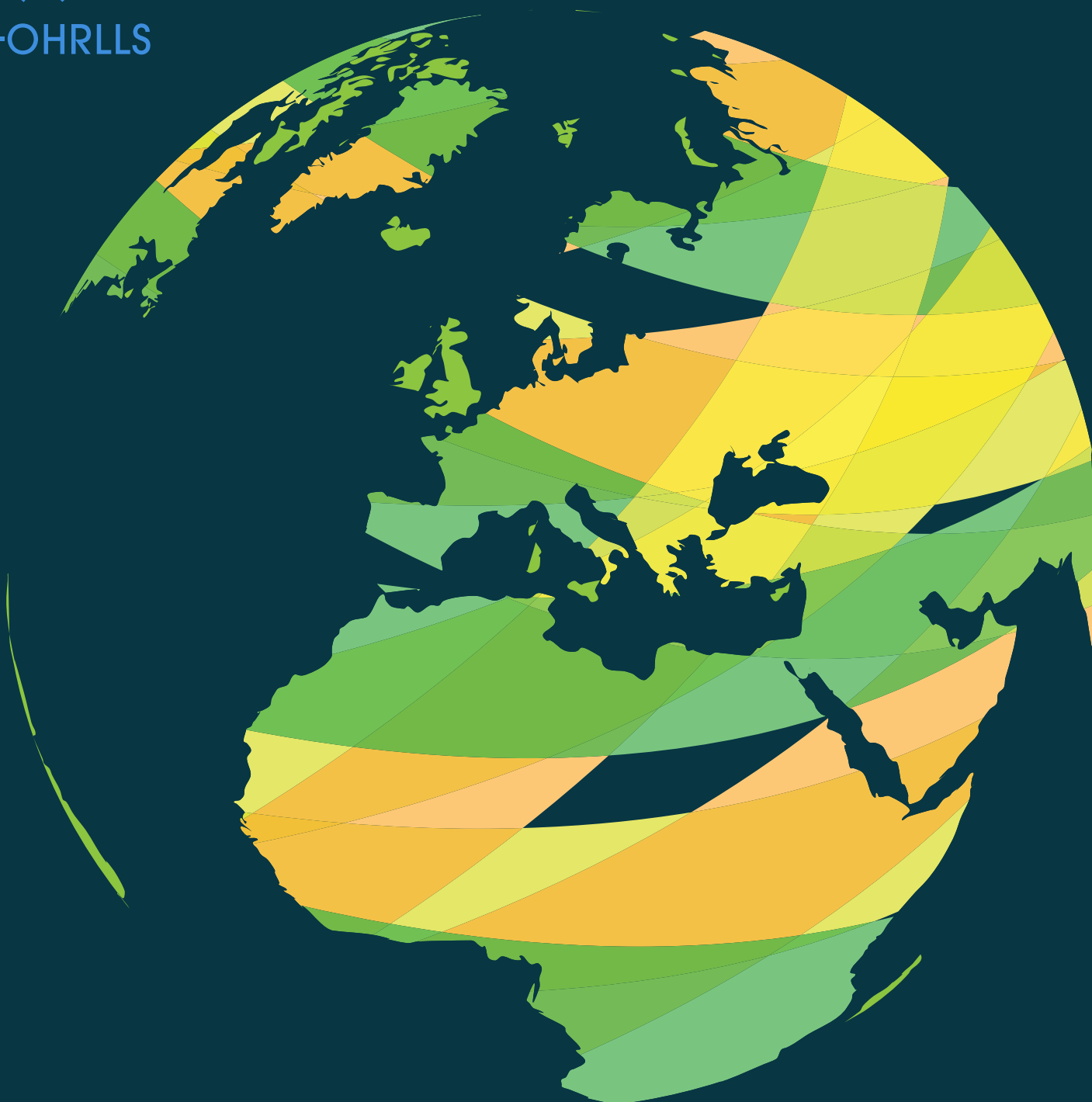
Promoting Investment for Energy Access in Least Developed Countries

UN-OHRLLS



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"Sustainable energy supply and access are key components underpinning balanced, resilient and dynamic development. However the acute energy access gap faced by LDCs is a major impediment to their transformation.

FOREWORD

Since the adoption of the Istanbul Programme of Action for the Least Developed Countries for the Decade 2011-2020, a lot of emphasis has been placed on the key role that sustainable energy plays for the structural transformation of the least developed countries (LDCs). It is featured in many international agreements, declarations and underlined repeatedly by LDCs themselves. Yet, still today, half of the world's unelectrified population is located in LDCs.

We, as the global community, must change this. The global 2030 Agenda for Sustainable Development is broader, more comprehensive and more inclusive than ever before and provides the blueprint for global development. The 2030 Agenda has a special focus on vulnerable countries with its central theme of leaving no one behind.

Sustainable energy is a key development enabler and essential to achieving the 2030 Agenda as well as the Paris Climate Change Agreement. It is in everyone's interest that the least developed countries can make rapid progress in energy access. All stakeholders, including bilateral donors, international organisations, development finance institutions, private sector and civil society, need to join their forces to support the efforts of the LDCs in accelerating energy access.

