Global Commission to
End Energy Poverty

2020 REPORT
ELECTRICITY ACCESS

SUMMARY FOR DECISION MAKERS

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CONTENTS

LETTER FROM THE CO-CHAIRS

A third of all humanity lacks access to reliable power. This blunt reality drives immense social inequities. Access to power spells the difference, literally, between darkness and light. It determines whether you have modern healthcare, transportation and telecommunications. Clean fuels for cooking and heating offer an escape from chronic respiratory illness. Reliable power opens the door to educational and economic opportunity.

Only by ending energy poverty can we end poverty itself.

This is why we assembled the Global Commission to End Energy Poverty.

This year of pandemic has driven home the urgent need to address the world's most glaring inequities. Energy plays a central role in modern healthcare, including in the treatment of Covid-19 and the eventual storage and delivery of vaccines. It will ultimately underpin the global economic recovery. Countries that lack adequate and affordable electricity to run their economies will recover more slowly. Many will lose ground in their efforts to expand energy access and industrialize.

We have seen the fragility of the electricity sectors of many countries exposed by the pandemic as tens of millions of households in Africa and Asia fell behind in paying their electricity bills. As a result, struggling utilities and off-grid startups are in dire straits. We could never have imagined when when the Commission first convened in 2019 that millions more people today would lack energy access. But it has happened. Our task is even more urgent and more challenging.

The international response must be rapid and sizable, but also far-sighted and sustained. Governments need vital support to fight and recover quickly from the pandemic in ways that reinforce the long-term viability of their energy sectors. That is the only way to create jobs and to power shops, factories, hospitals and schools – in short, to open the door to modernity itself for billions of people.

We must do all this in a sustainable way. Global shifts too often hit underserved societies the hardest, and so it is with climate change. We must expedite transition to clean energy. Greatly expanded energy access can be done via systems that take advantage of the opportunity emerging economies have to leap ahead with low-carbon solutions.

The Commission focused first on the pressing challenge of achieving universal access to adequate, affordable and reliable clean electricity. Our MIT-led research team adopted a practical on the ground approach and engaged directly with leaders and practitioners in government and the power sector, as well as with investors and the leaders of numerous developmental institutions, some of which are represented within our Commission.

The team's core work product is packaged in the form of an integrated framework and toolkit for reforming the fledgling electricity sectors of low-access countries. While comprehensive, the framework is not hard to grasp. Its

programs can be adapted to a wide range of national circumstances. This flexibility will be indispensable as we roll it out in dozens of countries, in close collaboration with all sectors and in partnership with committed political leaders. Throughout, we will meet our obligations and commitments as we hold ourselves and our partners accountable by measuring and publicly reporting our progress.

The energy poverty challenge is enormous in scale and scope – and our vision and ambition for future work as a Commission go well beyond the electricity sector. Therefore, while we now mark the end of the beginning for our Commission, we also mark the launch of a new and exciting phase.

Sincerely,

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President of the Rockefeller Foundation

Ernest J. Moniz
Cecil and Ida Green Professor of Physics and Engineering Systems Emeritus, Massachusetts Institute of Technology

Akinwumi A. Adesina
President, African Development Bank

COMMISSION AND RESEARCH TEAM

THE COMMISSION

The Global Commission to End Energy Poverty (GCEEP) comprises leaders from utilities, off-grid companies, multilateral development banks, academics, and others from across the electricity and development sectors. It operates under the joint chairmanship of the Rockefeller Foundation President Dr. Rajiv J. Shah; former U.S. Secretary of Energy Ernest Moniz; and Africa Development Bank President, Dr. Akinwumi Adesina. Members of the commission are as follows:

Akinwumi Adesina, Co-Chair, GCEEP; and President African Development Bank (AFDB)

Adnan Amin, Senior Fellow at the Belfer Center at the Harvard Kennedy School, USA; and Director General Emeritus, International Renewable Energy Agency (IRENA)

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Patrick Bitature, Chairman, Umeme Limited

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Hela Cheikhrouhou, Chairman and CEO, Nithio Holdings

Ashvin Dayal, Senior Vice President, Power and Climate Initiative, Rockefeller Foundation

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MIT ENERGY INITIATIVE AND ROCKEFELLER FOUNDATION TEAMS

This report was prepared by the MIT research team led by Ignacio Pérez-Arriaga, GCEEP Research Director and Robert Stoner, GCEEP Research Co-Director, along with Divyam Nagpal, and Gregoire Jacquot with substantive editorial and organizational contributions by Raanan Miller, Marika Tatsutani and Shivangi Misra. The Commission itself was conceived by the Rockefeller Foundation under the leadership of Ashvin Dayal, who along with his senior colleagues Suman Sureshbabu, Eric Gay, and Clare Boland played a central role in guiding its work, and also contributed extensively to this report. We also acknowledge the participation and contributions of Raquel de la Orden, Reja Amatya, and Andrés González-García.

OVERVIEW

Ending energy poverty is the necessary prerequisite to ending poverty itself. That central insight has driven our work since we first came together as the Global Commission to End Energy Poverty (GCEEP) in 2019. It is also at the heart of United Nations Sustainable Development Goal #7, which calls for universal access to affordable, reliable, sustainable and modern energy by 2030.

The COVID-19 pandemic has added urgency to the goal of ending energy poverty, highlighting the critical importance of access to electricity in particular, while also threatening to reverse decades of progress and putting hundreds of millions of vulnerable households and businesses at risk. But the current crisis also presents important opportunities to advance our agenda as governments undertake large investments in economic stimulus and recovery over the months and years ahead. These investments, as the International Energy Agency has pointed out "*will shape economic and energy infrastructure for decades to come and will almost certainly determine whether the world has a chance of meeting its long-term energy and climate goals.*"[1]

Against this backdrop, the quest to achieve universal access to electricity must be pursued with greater vigor than ever, and with an eye to challenges and consequences that will extend well beyond the pandemic. Developing innovative business models for both centralized and distributed energy solutions, deploying those models to attract greater private sector investment and participation, and formulating the policies and regulations needed to sustain progress toward a more equitable, sustainable, and prosperous energy future—these have been central themes of our work to date.

THE INTEGRATED DISTRIBUTION FRAMEWORK (IDF)

An early focus for the Commission has been addressing problems in distribution, which has emerged as the "weak link" in the power systems of many developing countries. To that end, we developed the IDF, which offers a flexible approach to large-scale electrification in a wide range of contexts. The IDF emphasizes the use of financially viable business models for the distribution of electricity to end consumers by all modes of electrification. Its key principles include:

i. A commitment to **universal access** that leaves *no one behind.* This requires permanence of supply and the existence of a utility-like entity with ultimate responsibility for providing access in a defined territory.

ii. Efficient and coordinated **integration of on- and off-grid solutions** (i.e., grid extensions, mini-grids and stand-alone systems). This requires integrated planning and appropriate business models for all types of consumers in a defined service territory.

iii. A **financially viable** business model for distribution. This will typically require some form of distribution concession to provide legal security and ensure the participation of external and mostly private investors, as well as subsidies for viability gap funding.

1 IEA (2020), Sustainable Recovery: World Energy Outlook Special Report, https://www.iea.org/reports/sustainable-recovery.

iv. A **focus on development** to ensure that electrification produces broad socio-economic benefits. This principle links expanded access to the delivery of critical public services (e.g., health, education) and to multiple economically beneficial end-uses.

Individually, all of these principles have been discussed for many decades. The power of the IDF lies in bringing them to bear *collectively* and *rigorously* to achieve a durable transformation of the entire distribution sector.

ACTIVITIES AND LESSONS LEARNED FROM THE COMMISSION'S FIRST YEAR

The GCEEP research team is actively engaged in efforts to apply the IDF approach in the countries of Colombia, Nigeria, Rwanda and Uganda and in the state of Odisha in India. Our experience so far suggests that the IDF can be applied in a range of contexts and to achieve a variety of goals, from expanding access to improving service quality. Successful implementation requires, first and foremost, a strong political commitment and an overarching vision and strategy that reflect the specific conditions and aspirations of individual countries. What we have found to be exciting and hopeful in our work with these "first action" countries is that each has an opportunity to meaningfully expand access—starting from its current situation, whatever that is.

Of course, many developing countries also face significant challenges in other key segments of the power sector. Overcoming these challenges requires identifying and disseminating the best regulatory and business models to spur investment in needed generation and transmission infrastructure, removing barriers to the deployment of medium and large renewable plants, and developing sound institutions and market rules to enable efficient regional trade. Thus, another important GCEEP activity over the last year has involved advising the West Africa Power Pool, following an initiative of the Tony Blair Institute, on regional-level reforms aimed at reducing operation costs, improving reliability, and supporting major renewable investments. Such reforms could deliver enormous economic and environmental returns for the countries of West Africa and provide a model for other regions that would benefit from increased integration and trade.

