center, who created and leads the Powering Peace initiative with EPP co-founders David Mozersky and Sherwin Das. The economic analysis was led by Jaron Rothkop, president of The Last Kilometer, a nonprofit focused on clean energy policy and technology, who offered many insights. Alex Hopkins, research assistant at the Stimson Center, provided valuable support and assistance in writing of this report. Additional colleagues at Stimson and EPP provided guidance and expertise.

The authors and Powering Peace would like to thank the leadership and staff of MONUSCO for its support and insights in carrying out this research. In particular, the team appreciates the assistance of UN Deputy Special Representative of the Secretary-General W. David Gressly. Many interviewees gave generously of their time and expertise, which enriched this study. Without them, the report could not have been written.

ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
ANSER	Agence Nationale des Services Energétiques Ruraux
ARE	Autorité de Regulation d'Electricité
COE	Contingent-owned equipment
DFS	United Nations Department of Field Support
DOS	United Nations Department of Operational Support
DPKO	United Nations Department of Peacekeeping Operations
DPO	United Nations Department of Peace Operations
DRC	Democratic Republic of the Congo
EMU	Electrical Mechanical Unit
EPU	Environmental Protection Unit
IOM	International Organization for Migration
kW	Kilowatt
kWh	Kilowatt hours
MONUSCO	United Nations Organization Stabilization Mission in the Democratic Republic of the Congo
MW	Megawatt
MWh	Megawatt hours
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PCC	Police-contributing countries
PV	Photovoltaic
QIPs	Quick impact projects
SINELAC	Société Internationale d'Electricité des pays des Grands Lacs
SNEL	Société Nationale d'Electricité
SOCODEE	Société Congolaise de Distribution d'Eau et d'Electricité
SRSG	United Nations Special Representative of the Secretary-General
SUR	Statement of unit requirement
TCC	Troop-contributing countries
UNHCR	United Nations High Commissioner for Refugees
Urubatt	Uruguayan Battalion

Figure 1. Democratic Republic of the Congo

Source: UN Geospatial Information Section, Map No. 4007 Rev. 11, May 2016, https://www.un.org/Depts/Cartographic/map/profile/drcongo.pdf.

EXECUTIVE SUMMARY

The Democratic Republic of the Congo (DRC) is home to one of the most protracted and complex crises in the world today. Eighty percent of the population are estimated to live in extreme poverty, and few people have access to electricity. The country, which lacks an interconnected national electric grid, has one of the lowest rates of electrification and energy consumption in the world.

Yet the DRC has considerable hydroelectric power potential and virtually untapped solar and wind power resources. MONUSCO, the United Nations peacekeeping operation deployed in the DRC, uses diesel generators for two-thirds of its electricity, with the other one-third coming from renewable hydroelectricity via local grids. Unique opportunities exist today to accelerate the transition by MONUSCO and other international actors to renewable sources of power. This transition would deliver short-term benefits for the missions and long-term benefits for the communities they are deployed to serve. In an environment of shrinking humanitarian and peacekeeping resources and increasing climate commitments, the adoption of a more strategic approach to electricity use in the field is both efficient and the right thing to do.

This report considers the DRC's electricity sector amid its history of conflict, including the available sources of energy. It then looks at an important but generally overlooked aspect of the international response to the crisis in DRC: current practice by humanitarian operations and MONUSCO around the consumption and production of electricity. Despite promising efforts to increase the share of renewable energy, existing United Nations (UN) practices remain largely diesel-dependent. The report examines ongoing efforts by international actors in the DRC to boost the share of renewable sources of energy; articulates the benefits of increasing diesel-to-renewable energy transitions for both the operations and the host country; details viable opportunities and potential challenges for implementing such transitions; and recommends next steps.

BENEFITS OF CHANGE

Renewable energy transitions by international field operations in the DRC, particularly MONUSCO, would have positive benefits, including the following:

- Generating cost savings associated with a reduction in expenditures on diesel fuel, fuel transport, generators, generator maintenance, and spare parts.

- Reducing the mission's environmental impact and carbon footprint consistent with UN principles and policies as set forth in the United Nations' *Greening the Blue* initiative, the Environment Strategy issued by the Department of Field Support (DFS, now Department of Operational Support, DOS), and the recently adopted 10-year Climate Action Plan.
- Stimulating the DRC's renewable energy sector via increased demand by UN actors for renewable energy, particularly hydroelectric and solar power.
- Facilitating implementation of MONUSCO objectives, particularly with regard to the peacebuilding aspects of its mandate that may be supported by the local economic benefits of renewable energy expansion.
- Supporting the government of the DRC to achieve its ambitious national target of 65 percent electrification by 2025 and, consistent with Sustainable Development Goal No. 7, 100 percent electricity access by 2030.

For MONUSCO, there are practical energy transition options available to realize these benefits:

- MONUSCO troop contingents collectively have the largest carbon footprint of the mission. In 2018, two MONUSCO military bases in North Kivu transitioned from diesel-powered self-generation to 24-hour hydroelectric power from Virunga SARL. The mission should consider extending this model to other sites where troops are deployed and where access to hydroelectric power is available, particularly in North Kivu. In doing so, the mission would be able to further expand its use of renewable energy with relative ease.
- Power generation at MONUSCO's Goma headquarters and Goma airport is currently split between diesel-powered self-generation (18 hours per day) and contracted hydroelectric grid power (6 hours per day) from the Congolese national utility SNEL (Société Nationale d'Electricité). The mission should avail itself of a competing option from the Société Congolaise de Distribution d'Eau et d'Electricité (SOCODEE) and Virunga SARL to source 24-hour hydroelectric grid power at these sites. This would generate at least US$155,000 in annual cost savings at Goma airport alone and reduce the mission's environmental impact.
- Were MONUSCO to transition to 24-hour hydroelectric grid power in Goma, its existing 650-kilowatt solar system could be redeployed to diesel-dependent field sites.
- Outside of Goma and the surrounding areas, which enjoy access to hydroelectric power that is lacking in other parts of the country, the mission should explore options to use more off-grid solar systems to meet its power requirements. For a typical MONUSCO site, the capital investment required

for deploying a solar and battery system would be paid back in less than four years, with potential cost savings of more than US$2.5 million over 10 years. Given mission downsizing, these expenditures could be justified at sites where a presence is expected to remain for an extended period.

- MONUSCO should explore options to enter into energy-as-a-service leasing agreements, whereby renewable power generation is outsourced. This is an emerging model that could create significant efficiencies for field missions.

CHALLENGES TO FACE

Despite these opportunities to increase MONUSCO's share of renewable electricity and their accompanying benefits, change is not without challenges.

- Despite the fortuitous proximity of some MONUSCO sites in eastern DRC to 24-hour hydroelectric power, the mission remains largely reliant on diesel. The lack of expertise within and guidance available to MONUSCO and the UN system at large for evaluating different energy options and assessing the business case for renewable energy transitions remain an obstacle to change that partly explains the current path dependency.
- Some troop contingents deployed in the DRC lack clear information about their ability to connect to local grid power or use on-site renewable energy. Troop contingents are reimbursed for the contingent-owned equipment (COE) with which they deploy. Reimbursement rates were recently introduced for renewable energy generators, but to date this has not proven to be a sufficient incentive, so troop contingents continue to deploy with traditional diesel generators.
- The limited transfer of institutional knowledge between missions with regard to renewable energy transitions, including lessons learned and the development of best practices, may be hindering the pace at which MONUSCO is able to implement energy transitions.

Despite these challenges, there is increasing appetite within the UN system to achieve progress in this area. The UN-wide *Greening the Blue* initiative and peacekeeping-focused DFS Environment Strategy identify goals and objectives to improve the United Nations' overall environmental practices, efficiency, and climate neutrality; and the newly adopted 10-year Climate Action Plan sets a UN goal of getting 80 percent of its electricity from renewable sources by 2030. Although results have varied by mission, these policies continue to provide a framework for measuring and achieving progress. The increased delegation of authority to heads of missions, emerging from UN reforms introduced

on January 1, 2019, should help facilitate decision-making by mission leaders that is better aligned with these broader policy objectives. Meanwhile, the 2020 triannual negotiations over COE present an opportunity for the Secretariat to issue more detailed guidance to troop-contributing countries (TCCs), which could further enable renewable energy deployment in field missions.

A WAY FORWARD

Accelerating the renewable energy transitions of international actors in the DRC is possible, but it will require an ongoing commitment from MONUSCO leadership, the Secretariat, and UN member states to equip field missions to achieve progress. In the larger context, modernizing UN field operations should include examination of the diverse options available for how these missions source and produce energy, not least to account for increasing global climate commitments, dramatic advances in renewable energy and storage technology, and significant reductions in the costs of these technologies. This will ultimately require a rethinking of the way peace operations are budgeted, planned, and managed. Getting this right will further expand the United Nations' positive impacts in the DRC in the form of new energy access, and the associated economic, climate, and peacebuilding gains.

RECOMMENDATIONS

For the leadership of MONUSCO:

- Undertake decision-making about the mission's electricity use and renewable energy targets in collaboration with the Mission Support component of the mission, including through a joint process with regard to strategic energy issues.
- Engage with SOCODEE/Virunga SARL about transitioning Goma headquarters, Goma airport, and other accessible TCC sites in the region to 24-hour hydroelectric grid power.
- Relocate the solar installation from Goma headquarters to diesel-powered off-grid location(s), such as Kananga, and explore deploying additional solar systems at other off-grid sites.
- Document MONUSCO's efforts to date to adopt hybrid energy options, as well as its use of local renewable energy sources, to capture lessons learned for the mission and for UN peace operations more generally.

For UN headquarters and member states:

- Prioritize electricity generation from renewable resources. Develop clearer goals, stemming from *Greening the Blue* and the DFS (now DOS) Environment Strategy, for the electricity generation practices of field missions, and provide the necessary support to achieve them.
- Create incentives and support packages to help UN field operations transition to renewable energy.
- Educate troop- and police-contributing countries on these goals and options for deployment, and create incentives to achieve them through the COE reimbursement system.
- Direct each UN mission to produce an electrification plan to help diversify energy sources and increase the use of renewables in line with the UN goal of carbon neutrality.

For the DRC government:

- Prioritize the creation of the Autorité de Regulation d'Electricité.
- Support the renewable energy sector by reducing or eliminating import duties and other restrictions on solar and other relevant equipment.
- Work with MONUSCO to further support national electrification goals and improve access to energy across the country.

INTRODUCTION

The Democratic Republic of the Congo (DRC) is among both the richest and the poorest countries in the world. Blessed with abundant natural resources, it has suffered from large-scale regional conflicts and recurring smaller-scale subnational conflicts for 25 years, leading to millions of people killed or displaced. These conflicts, along with weak governance and mismanagement, have left the DRC with some of the lowest development indicators in the world, including very low rates of electrification and energy access. The international community's response has included, since 2000, a United Nations (UN) peacekeeping mission (the UN Organization Stabilization Mission in the Democratic Republic of the Congo, MONUSCO) and large-scale humanitarian support. This report looks at an important but often overlooked aspect of that response, the electricity footprint, and considers the alternatives and their potential impact on peacebuilding.

Historically, the electricity consumed by UN operations in the DRC has been overwhelmingly supplied by diesel generators. This is a dirty and expensive option, and it will leave little tangible legacy when the mission departs. This report examines opportunities for MONUSCO and humanitarian operations to transition to renewable energy, with a focus on eastern DRC, exploring some of the hurdles to this transition and the potential benefits it could bring.

Since June 2007, the United Nations has been officially committed to *Greening the Blue*, a policy blueprint by which it seeks to improve its environmental footprint and work toward becoming climate-neutral. This commitment requires UN organizations to track and report their greenhouse gas emissions, measure and report waste, reduce their environmental impacts, and "explore the feasibility" of offsetting their greenhouse gas emissions.[2] On September 22, 2019, the UN Secretariat adopted an ambitious new 10-year Climate Action Plan, which includes a 45 percent emissions reduction target and a 80 percent renewable energy goal by 2030.[3] For peacekeeping in particular, the former Department of Field Support (DFS, now the Department of Operational Support, DOS) initiated in 2016 a six-year Environment Strategy setting forth a series of environmental goals for all peacekeeping missions, under the

2. *Greening the Blue*, https://www.greeningtheblue.org/our-approach.

3. "See "Ahead of Climate Action Summit, UN Secretariat Adopts Plan to Slash Own Emissions by Almost Half by 2030," United Nations, September 22, 2019, https://www.un.org/sustainabledevelopment/blog/2019/09/un-secretariat-climate-action-plan/.

broader aegis of the *Greening the Blue* agenda.[4] The UN commitment to *Greening the Blue* is welcome, but the challenge lies in implementation, particularly at the field level. This report aims to understand the United Nations' current practice around electricity generation in the DRC and identify opportunities for further progress, obstacles to achieving progress, and lessons that can be applied elsewhere in the UN system.

Peacebuilding is a core component of MONUSCO's mandate. Accordingly, this report recognizes that a transition to increased use of renewable energy by the mission has the potential to support peacebuilding initiatives in the DRC.[5] Conflict dynamics are complex, and although the lack of access to electricity does not, in and of itself, directly propagate conflict, this report argues that improving electricity supply in a poorly electrified country such as the DRC, particularly with renewable energy sources, can contribute to an enduring peace in a variety of ways, most obviously via improved public services and economic growth. If MONUSCO and other UN organizations transition to greater use of renewable energy for their electricity needs by replacing diesel generators with hydropower (where available) and solar power, and avail themselves of local suppliers and local capacity while doing so, the Congolese domestic renewables market will receive a boost. Solar power, in particular, offers decentralized energy solutions in areas without a grid connection. Such a boost would increase the availability and affordability of renewable energy for consumers, thus fueling economic growth and contributing to more peaceful and prosperous communities.[6] MONUSCO is cur-

4. See "UN Launches New Strategy to Minimize Environmental Footprint of Its Peace Operations," United Nations, November 29, 2016, https://news.un.org/en/story/2016/11/546562-un-launches-new-strategy-minimize-environmental-footprint-its-peace-operations.