This report has a unique focus on investment flows into energy access programmes suitable for the LDCs. It lays the foundation for helping to accelerate investment by better understanding their specific situation, the challenges, and inherent opportunities for pivoting sustainable energy options as a means to alleviate energy poverty. The report presents the energy access situation in light of how investment in sustainable energy can be unlocked in LDCs. Furthermore, it looks at the interplay between public and private sector investment flows, financing approaches, and specific barriers in the LDCs and provides recommendations for the way forward.

I would like to thank the Government of Finland for its generous financial contribution, which made it possible to prepare this report. I would also like to thank all the contributors and the interviewees for their time as well for sharing their expertise and experience. I sincerely hope that this report will offer a renewed perspective to the readers and provide new momentum on how we together can better support the LDCs struggling with energy poverty, to ensure a brighter future for their people.

FEKITAMOELOA KATOA 'UTOIKAMANU
Under-Secretary-General, and High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States

LIST OF ABBREVIATIONS

AAAA	Addis Ababa Action Agenda
ADB	Asian Development Bank
AEPC	Alternative Energy Promotion Center
AfDB	African Development Bank
AIIB	Asia Infrastructure and Investment Bank
BNEF	Bloomberg New Energy Finance
BOT/BOOT	Build–operate–transfer (BOT) or build–own–operate–transfer (BOOT)
BSP	Biogas Support Programme/Partnership
CEFPF	Clean Energy Financing Partnership Facility
CIF	Climate Investment Fund
COP 22	2016 United Nations Climate Change Conference
CPI	Climate Policy Initiative
CVF	Climate Vulnerable Forum
DFI	Development Finance Institution
DRC	Democratic Republic of the Congo
EU	European Union
ElectriFI	Electrification Financing Initiative
FDI	Foreign Direct Investment
FEI	Facility for Energy Inclusion
FS-UNEP	Frankfurt School - United Nations Environment Programme
GDP	Gross Domestic Product
GEF	Global Environment Facility
GiZ	German Corporation for International Cooperation GmbH
GNI	Gross National Income
GoU	the Government of Uganda
GWh	Gigawatt hours
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Association
IFC	International Finance Corporation
IMF	International Monetary Fund
IRENA	International Renewable Energy Agency
IPoA	Istanbul Programme of Action
IPP	Independent Power Producer
Lao PDR	Lao People's Democratic Republic
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LLDCs	Landlocked Developing Countries
LPG	Liquefied Petroleum Gas
MFI	Microfinance Institution
MW	Megawatt
NEA	Nepal Electricity Authority
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
OCI	Oil Change International
PAYGO	Pay-As-You-Go
PPA	Power Purchase Agreement
PPP	Purchasing Power Parity
PV	Photovoltaic
REB	Rural Electrification Board
REEI	Renewable Energy and Energy Efficiency Initiative
REFiT	Renewable Energy Feed-in Tariff
RISE	Regulatory Indicators for Sustainable Energy
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goal
SEforALL	Sustainable Energy for All
SIDS	Small Island Developing States
SME-RE	SME Renewable Energy
SPV	Special Purpose Vehicles
SREP	Scaling up Renewable Energy Programme
TFEC	Total Final Energy Consumption
UN-DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-OHRLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States
VAT	Value Added Tax
WB	World Bank
ZESCO	Zambia Electricity Supply Corporation

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Photo: *Nepal.* Rob Goodier, Engineering for Change/Flickr.

EXECUTIVE SUMMARY

The least developed countries (LDCs) are the most vulnerable countries in the world, facing severe gaps in socio-economic development, weak human and institutional capacities, low and unequally distributed income and scarce domestic financial resources. There are 47 LDCs, representing the poorest segment of the international community, accounting for less than 2 per cent of world GDP while at the same time being home to 13% of the world population. Sustainable energy supply and access are key components underpinning balanced, resilient and dynamic development, but the acute energy access gap faced by LDCs is a major impediment to their transformation. Electrification rates are low in LDCs and currently only 38 percent of the LDCs population has access to electricity and one half of the world's unelectrified population is located in these countries. LDCs will require significantly larger amounts of capital investments than what is currently available in order to finance the transition to a sustainable energy future that will lead to improvements in climate resilience, health, education, food security, and women's empowerment.

LDCs suffer disadvantages in generating local savings, collecting tax revenue, and attracting investment capital due to low GDP growth, less mature financial markets, and poor infrastructure. The average GDP per capita in LDCs is just $978, or less than one tenth of the global average. In many LDCs, the overall business environment requires further improvements and limits the prospective financial flows to energy sector. Furthermore, a large subset of LDCs faces additional geographic challenges of being landlocked or small island nation, which are significant impediments to trade and market development.

Several international commitments exist, such as the Istanbul Programme for Action, the 2030 Agenda for Sustainable Development, the Paris Climate Agreement and others, to chart a course for LDCs to pursue inclusive sustainable development. These international agreements provide the foundation for LDCs to meet goals and targets for increasing access to energy, facilitating investment in sustainable energy projects and programmes, promoting gender inclusive strategies, and increasing the adoption of renewable energy, energy efficiency and modern cooking options.