A CALL TO ACTION

Our action plan for the next phase of GCEEP activities aims to leverage the diverse perspectives, expertise, and influence of Commission members across a range of activities, including advocacy, research and technical assistance, engagement with key stakeholders, institutional and individual capacity building, and progress measurement. Ensuring that universal access is at the top of international and national agendas and economic recovery plans; further developing the IDF "toolkit"; working with committed governments and regional institutions to design and implement comprehensive access plans; and building capacity in critical areas such as regulation by helping to establish a new Africa School of Regulation will be among GCEEP's main priorities for the months and years ahead.

Throughout, we continue to see one of our most important roles as convening and providing a platform for the many actors who are already deeply engaged in the cause of ending energy poverty. Country leaders, development finance institutions, private sector lenders and investors, and utilities—all have indispensable parts to play. By actively bringing these diverse constituencies together and by rallying them to action—through our distinctive focus on practical solutions and with a consistent commitment to aligning global priorities and resources behind the best ideas—we remain firmly convinced that progress toward the goal of affordable, reliable, sustainable and modern energy for all is not only still possible, but very much in reach.

SUMMARY FOR DECISION MAKERS

INTRODUCTION

Launching the Global Commission to End Energy Poverty (GCEEP) in September 2019, we invoked a view of energy access as the "golden thread" that weaves together economic growth, human development, and environmental sustainability.[1]

In this report, as we take stock of the first year of GCEEP activities and chart a course for the Commission's next phase, we are even more firmly convinced that ending energy poverty, in broad alignment with United Nations Sustainable Development Goal #7, which calls for universal access to affordable, reliable, sustainable and modern energy by 2030, is the necessary prerequisite to eradicating poverty itself.

The emergence of the global COVID-19 pandemic has added urgency to our work, underscoring the human consequences of energy poverty and highlighting the centrality of electricity in delivering medical care and other essential services, in connecting people and societies, and in enabling remote work and learning. At the same time, the economic damages wrought by the pandemic have put many vulnerable households and firms at risk of falling back into energy poverty.[2] The International Energy Agency (IEA), for example, has predicted that the number of people without electricity in sub-Saharan Africa will increase in 2020—reversing several years of progress. The IEA further estimates that a rise in poverty levels worldwide may make basic electricity services unaffordable for more than 100 million people who already had electricity connections,

1 Former UN Secretary-General Ban Ki-moon, 2012. https://www.un.org/press/en/2012/sgsm14242.doc.htm
2 IRENA (2020), Post-COVID-19 recovery: An agenda for resilience, development and equality, https://irena.org/publications/2020/Jun/Post-COVID-19-Recovery

presaging a return for many to more polluting and inefficient sources of energy.[3]

Yet the COVID-19 crisis also presents new opportunities to accelerate progress toward a more sustainable and equitable energy future as governments invest in economic stimulus and recovery over the months and years ahead.

These investments will have to be large: the United Nations, for example, has estimated that a USD 2.5 trillion rescue package—including a near-term injection of USD 1 trillion of investment—is needed to help the world's emerging economies cope with the pandemic and its consequences.[4] They will also have long-lasting consequences. As the IEA pointed out in its 2020 World Energy Outlook Special Report, investments made in the wake of COVID-19 "*will shape economic and energy infrastructure for decades to come and will almost certainly determine whether the world has a chance of meeting its long-term energy and climate goals.*"[5] Similarly, Sustainable Energy for All has emphasized that governments have a "*unique, once-in-a-generation opportunity to reset their economies and address the underlying structures that enable development and competitiveness.*"[6]

Against this backdrop, the imperative to think big remains. Efforts to end energy poverty will certainly continue well beyond the current emergency and must be commensurate with the magnitude of the longer-term challenges and impacts that are at stake.

We continue to believe that our initial focus on access to electricity, the signature of modern societies, is appropriate as a readily available and effective means of making rapid progress. (The Commission intends to return to other critical aspects of energy poverty, such as access to clean cooking fuels, in the future.)

We also remain convinced of the need for substantial private sector participation, given the sizable investments needed to achieve full electrification, which can run into the billions of dollars even for small countries and into the tens of billions of dollars for larger countries with significant underserved populations. How such participation might be encouraged and appropriately channeled to advance energy access and other sustainable development goals—by public investment and by guarantees from governments and development finance institutions (DFIs), as well as by suitable policies and regulations and innovative business models that can support both centralized and distributed solutions—thus continues to be a central focus of our work.

SECTION 1

THE ECONOMIC, SOCIAL AND ENVIRONMENTAL CASE FOR INVESTING IN ELECTRICITY ACCESS

Investments in electricity access, if they are aligned with medium- and long-term climate and sustainability goals, will yield substantial socio-economic and environmental benefits and should be prioritized in the recovery strategies currently being developed by governments and international institutions. Now and in the post-COVID-19 world, universal access must be recognized as a necessary pillar of an inclusive economic recovery; a key contributor to delivering resilient services in healthcare, water, and education; and, when approached correctly, a

3 International Energy Agency (2020). "World Energy Outlook 2020". https://www.iea.org/reports/world-energy-outlook-2020
4 UN (2020), $2.5 trillion COVID-19-19 rescue package needed for world's emerging economies, https://news.un.org/en/story/2020/03/1060612
5 IEA (2020), Sustainable Recovery: World Energy Outlook Special Report, https://www.iea.org/reports/sustainable-recovery.
6 SEforAll (2020), The Recover Better with Sustainable Energy Guide for African Countries, https://www.seforall.org/publications/recover-better-africa.

crucial step toward achieving a clean and decarbonized economy.[7]

The role of electrification in catalyzing local economic activity, creating jobs and improving access to public services, especially in rural areas, is well documented. Evaluations of electricity investments in developing countries by development finance institutions (DFIs) have shown a significant impact on GDP; the effect is especially large in low-income countries with small power sectors.[8] In Senegal, GDP rose 1.7% with the commissioning of a 70 mega-watt (MW) generation project that reduced local electricity costs and increased the availability of power.[9] In Uganda, improvements in the electricity system, including the commissioning of a 250 MW hydropower plant, resulted in an estimated 2.6% boost to GDP.[10]

These types of projects create new jobs due to construction and operations, but their largest effects result from increased economic activity more broadly.[11] There is also growing evidence for the socio-economic benefits of off-grid solutions such as solar home systems. In East Africa, researchers estimate that one-third of the people who purchase such systems use them to extend the work day or boost enterprise activities, resulting in an average earnings increase of USD 46 per month, equivalent to a 14% increase in average income for the region.[12] Another analysis, discussed further in the main report, finds multiple economic benefits from linking rural electrification with the agriculture sector in Ethiopia.[13]

Finally, a strong case for universal electricity access can be made on environmental sustainability grounds since pathways to electrification can help accelerate the transition from traditional fuels to low-carbon energy sources.[14] An emphasis on energy efficiency and increasingly cost-competitive renewable energy solutions (both distributed and utility-scale), in particular, has the potential to deliver large net benefits by aligning the goals of expanded access, reduced climate impacts, and enhanced energy security and system resilience. Opportunities to realize such benefits are large. Globally, the capacity of backup generators in developing countries is estimated at 350–500 giga-watt (GW) spread across 20–30 million individual sites; annual CO^2 emissions from these generators are estimated to exceed 100 million metric tons.[15] Across sub-Saharan Africa, one out of every five liters of diesel and petrol is burned in a backup generator. The resulting emissions are equivalent to 20% of those from vehicles.[16]

The optimal trajectory for achieving universal access to electricity will, of course, vary depending on a host of country-specific considerations and priorities, including with respect to cost, development objectives, social aspirations, emissions, security and reliability of energy supply, and climate resilience and adaptation. These considerations, and the need in most cases to balance multiple objectives and constraints, will influence investment decisions across the power sector—from generation to last-mile distribution.

7 At its last meeting in July 2020, the key message of the High-level Political Forum, the United Nations central platform for reviewing progress on the 2030 Agenda for Sustainable Development, was a call for action for the next decade, keeping the focus on the Sustainable Development Goals (SDGs) while combatting the COVID-19 pandemic. The Forum also agreed that achieving universal access to energy (SDG #7) will "unlock substantial opportunities for billions of people through new economic prospects and jobs, as well as empower women, children and youth, enhance access to better education, water, sanitation and healthcare, more sustainable, equitable and inclusive communities, and provide greater protections from, and resilience to, climate change impacts." UN (2020), Summary by the President of the Economic and Social Council of the high-level political forum on sustainable development convened under the auspices of the Council at its 2020 session, https://sustainabledevelopment.un.org/content/documents/269252020_HLPF_Presidents_summary.pdf

8 CDC Group (2020), What is the impact of investing in power?, https://assets.cdcgroup.com/wp-content/uploads/2020/01/30151049/Whats-the-impact-of-investing-in-power.pdf

9 Steward Redqueen (2017), "The Link between Power Investments and Jobs in Senegal." London.

10 Steward Redqueen (2016), "What Is the Link between Power and Jobs in Uganda? Report to CDC Group PLC." London.

11 Ibid.

12 GOGLA (2020), Powering Opportunity: Energising Work, Enterprise and Quality of Life with Off-Grid Solar, https://www.gogla.org/sites/default/files/resource_docs/powering_opportunity_global_report.pdf

13 Borgstein, E., Wade, K., and Mekonnen, D. Capturing the Productive Use Dividend: Valuing the Synergies Between Rural Electrification and Smallholder Agriculture in Ethiopia, Rocky Mountain Institute, 2020. http://www.rmi.org/insight/ethiopia-productive-use/.