5. MONUSCO and the humanitarian interventions have had wide-ranging and complex impacts on conflict dynamics in the DRC and subregion, on peacebuilding, and on the political and socioeconomic environment. This report does not attempt to address all these issues, however, which are worthy of research beyond the implicit links noted in this analysis of MONUSCO's energy use.

6. The International Renewable Energy Agency highlights three broad categories of potential benefits from renewable energy transitions: job creation, macroeconomic benefits, and local value creation, all of which are relevant to the DRC. See https://www.irena.org/benefits. The potential of renewable energy as a tool for peacebuilding in other conflict settings has also been discussed by Dan Kammen, "Peace Through Grids," *MIT Technology Review*, April 21, 2015 , https://www.technologyreview.com/s/536716/peace-through-grids/; and Mozersky and Kammen, "South Sudan's Renewable Energy Potential." In addition, energy scholar Morgan Bazilian and others have argued that large-scale energy planning models are poorly suited to conflict-affected countries and fragile states and that the arguments for solar and other small-scale renewable projects can be

rently in the process of implementing a significant drawdown in many parts of the country due to budget pressures and, according to some senior MONUSCO sources, the changing DRC political dynamic, and it intends to scale back further. Nonetheless, the mission maintains, and intends to continue to maintain, a force of at least several thousand personnel, which appears set to remain in the conflict-affected east for the foreseeable future.[7]

ENERGY, PEACE, AND CONFLICT IN THE DRC

After a violent independence and early postindependence period, the DRC was largely peaceful during the rule of Mobutu Sese Seko. In the early 1990s, clashes broke out in North Kivu between rival militia, each claiming to speak for and defend a particular ethnic group. The escalation in the scale of violence was triggered by the 1994 arrival of Rwandan Hutu refugees, the defeated Rwandan armed forces, and the genocidal Interahamwe militia. Two years later, the armed forces of Uganda, Rwanda, and Angola and some militia combatants from eastern DRC teamed up to remove Mobutu from power, installing in his place Laurent Désiré Kabila in 1997. The Mobutu-aligned Zaïrean armed forces offered little resistance, and in most cases the coalition's victory was achieved at little human cost. The second Congo war, which began in 1998 when the Rwanda-backed Rassemblement Congolais pour la Démocratie launched a rebellion against Kabila, was far more deadly and destructive, both to human life and to infrastructure and economic activity. The war ended in 2002, but conflict has continued in eastern DRC, fought by an endless succession of armed groups, some armed and trained by neighboring states; the often-warring factions of the divided and poorly disciplined Congolese armed forces; and, at times, invading army units from Uganda, Rwanda, and Burundi.

Brutal conflict blazed in the southwestern Kasaï provinces during 2016–17, initially fueled by the manipulation of disputes between rival claimants to chief-

even stronger in such settings. See Bazilian's presentation "Energy, Peace and Conflict," Center for Strategic and International Studies, March 14, 2018, https://www.csis.org/events/electricity-peace-and-conflict.

7. MONUSCO has begun drawing down its presence in more stable areas no longer at risk of armed conflict. MONUSCO Special Representative of the Secretary-General (SRSG) Leila Zerrougui argued in a July 2019 briefing to the UN Security Council that this will allow the mission to consolidate its efforts on state-building and the protection of civilians in areas still at risk of armed conflict, highlighting threats in Ituri, North Kivu, and South Kivu in particular. See "With New President Pledging Reform, Democratic Republic of Congo Making Gains amid Fresh Violence in East, Mission Chief Tells Security Council," United Nations, July 24, 2019, https://www.un.org/press/en/2019/sc13897.doc.htm.

doms and later by covert political support from elements within the national government for violent ethnic cleansing by militia, particularly in areas with significant diamond deposits. The conflict in the Kasaï provinces began to calm down by late 2018, in part because of expectations from Kasaïans that their lot might improve with the presidency of Felix Tshisekedi, who is Kasaïan, although tens, if not hundreds of thousands, of people remain displaced from their homes.

In addition to being chronically affected by conflict, the Kasaï provinces are among the least electrified regions in the country, with their rural and urban areas unconnected to the country's main energy grids. The Kasaïs are, however, not unique in this. There are several other provinces in the country with towns and rural areas that have no grid electricity but are nonetheless generally peaceful and have been so for many years. Provincial capitals unconnected to the country's electricity grids include Kisangani, Mbandaka, Kindu, Gemena, Gbadolite, and Kamina.

The country's extremely low development indicators, including one of the lowest electrification rates in the world, inform the history of conflict. A case can be made that an increase in reliable and affordable electricity supply in the DRC would improve public services and boost economic growth while contributing to peacebuilding and stabilization. Former World Bank president Jim Yong Kim shared a similar assessment during a 2013 visit to Goma to promote, in part, new World Bank investment in the hydro sector: "The focus is all these things that we think are at the root of the conflict—lack of energy means the private sector doesn't invest and there are no jobs, lack of health care and education, lack of trade across borders so that people can run their businesses."[8] The question is, can MONUSCO and other international missions support these aims by modernizing their electricity practices and transitioning away from reliance on diesel generators toward a greater use of renewable energy sources?

For example, the conflict-afflicted North Kivu town of Rutshuru has benefited from rising employment and income levels due to its recent electrification by Virunga's Matebe plant, though improved access to electricity alone does not address the root causes of conflict in the town and surrounding territory, which include highly ethnicized land disputes, competition for mineral resources, regional interference, and dangerously divided armed forces.

The link between energy and insecurity is complex. Newly available hydroelectricity from Matebe, for example, has yet to dissuade the many thousands

8. See Nick Long, "UN, World Bank Say Development Is Key to Congo Peace," Voice of America, May 23, 2013, https://www.voanews.com/africa/un-world-bank-say-development-key-congo-peace.

of people who make charcoal from the trees in the forests of Virunga. Yet the electrification of Rutshuru has positively impacted employment and income levels, principally by enabling agricultural goods to be processed in Rutshuru rather than elsewhere. The potential of renewable energy to boost local employment and economic growth, including in manufacturing, is even more pronounced in larger and more industrialized cities such as Goma.

Armed group recruits in the DRC often cite unemployment and poverty as reasons for joining militias. With more employment and higher incomes, fewer people will feel incentivized to join armed groups. In this way, employment and income can have a stabilizing effect in conflict-affected communities, and where increased electrification helps to increase both (including by making it easier for children to attend school and study), it can support peacebuilding.[9] Furthermore, energy generated from renewable sources does not contribute to global warming or deplete scarce natural resources, as is the case, for example, with charcoal harvested from the precious hardwoods of the Virunga forest and burned across North Kivu.

As is discussed in this report, both MONUSCO and UN humanitarian operations have considerable scope to increase use of renewable energy for their electricity needs. Such a shift toward a greater reliance on renewable energy would generate considerable cost savings and support local energy development. It could also boost national demand for renewable energy and stimulate a positive local supply-side response. Total electricity production in the DRC would increase, stimulating the economy and, if more competition resulted, potentially reducing the cost to consumers of electricity generated from renewable sources. A drop in the price of renewable electricity, pushed down further by a lowering of the tax burden, would likely also boost consumer demand, thereby generating further economic stimulus.

9. Here, the term "peacebuilding" is used in the broader sense of the word. The United States Institute of Peace defines peacebuilding thus: "Originally conceived in the context of postconflict recovery efforts to promote reconciliation and reconstruction, the term peacebuilding has more recently taken on a broader meaning. It may include providing humanitarian relief, protecting human rights, ensuring security, establishing nonviolent modes of resolving conflicts, fostering reconciliation, providing trauma-healing services, repatriating refugees and resettling internally displaced persons, supporting broad-based education, and aiding in economic reconstruction. As such, it also includes conflict prevention in the sense of preventing the recurrence of violence, as well as conflict management and postconflict recovery." Dan Snodderly, *Peace Terms: Glossary of Terms for Conflict Management and Peacebuilding* (Washington, DC: United States Institute of Peace Press, 2019).

RESEARCH FOR THIS REPORT

The fieldwork for this report was conducted in Goma, eastern DRC, and Kigali, Rwanda, for two weeks during late March and early April 2019. During this period, the author identified, contacted, and conducted semistructured interviews with more than 30 people. Within MONUSCO, interviewees included the Deputy Special Representative of the Secretary-General, the chief of service delivery within the Office of Mission Support, the chief of the engineering section, members of this section's Electrical Mechanical Unit (EMU), the Goma head of office, the deputy chief of staff for operations and planning, the commanding officer of the Uruguayan Battalion (Urubatt), and the head of the Environmental Protection Unit (EPU). Other interviewees included a senior manager at the UN High Commissioner for Refugees (UNHCR); management representatives from Hashi Energy, Société Nationale d'Electricité (SNEL), Virunga SARL, Société Congolaise de Distribution d'Eau et d'Eléctricité (SOCODEE), Kivu Green Energy, and other solar energy suppliers; a representative of the provincial government; and senior managers at the Nile Equatorial Lakes Subsidiary Action Program (NELSAP).

The information provided in these interviews was supplemented with a literature review and with data subsequently supplied by some of the interviewees. In addition, MONUSCO's Office of Mission Support provided answers to a questionnaire and to follow-up questions. These answers informed the technical cost-benefit analysis presented here.

It was necessary at the outset to establish the overall quantity of electricity consumed by MONUSCO and other UN organizations in the DRC. Beyond this, the electricity generation options available to and used by these organizations were assessed, as were the steps taken to "Green the Blue" in terms of electricity consumption and generation. Finally, the research team identified obstacles preventing further progress in this area and considered how these constraints might be removed or mitigated.

The DRC presents an extremely challenging research environment. Field interviews were conducted with a diverse set of actors over a short time span, and the compilation and analysis of information often not publicly available was required. Accordingly, the research reveals a number of promising areas that deserve further inquiry. Nonetheless, due in large part to the generous sharing of information and time by many experts, this report identifies key

MONUSCO Force Headquarters in Goma, marking the International Day of Peacekeepers, May 31, 2019.

Photo taken by Michael Ali, MONUSCO, May 31, 2019, and shared under creative commons. Available at https://www.flickr.com/photos/monusco/47992782723/.

factors that explain why MONUSCO and other UN organizations in the DRC choose certain electricity generation options and suggests several ways in which these choices could be improved.[10]

ORGANIZATION OF THIS REPORT

The report considers the political economy of electricity production in the DRC, a vast Central African country that lacks a national grid, where most communities have little or no access to electricity, and in which successive governments have used investment in electricity infrastructure, or its absence, as a

10. The fieldwork for this report was conducted shortly after a major restructuring within the UN system that took effect on January 1, 2019. Accordingly, the report may refer to institutional structures that may no longer exist or that may not be constituted as they previously were.

political weapon. The report then focuses on the troubled east of the country, where much of the conflict that has afflicted the DRC over the last 30 years has played out and where MONUSCO is partly headquartered.[11] The report outlines the electricity generation options available to MONUSCO and other UN organizations in eastern DRC and details how these options have expanded considerably since the DRC government's liberalization of the electricity sector in 2014, before identifying and exploring the choices that MONUSCO and others have made thus far.

The report finds that MONUSCO and other UN organizations have taken some steps toward achieving the environmental sustainability goals laid out in the *Greening the Blue* initiative and the DFS Environment Strategy with regard to their electricity generation choices, but overall progress has been limited. The report examines the decision-making processes that have resulted in the current situation and considers factors that would encourage and incentivize these entities to improve their implementation of *Greening the Blue* and support new renewable energy development in eastern DRC.

11. MONUSCO's force commander and its Operations and Protection units are headquartered in Goma, where the Deputy Special Representative of the Secretary-General (DSRSG) is also based. The SRSG and the mission's political leadership are headquartered in Kinshasa.

1

THE POLITICAL ECONOMY OF ELECTRICITY IN THE DRC

The DRC has among the largest landmass and populations in Africa, the latter reckoned at more than 85 million, about 7 percent of the continent's total. Nine countries border the DRC, including the significantly militarized states of Angola, Rwanda, and Uganda. These considerations alone would make the DRC a highly geostrategic location, and this status is greatly amplified by the country's staggeringly rich natural resource base. The DRC's rain forests are a vital (though shrinking) consumer of carbon dioxide, slowing the planet's global warming. The Congo River funnels one-third of Africa's river waters to the Atlantic Ocean and has a huge hydroelectric potential long desired by the region's miners and industrialists. The country holds half of the world's reserves of cobalt, a key ingredient in lithium-ion batteries, on which all electric cars currently run.[12] The DRC is also home to 2.4 percent of the world's copper reserves,[13] and it has sizable reserves of colombo-tantalite (coltan), a mineral whose superconductor properties have made it indispensable to the manufacture of mobile phones.[14] Notoriously, the uranium used to make Little Boy and Fat Man, the atomic bombs that the United States dropped on Japan in 1945, came from Shinkolobwe, in Haut Katanga province.[15]

12. U.S. Geological Survey (USGS), *Mineral Commodity Summaries February 2019: Cobalt* (Washington, DC: USGS, 2019), 51.

13. The average diesel or petrol-powered vehicle uses around 50 kilograms of copper; the average electric car uses around 80 kilograms. USGS, *Mineral Commodity Summaries February 2019: Copper* (Washington, DC: USGS, 2019), 53.

14. Marjolein de Ridder, "Coltan, Congo and Conflict," Report no. 21/05/13, Hague Centre for Strategic Studies, 2013, 20.

15. Pia Hecher, "The Unknown Beginnings of Fat Man and Little Boy," *Brussels Express*, August 12, 2018, https://brussels-express.eu/the-unknown-beginnings-of-fat-man-and-little-boy.