The challenge to supply people in the LDCs with modern, sustainable energy services is formidable. At the same time, this represents an enormous potential market opportunity for the countries themselves, investors, donors, and the private sector. It is the responsibility of national governments to take necessary actions to shift funding priorities and design enabling policies to promote investments in the energy sector. International financial institutions, donor agencies, and the private sector will have to play a large role in providing the financial resources, mitigating risk and strengthening the entire energy value chain.

This report summarizes the types, sources, and amount of financing flows into LDCs, recognizing that such financing will be critical to deploying a wide range of energy solutions at the needed scale to tackle energy poverty. It takes stock of the current situation in the LDCs in terms of energy access, investment flows, financing hurdles, regulatory regimes, and private sector engagement, to define a set of recommendations for LDC governments, development partners, and investors to help unlock investment and spur an energy transition. This is premised on the need for well-functioning financial institutions, strong and transparent policy and regulatory instruments, business planning support, and capital to launch and scale up businesses.

Each country's transition to a sustainable energy future involves a unique mix of investment, budget allocations, and policy incentives. Purely private financing of sustainable energy projects in LDCs is still rare. What is becoming increasingly common is for international and domestic public finance to seek out public-private partnership opportunities. Public finance is increasingly trying to attract private sector partners, through co-investment, blended finance, the use of risk mitigation and credit enhancement tools, output-based financing, and early-stage grant support project development activities and the creation of enabling environments. Development finance institutions (DFIs) have the ability to subsidize financial returns going to other actors in the interest of increasing their leverage and mobilizing the private sector through blended capital solutions. The challenge for LDCs is to maximize sustainable energy access with the limited resources at their disposal, and leverage those resources to the utmost, spurring the private sector to act in concert with the public sector and DFIs to address the urgent needs in the countries. At the same time, they need to ensure that costs and benefits are carefully assessed, taking into account their impact on poverty, inequality and sustainable development.

For LDCs a number of general principles are identified to create an enabling environment for private sector investment to flourish and to accelerate the sustainable energy transition. This includes creating rules-based, transparent and level playing fields; dedicating sufficient resources to capacity building and project preparation, technical assistance and service provision as a means to unlocking investment; using risk management mindsets and understanding different incentives throughout the energy value chain; attempting to make transactions replicable and possible to aggregate to drive down transaction costs; and combining different forms of capital into tailored packages until it suits the risk,

return, size, and timeline of the projects and investors. Development partners also have a critical role to play in expanding sustainable energy access in LDCs and helping complete the transition to a sustainable energy future. Development partners can offer "first mover" finance, use their power to convene financing consortia, offer risk management products, and propagate best and innovative practices.

There is optimism for many LDCs stemming from the fact that they will make significant strides towards bringing sustainable energy services to their populations working hand in hand with their development partners and the private sector. Ample models for financing success exist (both within LDCs and in developing countries more broadly), technology is advancing rapidly in terms of functionality and price, and there is large, untapped market potential within their borders. On the public sector side, a common thread that emerged from the research related each success to a supportive policy environment and an empowered LDC government agency (a "champion") at the sub-ministerial level capable of leading a coordinated approach with multiple stakeholder groups. Government leaders can and will need to undertake a number of policy and regulatory reforms to help build credibility with investors to scale-up private investment that leverages public resources for country-level implementation. Development partners and investors will need to consider how to tap into the potential in LDCs and begin to diversify their portfolios to include more investments in sustainable energy and energy access—to capture financial, social and environmental returns. This report makes a clear case that there is an urgency in accelerating access to clean, affordable and reliable energy in all of the LDCs, and that this will only happen if governments, investors, donors and the private sector work together to unlock investment.

RÉSUMÉ

Les pays les moins avancés (PMA) sont les pays les plus vulnérables du monde, confrontés à d'importants écarts de développement socioéconomique, à la faiblesse des capacités humaines et institutionnelles, à des revenus faibles et inégalement répartis et aux ressources financières nationales limitées. Il existe 47 PMA, représentant le segment le plus pauvre de la communauté internationale avec moins de 2% du PIB mondial et habités par 13% de la population mondiale. L'approvisionnement en énergie durable et accessible est un élément clé qui sous-tend un développement équilibré, résilient et dynamique, mais l'important écart d'accès à l'énergie des PMA est un obstacle majeur à leur transformation. Les taux d'électrification sont faibles dans les PMA et actuellement seulement 38 pour cent des PMA ont accès à l'électricité et la moitié de la population mondiale n'ayant pas accès à l'électricité vit dans ces pays. Les PMA nécessiteront des investissements beaucoup plus importants que ceux disponibles actuellement afin de financer la transition vers un avenir fondé sur l'énergie durable qui permettra d'améliorer la résilience climatique, la santé, l'éducation, la sécurité alimentaire et l'autonomisation des femmes.

Les PMA sont défavorisés dans la formation d'épargne domestique, le prélèvement des recettes fiscales et l'attraction de capitaux d'investissement en raison de la faible croissance du PIB, des marchés financiers peu développés et des infrastructures insuffisantes. Le PIB moyen par habitant dans les PMA est de seulement 978 dollars, soit moins d'un dixième de la moyenne mondiale. Dans de nombreux PMA, l'environnement commercial global nécessite de nouvelles améliorations et de consacrer les flux financiers potentiels au secteur de l'énergie. En outre, un grand sous-ensemble de PMA qui sont confrontés à des défis additionnels d'ordre géographique liés à l'enclavement et à l'insularité, lesquels défis constituent un obstacle important au développement du commerce et des marchés.