14 In fact, several analysies have concluded that the direct climate impacts of achieving universal access would be neglible relative to emissions from existing patterns of consumption and fuel use worldwide. World Bank (2017), The Climate Change-Energy Access Nexus, http://documents1.worldbank.org/curated/en/465151494924794652/pdf/115064-BRI-P148200-PUBLIC-FINALSEARSFClimateChangeweb.pdf. Also IEA (2017), Energy Access Outlook 2017. From poverty to prosperity.

15 International Finance Corporation, *The Dirty Footprint of the Broken Grid: The Impacts of Fossil Fuel Back-up Generators in Developing Countries (2020),* https://www.ifc.org/wps/wcm/connect/dfab4f4c-9247-46ed-8f35-b25fa527b636/20190919-Summary-The-Dirty-Footprint-of-the-Broken-Grid.pdf?MOD=AJPERES&CVID=mR9UXpH.

16 Ibid.

SECTION 2

THE INTEGRATED DISTRIBUTION FRAMEWORK (IDF)

The Commission has deliberated extensively on the actions that are needed to accelerate electrification, identifying challenges that exist throughout the power sector in many low-access countries. For reasons detailed in our Inception Report, we have focused particular attention on distribution as the weakest link in most of these countries.[17]

A common problem is that incumbent distribution companies ('discos') do not charge tariffs that would allow them to recover their costs, resulting in a vicious cycle of underinvestment, unreliable and low-quality service, customer dissatisfaction, and growing inequities in access. This is the case for the vast majority of discos in sub-Saharan Africa, which are in chronically dire financial straits, require frequent publicly-financed bailouts,[18] and cannot attract the substantial capital needed to undertake significant rural electrification efforts or make other long-term infrastructure investments. Figure ES.1 illustrates these difficulties; a fuller discussion is provided in the main report and in the GCEEP's Inception Report.

The economic fallout of the current COVID-19 crisis, for individual households and businesses and for national budgets, clearly has the potential to exacerbate these challenges in the near term, especially in countries that already have high debt levels and little fiscal latitude to undertake additional spending.[19] With public financing in short supply, the longer-term sustainability of the power sector in many developing economies – whether governments pursue universal access or not – will continue to rest squarely on tackling challenges in distribution. Private capital is sorely needed but will remain difficult to attract absent viable business models.

Strategies for overcoming distribution challenges and expanding access can nonetheless be implemented by the application of best practices in regulation, effective integration of on- and off-grid technologies, and smart use of development finance. To that end, we have focused on "last mile" distribution, understood in the broad sense of providing electricity to end customers by whatever supply technology—grid extension, mini-grids, or stand-alone systems—is most appropriate. We have also focused on advancing a set of principles and a framework, which we call the integrated distribution framework (IDF), to guide the design and implementation of electrification programs with the aim of mobilizing capital and expertise at the right scale to achieve universal electricity access. The IDF approach shifts most of the economic burden of maintaining, improving, and expanding distribution systems from governments to defined entities (whether public, private, or a public-private partnership) that are empowered to enter into long-term contracts (typically 20 or 25 years) and are guided by cost-of-service regulations.

2.1 FORMULATION OF THE INTEGRATED DISTRIBUTION FRAMEWORK

Aspects of the IDF have been implemented successfully by electrification programs across the developing world. Yet there are very few instances in which this framework has been fully deployed for the express purpose of expanding electricity access.[20] Based on the conceptual contributions of the GCEEP research team, guidance from Commissioners, and lessons from ongoing engagements in several "first action" countries, this section elaborates

17 The Global Commission to End Energy Poverty (2019). Inception Report.https://www.endenergypoverty.org/reports

18 Trimble, Christopher, Masami Kojima, Ines Perez Arroyo, and Farah Mohammadzadeh. 2016. "Financial Viability of Electricity Sectors in Sub-Saharan Africa: Quasi-Fiscal Deficits and Hidden Costs." Policy Research Working Paper 7788, World Bank, Washington, DC. http://documents.worldbank.org/curated/en/182071470748085038/Financial-viability-of-electricity-sectors-in-Sub-Saharan-Africa-quasi-fiscal-deficits-and-hidden-costs

19 IMF (2020), "COVID-19-19 Response in Emerging Market Economies: Conventional Policies and Beyond", https://blogs.imf.org/2020/08/06/COVID-19-19-response-in-emerging-market-economies-conventional-policies-and-beyond/

20 The electrification of Morocco in the late 1990s and the PERMER I project in the Jujuy province in Argentina (1999–2012) are largely successful past experiences that contain most of the features of the IDF. We have learned from these concrete experiences and have defined IDF in more general terms that can be adapted to basically any context.

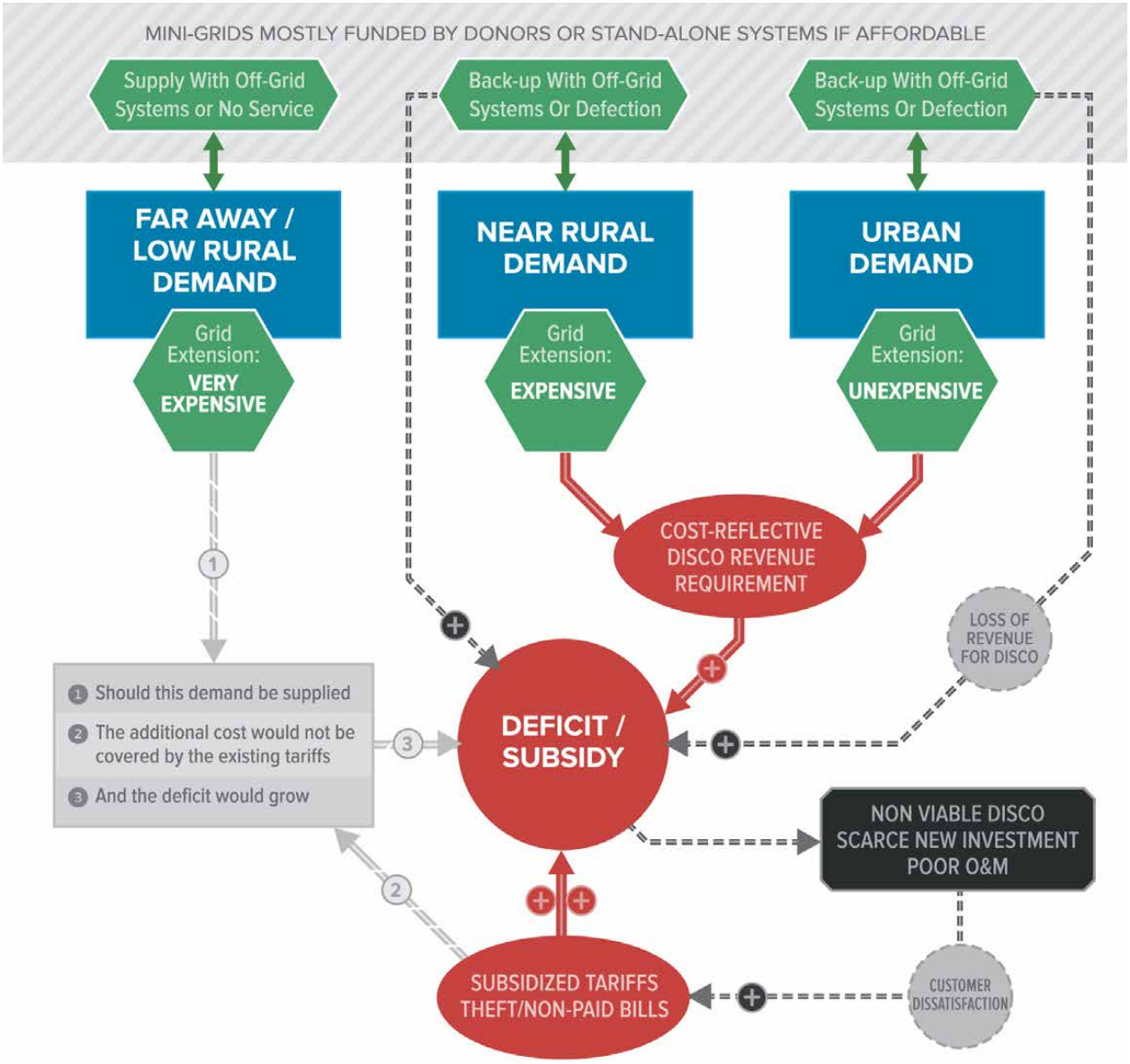


Figure ES.1 Viability challenges for distribution companies in low-access countries

on key principles and implementation guidelines for the IDF in a range of national contexts. A more detailed treatment can be found in the full report and in the collection of working papers prepared by the GCEEP research team.[21]

We have identified four guiding principles for the IDF:

- **A commitment to universal access that leaves no one behind. This requires permanence of supply and the existence of a utility-like entity with ultimate responsibility for providing access in a defined territory.**

21 Working Papers developed by the GCEEP research team can be accessed online here: https://www.endenergypoverty.org/reports

Figure ES.2 Pillars of the integrated distribution framework

- **Efficient and coordinated integration of on- and off-grid solutions (i.e. grid extensions, mini-grids and stand-alone systems). This requires integrated planning at the distribution level and appropriate business models that take a comprehensive view of all types of consumers in a defined service territory.**
- **A financially viable business model for distribution. This will typically require some form of distribution concession to provide legal security and ensure the participation of external and mostly private investors, as well as subsidies for viability gap funding.**
- **A focus on development to ensure that electrification produces broad socio-economic benefits. This principle links expanded access to the delivery of critical public services (e.g., health, education) and to multiple economically beneficial end-uses.**

Though simple in concept, the application of these principles in practice is often far from straightforward. Achieving all of them fully and from the outset, is often not possible—on the contrary, partial success may be the most that can be accomplished at points along the way. Ultimately, however, all four principles are essential and must be kept clearly in view as countries work to develop and implement effective strategies for expanding access.