The DRC was the second most highly industrialized country in Africa at independence in 1960, and it had highly developed mining and agro-processing sectors—the former concentrated in the south and the latter in the east. Both sectors, and the economy as a whole, suffered during the rule of Mobutu Sese Seko due to his determined use of the country's economic assets as tools of patronage to be dispensed or withdrawn according to the shifting sands of politics. This corruption led to asset stripping, embezzlement, and a collapse in maintenance, and by the late 1980s the industrial mining sector and commercial agriculture and agro-processing were on their knees.

The first, and shorter, war that raged in the country culminated in the installation of Laurent Désiré Kabila as president in 1997. The second, longer war, which began a year later and fizzled out into an acrimonious stalemate around 2002, resulted in further economic asset destruction and further impoverished the already hard-pressed Congolese population.[16]

The economy stabilized and grew during the presidency of Joseph Kabila, who assumed the presidency in 2001 after his father was assassinated. The economy was buoyed by peace in most of the country; substantial new foreign investment in the mining, telecommunications, and road infrastructure sectors; and, at least in the earlier years, considerable injections of international aid and concessional finance.[17] Sporadic conflict continued, however, in much of the east of the country (and, during 2016–17, in the Kasaï provinces).

The economic growth that has taken place has been unevenly distributed, and poverty remains pervasive, with more than 80 percent of the population reckoned to be living in extreme poverty. One in four children is malnourished, and only one-quarter of Congolese have access to clean water and sanitation. Despite all its natural resource wealth, the country's population is rated among the poorest in the world.[18]

1.1 ELECTRICITY ACCESS IN THE DRC

The DRC has one of the lowest electrification rates in the world. An estimated 19.1 percent of the population have access to electricity, according to World

16. Drawn from Georges Nzongola, *The Congo: From Leopold to Kabila, a People's History* (London: Zed Books, 2002).

17. That is, loans at concessional rates, such as those typically provided by international financial institutions.

18. World Population Review, "Poorest Countries in the World 2019," http://worldpopulationreview.com/countries/poorest-countries-in-the-world.

Bank data: 49.2 percent in urban areas and a sobering 0 percent in rural ones.[19] By comparison, 87 percent of the world's population have access to electricity: 97 percent of urban dwellers and 77 percent of those in rural areas.[20]

Unit Name	Rated Capacity
Western Grid Network	
Inga I	351 MW
Inga II	1424 MW
Zongo I	75 MW
Southern Grid Network	
Nseke	260 MW
Nzilo	108 MW
Mwadingusha	68 MW
Koni	42 MW
Isolated Hydroelectric Networks	
Ruzizi I & II	44 MW
Sanga	11 MW
Tshopo	18 MW
Kyimbi	18 MW
Mutwanga	10 MW
Other IPPs	135 MW

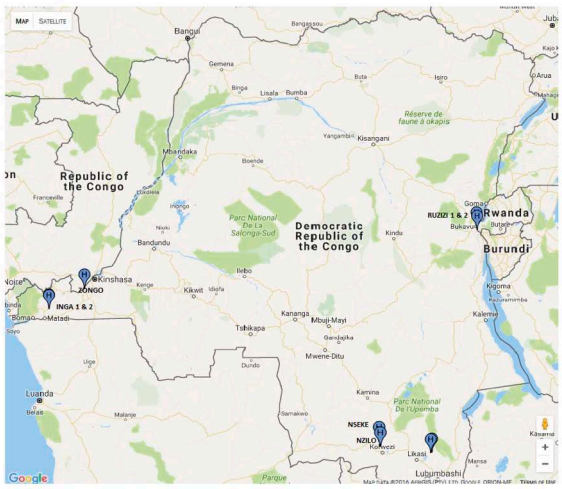

Figure 2. Major power plants and their locations in the DRC

Source: United States Agency for International Development (USAID), *Conceptual Plan for Enhancing Transmission Infrastructure to Expand Electricity Access in the Democratic Republic of the Congo (DRC)* (Washington, DC: USAID, 2017)

There are strong regional disparities in access to electricity within the DRC, and the country does not have an interconnected national transmission grid network. A main source of electricity is the state-owned utility SNEL, which operates three interprovincial grid networks in the west, the south, and the east. In some of the urban areas unconnected to these networks, SNEL operates limited service, with electricity produced by diesel generators, but the utility does not supply the rest of the country (see figure 1). For example, access to electricity is estimated at around 45 percent in the capital of Kinshasa, but under 1 percent in Kasaï Occidental province.[21] As a result of these ultralow electricity access rates, the DRC has one of the lowest levels of electricity consumption per capita in the world, at 110 kilowatt hours (kWh) per capita, per

19. World Bank, DataBank 1990–2017, https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS.

20. Ibid.

21. Essor, "Access to Electricity, Solar Powered Mini-Grids in the DRC: Preliminary Information Memorandum," 2016, 14.

year.[22] The global average is 27 times higher, at 3,000 kWh, or 3 megawatt hours (MWh) per capita, per year.[23] By comparison, the annual electricity consumption in the United States is 12.83 MWh per capita—117 times that of the average Congolese citizen.[24]

The total installed capacity of the DRC's central power plants is estimated at 2,590 megawatts (MW), with 96 percent generated from hydropower. Only about half of this total, however, is available for dispatch at any given time due to a maintenance backlog.[25] By way of comparison, Zambia (with a population of approximately 17 million) has installed capacity of 2,800 MW.[26] Angola's installed capacity is 4,400 MW, South Africa's is 51,309 MW,[27] Brazil's is 150,330 MW,[28] and the United States' is 1.2 million MW.[29]

SNEL's 50 power plants comprise 14 hydroelectric and 36 thermal plants and account for 94 percent of the DRC's total installed generation capacity.[30] Almost 70 percent of the country's installed capacity comes from two of those power plants, Inga I and Inga II on the Congo River, which account for 351 MW and 1,424 MW, respectively. Although SNEL's three regional grids do not connect with each other and are situated in different parts of the country, each is connected with the grids of neighboring countries. The western network is connected with the Republic of the Congo, the eastern network is connected with Rwanda and Burundi, and the southern network is connected with Zambia.[31]

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22. International Energy Agency, "Statistics: DRC Indicators for 2016," https://www.iea.org/statistics/?country=CONGOREP&year=2016&category=Key%20indicators&indicator=ElecConsPerCapita&mode=chart&dataTable=INDICATORS.

23. Ibid., https://www.iea.org/statistics/?country=WORLD&year=2016&category=Key%20indicators&indicator=undefined&mode=table&dataTable=INDICATORS.

24. Ibid., https://www.iea.org/statistics/?country=USA&year=2016&category=Key%20indicators&indicator=ElecConsPerCapita&mode=chart&dataTable=INDICATORS.

25. Essor, "Access to Electricity," 13.

26. USAID, "Zambia: Energy Sector Overview," updated November 28, 2018, https://www.usaid.gov/powerafrica/zambia.

27. USAID, "South Africa: Energy Sector Overview," updated November 19, 2018, https://www.usaid.gov/powerafrica/south-africa.

28. Ministry of Mines and Energy, 2016, cited in https://en.wikipedia.org/wiki/Electricity_sector_in_Brazil.

29. U.S. Energy Information Administration, "Electric Power Annual," October 22, 2018, https://www.eia.gov/electricity/annual/html/epa_04_03.html.

30. Ibid.

31. USAID, *Conceptual Plan for Enhancing Transmission Infrastructure to Expand Electricity Access in the Democratic Republic of the Congo (DRC)* (Washington, DC: USAID, 2017), 8, 13–15.

In addition to these grid networks, electricity is supplied by SNEL-operated mini-grids, privately operated mini-grids (both diesel and solar), and individual systems.[32]

In 2015, the country had approximately 5,500 kilometers of high-voltage transmission lines, all connecting Inga I and II with the largest city, Kinshasa, and with provinces in the center and southeast areas of the country. This amount of high-voltage lines is relatively large by continental standards—Sudan, for example, which is of comparable size, has 1,129 kilometers—although far lower than South Africa's 27,770 kilometers. Electricity from high-voltage transmission lines is distributed via medium- and low-voltage lines, although the DRC's network is limited. The country has fewer than 5,000 kilometers of medium-voltage lines and a little more than 12,000 kilometers of low-voltage lines. As a result, most of the country has no access to the grid (see figure 2). South Africa, by contrast, has at least 325,000 kilometers of medium- and low-voltage lines.

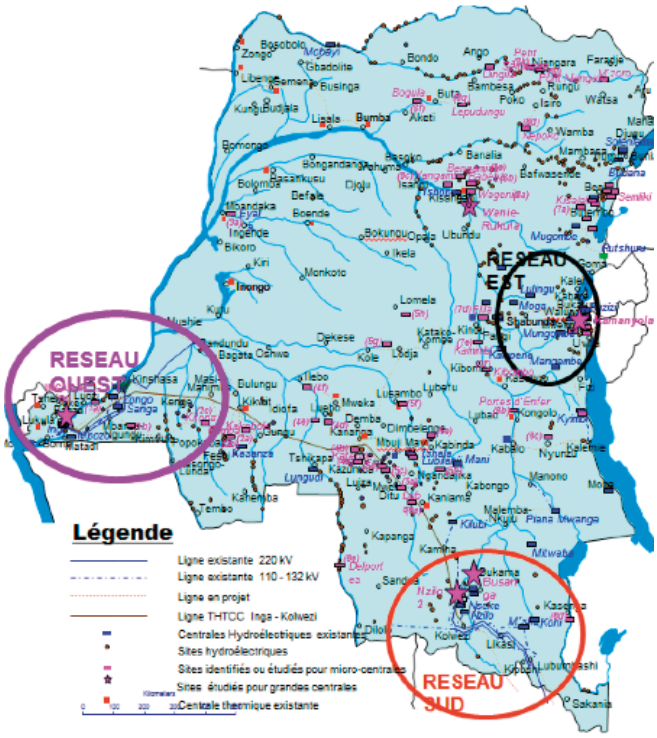

Figure 3. Existing transmission networks in the DRC

Source: Essor, "Access to Electricity, Solar Powered Mini-Grids in the DRC: Preliminary Information Memorandum," 2016. Thanks to Essor for consenting to its reuse. Essor drew on SNEL for the pie chart, USAID-SNEL for the map, and SNEL for the list of major transmission lines.

32. Elan RDC, *Privately Run Mini-Grids* (Kinshasa: Adam Smith International, 2016).

The demand for electricity in the DRC has soared in recent years—tripling between 2006 and 2016, according to an estimate by Essor, a UK-funded development program in the DRC. A main driver appears to be growth in the mining industry, but burgeoning urban consumer demand for power is also a factor. The current electricity supply from SNEL and private mini-grid operators meets less than one-third of this demand, a major barrier to economic growth.[33] In addition to hydropower, there is enormous potential for solar power in the DRC, with strong solar irradiation—which translates into high energy generation from solar panels—throughout the country. There are no reliable figures for solar energy output in the DRC, but current output is tiny and a fraction of demand.[34]

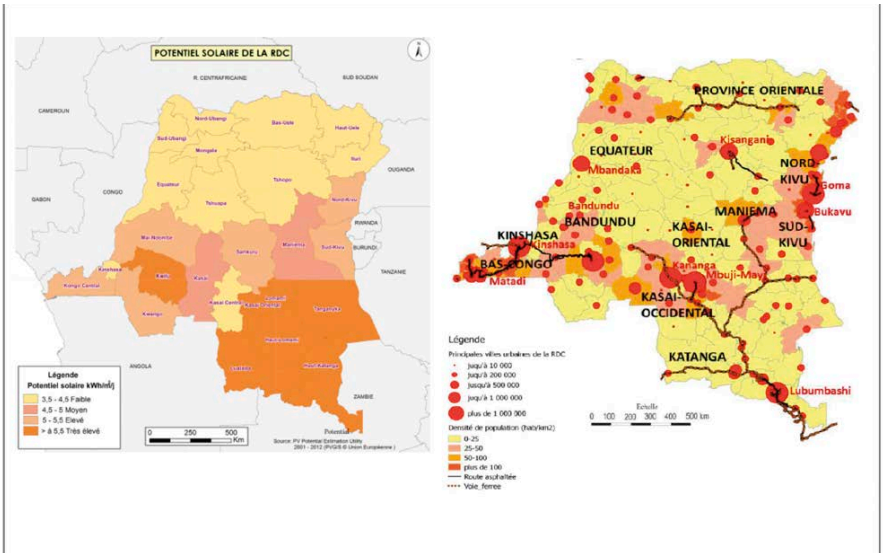

Figure 4. Solar irradiance and population density

Source: Essor, "Access to Electricity, Solar Powered Mini-Grids in the DRC: Preliminary Information Memorandum," 2016. The source of Essor's map is United Nations Development Programme, *Atlas des Energies Renouvelables*.

33. Essor, "Access to Electricity," 15.

34. Solar irradiation—a key factor in how much electricity a solar panel generates from the sun—is very favorable for solar power potential in the DRC, ranging from 3.5 to 5.5 kWh/m2/day and in some areas up to 6.8kWh/m2/day (see figure 4). USAID, *Conceptual Plan*, 11. See also Ranjit Deshmukh, Ana Mileva, and Grace C. Wu, "Renewable Riches: How Wind and Solar Could Power DRC and South Africa," *International Rivers*, September 25, 2017, https://www.internationalrivers.org/resources/renewable-riches-how-wind-and-solar-can-power-drc-and-south-africa-16532. The nongovernmental organization Resource Matters also hosts an excellent interactive map showing existing and potential renewable energy resources in the DRC, available at https://resourcematters.org.