Plusieurs engagements internationaux existent, entre autres, le Programme d'action d'Istanbul, le Programme de développement durable à l'horizon 2030 et l'Accord de Paris sur le climat, afin d'établir un plan permettant aux PMA de poursuivre un développement durable inclusif. Ces accords internationaux établissent les bases afin que les PMA atteignent les objectifs et les cibles pour accroître l'accès à l'énergie, en facilitant l'investissement dans des projets et programmes axés sur une utilisation durable de l'énergie, des stratégies incluant davantage le genre, et en augmentant l'adoption d'énergies renouvelables, l'efficacité énergétique et les options de combustibles modernes pour la cuisine.

Le défi qui consiste à fournir aux populations des PMA des services énergétiques modernes et durables est une tâche impressionnante. Dans le même temps, cela représente une énorme opportunité de marché potentiel pour les pays eux-mêmes, les investisseurs, les donateurs et le secteur privé. Il incombe aux gouvernements nationaux de prendre les mesures nécessaires pour modifier les priorités de financement et concevoir des politiques permettant de promouvoir les investissements dans le secteur de l'énergie. Les institutions financières internationales, les organismes donateurs et le secteur privé devront jouer un rôle important en fournissant les ressources financières, en atténuant les risques et en renforçant l'ensemble de la chaîne de valeur énergétique.

Ce rapport résume les types, les sources et le montant des flux de financement dans les PMA, en reconnaissant qu'un tel financement sera essentiel au déploiement d'un large éventail de solutions énergétiques à l'échelle nécessaire pour lutter contre la pauvreté énergétique. Il tient

compte de la situation actuelle dans les PMA en termes d'accès à l'énergie, de flux d'investissements, de difficultés de financement, de régimes réglementaires et d'engagement du secteur privé, afin de définir un ensemble de recommandations pour les gouvernements des PMA, les partenaires au développement et les investisseurs dans le but de débloquer les investissements et de stimuler une transition énergétique. Cela repose sur la nécessité de mettre en place des institutions financières efficaces, d'instruments politiques et réglementaires solides et transparents, de soutien aux plans d'affaires et de capital pour lancer et étendre leurs activités.

La transition de chaque pays vers un futur énergétique durable implique une combinaison unique d'investissements, d'allocations budgétaires et d'incitations politiques. Le financement purement privé des projets d'énergie durable dans les PMA est encore rare. Ce qui devient de plus en plus courant, c'est la finance publique nationale et internationale cherchant des opportunités de partenariats public-privé. Les finances publiques tentent de plus en plus d'attirer les partenaires du secteur privé, par le biais des co-investissements, du financement mixte, de l'utilisation d'outils d'atténuation des risques et d'amélioration du crédit, du financement basé sur les résultats, des subventions de soutien au stade précoce des projets de développement d'activités et la création d'environnements propices. Les institutions de financement du développement (IFD) ont la capacité de subventionner les rendements financiers allant à d'autres acteurs dans l'intérêt d'accroître leur levier et de mobiliser le secteur privé grâce à des solutions de capitaux mixtes. Le défi pour les PMA est de maximiser l'accès à l'énergie durable avec les ressources limitées dont ils disposent et d'en tirer le maximum de profits, incitant le secteur privé à agir de concert avec le secteur public et les IFD pour répondre aux besoins urgents des pays. Parallèlement, ils doivent veiller à ce que les coûts et les avantages soient soigneusement évalués, en tenant compte de leur impact sur la pauvreté, les inégalités et le développement durable.

Pour les PMA, un certain nombre de principes généraux sont identifiés pour créer un environnement propice à l'investissement du secteur privé et pour accélérer la transition vers un une énergie durable. Cela comprend la création de règles de concurrence égales et transparentes, en consacrant suffisamment de ressources au renforcement des capacités et à la préparation des projets, à l'assistance technique et à la fourniture de services comme moyen de débloquer l'investissement; en utilisant la culture de gestion des risques et en maîtrisant les différentes incitations tout au long de la chaîne de valeur énergétique; en essayant de rendre les transactions reproductibles et agrégées afin de réduire les coûts de transaction; et en combinant différentes formes de capital dans le cadre de politiques taillés sur mesure afin de correspondre aux risques, aux rendements, à la taille et au calendrier des projets et des investisseurs. Les partenaires au développement ont également un rôle essentiel à jouer dans l'élargissement de l'accès à l'énergie durable dans les PMA et contribuer à la transition vers un avenir énergétique durable. Les partenaires au développement peuvent aussi proposer des financements «prime au premier entrant», utiliser leurs pouvoirs pour convoquer des consortiums de financement, proposer des produits de gestion des risques et diffuser les meilleures pratiques innovantes.