The principle of universal access requires a **utility-like company or entity** (whether public, private, or a public–private partnership) that takes responsibility for a territory and commits to supplying its customers with at least a minimum level of service and reliability through an appropriate mix of on- and off-grid solutions. The entity would accept the role of default supplier (that is, the party responsible for ensuring that everyone has service) and supplier of last-resort (the party that actually provides service in the event a current supplier fails to do so). It is important to note that the requirement for **universality** entails **permanence**. This will guide investments in new connections, whether through on- or off-grid solutions, that are aligned with a **sound long-term vision** of the power sector, based on proven regulatory and business fundamentals.

Thus, permanence of supply and compatibility with a sound long-term vision of the power sector are additional requirements that follow from a commitment to universality. Unfortunately, both are frequently ignored in

electrification initiatives that focus solely on meeting short-term access targets while ignoring the regulatory and business model aspects of program design that are needed to guarantee continuous service far into the future.

Too often this results in electrification projects that become inactive after a few years because of the absence of proper maintenance, funding, or management, or when demand grows and equipment needs to be repaired, replaced, or upgraded.

Defining a long-term vision for the power sector in low-access developing countries is challenging, especially given the transformative technological changes taking place within the sector globally.[22] However, a century of experience with electricity policy and regulation provides some important lessons:

i. **Distribution companies, which are often ailing in developing countries, play a critical role.** As demand grows, the viability of grid extensions will increase relative to off-grid solutions, resulting in hybrid electricity systems with grid service augmented by distributed energy resources. Planning strategies and regulation must account for this dynamic interaction.

ii. **The regulated revenue requirement of the distribution activity must be cost reflective.** The distribution network activity must be remunerated using some version of the cost-of service method, perhaps adding performance-based incentives. Deviating from this basic regulatory approach increases the cost of capital, deters investment, and compromises service reliability and quality of service. The IDF applies this method to an expanded view of distribution that encompasses both on- and off-grid solutions.

In practical terms, guaranteeing the inclusivity conditions laid out above will require strong instruments, such as long-term concessions, to attract the private and public capital needed for universal access. So far, distribution concessions have generally been used in exclusive settings— only in urban or rural areas, and in technology-specific applications (i.e., mini-grids and stand-alone systems)—with mixed results.

The principle of **coexistence of on- and off-grid solutions** requires the development of a least-cost, integrated electrification plan that includes all electrification modes. Such a plan should provide (i) a roadmap for investment and project implementation that meets electrification targets at least cost, subject to the availability of funds and in accordance with political, social, development, or environmental priorities and (ii) estimates of the cost of supply, which are needed to calculate regulated tariffs and assess the need for subsidies.

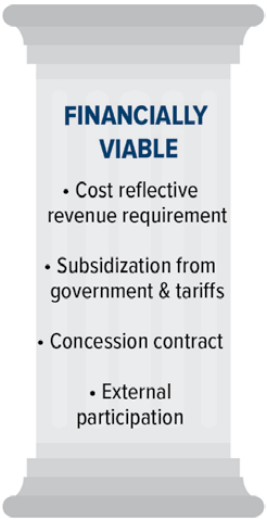
A sufficiently detailed plan can provide the bill of materials and the associated cost of the investments to be made every year, as well as the costs of managing, operating, and maintaining them. It will also contain the information needed to develop a business plan and identify financing needs, including estimates of demand and revenue based on the tariffs applicable to each type of customer.

On-the-ground surveys or geospatial tools combined with advanced machine learning techniques can be used to estimate demand and optimize electrification strategies (see Figure 3 in the full report). The plan can be adjusted over time to account for changes in demand, reliability of the main grid, costs of components, or wholesale energy prices.

Turning a geospatial plan into reality requires addressing additional challenges with respect to the design of mode-specific regulations for remuneration, the management of interfaces between modes, provisions for default and last-resort service, and the dynamic integration of different supply modes with changing demand over time. These challenges and potential solutions are discussed in detail in the full report.

Several developing countries have tested various approaches to developing the **financially viable**

22 See Pérez-Arriaga, I., et al. "The MIT Utility of the Future Study"(December 2016) for an analysis of the opportunities and challenges resulting from the growing presence of distributed energy resources (DERs) in power systems globally.



distribution business models needed to attract private partners who can mobilize investment capital, advanced technologies, and technical and managerial expertise. These have varied in design and outcomes. Some involved management contracts and the engagement of franchisees to conduct part or all distribution activities within a concession area. Under specific conditions, these interventions have yielded benefits in terms of reduced aggregate technical and commercial collection (ATC&C) losses, increased revenues, and improved customer engagement; however, they have generally focused on urban centers, where large gains are achievable at relatively low cost.[23]

Where investment mobilization needed is significant, long-term concessions usually covering a period of 20 years or more have proven to be effective instruments for mobilizing private sector expertise and capital, with successful examples emerging in a range of settings from Argentina, Morocco, and Uganda to India's capital city, Delhi. Less successful examples also exist, for instance in Senegal, that offer important lessons.[24]

Financial viability also requires *a stable and predictable regulatory environment*. A distribution company or concessionaire is dependent on the legal security in the country of operation, particularly if it works under an explicit mandate for electrification and relies on subsidy support for the viability of its business model. Governments, supported by DFIs, must provide the necessary backstops in the form of guarantees (e.g., payment security mechanisms, political risk guarantees, etc.).

Experience so far has shown that such guarantees are hard to secure in countries with poor investment climates and high perceived investment risks. These conditions are common in low-access countries, and they are likely being compounded by the COVID-19 crisis. The situation is even more difficult for privatized distribution companies. Such companies are exposed to the same regulatory and legal risks as public firms; yet they have less access to public financial support and face additional pressures and scrutiny from shareholders and consumers.

We have found that a long-term, investment-worthy concession can generally be an adequate instrument for delivering permanent, sufficient, reliable, affordable and universal access to electricity in a given area, provided its design is guided by a robust electrification plan and adequate public support to ensure cost-of-service recovery for all three electrification modes.

The goal of universal access goes well beyond just connecting customers. A top-down approach has to be complemented by the bottom up participation of electricity end-users. Other entities such as NGOs, foundations, and cross-sector agencies have important roles to play. No electrification scheme will work if the end customers do not receive quality service, and are not properly metered and billed. Beyond connection, productive and consumptive end-uses also need to be supported in ways that comport with community desires and priorities. In short, the electrification process must **focus on delivering socio-economic benefits**.

Focusing on these benefits will be particularly crucial in a post-COVID-19 world. It is already evident that the pandemic will leave millions of people in emerging economies unemployed and potentially resulting in the reverse migration from cities to rural areas in some countries. Thus, as governments and DFIs map out their recovery strategies, support for energy access and for improved livelihoods in rural areas must remain key priorities.

Stronger links between electricity supply and productive uses of electricity would also strengthen the financial

23 See Working Paper "How is the distribution sector in low-access countries attracting private sector participation and capital?" which reviews various approaches for increasing private sector engagement in the distribution sector.

24 See Jacquot et. al. (2019), "Assessing the potential of electrification concessions for universal energy access: Towards Integrated Distribution Frameworks", MIT Energy Initiative Working Paper.

viability of business models for expanding access.[25,26] It is now well known that access to modern energy, by itself, does not necessarily unlock the full potential of productive end-uses in rural and underserved communities.[27,28] Rather, access must be complemented by targeted efforts to facilitate the purchase of efficient appliances, consumer and enterprise financing, access to markets, capacity building, and data and information.[29] More attention is also needed to achieving gender equitable outcomes when promoting productive end-uses.[30]

Finally, institutions such as the World Health Organization, the World Bank, SE4All, DFID, IRENA and others have emphasized the critical role of energy access in the delivery of timely healthcare and other public services.[31] A concerted effort to deploy energy solutions for strengthening healthcare infrastructure in the short-term should align with a long-term perspective that advances resilience in both the health and energy sectors long after the pandemic abates.