1.2 THE POLITICAL ECONOMY OF THE DRC'S ENERGY SECTOR

Energy is one of the few sectors that has benefited from major investment by the state during the postindependence era. The Belgian colonial administration discussed harnessing the power of the Congo River to generate electricity as early as the 1920s, but it was only in 1957 that the government finally approved plans to build a dam at Inga on the Congo River, with construction planned between 1958 and 1965. The project was delayed for lack of funds, however, and had not yet begun at the time of Congo's independence in 1960. Zairean president Mobutu Sese Seko revived the project several years later, and Inga I, with six turbines, was built by the state between 1968 and 1972. Inga I supplied surrounding areas, and in a limited way Kinshasa, whereas its successor, Inga II, was intended to power the Katangan mining sector. Inga II was completed in 1982 and has eight turbines.

To connect Inga II to Katanga, Mobutu ordered the construction of a 1,800-kilometer high-voltage DC power line, at the time the world's longest. This immense construction project went massively over budget and by 1980 was responsible for one-quarter of the country's ballooning national debt.[35] Mismanagement of the project was rampant, particularly at the top, and the power line's subcontracts handsomely enriched Mobutu and his cronies. The real purpose of the Inga power line for the Mobutu regime was political, with the president seeking to ensure Katanga's dependence on the country's west for electricity, which he hoped would thwart that restive province's desire for independence.[36]

There has been much discussion about constructing Inga III, which was initially conceived by SNEL as a 3,400 MW project, and Grand Inga, which the company reckons could generate 44,000 MW. The Congolese government issued a tender for the construction of Inga III in 2010 and later selected two consortia for the task: one including Spain's Actividades de Construccion y Servicios and AEE Power, and the other led by Three Gorges Corporation and consisting of Chinese companies. In 2015 President Joseph Kabila assumed managerial control of the Inga III project, which caused the World Bank to withdraw its support. The government pressed on, and in 2017 it requested that the two consortia merge their proposals. They did so, and have since proposed building a much bigger version of Inga III, capable of generating 11,000

35. Crawford Young and Thomas Turner, *The Rise and Decline of the Zairean State* (Madison: University of Wisconsin Press, 1985), 298–301.

36. David Van Reybrouck, *Congo: The Epic History of a People* (London: HarperCollins, 2014), 367.

MW, for US$13.9 billion. Up to 5,000 MW of this power is supposed to be purchased by Eskom, South Africa's state-owned power utility, though it is unclear whether the cash-strapped company will be able to do so.

When Augustin Matata Ponyo was prime minister of the DRC from 2012 to 2016, he championed legislation to liberalize the Congolese economy. Law No. 14-011 of June 17, 2014 (the energy liberalization law), liberalized the generation, transmission, distribution, and export of electricity, thereby ending the monopoly previously enjoyed by SNEL over all of these functions. The company had previously been transformed into a commercial, limited liability company in 2011. The energy liberalization law seeks to encourage:

- Increased decentralization in policy making on energy (generation, transmission, distribution) from the national to the provincial level for non-nuclear, provincially bound power. The national government maintains authority over some areas, such as interprovincial, international, and nuclear energy.
- Diversification of the country's energy mix
- Greater emphasis on energy conservation and efficiency
- Energy pricing that better reflects market realities[37]

The electricity tariffs that SNEL charges to consumers have remained regulated by the state. The tariffs were set in 2009 and have hardly been adjusted since, leaving them among the lowest in the world and inadequate to cover SNEL's operational costs.[38] As a result, SNEL has had to resort to desperate measures to stay afloat, including cutting infrastructure maintenance to a minimum, falling significantly behind in the payment of staff salaries and, a particularly unfortunate practice, cutting households' and businesses' electricity connections and then imposing fees to reconnect them.

The 2014 law envisages the creation of two institutions under the supervision of the Ministry of Energy: the Autorité de Regulation d'Electricité (ARE) and the Agence Nationale des Services Energétiques Ruraux (ANSER). ANSER is intended to increase access to energy services in rural and peri-urban areas, whereas ARE is to be a regulatory body, monitoring sector reforms and the behavior of market players and their tariffs.[39] Although a decree was issued in April 2016 providing for the creation, organization, and functioning of

37. The text of this law can be found at https://leganet.cd/Legislation/Droit%20economique/Energie/Loi.14.011.17.06.2014.htm.

38. Essor, "Access to Electricity," 17.

39. Ibid.

ARE, the body has not yet been constituted. One reason for the delay may be the demanding requirements laid down in the decree about the appointment of ARE's leadership, including that the director general be proposed by a full council of government ministers (not just the energy minister) and confirmed by the state president. This process has not yet taken place, although the likelihood that it will happen increased with the May 2019 appointment of Sylvestre Ilunga Ilukamba as prime minister. Until ARE is formed, the country will continue to lack an independent regulator for its energy sector, leaving the Ministry of Energy to do the job.

The government's official target is that 65 percent of the population will have access to electricity by 2025 and 100 percent by 2030. The hope is that the energy liberalization law will move the country toward these targets by stimulating private sector electricity generation. Additional government incentives include reductions on customs duties of up to 100 percent for the import of materials required for the construction of large- and medium-scale electricity generation plants. So far this reduction has been applied almost exclusively to hydropower projects. Solar energy product suppliers, by contrast, continue to pay significant customs duties on their imports, unless they are able to secure case-by-case exemptions with the National Investment Promotion Agency. Extending these same incentives to the solar energy sector represents an obvious way for the government to stimulate and support renewable energy. Additional official costs for private sector electricity producers and retailers of renewable energy products include nationally and provincially imposed licensing fees, which many in the private sector have decried as unjust and onerous.

1.3 THE POLITICAL ECONOMY OF ENERGY IN EASTERN DRC

Eastern DRC, bordering Uganda, Rwanda, Burundi, and Lake Tanganyika, is the most densely populated region of the country and home to a complex and frequently volatile mix of ethnic communities. Commercial agriculture, agro-processing, and tourism dominated the region's economy during the colonial era, which also saw large-scale immigration from Rwanda. Little is left of these economic sectors, however, and today the regional economy is dominated instead by subsistence agriculture and artisanal mining for gold, tourmaline, tungsten, tin, and coltan. Mining and related trade has become a significant source of revenue for many armed groups in the region and for elements within the Congolese armed forces. There has long been intense competition in many areas for land, and this competition has become increasingly ethnicized since the 1990s and exacerbated by the interventions of regional powers.

Aerial view of Goma.

Source: Photo taken by Abel Kavanaugh, MONUSCO, and shared under creative commons. Available at https://www.flickr.com/photos/monusco/20874585058/.

UN humanitarian organizations established a significant presence in eastern DRC in response to the influx of refugees from Rwanda after the 1994 genocide there. MONUSCO's predecessor, MONUC, first deployed in eastern DRC in 2000, and today the mission has a significant presence there, particularly in the North Kivu capital of Goma.

Despite hydropower electricity generation from a growing number of sites, most of eastern DRC has no access to electricity, and where supply does exist, it is tightly constrained. The Ruzizi I hydroelectric dam was built in 1958 by the Belgian colonial administration at the Ruzizi River outlet from Lake Kivu. It has a hypothetical peak generating capacity of approximately 30 MW. A second dam, Ruzizi II, was added in 1989, and it has a hypothetical peak generating capacity of 44 MW. The two dams are operated by the Société Internationale d'Electricité des pays des Grands Lacs (SINELAC), a company created by the

Communauté Economique des Pays des Grands Lacs, a regional grouping of the DRC, Rwanda, and Burundi. SINELAC's power output is shared among the three countries. Due to a variety of factors, including a maintenance backlog, falling water levels in Lake Kivu, and worsening plastics pollution, actual output at Ruzizi I and II is typically 21 MW and 30 MW, respectively, or 51 MW in total. SNEL purchases 26 MW of this amount, with the rest divided between Rwanda and Burundi. SNEL sells 7 MW to Bralima, a local brewery, and typically allocates 6.5 MW to the city of Goma and 12.5 MW to the city of Bukavu. No other locations in North or South Kivu receive electricity from SNEL.[40]

Plans drawn up for the construction of Ruzizi III aim for it to generate 145 MW of electricity at a construction cost of US$625 million. Some money has been pledged, primarily by the African Development Bank (AfDB),[41] and some construction is reported to be underway on site,[42] though it is unclear when the project will be completed or fully funded.

The 6.5 MW of hydropower that SNEL reports it supplies to Goma, a city of well over one million people, is a tiny fraction of the city's demand, which is estimated at 80–100 MW. Further, experts estimate that the actual amount of electricity SNEL supplies to Goma is often considerably less than publicly stated.[43] In a survey conducted in the city, users reported receiving power from SNEL for an average of 6.7 hours a day, 5.5 days per week, and complained that there was little consistency or reliability in their energy supply, which hampered business and resulted in low trust in SNEL. The study also found that few SNEL customers had meters and that the company's actual charges to consumers in the city worked out to an average of US$0.41 per kWh, approximately four times higher than the official SNEL electricity tariffs.[44]

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40. Venant Nkundimana Gatimbirizo, interim provincial director, SNEL North Kivu, interview, Goma, March 2019.

41. Michael Harris, "AfDB Announces Financing for 147-MW Ruzizi 3 Hydropower Plant," *Hydroworld*, March 22, 2016, https://www.hydroworld.com/articles/2016/03/afdb-announces-financing-for-147-mw-ruzizi-3-hydropower-plant.html.

42. International Hydropower Association, "Regional Cooperation Catalyst for Hydropower Development in East Africa," *ESI-Africa*, January 5, 2018, https://www.esi-africa.com/industry-sectors/generation/regional-cooperation-catalyst-hydropower-development-east-africa-2.

43. Several energy private sector interviewees claimed that the actual amount SNEL supplies Goma is often considerably less than stated.

44. One-third of users said they were unable to predict when they would receive electricity from the utility; two-thirds said they did not trust their bills from SNEL; and 86 percent of people with businesses said that the lack of reliable energy prevented their business from working properly. Flavia Howard, "SME Market Research in the Kivu Regions," *RDC*, August 2018.

1.4 THE VIRUNGA HYDRO PROJECTS: ELECTRICITY AS A TOOL FOR PEACE AND DEVELOPMENT

Virunga National Park was established in 1925 and was one of the first protected natural areas in Africa. The park is 8,090 square kilometers in size, home to more than 3,000 faunal and floral species, more than 300 of which are endemic to the area, including the famous eastern gorilla. The park is also home to two active volcanoes, Mount Nyiragongo and Mount Nyamuragira. Several armed groups operate in Virunga Park, including the Forces démocratiques de libération du Rwanda. Clashes are common, not only between park rangers and armed group combatants but also among poachers.

Virunga SARL is the commercial arm of the Virunga Alliance, which is made up of the Institut Congolais pour la Conservation de la Nature, a state-owned body responsible for the protection of the Virunga and Kahuzi-Biega national parks, and the Virunga Foundation, a nongovernmental organization (NGO). Generously financed by the Howard G. Buffett Foundation and by the U.S. Centers for Disease Control and Prevention, the European Union, the United States, and the World Bank, among others, Virunga SARL initially constructed a small 0.35 MW hydropower project called Mutwanga I, followed in 2015 by the construction of the much larger Matebe project near Rutshuru, which generates 13 MW. Mutwanga II, which generates 1.4 MW, came on stream in early 2019. A fourth site, Luviro, which will generate 14.6 MW, is due to come on stream in October 2019. Virunga's management has said that four additional hydropower projects are possible in the park, and total production could reach 105 MW.[45]

Luviro is situated near the town of Lubero and is expected to provide energy for it and, potentially, for nearby Butembo. Butembo's energy is partially supplied by a hydroelectric plant built and operated by a consortium called ENK. Matebe supplies Rutshuru and its surrounding area, but the small town lacks energy-intensive industry and is unable to use much of the electricity available. In 2016, the SOCODEE,[46] a consortium of powerful and politically connected local businesspeople, constructed an electricity transmission line from Matebe to Goma; since 2017, SOCODEE has been building distribution lines feeding from this line. Virunga SARL has run a distribution line from the same transmission line to supply the Goma neighborhood of Nyiragongo. SOCODEE has a contract

45. Virunga SARL manager, interview, Goma, March 2019.

46. This translates as "the Congolese company for the distribution of water and electricity."

with Virunga to purchase 5 MW and, at the time of research, had clients for 1.4 MW and was actively seeking new clients.[47]

It is notable that Virunga SARL has opted not to connect to the grid of the national utility, SNEL, or to sell its electricity to SNEL. Virunga SARL does not believe it would be regularly or sufficiently paid by SNEL, a concern that SNEL's management concedes is reasonable. Several interviewees alleged that SNEL does not pay its bills regularly to SINELAC, for example, and could not reliably be expected to do so with Virunga. Virunga SARL further reasons that it would not be allowed by provincial politicians to cut SNEL off for non-payment for fear of the impact on essential services.[48]

The North Kivu management of SNEL has expressed dismay at the entry of SOCODEE and Virunga into the market and has alleged that the competition with SNEL for customers from Virunga SARL is unfair:

> We know the Electricity Law allows for liberalisation, but not for an operator to come into the concession of another operator. That is not normal. But here in Goma these companies have come to where we are and put up their own distribution lines. They have taken many of our big clients. This competition is not fair. We tried to get it stopped at the tribunal, but we did not succeed. Since the ARE is not in place, the national ministry itself should intervene and apply the law. We are waiting.[49]

SNEL's interpretation of the energy liberalization law is disputed by Virunga SARL, SOCODEE, and, crucially, the North Kivu provincial government. According to Jules Simpeze Banga, a senior advisor to the then-provincial minister of mines and energy, Anselme Paluku Kitakya, "SNEL's interpretation is not correct. Operators' concessions are not exclusive. Article 19 of the Electricity Law says that customers have the right to choose. How can they have this right if there is only one operator in each concession?"[50]

Simpeze stated that the North Kivu government regarded the energy liberalization law as a valuable opportunity to expand the province's sovereignty: "The law supports decentralization, and we are in favor of that. Of course, Kinshasa always resists decentralization and encourages energy op-

47. Théogene Rukondo, project manager, SOCODEE, interview, March 2019.

48. Industry sources, interviews, March 2019.

49. Venant Nkundimana Gatimbirizo, interim provincial director, SNEL North Kivu, Goma, interview, March 2019.

50. Jules Simpeze Banga, advisor to the North Kivu minister of mines and energy, interview, Goma, March 2019.

erators to continue to pass by Kinshasa. But in fact, everything can now be done through us."[51]

Simpeze added that the provincial government had issued—and charged for—numerous licenses since the 2014 energy liberalization law was passed, including an electricity generation license and a distribution license for Virunga, an electricity distribution license for SOCODEE, and a generation and distribution license for solar mini-grid developer Kivu Green Energy. So far, it seems, SNEL has not applied to the province for any license.