Il existe un certain optimisme quant à la situation de nombreux PMA qui tient au fait qu'ils progresseront de manière significative vers la fourniture des services énergétiques durables à leurs populations, travaillant main dans la main avec leurs partenaires au développement et le secteur privé. Des nombreux modèles pour le succès du financement existent (tant dans les PMA que, plus largement, dans les pays en développement), la technologie avance rapidement en termes de fonctionnalité et de prix, et il existe un grand potentiel de marchés inexploités à l'intérieur de leurs frontières. Du côté du secteur public, une tendance révélée par l'étude est que chaque réussite est liée à un environnement de soutien politiques et un organisme gouvernemental compétent (un «champion») au niveau sous-ministériel capable de mener une approche coordonnée avec plusieurs groupes d'intervenants. Les dirigeants gouvernementaux devront entreprendre un certain nombre de réformes politiques et réglementaires pour assoir une crédibilité avec investisseurs afin d'accroître l'investissement privé qui tire parti des ressources publiques pour la mise en œuvre au niveau des pays. Les partenaires au développement et les investisseurs devront considérer comment exploiter le potentiel des PMA et devront commencer à diversifier leurs portefeuilles pour inclure davantage d'investissements dans l'énergie durable et l'accès à l'énergie - pour tirer des profits des rendements financiers, sociaux et environnementaux. Ce rapport met en évidence l'urgence de la nécessité d'accélérer l'accès à l'énergie propre, abordable et fiable dans tous les PMA et cela ne se fera que si les gouvernements, les investisseurs, les donateurs et le secteur privé travaillent ensemble pour débloquer les investissements.

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I. PURPOSE

The international community recognizes that the least developed countries (LDCs) will require a large influx of capital in order to seize the opportunity for transformative change that will eliminate energy poverty and promote sustainable development in these countries. Being a key development multiplier, reliable and affordable access to energy is essential for private sector development, building of productive capacity and expansion of trade. Energy access has strong linkages to climate action, health, education, water and food security, and women's empowerment. However, investment flows to the LDCs are limited due to unpredictable policy regimes, less mature local financial markets and institutional capacity constraints. Furthermore, projects tend to be of small scale and do not have an impact that triggers transformational change. With government budgets being severely constrained in the LDCs it is all the more important to leverage investments from Official Development Assistance (ODA) and from multilateral and regional development banks, which can play a key role in enhancing the flow of capital for energy access. The growing interest of the private sector, including the social enterprise sector, is also a new and emerging way to bring in capital and know-how to address the financing gap in the LDCs.

This report delves into the financing flows in the LDCs for sustainable energy by presenting examples of programmes, companies, and projects that illustrate the different models that are currently in play. It also examines the progress that has been made on increasing energy access in the LDCs and the goals on sustainable energy in various international agreements, including the Istanbul Programme of Action, the Sustainable Development Goals, and the Sustainable Energy for All Initiative. Considering the ambitious global policy objectives on sustainable energy and the acute energy access gap in LDCs, rapid energy transition will require a strong and concerted effort from all stakeholders coupled with significant investment and deployment of modern technologies. The purpose of this report is to take stock of the current situation in the LDCs in terms of investment flows, financing hurdles, regulatory regimes, and private sector engagement, to define a set of recommendations for LDC governments, development partners, and investors. It is clear that support across all parts of the energy value chain is needed, including well-functioning financial institutions, strong and transparent policy and regulatory instruments, business planning support, and capital to launch and scale up businesses. Also governments and utilities can focus on improving the governance and management of their operations to increase profitability and to enhance their creditworthiness. All of these will serve to build credibility with investors and leverage public resources for expansion of energy access.

Specific objectives of the report are to:

01 Review the energy access situation in the least developed countries and analyse progress made since the adoption of the Istanbul Programme of Action;

02 Analyse the main challenges LDCs have in accessing sustainable energy giving a special focus to unlocking investment for energy access;

03 Analyse the current financing flows to sustainable energy projects in LDCs and identify the main impediments to new investments;

04 Provide recommendations on how the private sector could unlock finance in LDCs and tap into business opportunities these countries offer in the area of sustainable energy; and

05 Provide recommendations on how LDC governments and their development partners can support the unlocking of finance for sustainable energy in LDCs.

The report is structured in a way to create a clear understanding and assessment of the situation in LDCs and makes the case for creating a push from all stakeholders to increase investments and deploy sustainable energy technologies within a conducive financing and policy framework. Following the introduction to the report in **Chapters 1** and **2**, **Chapter 3** provides the context and background for the energy situation in the LDCs, including the economic and social trends; the international policy goals and targets that form the backdrop for energy projects and programmes in LDCs. **Chapter 4** presents the overall progress in LDC's energy access and challenges.