2.2 IMPLEMENTING THE IDF

Given the stakes and the magnitude of the challenge, and based on experience in countries that have sought to expand access by applying aspects of the IDF,[32] we submit that success is not possible absent visionary leadership and strong political commitment. This commitment must be further backed by key DFIs and embedded in a lead ministry or public agency that can guide the efforts of the many stakeholders and participants who will be involved.

All of this suggests a dramatic change from the current piecemeal approach to expanding energy access in most developing countries, which has often suffered from the lack of an ambitious and comprehensive overarching vision and strategy.

Perhaps more problematic has been the tendency of energy access policy to be driven by the availability of specific concessional financing instruments in search of medium-sized investment problems to be addressed.

Our work shows that the IDF can be successfully tailored to the specific conditions of particular countries. Indeed, within its flexible set of guiding principles, it seems possible to design large-scale, comprehensive electrification programs backed by rigorous, quantitative business plans for a wide variety of situations.

The promising examples now unfolding in sub-Saharan Africa, Latin America and South Asia show that the IDF is not only a theoretical construct, but the basis for a practical methodology.

Assuming active public support and political leadership, as well as interest on the part of significant stakeholders the specific actions needed to implement the IDF are summarized in Figure ES.3, which draws upon lessons learned in our preliminary engagements with first action countries. Each of the key steps shown in the figure—developing an integrated electrification plan, preparing a preliminary business plan, identifying the most appropriate partnership model between various agents, defining a concession agreement and awarding the concession through an auction (tender) or direct allocation, and focusing on electricity as enabler of socio-economic growth—is described in more detail in the full report.

In cases where local buy-in is lacking, there is insufficient generation capacity, or where there is simply concern about sustaining an implementation program over many years—perhaps because of regional instability or for other reasons—implementation can proceed in a partial or phased manner. For instance, a number of independent

25 EEP. Opportunities and Challenges in the Mini-grid Sector in Africa: Lessons Learned from the EEP Portfolio, 2019. https://eepafrica.org/wp-content/uploads/2019/11/EEP_MiniGrids_Study_DigitalVersion.pdf

26 World Bank. Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers (Executive Summary), 2019. https://openknowledge.worldbank.org/bitstream/handle/10986/31926/Mini-Grids-for-Half-a-Billion-People-Market-Outlook-and-Handbook-for-Decision-Makers-Executive-Summary.pdf?sequence=1&isAllowed=y

27 IIED, Off-grid productivity: powering universal energy access, 2019. https://pubs.iied.org/pdfs/17492IIED.pdf

28 IEA, IRENA, UNSD, World Bank and WHO. *Tracking SDG 7: The Energy Progress Report, 2019.* https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/2019-Tracking-SDG7-Report.pdf

29 IIED and Hivos. *Remote but Productive: Practical lessons on productive uses of energy in Tanzania, 2019.* https://pubs.iied.org/pdfs/16652IIED.pdf

30 ENERGIA. *Unlocking the Benefits of Productive Uses of Energy for Women in Ghana, Tanzania and Myanmar*, 2019. https://www.energia.org/cm2/wp-content/uploads/2019/03/RA6-Unlocking-the-benefits-of-productive-uses-of-energy.pdf

31 World Bank (2020), "Energy access takes center stage in fighting COVID-19-19 (Coronavirus) and powering recovery in Africa", https://www.worldbank.org/en/news/opinion/2020/04/22/energy-access-critical-to-overcoming-COVID-19-19-in-africa

32 Later sections discuss the experience in a handful of "first action" countries that are in various stages of undertaking important access expansion programs consistent with IDF principles.

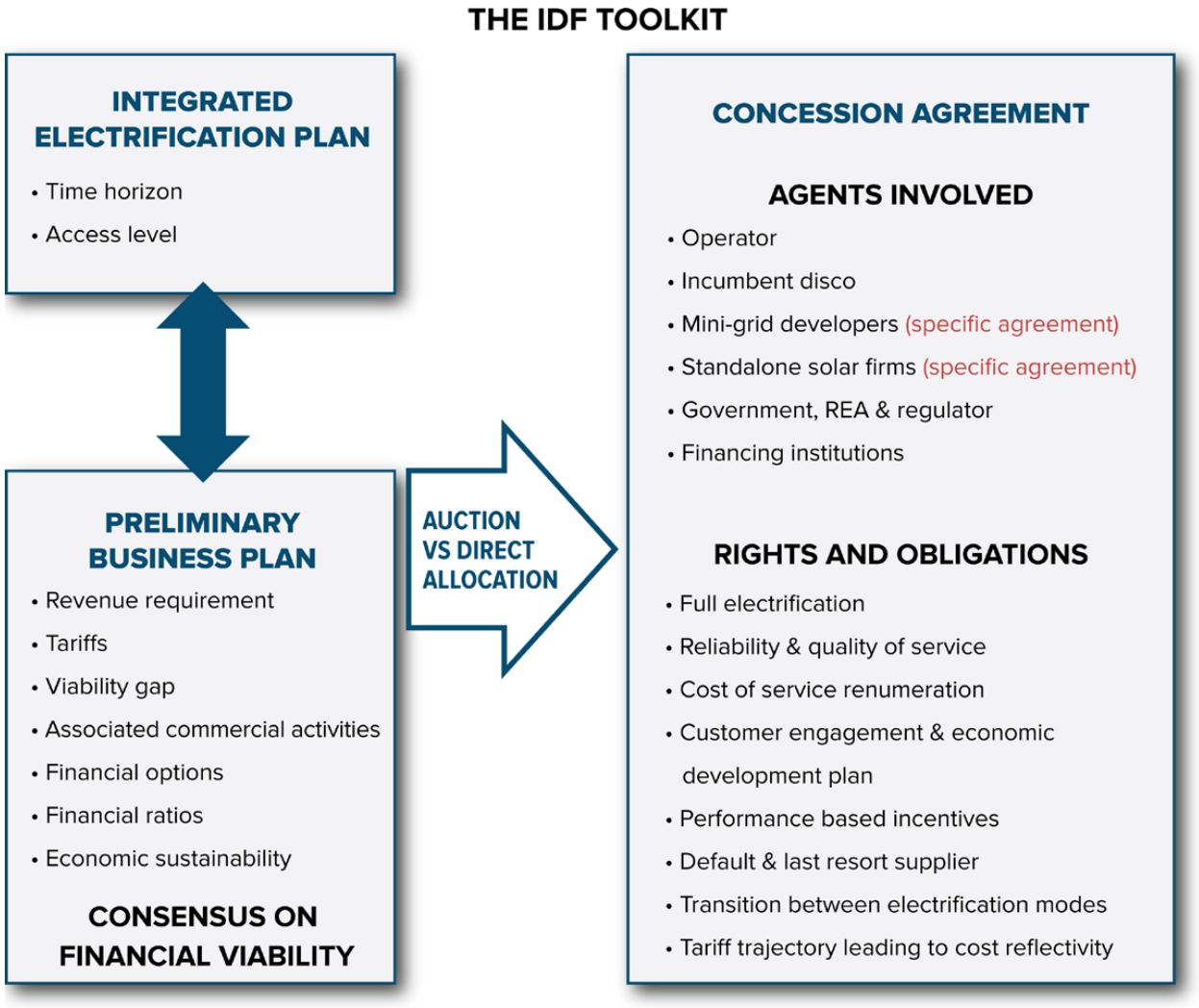


Figure ES.3 The integrated distribution framework toolkit

initiatives are currently underway to expand electricity access through single modes, such as mini-grids. Led by DFIs, foundations, private entities, NGOs and governments, these efforts can deliver important near-term gains in electrification, and so it is important to consider how they can eventually be integrated with the IDF approach, which requires broader regulatory support and a comprehensive business plan.

Rather than viewing targeted "bottom-up" programs as in conflict with the decidedly "top-down" IDF, we argue that these programs should be designed to include elements that provide for future integration into a regulated distribution business regime.[33] Indeed, the mindset that innovative bottom-up programs should be delayed or scaled back until after comprehensive integrated planning and reform of the distribution sector are in place must be resisted: rather, planning and reform must take successful bottom-up initiatives into account.

33 Examples of such design features could include: (i) stress tests of mini-grid business and financing models to shift from willing buyer/willing seller tariffs to a cost-of-service regime to identify optimum points of transition; (ii) the ability to anticipate and address information asymmetries to facilitate evaluation of mini-grid revenue requirements by regulators; (iii) providing clarity to mini-grids that may be subject to multiple regulatory regimes through project lifetime (e.g., mini-grid regulation, sub-concession/franchisee agreements); (iv) ensuring compatibility of mini-grid infrastructure with the grid to facilitate transition; and (v) building regulator capacity to assess mini-grid business and financing models.

SECTION 3

INTEGRATED DISTRIBUTION FRAMEWORK: ACTIVITIES AND LESSONS LEARNED

The GCEEP research team is actively engaged in efforts to apply the IDF approach in several "first action countries": Colombia, Nigeria, Rwanda and Uganda. In addition, we have been engaged in the somewhat unique

case of Odisha, India, where the largest distribution zone has transitioned to a private concessionaire.