SNEL is hoping for an additional hydroelectric resource via the NELSAP, a project of the Nile Basin Initiative (NBI). The NBI, which was founded in 1999, is a partnership of riparian states that seek to develop the Nile in a cooperative manner with support from the World Bank. The NBI hopes that by so doing, it can contribute to the eradication of poverty, the promotion of economic growth, and the reversal of environmental degradation in the Nile Equatorial Lakes Region.[52] Goma is supposed to be connected from Rwanda as part of a NELSAP Interconnection Project connecting five countries: Burundi, the DRC, Kenya, Rwanda, and Uganda. As of mid-2019, however, neither Goma nor any other location in the country had been connected. According to NELSAP, this gap exists because "work at the Goma substation ran into implementation difficulties that SNEL is trying to solve."[53] SNEL, however, believes that implementation difficulties, which allegedly relate to a subcontractor absconding with funds intended for the construction of the substation, need to be fixed not by SNEL but by the AfDB, which is partly funding the project. If the project is completed, SNEL claims that a massive 80 MW will become available to Goma and Bukavu.[54] The provincial government concurs with SNEL that the AfDB needs to identify a new subcontractor in order for NELSAP to move forward.[55] When or if the project will be completed is anyone's guess.[56]

A number of new companies are entering the electricity generation and distribution sectors in eastern DRC. Kivu Green Energy installed the country's

51. Ibid.

52. Nile Basin Initiative, "Vision Statement," http://nelsap.nilebasin.org/index.php/en/.

53. NELSAP's Kigali office, email communication, April 2019.

54. Venant Nkundimana Gatimbirizo, interim provincial director, SNEL North Kivu, interview, Goma, March 2019.

55. Jules Simpeze Banga, advisor to the North Kivu minister of mines and energy, interview, Goma, March 2019.

56. The AfDB has not responded to email requests for comment from the author.

Kivu Green Energy's 55kW solar system in Beni, North Kivu.

Source: Photo courtesy of Kivu Green Energy.

first solar mini-grid, generating 55 kilowatts (kW), in Beni in 2017. The company is constructing a larger 1.3 MW solar mini-grid in Goma that is due to come on line in October 2019 and projected to be one of the largest mini-grids in sub-Saharan Africa.[57] BBoxx, in alliance with telecommunications company Orange, sells and services solar kits to households and small businesses and counts 3,500 customers in Goma and 5,000 in Kinshasa.[58] Altech installs, but does not service, solar kits and offers clients the option of managing the high up-front cost by purchasing on credit. The company reports that it has sold 120,000 solar lights and 30,000 solar kits across the DRC over five years.[59]

Electricity output is steadily rising in eastern DRC due to the new hydropower stations constructed by Virunga SARL and new solar mini-grids and small-scale solar home systems. Total energy supply in the region remains well below total demand, however, and most inhabitants have little or no access to electricity. An additional electricity supply is potentially available to SNEL in eastern DRC via NELSAP, but it remains unclear when or if this will materialize. SOCODEE, meanwhile, has too few clients for the energy it sources from Virunga SARL, and it has more than 3 MW available that, so far, the company has not been able to sell.

57. Jonathan Shaw, Kivu Green Energy, interview, April 2019.
58. Max Gopfert, BBoxx DRC manager, interview, Goma, March 2019.
59. Washikala Malongo, Altech managing director, interview, Goma, March 2019.

In this context, it is worth considering the impact of international and UN field operations in the DRC in general, and MONUSCO's role on eastern DRC's electricity political economy more specifically, and the opportunities and potential impacts of transitioning to greater renewable energy use.

2

UN ORGANIZATIONS AND RENEWABLE ENERGY

This section reviews MONUSCO, the largest of all the current UN peacekeeping missions, its energy use, and its ongoing transition toward greater use of renewable energy. Even as the mission implements a drawdown in parts of the country, it has the opportunity to significantly increase its use of renewable energy by switching to full-time hydropower in Goma and by increasing the use of solar power in its off-grid locations. Despite some progress, MONUSCO has faced challenges in accelerating the use of those sources. The opportunities and potential benefits are explored here, with lessons for both MONUSCO and the United Nations more broadly.

2.1 MONUSCO AND ITS ENERGY FOOTPRINT

Of all the UN and other international organizations active in the DRC, none is as large or as influential as MONUSCO. With more than 20,000 personnel, MONUSCO is the world's largest UN peacekeeping mission and among its most expensive, with an annual budget exceeding US$1 billion. The UNHCR, the World Food Programme, the UN Children's Fund, and the UN Office for the Coordination of Humanitarian Affairs (OCHA) are among the other UN agencies with a large presence in the country, supporting a range of nongovernmental and governmental programs and an (underfunded) US$1.65 billion humanitarian operation that includes both UN agencies and local and international NGOs.[60]

UN peacekeeping missions are civilian led, with civilian, police, and military personnel deployed to support peace agreements, protect civilians, and strengthen governance and the rule of law. Most UN peacekeepers, including those in

60. The 2019 consolidated humanitarian response plan for the DRC seeks to raise US$1.65 billion; this goal was 29 percent funded as of August 2019. The 2018 humanitarian appeal raised 48 percent of the US$1.675 billion sought for humanitarian operations in the DRC; see https://fts.unocha.org/appeals/673/summary.

MONUSCO, are authorized to use force in defense of themselves and their mandate, which includes the protection of civilians from physical violence. In addition to the mission's uniformed police and troops, who make up around 80 percent of the total personnel, MONUSCO's civilian staff carry out numerous important functions to implement the mission mandate, including civil affairs, political affairs, and human rights. MONUSCO, like all missions, is dependent on multiple support functions, including procurement, logistics, transportation, facilities management, and supply chain management. On the uniformed side, most personnel deploy as contingents from troop-contributing countries (TCCs) and police-contributing countries (PCCs). As of July 2019, 54 countries had contributed personnel to MONUSCO, with the largest number of troops from Pakistan (2,695), India (2,613), and Bangladesh (1,657); the largest police contingents were from Egypt (321), Senegal (295), and Bangladesh (182).[61]

Unsurprisingly, given its size and the scope of activities, MONUSCO has a large electricity footprint. Determining the precise amount, however, is difficult. MONUSCO reports that its annual electricity consumption is 46,552,583 kWh—roughly equivalent to the total annual electricity consumption of 4,500 American households.[62] Also according to MONUSCO, approximately one-third of its total electricity consumption in the DRC as a whole is supplied by SNEL.[63] This suggests that the remaining two-thirds of the mission's electricity is supplied by the mission's diesel generators and that these generators produce 31,190,230 kWh of electricity a year.

MONUSCO's engineering unit reports that the mission's generators, on average, consume 0.23 liters of diesel per kWh, a surprisingly low figure.[64] On that basis, 31,190,230 kWh of output would require 7.17 million liters of fuel. It is reckoned that 2.6 kilograms of carbon dioxide are released per liter of

61. United Nations, "MONUSCO Fact Sheet," https://peacekeeping.un.org/en/mission/monusco.

62. MONUSCO Office of Mission Support, correspondence, August 2019. The U.S. Energy Information Administration reports that the average annual electricity consumption for a U.S. residential utility customer in 2017 was 10,399 kWh; https://www.eia.gov/tools/faqs/faq.php?id=97&;t=3.

63. It is worth noting that officials within MONUSCO provided different figures, which were difficult to verify. For example, according to the mission's EPU, SNEL supplies only 5,100 MWh to MONUSCO annually in Goma and Kinshasa, representing just 1.2 percent of the mission's total.

64. Researchers for the Essor program estimate average consumption of 0.6 litres of diesel per kWh, more than double the MONUSCO figure. For similarly sized and well-maintained generators, the average is 0.32–0.36 litres per kWh.

burned diesel fuel,[65] which implies that MONUSCO's carbon dioxide emissions from diesel generators are 18,652 tons per year—equivalent to the carbon footprint of approximately 4,054 cars on the road per year.[66]

MONUSCO's total budget for 2019–20 is US$1.01 billion, down slightly from US$1.189 billion in 2017–18.[67] Of this budget, a little over half is planned for reimbursing military and police personnel,[68] while civilian personnel account for slightly more than 20 percent.[69] The cost of electricity generation is hard to quantify for MONUSCO and other missions, as costs are spread across different budget lines: these include equipment such as generators, diesel procurement, transport and protection of fuel and associated staff costs, and maintenance. For example, MONUSCO spends roughly US$50 million a year on facilities and infrastructure.[70] Within this overall sum, generators are recorded as a stand-alone budget line costing the mission US$636,000 in 2017–18 and US$1.3 million in 2018–19, and they are budgeted at US$1 million in 2019–20. Petrol, oil, and lubricants for the mission and TCCs cost US$13 million in 2017–18 and US$11.5 million in 2018–19, and they are expected to cost US$11.5 million in 2019–20.

Establishing Environmental and Energy Targets

In 2009, the UN Department of Peacekeeping Operations (DPKO) and DFS adopted a new policy requiring all UN peace operations to establish their own environmental targets in order to reduce environmental impacts and improve the health and safety of UN staff and local communities. By 2017, all UN missions had environmental action plans for the 2017–18 budgetary cycle.[71]

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65. Energy Education, https://energyeducation.ca/encyclopedia/Diesel_generator.

66. 7.17 million x 2.6 = 18.65 million kilograms = 18,652 tons. The U.S. Environmental Protection Agency estimates that a typical passenger car emits roughly 4.6 metric tons of carbon dioxide per year. 18,652 tons ÷ 4.6 tons per car = 4,054 cars.

67. All statistics in this paragraph are from the MONUSCO annual budgets that were shared with the researcher in March 2019.

68. The cost was US$562.7 million in 2017–18 and US$535 million in 2018–10, and US$465.6 million was budgeted for 2019–20.

69. US$291 million in 2017–18, US$257 million in 2018–19, and projected US$207.8 million in 2019–20.

70. US$52 million in 2017–18, US$58.6 million in 2018–19, and projected US$48.5 million in 2019–20.

71. Lucile Maertens, "From Blue to Green? Environmentalization and Securitization in UN Peacekeeping Practices," *International Peacekeeping* 26:3 (2019), 302-326, https://doi.org/10.1080/13533312.2019.1579648.

MONUSCO's EPU, established in 2011, started functioning in 2012. The EPU's initial area of focus was eliminating the use of wood for fuel by UN troops, a goal the EPU claims has been achieved. Today, the EPU's current area of focus is reducing MONUSCO's dependence on diesel generators. Its approach involves persuading the mission leadership to advance changes not only by appealing to the spirit and principles of the *Greening the Blue* initiative but also by demonstrating via a cost-benefit analysis that doing so will reduce MONUSCO's fuel and maintenance costs. The EPU concedes that progress has been slow but points to the mission's use of SNEL's hydroelectric power in Kinshasa and Goma since 2014 as evidence that this environmental policy is being implemented. The EPU also highlights the recent installation of a 650 kW-capacity solar farm on UN properties in Goma and the steady rollout of solar security lighting and water heaters in MONUSCO field offices.[72] The bulk of the panels on MONUSCO's Goma solar farm are installed on the mission's RVA hospital,[73] with the whole system synchronized with SNEL's electricity supply. There are no batteries to store the energy generated by the panels, but during daylight hours, the system is usually capable of supplying more than the hospital's energy needs. MONUSCO returns much of the excess to the SNEL grid for free.[74] MONUSCO's solar streetlights, meanwhile, have a capacity of 375 kW, while small solar systems that support the mission's communications equipment have a capacity of 6 kW.[75]

Another area where MONUSCO has pressed for introducing renewable energy is its community-oriented quick impact projects (QIPs), on which the mission spends roughly US$1.5 million per year. Many projects include a renewable energy component. From 2014 to 2019, US$2.85 million was disbursed for renewable energy QIPs, roughly one-third of total spending during this period. In nearly every instance, the money was spent on community solar lighting.[76] Beginning in 2019, MONUSCO's QIP review committee declined to fund any project proposals that require expenditure on diesel generators.[77]

72. EPU, March 2019; information about the installed capacity of the solar farm was supplied by MONUSCO via email, August 2019.

73. The hospital is situated on land belonging to the Regie des Voies Aeriennes (RVA).

74. MONUSCO engineers, RVA hospital, interviews, Goma, March 2019.

75. MONUSCO Office of Mission Support, email correspondence, March 2019.

76. Information supplied by the Program Management Unit, Office of the DSRSG, March 2019.

77. Chair of the QIP review committee, interview, Goma, March 2019.

MONUSCO's Goma office handing over solar panels and FM transmitters to support local radio stations.

Source: Photo taken by Myriam Asmani, MONUSCO, September 16, 2016, and shared under creative commons. Available at https://www.flickr.com/photos/monusco/29767433721.

MONUSCO's spending priorities for QIPs show the mission's growing commitment to reduce diesel dependence and promote renewable energy deployment. Yet the same commitment has proved more problematic for MONUSCO's own operations. For many years, MONUSCO and all its TCCs relied exclusively on diesel generators; the mission started to use SNEL's power only in 2014, five years after the option became available. Though late in coming, this was important progress for MONUSCO nonetheless, since almost all of SNEL's power is generated from renewable hydro sources. Because SNEL's power output is patchy, insufficient, and unavailable in most places, however, MONUSCO still relies on expensive and dirty diesel generators.