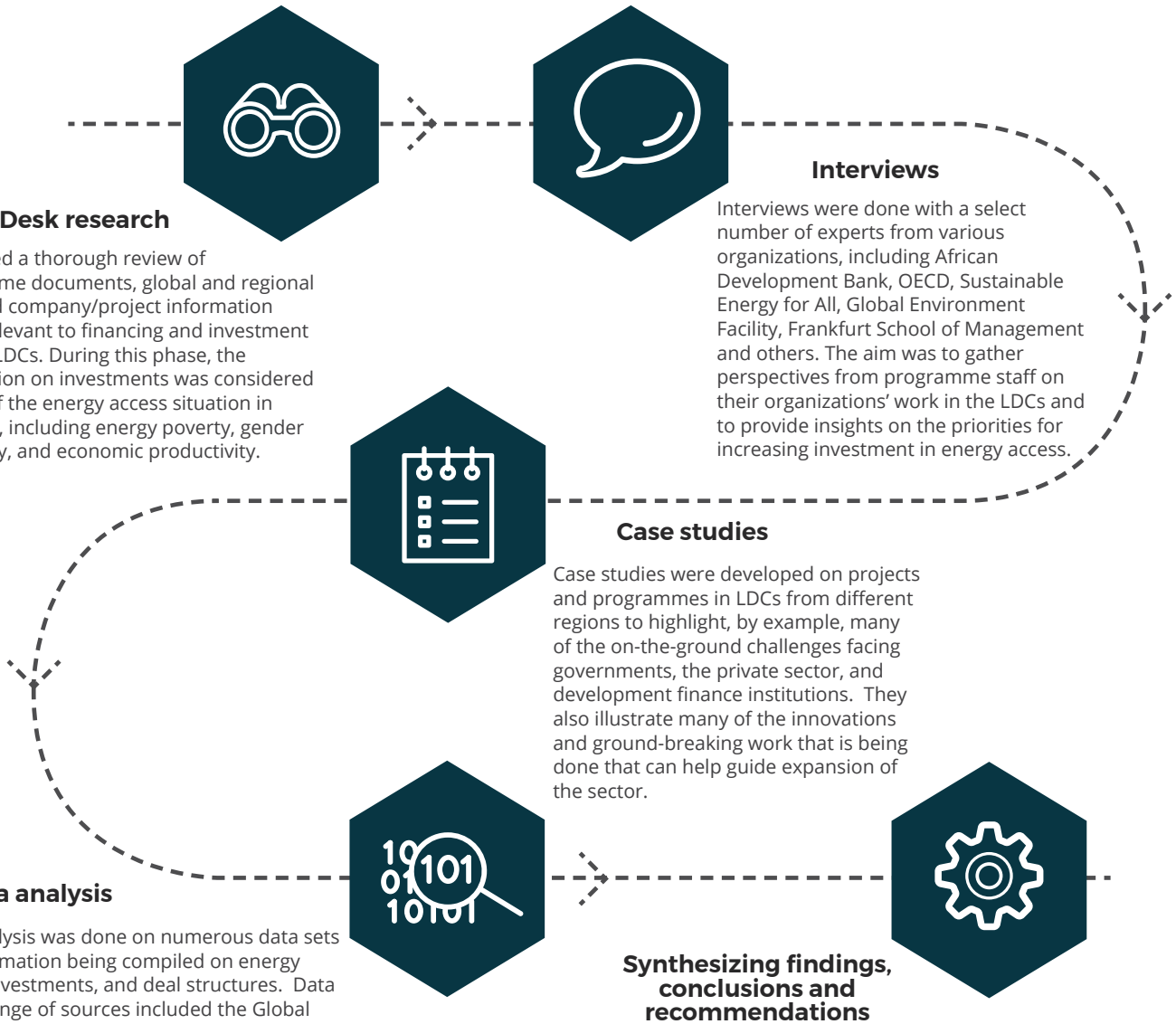
Chapter 5 takes a deep dive into the financing flows and investment trends in the LDCs, with a focus on the types of investors and characteristics of investment flows; specific features of public and private investments in medium to larger energy infrastructure projects; the investments being made in the off-grid sector through smaller projects and innovative financing mechanisms; and closing with a clear presentation of the data challenges for comprehensive and accurate information on investments and financing flows in LDCs. The financing challenges in LDCs are presented in **Chapter 6**, is structured according to the four main challenges that were identified in the research. These include challenges for LDCs centered on sustainable energy project designs and features; less mature financial markets and investment conditions; lack of capacity of across the energy value chain; and policies and regulatory frameworks that are not conducive to expanding investments. **Chapter 7** brings together all of the different aspects of the research and findings to design a set of recommendations tailored to different actors in the LDCs on unlocking investments. The chapter includes first a clear set of principles to be considered in mobilizing private and public sector investment; then it identifies opportunities unique to the LDCs for private sector project developers; and closes with two sets of recommendations for spurring action by LDC governments and development partners.

Following the concluding **Chapter 8**, there are a series of **Annexes** with data and case studies. The data tables present a compilation of energy access statistics and renewable energy consumption for all of the LDCs. The **Annex II** also includes a set of **8 case studies** from LDCs around the world to highlight different approaches and business models for expanding access to sustainable energy.

Photo: *Kenya.* Corrie Wingate Photography, SolarAid/Flickr.

II. METHODOLOGY

The approach is designed to be both practical and evidence-based, relying on currently available data and examples in order to arrive at the recommendations for action on expanding investment flows in LDCs. The approach included five basic elements:



Desk research

It included a thorough review of programme documents, global and regional data, and company/project information that is relevant to financing and investment flows in LDCs. During this phase, the information on investments was considered in light of the energy access situation in the LDCs, including energy poverty, gender inequality, and economic productivity.

Interviews

Interviews were done with a select number of experts from various organizations, including African Development Bank, OECD, Sustainable Energy for All, Global Environment Facility, Frankfurt School of Management and others. The aim was to gather perspectives from programme staff on their organizations' work in the LDCs and to provide insights on the priorities for increasing investment in energy access.