We believe that the principles described in Section 2—universality of access, financial viability, integration of on- and off-grid solutions, and a focus on development outcomes—apply in all situations where countries face the dual challenge of improving the long-term viability of the distribution sector and achieving universal access, including by utilizing opportunities offered by distributed energy solutions. *Individually*, all of these principles have been widely discussed for many decades. The power of the IDF concept lies in bringing them to bear *collectively* and *rigorously* to achieve a durable transformation of the entire distribution sector.

Nevertheless, the IDF is not a one-size-fits-all solution—the fact that it can, and indeed must be, adapted to specific contexts means that its usefulness is not limited to a few countries with some favorable characteristics. Indeed, our experience has been that the IDF approach is applicable across a range of countries that have very little in common in terms of electricity sector regulation and business models. And while all the core principles of IDF are important and must be applied (as opposed to choosing some principles and leaving others out), they can be pursued incrementally as political economy, financial and human capacity, and experience permit. This is what we have found to be exciting and hopeful in our dealings with first action countries: each has an opportunity to make substantial progress toward achieving universal electricity access starting from its current situation, whatever that is.

3.1 A CANONICAL IDF EXAMPLE: THE CASE OF RWANDA.

The government of Rwanda has established an ambitious and comprehensive National Energy Sector Strategic Plan (ESSP)[34] that targets 100% electrification by 2024. With the support of multiple development partners, Rwanda successfully increased access to electricity from 10% of the population in 2010 to 43% in 2018, almost exclusively through grid extension.[35] But the pace of grid extension remains insufficient to meet the country's electrification target on schedule; in addition, increasingly cost-competitive off-grid solutions are now available.

With technical support from the national utility, Rwanda Energy Group (REG), and funding from the World Bank, the MIT/Comillas Universal Access Laboratory used its Reference Electrification Model (REM) software tool to develop a master electrification plan for the entire country. This plan describes a least-cost path to achieve universal access by 2024, subject to country-specific constraints and the national priorities laid out in the ESSP. Results from the modeling study can help inform prospective investors about off-grid market opportunities; they will also inform Rwanda's National Electrification

34 National Energy Sector Strategic Plan (ESSP) (2018), http://mininfra.gov.rw/fileadmin/user_upload/new_tender/Energy_Sector_Strategic_Plan.pdf
35 MININFRA and ESMAP et al. report "Rwanda: Beyond connections. Energy access diagnostic report based on the multi-tier framework", June 2018.

Strategy (NES) and National Electrification Plan (NEP).

In Rwanda, electrification is primarily a rural challenge: 77% of the urban population has access to electricity and receives high-tier service. By contrast, 84 % of the rural population has no access, with very few customers receiving high-tiers of service. Off-grid solutions are common in rural areas, but typically provide only low levels of service.

Because the country is small and densely populated, it will almost certainly be fully, or almost fully electrified through the national grid eventually. However, using grid extension to reach clusters with low demand is currently too expensive. In light of steep cost reductions in distributed solar technologies, the government has reconsidered its initial strategy, which was based on grid extension, and shifted focus to off-grid solutions that meet basic electricity needs for households. To enable the new approach, the government launched the MIT/ Comillas study, and has adopted new regulations for simplified licensing and development of small-scale mini-grids.[36]

In 2019, members of the GCEEP research team initiated conversations with key stakeholders in Rwanda about potentially adopting the IDF approach. Conversations have continued since, including with some GCEEP commissioners. The research team continues to examine the potential for a concession approach in Rwanda and, with support from SEforAll, is involved in ongoing discussions with the Ministry of Infrastructure, Transport, Energy and Sanitation (Mininfra) about drafting a electrification business plan.

In many objective respects, Rwanda is well-situated for a straightforward implementation of the IDF. Favorable conditions exist for each of the four IDF pillars and the government has made full electrification by 2024 a priority. Concentrated governance, and the existence of a single national utility capable of coexisting with mini-grid developers and stand-alone solution providers should help facilitate the design and adoption of a distribution concession agreement that encompasses the entire country.

The business plan developed so far by the GCEEP's research team includes a detailed quantitative template in spreadsheet format accompanied by an explanatory document. However, it addresses only the fraction of the distribution system that is still to be developed, including off-grid solutions, and will have to be expanded to include the existing distribution system under the Rwanda Energy Group (REG).[37] For the time being, the template is being used as a tool for discussion with key stakeholders, and to clarify and test the investment proposition for applying the IDF in Rwanda and elsewhere.

3.2 INTRODUCING IDF PRINCIPLES INTO A CONCESSION RENEWAL: THE CASE OF UGANDA.

Uganda's power sector has seen major changes over the last two decades as a result of comprehensive reforms adopted in 1999.[38] These reforms have yielded important results, particularly in generation where the country reached self-sufficiency, and currently has excess capacity. Unfortunately, limited investment and implementation challenges in the transmission sector are constraining the absorption of excess capacity. Uganda's priority now, in addition to expanding access, is to stimulate demand through industrialization, railway electrification, connection of large loads, and productive uses of electricity.

36 IRENA (2019). Policies and regulations for renewable energy mini-grids.

37 The detailed cost estimates provided by the MIT/Comillas electrification plan refer only to what remains to be electrified, not to what has to be done in the existing distribution network. The business plan can only be completed once this information is included in the financial analysis of the distribution concession business model.

38 World Bank Group (2019). Rethinking Power Sector Reform in the Developing World. https://www.worldbank.org/en/topic/energy/publication/rethinking-power-sector-reform

Extremely low rates of access represent a large and untapped demand opportunity for Uganda. Only 24% of the population has access to the grid compared to an average of 42% for Africa as a whole.[39] If off-grid sources are included, the access rate likely increases to 36%.

In 2005, Uganda Electricity Distribution Company Limited (UEDCL) leased its distribution assets, which were inherited from the Uganda Electricity Board (UEB), to Umeme Limited (a private entity) under a 20-year concession arrangement that was intended to reduce system losses, increase collection efficiency and attract private financing, and improve service for customers. Currently, the Umeme-operated network covers more than 90% of the entire electricity distribution network across major urban and peri-urban areas. It has almost no presence in rural areas. Umeme has been able to recover most of its tariff costs and has the distinction of being one of very few financially viable utilities in sub-Saharan Africa.

Besides Umeme, eight other service providers operate in Uganda outside Umeme's footprint. These consist mainly of small cooperatives with limited capacity, operating in rural areas with largely unviable business models. There is significant interest in developing mini-grids in areas where access is difficult and expensive, and in increasing the penetration of home-based solar systems. The level of activity in this area, mostly by private entities, has been remarkable.

In 2017, the MIT/Comillas Universal Access Lab partnered with GIZ to model the potential for using mini-grids to electrify Uganda's Southern Territory. Shortly afterwards, members of the present GCEEP research team, together with members of the Shell Foundation (SF), initiated contacts to discuss IDF with key stakeholders in Uganda. This relationship continues, facilitated by the presence of the Chairman of Umeme on the GCEEP. The director of the GCEEP research team is currently participating in a Technical Assistance Facility of the European Union to provide a better understanding of how distribution system reforms and concession agreements could be used to increase electricity access in Uganda. The GCEEP research team has also sent a technical note to relevant stakeholders in Uganda that highlights how the IDF could guide the design of the distribution business model in the next period and ensure that full electrification is a priority.[40]

3.3 APPLYING THE IDF TO ELECTRIFY THE LAST 5%: THE CASE OF COLOMBIA.

With support from the Inter-American Development Bank, the government of Colombia has embarked on a project of transforming and modernizing the country's power sector.[41] A component of this project involves designing a business model to extend access to some 3 million people (about 400,000 households) in "non-interconnected zones." These zones constitute around 51% of Colombian territory.

Colombia's existing level of electrification exceeds current averages for Latin American and the Caribbean. In fact, 97% of homes have access to electricity. Yet there are still more than 400,000 households without access, more than half of which are located in zones adjacent to the National Interconnected System (SIN). The rest are in non-Interconnected zones (ZNI), which are often difficult and expensive to access.

Achieving complete and sustainable electricity coverage in the ZNIs requires investment, especially by the private sector. The director of the GCEEP research team, in collaboration with Colombian experts, has been advising the government on designing a business model for the electrification of the non-interconnected zones. Preliminary recommendations were delivered to the

39 According to other sources, such as the National Development Plan III 2021–2025, the access rate is somewhat higher, at 28%. Uganda's overall population is estimated to be 41.2 million (population growth 3.02%) of which 84% is considered rural, with annual per capita GDP of USD 878. Uganda remains one of the poorest countries in the world, with 21.4% of the population living on less than USD 1.25 a day.

40 Pérez-Arriaga, I. and Stoner, R. "Uganda distribution sector diagnostic. Comments." Technical Note. January 2020.

41 The title of the project is: "Transformation and modernization of the power industry: Roadmap for the energy of the future."