Making Real Change: Embracing Virunga Hydropower

At the end of 2018, two MONUSCO military bases in North Kivu, in the small settlements of Munigi and Kiwanja, were linked to Virunga's Matebe power line.

In Munigi, the line passes within 20 meters of the UN camp. Because the Virunga access line was built in 2017, mission leadership has pushed to ensure that the mission make use of this energy source.[78] Virunga staff conceded that the process of eventually connecting the two MONUSCO bases to its energy supply line had been challenging. A manager noted, "We were continuously blocked by MONUSCO until [MONUSCO Deputy SRSG David] Gressly became involved, even though it was obvious that having continuous power from us would be better for the military bases situated near our cable than using generators."[79]

The commander of the Indian military battalion at Munigi reported that the situation at the camp was transformed after the connection to Virunga power: "We used to run on generators 24/7, but now we have electricity from Virunga full-time. The noise reduction is the biggest change for us. It is so peaceful now. And of course we use far less fuel. Before, we were burning 2,000 liters a day."[80]

In Goma, which hosts MONUSCO's eastern headquarters, the option to source electricity from Virunga has been available for more than two years. According to SOCODEE, which ran an electricity transmission line from the Matebe power station into central Goma in late 2016, and still has excess power it is trying to sell, it has been trying to persuade MONUSCO to sign up as a customer since:

> We can give them green energy, 24 hours a day! And they would not even have to purchase transformers. We will supply the transformers for free! If they gave the word, we could connect the MONUSCO HQ in Goma in two weeks. They know SNEL cannot give them what they need, and yet they stick with them. It is as if they prefer to use generators. It is remarkable.[81]

In a bid to move the process forward, SOCODEE submitted a formal offer to supply MONUSCO with power in Goma in November 2018. At the time of writing, SOCODEE was still awaiting a response.[82] Within MONUSCO, there are differing views about whether the mission should switch from the SNEL-plus-diesel-generator status quo to 24-hour Virunga hydropower (directly or via SOCODEE). One justification offered for maintaining the status quo is that SNEL's rates are cheaper than SOCODEE's. A senior Mission

78. Senior leadership, MONUSCO, interview, Goma, March 2019.

79. Virunga manager, interview, Goma, March 2019.

80. Lt.-Col. Dushyant, Munigi base commander, MONUSCO, interview, Munigi, March 2019.

81. Théogene Rukondo, project manager, SOCODEE, interview, Goma, March 2019.

82. Ibid., and subsequent correspondence.

Old generators at the TCC base at Munigi, out of service since the site was connected to hydropower.

Source: Photo taken by Gregory Mthembu-Salter, Munigi, 2019.

Support officer conceded, however, that although the mission should be eligible for a US$0.08 per kWh rate from SNEL, in fact MONUSCO pays US$0.18 per kWh.[83] SOCODEE charges US$0.21 per kWh[84] but can supply continuous power, whereas SNEL usually manages to provide about 6 hours of power per day. Switching suppliers would mean the mission would no longer have to run expensive and dirty diesel generators 18 hours a day.

Given these cost figures, it is worth exploring what a transition would mean in practice. For the MONUSCO-supported Goma airport, for example, MONUSCO could save more than US$155,000 per year by switching from using SNEL for 6 hours and diesel for 18 hours to using SOCODEE 24 hours a

83. Senior officer, MONUSCO Office of Mission Support, interview, Goma, March 2019.

84. Théogene Rukondo, project manager, SOCODEE, March 2019.

day (see table 1), even at the higher hourly rate (SNEL's US$0.18 per kWh rate versus SOCODEE's US$0.21 per kWh rate). A similar level of cost savings would presumably be available to MONUSCO's Goma headquarters as well as to locally deployed UN contingent sites if they switched from SNEL and diesel to SOCODEE/Virunga.

SNEL could connect to NELSAP and then have sufficient hydropower for all its clients, but there is no clear time line for this option becoming available. Switching to SOCODEE would render the mission's recently installed 650 kW Goma solar farm redundant, so some observers argue against a transition. A sensible win-win option would be for MONUSCO to first switch its Goma sites to SOCODEE, then relocate the solar farm to one or more alternate locations that currently rely on diesel generators. Although MONUSCO is in the process of a drawdown, it is likely to maintain a sizable presence for the foreseeable future in conflict-affected locations, such as Ituri, North Kivu, South Kivu, and probably Tanganyika and some of the Kasaï provinces.

In early 2019, the Office of Mission Support halted the tendering process for supplying MONUSCO's electricity requirements in Goma because SNEL had not been invited to bid. The new tendering process was due to begin in June 2019 but, at the time of writing, had yet to do so.[85] Managers at SNEL,

Table 1. Cost-benefit analysis of transitioning Goma airport from SNEL (6 hours) and diesel (18 hours) to SOCODEE/Virunga (24 hours)

All values in US$	SNEL + Diesel	SOCODEE
Key Assumptions		
Diesel $ per liter	0.85	—
Grid $ per kWh	0.18	0.21
Year 1 Expenses		
Grid	(6 hrs) 33,607	(24 hrs) 143,765
Generator	(18 hrs) 265,430	—
Total expenses, year 1	299,037	143,765
Results		
Savings in year 1	–	155,272
10-year expense	$3,652,763	$1,468,203
Savings over 10 years	**–**	**2,184,561**
CO_2 reduction, kg per year	–	476,531

85. Senior officer, MONUSCO Office of Mission Support, interview, Goma, March 2019, and update from MONUSCO, August 2019.

concerned about the entity's financial solvency, hope that MONUSCO will continue to remain a client. According to the company's commercial director in Goma:

> We really need MONUSCO. When MONUSCO pays us, that is when we can pay the salaries of our staff. So we do everything we can to satisfy MONUSCO. If necessary, we can cut our other clients to serve them! For example, at Goma airport, they wanted more lights and for us to supply the power. We did that and gave the power to them. We even cut power from some parts of Bukavu to give it to them.[86]

This suggests that the service agreement between SNEL and MONUSCO comes at a cost to SNEL's residential customers. Senior MONUSCO officials were unaware that SNEL was cutting off Congolese customers in Bukavu to supply the mission and retain its business. Several officials commented that if MONUSCO is unwittingly contributing to power cuts for Congolese citizens—who already endure chronic shortages—that is unwelcome news.[87] Civil society activists in Bukavu, meanwhile, have complained that the electricity supply in the city has worsened dramatically since the beginning of 2019, even by SNEL's low standards. The activists have organized increasingly vocal protests about the matter, including a march through Bukavu to SNEL's offices in mid-April 2019.[88]

2.2 MEETING THE ENERGY NEEDS OF TROOP-CONTRIBUTING COUNTRIES

The UN's uniformed contingents make up the bulk of MONUSCO's personnel and are responsible for most of MONUSCO's electricity consumption. With the exception of Munigi and Kiwanja, all MONUSCO military bases in the DRC generate their own power—save for perimeter lighting in some camps that is powered by solar—with diesel generators. The uniformed contingents

86. Commercial director, SNEL, interview, Goma, March 2019.

87. Interviews with MONUSCO officials, Goma, March 2019.

88. Civil society activists in Bukavu, communication, April 2019. See also "Bukavu: 'Amka Congo' lance 'l'acte 2' contre la SNEL ce mercredi 17 avril," *La Prunelle*, April 15, 2019, http://www.laprunellerdc.info/2019/04/15/bukavu-amka-congo-lance-lacte-2-contre-la-snel-ce-mercredi-17-avril.

are required to deploy with specific capacities, for which they are reimbursed. In many cases, such as with Munigi before it made the transition, the generators are old, inefficient, and dirty. To date, neither the United Nations' overall goal to use more renewable energy nor its specific call in 2017 for more efficient generators (including hybrid solar generators) has been reflected in the headquarters-based process of recruiting and organizing TCC and PCC contingents.

A statement of unit requirement (SUR) defines what the military component of MONUSCO expects from contributing countries, including the number and type of personnel and equipment and their roles and responsibilities. TCCs that plan to deploy to a peacekeeping mission are required to provide their own kits and be self-sufficient, including in power generation. Before TCCs arrive in the DRC, the United Nations provides peacekeeping contingents with the mission's requirements and works with them to validate that they meet those standards. For its part, the UN mission—in this case, MONUSCO—covers the cost of transport into the country of a peacekeeping contingent's equipment, including their means of electricity generation. The mission also supplies the fuel for the contingent's operations if they use generators—which is the case for every MONUSCO site except the Virunga-connected Indian bases at Munigi and Kiwanja. The office of the deputy chief of staff for operations and planning is responsible for supplying MONUSCO troops' basic needs when they are operating outside their camps on patrol.[89]

There are steps that the Secretariat could take to incentivize TCCs to switch to renewable energy. For example, it could help press more TCCs and PCCs to diversify their power sources. According to MONUSCO's Office of Mission Support, MONUSCO's SURs have never reflected a preference for contributing nations to meet even the smallest percentage of their contingents' power needs from renewable sources. Within MONUSCO, some suggest that explicitly articulating such a preference or requirement could have an impact, as could efforts to modernize and support more efficient and cleaner generators. If generators were required to be of new design, more efficient, and less dirty, "we could make a huge impact," stated one official with the mission. Because peacekeeping contingents (military and police units) are reimbursed for their contribution to UN peacekeeping missions, that also influences what equipment they bring.[90] In 2017, the United Nations added a

89. Senior commander, MONUSCO deputy chief of staff for operations and planning; interview, Goma, March 2019. Within MONUSCO, the Office of Mission Support also organizes the provision of sites and the basic capacities of running water.

90. Each contingent is paid a monthly stipend based on the number of personnel, as well

reimbursement option as an incentive for TCCs to bring more efficient generators and solar-powered generators.[91] There is no evidence that any TCCs or PCCs have deployed with this equipment yet, however.

One TCC that has switched to using more modern generators in the DRC is Uruguay, although it has yet to make a transition to renewable energy. Since 2018, Urubatt has replaced the older generators at its Goma base with more modern models. The result, according to the base commander, is a huge reduction in noise, fuel consumption, and—presumably—carbon emissions. The commander believed that Urubatt was not permitted by the United Nations to use SNEL, Virunga, or SOCODEE electricity because of the SUR condition that TCC units be self-sufficient and independent of external electricity supplies for power.

Given the Indian military battalion's experience in Munigi, this suggests the absence of a common understanding among TCCs about power generation requirements. In practice, MONUSCO contingents could rely on a diverse range of sources, including 24-hour Virunga power, as in Munigi and Kiwanja, or solar power. The Urubatt commander expressed a desire to increase Urubatt's use of solar energy, noting that he would be interested in the installation of solar perimeter lighting, while adding that he understood such an intervention to be the responsibility of the mission rather than the contingent.[92] A larger problem may be that few TCCs currently have solar power or renewable energy options available at home from which they can draw to support their peacekeepers' deployments.[93]

as negotiated reimbursement rates for equipment that they bring. The precise formulas for these reimbursement rates are negotiated between TCCs and the United Nations every three years through a COE working group. White papers with proposals are shared between the United Nations and member states that include ideas on adding or changing the types of equipment and the rates of reimbursement. These white papers provide a forum for member states to embrace a greater use of renewable energy and/or a pivot toward contingents deploying more of their own renewable energy capacity to a mission. Senior officer, MONUSCO Office of Mission Support, interview, Goma, March 2019.

91. UN General Assembly, "Manual on Policies and Procedures concerning the Reimbursement and Control of Contingent-Owned Equipment of Troop/Police Contributors Participating in Peacekeeping Missions," UN Doc. A/72/288, https://operationalsupport.un.org/sites/default/files/contingent-owned_equipment_manual_2017_0.pdf.

92. Urubatt commander, interview, Goma, March 2019.

93. Senior UN official working on energy issues, telephone interview, July 26, 2019.

UN staff standing by the generators at the site of the Uruguayan Battalion in Goma.

Source: Photo taken by Gregory Mthembu-Salter, Goma, 2019.

Considering Solar Power for Off-Grid Sites

All these factors have major implications for energy provision in field missions and significant economic impacts for the United Nations. The existence of multiple hydropowered grid options for MONUSCO in Goma is relatively unique, and therefore the applicability to other locations is limited. While other mission sites in the east could be linked up to hydropower, this is not an option for much of the country, and nor is it an option for many UN peacekeeping sites around the world, which are often in off-grid settings. For such locations, in DRC and beyond, integrating solar power—either directly or with batteries—offers an ideal solution, particularly in sunnier regions such as Africa and the Middle East, where the UN has large peacekeeping and humanitarian deployments.

A transition to more solar power offers many potential benefits, but it poses challenges as well. Solar systems can last up to 25 years, but they require a single large up-front capital expenditure, which then pays for itself in energy cost savings over time. This up-front capital requirement presents a challenge for UN peacekeeping operations such as MONUSCO, given their 12-month budget cycles. One option, where available, is for the mission to engage local or regional

solar companies in an energy-as-a-service solar leasing model, in which power generation is outsourced entirely, with the exception of backup power.[94]

To better illustrate the economics of transitioning to solar, table 2 shows a cost-benefit analysis for installing a solar photovoltaic (PV) and battery system at a hypothetical average-sized MONUSCO contingent base that is currently running two diesel-powered 150 kilovolt amp (KVA) generators for power. Such a switch could achieve considerable cost savings for the mission over time: Adding a 200 kW solar system with 200 kW/450 kWh of batteries would reduce diesel usage for electricity generation by 80 percent, with a payback period of less than four years and 10-year savings of nearly US$2.6 million.

Solar and battery systems are a viable solution for many of MONUSCO's off-grid sites, and offer an approach that can be applied across many peacekeeping missions. The benefits are many. Notably, unlike the hydro transition discussed for Goma above, building new solar systems has the added impact of bringing new energy systems with a 25-year lifespan into poorly electrified communities and parts of the country. These systems can help support local electrification efforts and can be transitioned to local ownership following a mission drawdown, thus creating the peace dividends of tomorrow, today.