Case studies

Case studies were developed on projects and programmes in LDCs from different regions to highlight, by example, many of the on-the-ground challenges facing governments, the private sector, and development finance institutions. They also illustrate many of the innovations and ground-breaking work that is being done that can help guide expansion of the sector.

Data analysis

Data Analysis was done on numerous data sets and information being compiled on energy access, investments, and deal structures. Data from a range of sources included the Global Tracking Framework, Sierra Club, IEA, Ren21, OECD, Bloomberg New Energy Finance, and others were compiled and analysed to formulate recommendations. Weighted averages were calculated using the United Nations Population Division dataset "World Population Prospects: The 2017 Revision."

Synthesizing findings, conclusions and recommendations

Synthesizing findings, conclusions and recommendations were done to develop this report. A set of actions are mapped out for different stakeholders along with a clear description of the associated challenges.

MODERN ENERGY
IS FUNDAMENTAL

Access to reliable, affordable modern energy is fundamental to enabling much-needed structural transformation in LDCs. It is critical to supporting economic growth, and to improving health, education, climate action, water and food security, and women's empowerment. With productive and human capacity lagging in LDCs, creating an environment that enables private sector development is a key.

Photo: *Tanzania.* Angaza. DIVaUSAID/Flickr.

Photo: *Afghanistan.* Sofie Tesson, World Bank/Flickr.

Photo: *Kenya.* Solar Electric Light Fund/Flickr.

III. CONTEXT AND BACKGROUND

OVERVIEW OF THE LEAST DEVELOPED COUNTRIES

The 47 least developed countries (LDCs), comprising 33 in Africa, 13 in Asia, and Haiti, are low-income countries that face severe structural impediments to sustainable development and low human development, and are highly vulnerable to economic and environmental shocks. Collectively, the LDCs represent just 2% of world GDP, but are home to 13% of the world's population, an estimated population of 954 million that is expected to double between 2015 and 2050 (UN-OHRLLS, 2017). High population growth rates will put even greater pressure on countries already struggling to overcome severe gaps in socioeconomic development, institutional and human capacity, and adequate, equitable access to financial resources, which will result in widening gaps, without concerted international and domestic efforts to accelerate (and finance) investment in productive capacity, human assets, and institutions.

Access to reliable, affordable modern energy is fundamental to enabling much-needed structural transformation in LDCs. It is critical to supporting economic growth, and to improving health, education, climate action, water and food security, and women's empowerment. With productive and human capacity lagging in LDCs, creating an environment that enables private sector development is a key. The average GDP per capita (2015) in LDCs is USD 978, which is less than one-tenth of the global average of USD 10,112 (World Bank, 2015). According to the World Bank Doing Business Indicators, which provide an indication of the capacity for private sector involvement in an economy, the LDCs have a long way to go. Most of the LDCs fall towards the bottom of this ranking, with 34 in the bottom quartile, and a median rank of 153 (out of total of 190 countries). With respect to the "Ease of Getting Electricity" indicator for Doing Business; 32 of the LDCs fall in the bottom quartile. Economically, unreliable electricity supply contributes to reduced output, lower productivity, and a higher cost of electricity for consumers, and is estimated to reduce GDP by approximately 2% annually (Scott, 2015). Increasing access to reliable, affordable electricity could contribute to creating a more business-friendly environment, but expansion of modern energy services in most LDCs has been slow, and it is both a cause and outcome of their low levels of development.

Focusing on the role of a country's regulatory environment in advancing (or hindering) sustainable energy progress, the World Bank Regulatory Indicators for Sustainable Energy (RISE) scorecard assesses the extent to which each country's regulatory and policy framework supports the three pillars of sustainable energy: energy access, energy efficiency, and renewable energy development. All LDCs fall below the average RISE score of 56, and 35 LDCs were found in the bottom 40 (RISE, 2017). Accelerating sustainable energy investment and deployment in LDCs will require substantial attention to creating a more attractive, navigable, and secure environment for potential investors.

Within the LDC group, the landlocked LDCs and the Small Island Developing States (SIDS) face additional geographic barriers to economic as well as sustainable energy development. Out of the 32 landlocked developing countries (LLDCs), half are found in the LDC group. Landlocked LDCs face a number of challenges related to their lack of direct access to the sea, which results in isolation from markets and dependence on other countries for trade and transit. Landlocked LDCs suffer from high transport and transport-related trade costs, which increases the cost of doing business in those countries, inhibits productive capacity gains, and limits economic growth opportunities. Investment in energy infrastructure, along with information and communications technology, underpins the ability of landlocked LDCs to structurally transform, and is a key priority for all landlocked developing countries, as highlighted in the Vienna Programme of Action, which specifically focuses on how LLDCs can overcome the unique barriers they face to sustainable development and structural transformation (UN-OHRLLS 2017a). Increasing energy access, reliability, and affordability in the landlocked LDCs would create much more favorable conditions for advancing economic diversification, productive capacities and building a stronger industrial base in these countries.

The SIDS LDCs are also geographically isolated from global markets, with transport to the remote islands posing logistical and financial challenges for trade. SIDS LDCs are generally heavily reliant on imported fossil fuels for both transport and electricity generation, which makes them highly vulnerable to fluctuations in global oil prices and increases the cost of doing business in those countries. The majority of SIDS relies on widespread use of oil-based generators for electricity, but with small, dispersed populations, the grid does not reach the majority of inhabitants in many islands. While some SIDS have set ambitious renewable energy targets, there is more limited access to lower cost renewable energy technologies (e.g., wind, biomass, and hydro) in the SIDS. To date, solar is the most promising resource and deployment of renewable energy technologies has been slow to take off in SIDS (Dornan, 2015).