Minister of Energy on November 15, 2019. A final report was presented in Bogotá on January 28, 2020, followed by meetings with the main stakeholders. The report strongly recommended direct application of the IDF, suitably adapted to the conditions of Colombia's ZNIs.

Details of the research team's recommended approach are described in the main report and in a GCEEP working paper. Broadly speaking, this approach encompasses (i) the need for integrated benchmark planning; (ii) a regulatory framework in line with the IDF that permits scalability and mobilization of all required efforts for universal service and long-term sustainability; and iii) an institutional framework as well as a governance structure.

In May 2020, the Colombian Institute for Planning and Promotion of Energy Solutions (IPSE) launched a project in the ZNIs with a group of experts coordinated by the director of the GCEEP research team and one of its members. The project, also funded by the IADB, has collected information about international best practices in the electrification of isolated rural areas with solar home systems. Project members issued IDF-aligned recommendations for application to Colombian ZNIs.

3.4 EXPERIENCES IN PURSUING IDF IMPLEMENTATION: THE CASE OF NIGERIA.

As the country with the largest population that still lacks access to electricity, Nigeria is a priority for efforts to reduce energy poverty. Nigeria is also among the few sub-Saharan countries that have a relatively progressive policy and regulatory environment; its distribution sector is privatized and comprises eleven discos. Nonetheless, the sector still faces severe liquidity and operational challenges that result in low quality of supply for consumers and low investments in expanding electricity access. Nigerians currently spend an estimated USD 14 billion annually on self-generation due to the poor reliability of grid-connected power.

In 2017, the MIT/Comillas Universal Energy Access Lab and Shell Foundation met jointly with key stakeholders in Nigeria (including several distribution companies). The objective was to define a viable large-scale distribution business model that could be deployed in one or more developing countries. This collaboration produced the concept of the "integrated distribution company" or, alternatively, the "energy company of the future"—a first version of the IDF concept. A start-up, called Konexa, was then created to implement it. Konexa applied MIT/ Comillas REM tool within the sub-concession area to determine the combination of grid extension and off-grid technologies that would provide adequate supply at least cost.

Another set of IDF-related activities in Nigeria involves the Abuja Electric Distribution Company (AEDC), a privately-owned disco. AEDC's total franchisee area represents about 15% of the entire country by land area. Much like other discos, AEDC is also facing substantial and mutually reinforcing challenges related to liquidity crunch, non-cost reflective tariffs, high AT&C losses, and high cost of service.

As part of its Performance Improvement Plan, AEDC has developed a "Distributed Energy Solutions Strategy" (DESSA) to attract third-party and private investments in distributed energy solutions in selected areas within its service territories.[42] (A pilot has already been conducted with the Wuse Market interconnected mini-grid.) With its focus on integrating grid-based and distributed solutions, creating a legal framework for private sector participation and capital, and advancing the long-term viability of the disco, DESSA is an important step in the direction of an IDF-like approach and could provide a blueprint for similar programs in Nigeria and elsewhere.

42 This includes the use of distributed generation, storage and demand side management solutions.

3.5 OFF-GRID SOLUTIONS UNDER THE GRID: THE EVOLVING CASE OF ODISHA AND TPRM IN INDIA

The state of Odisha, in India, offers an opportunity to apply the IDF in a situation where most consumers have grid connections and the focus is more on improving the quality of supply. Tata Power recently won a concession for the largest distribution zone in Odisha. The concession follows a similar public–private partnership structure that has been successfully applied in the city of Delhi but it covers an area that is largely rural and that has low population density and low rates of consumption.[43]

The recent launch of Tata Power Renewable Microgrid (TPRM) company is a key related development. With support from the Rockefeller Foundation, TPRM anticipates setting up 10,000 mini-grids in India by 2026.[44] To reach this goal, grid-compatible mini-grids will have to be developed in areas with an already existing infrastructure.

Implementation of the IDF in Tata Power's concession area in Odisha might begin with a least-cost planning assessment to identify areas that are more economically served by deploying distributed energy sources (including generation assets, storage, and some network developments) instead of extension and/or reinforcements of the main grid. The detailed nature of the underlying business models will depend on the regulatory regime for distribution in India, which is gradually evolving towards more public-private-partnerships (e.g., through sub-licenses and franchises).[45]

The GCEEP research team continues to monitor developments in India while engaging with key stakeholders (including regulators, the private sector, Tata Power and Smart Power India) to identify optimal ways of leveraging distributed energy solutions as part of the IDF approach in the Indian context.

3.6 WHAT LIES AHEAD

To advance beyond the present stage and enable IDF adoption by the many countries where we believe it could be applied requires continued effort on multiple fronts. A first priority is to **further develop the IDF implementation toolkit** so that it provides the additional detail needed to address practical challenges arising from IDF adaptation and implementation at the national level (for example, with respect to issues such as the design of concession agreements, financial analysis of electrification plans, and financing arrangements). Another task is to **evaluate and prioritize additional countries** that could be candidates for IDF implementation in the near term. This should be done in consultation with stakeholders (internal and external) and national governments, with the aim of identifying and engaging local champions and convening parties to create consensus.

Finally, further **advocacy and engagement** are needed to create broader understanding of the social and economic value of expanding electricity access through the IDF approach. This will involve continued interaction with relevant stakeholders—DFIs, governments, large energy companies and influential institutions—and efforts to mobilize resources for implementation.

43 Tata Power – DDL is a public-private-partnership between Tata Power (51% ownership) and the Government of Delhi (49% ownership) which has a concession to undertake distribution in one of four zones of Delhi. See Working Paper on "How is the distribution sector in low-access countries attracting private sector participation and capital?" for further details.

44 https://www.rockefellerfoundation.org/news/tata-power-rockefeller-foundation-announce-breakthrough-enterprise-empower-millions-indians-renewable-microgrid-electricity/

45 This point is reflected in the proposed amendments to the Electricity Act. See: https://economictimes.indiatimes.com/news/economy/policy/power-ministry-brings-new-draft-of-electricity-amendment-bill/articleshow/75220967.cms. See main report for further discussion of the interaction between regulation and viable business models.

SECTION 4

ISSUES IN GENERATION, TRANSMISSION AND REGIONAL TRADE

While distribution remains a key point of failure in many developing countries, a holistic view of the power sector—one that encompasses centralized generation, transmission, distribution with retail, and off-grid solutions—remains essential to achieve access and sustainability objectives.

For sub-Saharan Africa, in particular, key challenges include mobilizing the very large investments needed to finance major expansions of generation and transmission capacity, managing the rapid growth of variable renewable energy technology, improving resilience and mitigating and adapting to climate change, strengthening regional institutions, and realizing greater benefits from trade. Opportunities to make progress in the bulk power sector in individual countries and in the region as a whole are clear and very sizable. Natural resources are plentiful and potential future demand is enormous – but creating economic value from this potential will require commensurate investments in transmission and generation infrastructures. Cross-border trade can justify the installation of cross-border lines and the construction of power plants to unlock the outsized resources of individual countries, benefitting them and their neighbors. Sound regulations and business models, backed up trustworthy institutions, are the sine qua non conditions to attract the required amounts of private investment.

Our recommendations for these segments of the power sector can be summarized as follows: There is need to identify and disseminate the best regulatory and business model practices that can make possible large investments in transmission and generation infrastructures. Particular attention should be focused on removing barriers to the deployment of medium and large renewable plants. Best practices must be adapted to local situations, and their adoption must be promoted among the political leadership and other decision makers. The same can be said of regional trade, where it is not only necessary to revise market rules and transmission regulation at the regional level, but also to upgrade the regional institutions themselves so that they have real executive power and can make sure that opportunities for efficient power exchanges are not missed and transmission lines that are well-justified economically are built. [46]

On the issue of market rules for regional power trade and transmission regulation in particular, the GCEEP research team, following an initiative of the Tony Blair Institute, is advising the West Africa Power Pool (WAPP) on reforms aimed at reducing operation costs, improving reliability, and supporting major investments in renewable energy. West Africa is an appropriate candidate for enhanced trade—some countries have generation surpluses while others have deficits and high costs, and parts of the region have substantial renewable energy potential. In fact, the World Bank "*estimates that the economic benefits of a fully integrated power market are on the order of USD 5-8 billion per year for West Africa, with the potential to reduce the cost of electricity services by half in many countries in West Africa.*"[47] An analysis conducted by the Tony Blair Institute, USAID, and Power Africa estimates that USD 30 billion in savings could be achieved through mutually beneficial power trading and large-scale regional solar development.[48]

The transmission cost allocation methods proposed for WAPP so far, however, do not seem to reflect best practice internationally. For instance, allocating the costs of cross-border transmission infrastructures only to those parties engaged in cross-border commercial transactions is a major flaw that disincentivizes trade without any economic justification – even if the rule sounds "intuitively

46 There are currently five regional power pools in sub-Saharan Africa, all at varying stages of maturity. So far these power pools have largely performed below expectations – or just failed to start functioning.