2.3 MONUSCO DECISION-MAKING ABOUT ENERGY USE

Senior mission leadership has historically had a limited role in Mission Support decisions related to electricity generation. The main decisions about electricity have, historically, been taken by the Engineering Section within Mission Support, which in MONUSCO is one of the largest sections in the mission.[95] The principal tasks of the Engineering Section's EMU are to calculate, provide, and maintain the electrical power needs of MONUSCO,

94. A recent example of this approach is South Sudan, where the IOM agreed to a solar lease, with private solar companies Scatec Solar and Kube Energy, for the internally displaced persons camp in Malakal. The companies will finance the construction of a 700 kW solar system for the camp's Humanitarian Hub, with the IOM committing to purchase energy from the system for a set period of time. This solar lease provides cost savings for the IOM from day one, while leveraging private sector investment to pay for the up-front costs of building the system.

95. MONUSCO's Engineering Section is 300–400 people strong, reportedly the largest single section in the mission. Chief, MONUSCO Engineering Section, interview, Goma, March 2019.

Table 2. Integrating solar power: Cost-benefit analysis of transitioning from two KVA diesel generators to incorporate a 200 kW solar system with 200 kW/450 kWh of batteries

All values in US$	100% Diesel	Solar PV + Diesel
Key Assumptions		
Diesel $ per liter	0.85	0.85
Year 1 Expenses		
Generator	284,388	19,907
Solar PV	–	1,167
CAPEX, Solar PV/BESS	–	829,917
Total expenses, year 1	284,388	850,993
Results		
10-year expense	3,685,663	1,090,890
Payback, years	–	3
Savings over 10 years	–	**2,594,772**
CO_2 reduction, kg per year	–	334,462

Note: The economic analysis for this 200 kW solar system and 200 kW/450 kWh lithium-ion batteries assumes a total installed cost of US$3 per watt (US$2.1 per watt of solar, and US$0.91 per kWh for the battery energy storage system [BESS]).

including, though to a limited extent, the TCC contingents.[96] The EMU's calculations about what is needed to meet the mission's electricity needs—principally in the form of diesel for generators, but also spare parts and new generators—eventually become part of the mission's budget proposal, which is reviewed at multiple levels of the bureaucracy and ultimately requires the approval of the UN General Assembly. At the mission level, the fuel requirements calculated by the EMU are relayed to Life Support, which places the order for the necessary fuel. The procurement of fuel, generators, solar panels, and much else is handled by the Procurement Section of the Supply Chain Management component of the Office of Mission Support.[97]

96. The Engineering Section falls under the Service Delivery Management component of the Office of Mission Support, along with Transport, Medical, Aviation, and Life Support sections. The other components of Mission Support are Supply Chain Management and Operations and Resources Management. MONUSCO Office of Mission Support organogram, supplied by MONUSCO.

97. Senior officer, MONUSCO EMU, interview, Goma, March 2019.

MONUSCO's sizable fuel requirements are supplied exclusively by Kenya-based Hashi Energy, which won the contract in 2015 and was the first small oil company to do so. Asked to describe the services that the company provides to the mission, a senior Hashi manager replied, "We do everything! MONUSCO does not have to do anything. We source the fuel, bring it in, deal with customs, deal with transport challenges, security, everything. We supply to site." The manager explained that roughly half the fuel supplied by Hashi served to meet the mission's aviation requirements, but Hashi also supplied all the fuel for UN vehicles and for generators.[98]

TCCs are responsible for servicing contingent-owned equipment (COE), including their own generators; until recently, the Office of Mission Support serviced UN-owned equipment, including generators operated by MONUSCO. In March 2019, maintenance for UN-owned generators, though not those owned by contingents, was outsourced for the first time.[99]

The EMU and its proposals for MONUSCO's energy requirements, for example, need to be approved by the chief of Service Delivery Management and the director of the Office of Mission Support. This is partly a legacy of institutional reforms introduced in 2007 that established the DFS as a separate entity from the DPKO, with an undersecretary-general appointed to oversee the provision of dedicated support to peacekeeping and political field missions.[100] Hence, Mission Support managers have navigated dual reporting lines with responsibilities often dependent on multiple chains of command. In practice, this has meant that MONUSCO's senior mission leadership has not had clear authority over issues directed by the Office of Mission Support, whose director or chief has typically reported to the DFS and now reports to the DOS. This arrangement has led to important Mission Support decisions, including those related to MONUSCO's energy mix, being made without consultation with the mission's political leadership.

In January 2019, new reforms led by UN Secretary-General António Guterres reconfigured key departments and shifted more decision-making responsibility from headquarters to the field, notably increasing the authority of the SRSG, including on technical decisions that are integral to the mission. Although Mission Support components have traditionally taken decisions on matters related to electricity generation that are considered technical, this latest reform presents broader opportunities to support the political and strategic

98. Senior Hashi Energy manager, telephone interview, March 2019.

99. Senior officer, MONUSCO Office of Mission Support, interview, Goma, March 2019.

100. https://en.wikipedia.org/wiki/United_Nations_Department_of_Field_Support.

objectives of the mission and the UN organization. For example, decreasing dependence on fossil fuels in peace operations supports the mission's environmental policy objectives and reduces its carbon footprint in host countries while potentially reducing security vulnerabilities related to fuel convoy transport, a principal concern for many field operations. For MONUSCO, these and other considerations, linked to what have traditionally been viewed as technical matters, increasingly warrant the attention and involvement of the mission's leadership in decisions related to how MONUSCO sources its electricity.

Numerous interviewees within MONUSCO noted the value of greater involvement by mission leadership in strategic operational support decisions, including those about electricity generation. They also highlighted the importance of rotating staff, particularly in technical departments, to deter the development of personal and potentially corrupt vested interests over a prolonged period and ensure alignment between the mission's operational and policy objectives.[101] In the short term, mission-wide goals to reduce energy costs, increase energy efficiency, and support the use of renewable energy should be reviewed by the Office of Mission Support together with the mission leadership.

The January 2019 UN reforms may open the way for strengthening the ability of MONUSCO and other missions to accelerate implementation of *Greening the Blue* and the DFS Environment Strategy; encouraging the rotation of staff, including from within the Office of Mission Support; and developing greater oversight on decisions that impact the way the mission sources and uses electricity.[102]

2.4 UN HUMANITARIAN ORGANIZATIONS

The fieldwork conducted for this study on energy use by UN humanitarian organizations was less exhaustive in its scope than the research on MONUSCO but did yield several preliminary findings. Like MONUSCO, UN humanitarian organizations in eastern DRC have often connected to SNEL where this option

101. Today the DFS is the Department of Operational Support (DOS), with an expanded responsibility to provide "operational support to all UN Secretariat entities, including advisory, operational, and transactional support services," serving almost 100 UN entities around the world. The DPKO is now the Department of Peace Operations (DPO), and the Department of Political Affairs is now the Department of Peacebuilding and Political Affairs, with merged regional offices serving both DPO and the Department of Peacebuilding and Political Affairs. All three departments are headed by an undersecretary-general. Members of MONUSCO's leadership, interviews, Goma, March and April 2019.

102. Ana Maria Labada, "'New Year, New United Nations': Structural Reforms Begin," International Institute for Sustainable Development, January 22, 2019, http://sdg.iisd.org/commentary/policy-briefs/new-year-new-united-nations-structural-reforms-begin/.

is available, and they have supplemented SNEL power with electricity supplied by diesel generators. The UNHCR office in Goma, for example, is connected to SNEL, but it has three backup diesel generators that are used daily, as well as two solar panels used to charge batteries in the UNHCR radio room. The UNHCR's camps for internally displaced people and its transit sites for Rwandan refugees in eastern DRC also depend on diesel generators, but the latter also have a few solar panels for lighting.[103] According to Goshop, a company that sells and installs solar energy products in Goma, UN humanitarian organizations in the city have been interested in using solar energy products mostly to provide backup for critical services, such as servers, and for night lights.[104] Among the UN organizations in Goma, only OCHA and the International Organization for Migration (IOM) are currently serviced by SOCODEE's hydropower distribution line from Virunga SARL.[105]

103. UNHCR manager, interview, Goma, March 2019, and subsequent correspondence.

104. Director of Goshop, interview, Goma, March 2019.

105. SOCODEE, correspondence, April 2019.

3

IMPACTS AND IMPLICATIONS OF RENEWABLE ENERGY TRANSITIONS

The fieldwork for this study took place in Goma, where since 2017 and the arrival of SOCODEE's distribution line from Virunga SARL, MONUSCO and UN humanitarian organizations have had the option to transition almost entirely to a reliable and constant source of renewable energy in the form of hydropower. By purchasing electricity from SOCODEE, these organizations would be realizing the cost-saving benefits detailed in this report while supporting Virunga SARL's business and mission to protect Virunga National Park, which is a United Nations Educational, Scientific and Cultural Organization World Heritage Site. At the time this field research was conducted, most of these organizations had not yet initiated steps toward a transition, with the exception of the IOM, OCHA, and the two aforementioned MONUSCO military bases in North Kivu.

In 2017, MONUSCO installed a solar farm in Goma. The system, with its current capacity of 650 kW, is the mission's one and only solar farm in the DRC. As mentioned above, MONUSCO and other UN humanitarian organizations partially source electricity from SNEL, whose production derives from renewable hydropower sources. Apart from SNEL hydropower and the Goma solar farm, renewable energy use by MONUSCO and UN humanitarian organizations is limited to:

- Solar lighting in some areas, and particularly perimeter fencing
- Limited solar backup systems for critical services
- Home solar systems installed at the residences of UN personnel

This section considers the potential beneficial impacts, disincentives, and implications of a more thorough transition by MONUSCO and UN humani-

tarian organizations to renewable energy: principally hydropower where available, and solar power for off-grid settings.

3.1 THE ENVIRONMENT

MONUSCO's carbon emissions from generators are estimated to be approximately 18,652 tons annually. If the MONUSCO's Goma headquarters transitioned to 24 hours of renewable energy from SOCODEE/Virunga, the mission would avail itself of consistent electrical power while significantly reducing its diesel consumption and hence its carbon emissions and noise pollution. The same is true for all the UN humanitarian organizations based in Goma. MONUSCO would also be able to relocate its solar farm to other mission sites that currently depend on diesel, such as Kananga, thus further expanding the environmental benefits.

3.2 ECONOMIC COST SAVINGS AND BENEFITS

Although power supplied by SOCODEE and Virunga SARL is more expensive per kWh than SNEL, it is more reliable and would significantly reduce expenditures on fuel, fuel transportation, generator maintenance, generators, and spare parts. The findings from the economic analysis of Goma airport demonstrate that MONUSCO would save more than US$155,000 annually by switching from the status quo—SNEL power plus diesel generators—to SOCODEE/Virunga-supplied hydropower at that site, and that similar savings could be realized by transitioning Goma headquarters. The economic analysis for diesel-reliant TCC sites in off-grid areas also demonstrates the significant cost savings over time from switching to solar power as the main form of generation, with generators employed as a backup power source.

MONUSCO could save millions of dollars per year in energy costs through these transitions to renewable energy. As discussed earlier, however, solar systems—which are the most viable alternative for diesel-dependent off-grid locations that lack a hydropower option—require large, one-time up-front capital expenditure which poses a financing challenge for MONUSCO and other field missions given their short-term mandates and budgets. As this is a challenge for UN peacekeeping beyond just the DRC, the United Nations should consider flexible financing solutions, such as the creation of a fund to help finance the up-front costs of solar systems in field missions, as cost is a challenge for every mission.

The principal issue, from MONUSCO's perspective at least, would be the capital costs associated with these new solar installations. In Goma, however, MONUSCO is in the extraordinary position of being able to transition to 24-hour renewable energy without any investment in new equipment or added expenses, that is, with no cost implication. In Kinshasa, no other hydropower resources are available beyond the partial power supplied by SNEL. In order to increase its share of renewables in Kinshasa, MONUSCO would need to invest in new solar equipment and installation. With mission downsizing already underway, this could be justified at sites where a mission presence is expected to remain for an extended period, such as Bukavu, Bunia, and Kananga.

3.3 RENEWABLE ENERGY INFRASTRUCTURE

With a transition to SOCODEE/Virunga where available, and investment in new solar systems for other off-grid sites, MONUSCO could redeploy its existing renewable energy assets to new locations. If MONUSCO's Goma operations transitioned to SOCODEE/Virunga for energy, its solar farm currently situated in Goma could be relocated. The farm, which was originally intended for Entebbe, Uganda, could be used at another diesel-dependent field site without renewable hydropower availability, such as Kananga. There are plentiful opportunities for MONUSCO and/or UN humanitarian sites to increase their solar energy usage.

3.4 LOCAL ENERGY CAPACITY

Expanding the mission's use of solar and other renewables could also provide significant local benefits. Currently MONUSCO's solar panels are procured centrally in New York through a pre-negotiated organization-wide contract, leaving little scope for using DRC-based solar energy companies. If MONUSCO and UN humanitarian organizations made greater use of local suppliers for purchase, installation, or maintenance, it would boost these companies' businesses, their capacity, and their expertise. That could result in economies of scale and a decrease in prices that would then be passed on to Congolese consumers. The positive local impacts could be multiplied further through additional training and capacity-building programs to help build the Congolese renewable energy sector, whether administered by MONUSCO or other donor-supported programming.

3.5 LOCAL GOVERNMENT AND INCREASED REVENUE GENERATION

Although SOCODEE and Virunga SARL would be the main direct economic beneficiaries of a transition to renewable energy by Goma-based UN organizations, so, too, would the Direction Générale des Impôts, one of the country's three national tax agencies, and probably also the provincial revenue authority, the Direction Générale des Recettes du Nord Kivu, which would be in line to collect more tax from SOCODEE and Virunga. This new revenue would be a net positive for the state, as UN missions do not pay taxes on their fuel imports.

3.6 PEACEBUILDING

In the longer term, increased and diversified energy access through greater renewable energy could have a positive multiplier effects on peacebuilding efforts, principally by boosting incomes, employment, and economic growth that flows from greater electrification.[106] These economic benefits could, in turn, help reduce the incentives for people to join armed groups. Increased nighttime lighting from solar energy can help improve neighborhood security, particularly for women and girls, and enable after-dark activities, such as students studying and businesses operating.

The two scenarios discussed here include MONUSCO switching to greater hydropower in Goma, and introducing new off-grid solar systems in non-grid-connected locations. The first scenario would directly support the Virunga hydropower projects, which aim to help mitigate the drivers of conflict in eastern Congo.[107] The second scenario offers a way to leverage the UN footprint to introduce new solar infrastructure in off-grid locations in one of the

106. The international campaign Sustainable Energy for All (SE for All) is working on documenting the specific benefits of increased energy access in poorly electrified countries. Their first report looks at case studies on Bangladesh, Kenya and Ethiopia, and highlights the economic savings, educational impact, and climate benefits in particular. While not specifically focused on renewable energy, the report highlights the opportunities for small-scale decentralized renewable energy as often being the easiest and fastest off-grid solutions available, and highlights the potential of small-scale solar systems in particular. See "Why Wait? Seizing the Energy Access Dividend," Sustainable Energy for All, Power for All, and Overseas Development Institute, 2017.

107. See https://virunga.org/alliance. Some have questioned the peacebuilding claims of the Virunga project, however, and argued that the positive marketing claims do not match the reality. See Esther Marijnen and Peer Schouten, "Electrifying the Green Peace? Electrification, Conservation, and Conflict in Eastern Congo," *Conflict, Security & Development* 19:1 (2019), 15–34, https://doi.org/10.1080/14678802.2019.1561615.

least electrified countries in the world. The introduction of these new renewable energy assets into Congolese communities may also facilitate implementation of the mission's peacebuilding mandate by providing peacebuilding actors, including MONUSCO civil affairs officers, with new entry points to promote cooperation and confidence-building between communities. As a new approach for the United Nations, the potential and opportunity of renewable energy as a tool for peacebuilding is an area for further research and greater study.

3.7 WHO LOSES?

There would be losers in this proposed transition. The negative economic consequences of MONUSCO and UN humanitarian organizations fully transitioning to renewable energy in Goma would be borne primarily by SNEL. Although SNEL could find other customers to make up the demand shortfall if it lost MONUSCO and other UN organizations as clients, SNEL managers concede that the loss of its principal tariff-paying anchor client would be significant. Ultimately, it is unclear what the impact of losing MONUSCO as a customer in Goma would be to SNEL.

The transition would ostensibly free up limited electricity supply that is desperately needed by SNEL's Congolese customers, however, particularly in Bukavu. MONUSCO fuel supplier Hashi Energy and its successors would also be impacted by an energy transition given the lower resulting mission requirements for diesel fuel. The company would, however, retain its lucrative aviation and vehicle fuel contracts. Decreased generator use may also impact contractors responsible for generator maintenance.

3.8 RENEWABLE ENERGY OPTIONS IN THE KASAÏ PROVINCES

Given the downsizing of MONUSCO, the potential for introducing off-grid solar solutions in non-grid-connected MONUSCO sites is most relevant for conflict-affected settings where MONUSCO is likely to maintain a presence for the foreseeable future: the Kasaï provinces meet this criteria, and present a strong case for greater use of solar power. MONUSCO increased its presence in the Kasaï provinces after violence flared in the region between 2016 and 2018, and the mission seems likely to remain there in the near term. In Kananga, the capital of Kasaï Central, a private consortium composed of the DRC's 7th Engineering and South Africa's Megatron built a 2.5 MW solar PV plant in

2015.[108] The plant operated for 12 months as a joint venture between Megatron and SNEL, with the former generating power, the latter distributing and selling it, and the two sharing the proceeds. The plant shut down, however, as SNEL's apparent failure to collect tariffs left Megatron unpaid for a year's worth of electrical power. The situation remains unresolved.[109]

Currently, the offices of MONUSCO, the World Food Programme, and other UN agencies in Kananga run entirely on diesel generators. Yet Kasaï Central and the other Kasaï provinces appear to be among the most promising locations for further expanding UN organizations' renewable energy production, for several reasons:

- SNEL provides almost no electricity to these provinces, except for a very limited supply from diesel generators in the major towns.
- The Kasaïs, like the rest of southern DRC, are blessed with high potential for solar energy generation—considerably higher, for example, than the cloudier Kivu provinces.
- Importing decent-quality diesel fuel for generators is difficult, expensive, and slow due to major logistical constraints.
- Increased UN demand for solar energy in the Kasaïs would boost the business of local solar energy companies and would likely bring down the cost of solar energy installation and equipment to other consumers in the provinces.

108. Essor, "Access to Electricity," 20.

109. Megatron engineer, interview, Kinshasa, July 2019.

4

CONCLUSIONS AND RECOMMENDATIONS

There are significant opportunities for the United Nations, particularly MONUSCO and UN humanitarian operations, to shift to greater use of renewable energy in the DRC. This report demonstrates that opportunity, and how implementing this shift would unlock significant potential benefits for MONUSCO, as well as for Congolese communities. The report concludes that this transition is achievable, but that longer-term changes are needed in how the United Nations manages its own energy use.

An Easy Win

Hydroelectric power generated by Virunga SARL (and distributed by SOCODEE) is an available and cost-saving option in Goma, home to MONUSCO's headquarters in eastern DRC. Switching to that electricity supply presents an easy win for the UN mission: MONUSCO can increase its share of electricity generated from renewable sources while realizing immediate cost savings. Secondary benefits of connecting to Virunga power are meaningful too, including support for the livelihoods of people in the area and for Virunga National Park's conservation efforts. Despite the close proximity, this transition has been slow to occur. The delay is due to a range of institutional challenges; some are specific to MONUSCO, while others are reflective of the existing approach to UN field operations more generally. Nonetheless, MONUSCO's consideration of using the energy produced by Virunga holds lessons for both the mission and the broader United Nations.

Linking Goals and Actions

Despite UN commitments to reach carbon neutrality by 2020, increase energy efficiency, and shift to more renewable energy technologies, the UN mission in the DRC is not set up to evaluate or implement a comprehensive renewable energy transition, including for troop and police contingents. Strategic decision-

making to implement elements of the *Greening the Blue* initiative and the subsequent DFS Environment Strategy have been compromised by the way in which MONUSCO evaluates its energy needs (including limited energy-related data and difficulty tracking that data), designs budgets, and assigns incentives and disincentives for the multiple components of the mission. To implement a successful energy transition, the mission should set more precise targets for renewable energy consumption and generation, create compelling incentives for achieving those targets, and track progress. MONUSCO will also need active support from the UN Secretariat and UN member states to accomplish these goals. For these policies to be implemented, UN missions need flexibility and revised budget and management rules; uniformed peacekeepers need to be incentivized to adopt renewable energy options; and senior managers and staff within UN peace operations need to be recognized for their innovation and efforts.[110]

The UN commitments to achieve carbon neutrality, increase energy efficiency, and adopt modern renewable energy technologies require a shift in how the UN system operates. Political engagement and oversight by senior mission leadership is needed for energy-related decisions to impact strategic mission priorities, including fulfilling their UN mandates, strengthening peacebuilding objectives, and supporting environmental impact targets. In this context, the UN secretary-general's latest reforms, which delegate greater authority to field missions, are encouraging. MONUSCO leadership should review the mission's energy requirements and adopt precise targets for increasing the proportion of renewable energy consumed and generated within the next five years.[111] Continued support from the Secretariat will be necessary to ensure that greater delegated authority in the field translates into improved outcomes in this area.

Supporting the Field

To enlist greater involvement of mission leadership in operational decisions that have strategic implications, such as those over electricity generation, consensus on these matters should be built between senior mission leaders and managers in the Office of Mission Support. One option is holding joint workshops on

110. Powering Peace is researching UN goals and policies for its operations and will issue a future report on the opportunities and obstacles to achieving those goals in practice.

111. The new Environmental Action Plan adopted by the UN Secretariat on September 22, 2019, is an encouraging step in the right direction. It includes ambitious targets by 2030, including reducing emissions by 45 percent and sourcing 80 percent of its electricity from renewable energy.

energy issues with the DSRSG, the head of Mission Support, and relevant section chiefs to foster thorough consultation on and consideration of options.[112] Such a process would help integrate the broader policy aims of reducing carbon emissions and achieving economic multiplier effects from increased and cheaper renewable energy in host communities into Mission Support's energy planning and implementation, thus contributing to peacebuilding and development by leveraging MONUSCO's energy needs and purchasing power.

Briefing TCCs

Currently, member states sending peacekeeping troop and police contingents do not have a clear material or financial incentive to ensure that any of the electricity their contingents consume is from renewable sources. Some MONUSCO TCCs also mistakenly believe that mission requirements concerning energy self-sufficiency prohibit them from connecting to locally available hydropower grid options, despite two Indian contingents' bases, Munigi and Kiwanja, having already connected to SOCODEE/Virunga. Internationally, many peacekeepers are unaware of the COE reimbursement for solar generators approved in 2017.[113] Furthermore, it is unclear how many countries possess renewable energy equipment that would be available to send to support their contingents to UN missions. Some TCCs worry that an attempt to transition to renewable energy would be refused by the United Nations. The unfortunate result in the DRC is that no TCCs send contingents with capacity to generate power from renewable sources.

Both the United Nations and TCCs should adopt new ways of thinking to meet mission goals. The United Nations should make clear to TCCs that it actively supports their options for renewable energy transition in field missions and will ensure that the transition is incentivized and supported. The DPO and DOS should commit to support TCCs' transition to renewable energy wherever possible and feasible.

112. Options suggested by MONUSCO staff, telephone interview, March 2019.

113. UN General Assembly, "Manual on Policies and Procedures Concerning the Reimbursement and Control of Contingent-Owned Equipment of Troop/Police Contributors Participating in Peacekeeping Missions," 161–162. On page 42, paragraph 22, this manual also states, "The use of renewable energy electrical generation equipment to provide electrical self-sustainment in lieu of all or part of it being provided by fuel-powered generators is encouraged and will be treated as a special case."

Humanitarian Transitions

UN humanitarian organizations have also been slow to transition to renewable energy in the DRC. They lag behind many in the local private sector in Goma despite the availability of a 24-hour clean grid option. UN organizations have a chance to lead the way and take advantage of the round-the-clock renewable energy available from SOCODEE/Virunga. MONUSCO and UN humanitarian organizations in other parts of the DRC should also embrace a transition to renewable energy wherever possible, particularly through the use of off-grid solar and solar mini-grids, which are available at diminishing cost from the Congolese private sector.

Maximizing Impact

MONUSCO and UN humanitarian organizations are deployed in the DRC by the international community to support much-needed peace and stability. In working toward that important objective, their approach could be positively reinforced by employing renewable energy for the mission and its facilities. MONUSCO emits more than 18,600 tons of carbon dioxide from its diesel generators every year. There are options to significantly reduce this output, while boosting the local economy and helping peacebuilding. Sticking with the status quo is more expensive, provides little economic or peacebuilding stimulus, and imposes a heavier cost on the planet. The current approach needs to change.

Recommendations and Areas of Further Investigation

To that end, the following actions are recommended.

For the leadership of MONUSCO:

- Integrate discussions and decision-making about electricity generation and renewable energy targets between the political and operational sides of the mission, including through a joint process with mission leadership around strategic energy issues.
- Engage with SOCODEE/Virunga SARL about transitioning Goma headquarters, Goma airport, and other accessible TCC sites in the region to 24-hour grid hydropower.
- Relocate the solar installation from Goma headquarters to diesel-powered off-grid location(s), such as Kananga, and explore deploying additional solar systems at other off-grid sites.
- Document MONUSCO's efforts to date to use hybrid energy options,

as well as its use of local sources and renewable energy, to provide lessons learned for future adoption of renewable energy sources.

For UN headquarters and member states:

- Prioritize electricity generation from renewable resources. Develop clearer goals, stemming from *Greening the Blue*, for the electricity generation practices of field missions, and provide the necessary support to achieve them.
- Create incentives and support packages to help UN field operations transition to renewable energy.
- Educate troop- and police-contributing countries on these goals and options for deployment, and create incentives to achieve them through the COE reimbursement system.
- Direct each UN mission to produce an electrification plan to help diversify energy sources and increase the use of renewables, in line with the UN goal of carbon neutrality.

For the DRC government:

- Prioritize the creation of the ARE.
- Support the renewable energy sector by reducing or eliminating import duties and other restrictions on solar and other relevant equipment.
- Work with MONUSCO to further support national electrification goals and improve access to energy across the country.

This report points to areas for further investigation. Overall, the consideration of the energy dynamics in conflict-affected countries can assist international actors and the UN in achieving their goals of peace and security, as well as their goals of increased efficiencies and effectiveness. In the DRC, areas for further consideration include how greater access to energy could support longer-term peacebuilding and stability, such as in the Kasaï provinces, and what role a transitioning UN peace operation could play in support of those goals. For MONUSCO, the positive and negative impacts of switching from SNEL should be examined, as well as the impact on the Congolese (especially in Bukavu). In addition, further research is needed into how the UN could further expand its use of locally available energy sources, tackle the up-front costs associated with expanding use of off-grid renewable energy such as solar power, and adopt innovative technology given traditional budget processes. Finally, more research is needed into the role of member states and TCCs in supporting that shift in the field, their role in self-sustainment as peacekeepers, and the incentives and disincentives they face. These questions are worthy of further consideration, given the rich opportunity to support a better future for all those engaged in working for a better peace throughout the DRC and elsewhere.

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