47 The World Bank. 2019. "Burkina Faso Electricity Access Project." Project Information Document.

48 Tony Blair Institute for Global Change. 2019. "West Africa Power Trade Outlook." Power Africa Senior Advisors Group Program.

reasonable."[49] Sound regulations, by contrast, should: (i) facilitate investment in transmission by reducing as much as possible any economic justification for the stakeholders to oppose a beneficial project, and by reducing any unnecessary risks in the agreed remuneration of the project; (ii) promote investment in generation by reducing the risk of future uncertain transmission charges; and iii) facilitate efficient trade by avoiding charging enormous – and unjustified – fees to those who sign bilateral contracts with agents in other countries. A Working Paper by the GCEEP research team [50] addresses these issues in detail, highlighting the need for capacity building in development of operational rules for power pools in sub-Saharan Africa.

Indeed, capacity building in power sector regulation – and power trading in particular – is one of the main recommendations of the African Union-European Union High Level Energy Platform where several members of the GCEEP participate. An ambitious capacity building program on energy regulation is presently being prepared by a small group that includes several members of the GCEEP.

SECTION 5

THE WAY FORWARD

5.1 TAKING STOCK AFTER THE FIRST YEAR

The Commission's quest to design a flexible approach for expanding electrification through the use of financially viable business models has led us to develop the IDF concept described in Section 2 of this summary. As we have seen, the IDF approach has already gained traction in a number of countries. We have also collaborated closely with the Tony Blair Institute to establish a basis for informing decision-making about regional-scale transmission and generation projects in West and East Africa. A team of GCEEP members would be well-positioned to provide technical support as well as inputs at a political level to strengthen regional institutions across Africa.

Looking ahead, regulation stands out as an applied field of knowledge – blending engineering, economics, and law – that is essential to helping developing countries plan and implement the transition to a more inclusive, sustainable, and prosperous energy future. In an effort to support capacity building in power sector regulation, several GCEEP members, in collaboration with other institutions, are spearheading an initiative to launch an African School of Regulation (ASR). We envision a center of excellence, headquartered at some African academic institution, that supports independent discussion and knowledge exchange in support of higher-quality energy regulation and policy formulation. The ASR would bring together academics and practitioners, offer training courses, develop best-in-class tools and templates, and sponsor policy dialogue as well as applied research. It would engage not only with energy regulators but also with other key stakeholders who are affected by regulation and who have important roles to play in achieving the goal of universal access to affordable, reliable, sustainable, and modern energy.

Africans will shape the sustainable energy transition on the continent, enhancing or creating the institutions needed to build and operate their infrastructures. Training and education offer a low-cost opportunity to build increased capacity for addressing challenges, especially compared to the capital and operating costs of energy infrastructure. Moreover, encouraging local empowerment and ownership through capacity building can create a domino effect of improvements throughout the entire energy supply chain. The ongoing process of digitalization represents an opportunity to accelerate this process.

49 After long debates in the early 2000s, the regulation of the Internal Electricity Market of the European Union explicitly stated that transmission charges must not depend on commercial transactions. See Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the Internal Market for Electricity.

50 GCEEP research team Working Paper "On transmission cost allocation in the West African Power Pool (WAPP). The case of the OMVG transmission project", Ignacio Pérez-Arriaga, 2020.

Clearly, the context in which our Commission operates has changed in the past year. We find ourselves in the middle of a global pandemic and facing the prospect of a lengthy and uneven economic recovery that could compound inequalities and erase decades worth of progress on poverty alleviation. The urgency for governments to take strong action to address the health and socio-economic fallout from the current crisis cannot be overstated.

Thus, we strongly endorse the call by the United Nations' High-level Political Forum to place its 2030 Agenda at the heart of the COVID-19 recovery effort. We agree that the international community must respond by implementing a "Marshall Plan" for economic recovery in the developing world and by accelerating progress toward sustainable development goals, including the goal of achieving universal energy access.

In terms of GCEEP activities for the next year, we will continue supporting promising ongoing developments in the first action countries. We also propose to launch a portfolio of selected actions that will be centered on ending energy poverty and that can be included as a key component of larger "sustainable energy infrastructure" efforts to be undertaken in the context of COVID-19 recovery. Specific elements of a GCEEP action plan are discussed in the next section.

5.2 ACTION PLAN

GCEEP's action plan aims to leverage the diverse perspectives, expertise, and influence of Commission members to advance our mission of ending energy poverty around the world. It encompasses several categories of activity, including advocacy, technical assistance, stakeholder engagement, capacity building, and evaluation. Specific action items in each category are summarized below:

Advocacy

1. Universal energy access must be at the top of agendas for health, economic recovery, and sustainable energy. As the world fights the unprecedented crisis presented by COVID-19, a stubborn commitment to ending energy poverty by 2030 must remain central. Conveying this message at decision-making levels, convening the relevant stakeholders, and providing technical support for the adoption and implementation of the IDF in developing countries with access deficits is a critical part of the mission of the GCEEP. As governments and other institutions plan trillions of dollars of stimulus funding, investing in energy access in developing countries must be a priority in international and national efforts to "build back better" and be guided by sustainable development and climate objectives.

Research and Technical Assistance

2. In the short-term, extend technical and advisory support to governments and utilities to design mechanisms that enable end consumers (households, enterprises, and public institutions) adversely affected by the COVID-19 pandemic to remain connected. Tailored support will also be needed for enterprises in the power sector that have experienced significant financial and operational disruption.

3. Lead further development of the IDF toolkit through orderly engagement with low-access countries by one or more suitably staffed "engagement teams." These teams should include a full-time core of technical, regulatory and financial experts, as well as scholars and other specialists who participate on a part-time or case-by-case basis.

4. Facilitate the utilization – by governments, DFIs and other authorized stakeholders – of advanced software tools for key tasks such as electrification planning,[51] demand forecasting (and its relation to productive uses), and financial analysis.

5. Work with committed governments to develop comprehensive access programs based on IDF principles, and incorporating best practices from around the world, including in the area of blended finance.

Engagement with Regional Leadership on Energy Cooperation

6. Provide technical assistance and political support to regional institutions and governments in Africa to

51 An example is the suite of models for geospatial electrification planning developed by the MIT/Comillas Universal Energy Access lab, see http://universalaccess.mit.edu

reinforce these institutions and improve existing rules for regional trade in electricity.

7. Engage national political and business leaders to build support for regional cooperation on energy projects with the explicit goals of reducing costs, improving resiliency to natural and man-made disasters, and planning for a substantially decarbonized power system.

Institutional and Individual Capacity Building

8. Share innovative approaches and best practices from the accumulated experience of countries that are pursuing aggressive universal access programs consistent with IDF principles, including by making extensive use of online platforms and teaching opportunities.

9. Engage and leverage the skills of specialized institutions, such as the proposed Africa School of Regulation as well as MIT and other research universities that have active programs in fields such as energy regulation, planning, and low-carbon development.

Progress Measurement

10. Adopt a practical methodology to enable tracking and inform the design of successful programs to end energy poverty. Important dimensions to track include those that relate the IDF principles, as well as other factors such as affordability, reliability of service, and adequacy for healthcare and education. Periodic reporting on the progress countries have made will be important, both to sustain momentum and to develop insights about how efforts can be further accelerated.

A key role for the Commission in advancing this plan will be to help convene and provide a platform for the many actors who are already deeply engaged in the cause of ending energy poverty. All must be part of a call to action to achieve the goal of universal access to affordable, reliable, sustainable and modern energy.

Specifically, we call on **country leaders** to develop national plans aligned with the principles of the IDF for eradicating energy poverty by 2030, and to articulate commitments to specific programs and reforms designed to achieve this goal. We also call on country leaders to join us in seeking ways to increase investments in generation and transmission nationally and to facilitate regional trade in power.

We call on **DFIs** to explicitly link near-term recovery packages aimed at ensuring the continuity of essential services to the achievement of long-term investment in resilient infrastructure necessary for ending energy poverty and meeting multiple sustainable development goals. We also call on DFIs to dramatically increase the role of blended finance (with a focus on lowering financial risk to private investors in distribution utilities organized under IDF principles) and to identify and find ways to overcome barriers to private sector investment in distribution, generation, and transmission more broadly.

We call on **private sector lenders and investors**, notably pension funds and others that traditionally invest in utilities in advanced economies, to join with DFIs and national governments in blended financing arrangements for IDF-modeled distribution companies, and upstream transmission and generation projects. To facilitate the necessary dialogue, we propose to form an expert subcommittee on expanding private sector investment in the electricity sectors of low access countries.

Finally, we call on **utilities** around the world to develop, in partnership with national governments, investable business plans for the distribution system that are aligned with IDF principles. We also call on utilities to provide financial support to critical training and capacity-building programs, such as the proposed Africa School of Regulation and other regional centers.

As for the GCEEP, we look forward to expanding our engagement with all relevant actors and with other key stakeholders as we advance critical energy and sustainable development goals in the months and years ahead. Throughout, we intend for our work as a commission to continue to be distinguished—both by a singular focus on practical solutions and by a commitment to consistently aligning global priorities and resources behind the best ideas.