INTERNATIONAL POLICY GOALS AND TARGETS

The need to advance a sustainable energy transformation in LDCs is articulated and supported by major international policy frameworks that have been drafted and approved by the United Nations Member States in recent years. Collectively, this set of international agreements chart a course for pursuing inclusive, climate-friendly sustainable development, and recognize the need to promote enhanced international and technical cooperation, as well as the practical concerns and realities around financing such efforts. These international goals and commitments related to sustainable energy and inclusion of the LDCs set the stage for even more concerted and creative efforts to unpack and address the challenges in accelerating investment in sustainable energy projects in LDCs.

ISTANBUL PROGRAMME OF ACTION FOR THE LEAST DEVELOPED COUNTRIES FOR THE DECADE 2011 – 2020

Agreed upon at the Fourth United Nations Conference on Least Developed Countries, the Istanbul Programme of Action (IPoA) charts out a path to accelerate the LDCs progress in promoting sustainable development and articulates the international community's commitment to supporting the journey of LDCs on this path. The IPoA aims to overcome the structural challenges faced by LDCs, to eradicate povert and to enable half of the LDCs to meet the criteria for graduation from the LDC category by 2020. Recognizing that LDCs feature limited productive capacities, restricting efficient economic growth, the IPoA also underlines the role that energy plays in enabling the development of viable industries and services, and creating a business-friendly environment (United Nations, 2011).

The IPoA highlights energy access as a priority area for action, and sets the following goals:

- Strive to increase total primary energy supply per capita to the same level as other developing countries;
- Significantly increase the share of electricity generation through renewable energy sources by 2020; and
- Enhance capacities in energy production, trade and distribution with the aim of ensuring access to energy for all by 2030.

The Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States (UN-OHRLLS) is responsible for ensuring the effective implementation of the IPoA. Between 2016 and 2017, UN-OHRLLS convened two regional meetings uniquely focused on accelerating the sustainable energy transition in the LDCs, one for Asia-Pacific LDCs and one for African LDCs[1]. These meetings aimed to build national leadership in the sector and to facilitate multi-stakeholder partnerships to improve access to finance.

THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

Adopted by UN Member States in 2015, the 2030 Agenda for Sustainable Development sets out a path and priorities for inclusive social, economic, and environmental development, reflected in the 17 Sustainable Development Goals. The 2030 Agenda includes ensuring access to affordable, reliable, sustainable, and modern energy for all as Sustainable Development Goal 7, highlighting the cross-sectoral role that energy plays in enabling progress towards all other goals.

The targets that support achievement of Sustainable Development Goal 7 are:

7.1: By 2030, ensure universal access to affordable, reliable and modern energy services

7.2: By 2030, increase substantially the share of renewable energy in the global energy mix

7.3: By 2030, double the global rate of improvement in energy efficiency

7.A: By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology

7.B: By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.

ADDIS ABABA ACTION AGENDA (AAAA)

Adopted in 2015, the Addis Ababa Action Agenda (AAAA) provides the foundation and framework for financing the realization of the 2030 Agenda for Sustainable Development, described above. The AAAA is a comprehensive set of policy actions that aim to realign financing flows with public goals, and recognize and define the respective roles of all sources of finance, public and private, and domestic and international, while also underscoring the need to develop regulatory environments that support private sector investment. The AAAA recognizes the role of energy and infrastructure in enabling sustainable and inclusive industrial development, and acknowledges both that investment is hindered by technical capacity and that greater technological cooperation and knowledge sharing is needed. In that light, countries commit to promoting public and private investment in energy infrastructure and clean energy technologies, with the aim of substantially increasing the share of renewable energy, doubling the rate of energy efficiency, and ensuring universal access to affordable, reliable, and modern energy services for all by 2030. The AAAA also recognizes that the LDCs are furthest from achieving the SDGs and that Official Development Assistance (ODA) directed to them has declined in recent years, falling by 16% in the year prior to the AAAA. The AAAA seeks to ensure that the LDCs are not left behind (and to reverse the declining trend of ODA to LDCs) by establishing an 'LDC package', which stipulates that developed countries recommit to the ODA targets of the IPoA and other previous agreements, including at least 0.15 – 0.2% of GNI provided as ODA to LDCs. Developed countries are encouraged to strengthen their commitment by setting a target to provide at least 0.2% of ODA / GNI to LDCs, with the EU promising to do so by 2030 (UN-DESA, 2015). In addition to financing, the AAAA acknowledges the importance of bridging the technological gap that exists in LDCs to increase productivity, and governments

agreed to operationalize a Technology Bank to help LDCs strengthen their science, technology, and innovation capabilities (A/RES/69/313).

PARIS CLIMATE AGREEMENT

In December 2015, at the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC), the 195 member states negotiated and arrived at the Paris Agreement, which is the world's first comprehensive climate change agreement, covering greenhouse gas emissions, climate change adaptation, and financing. The Paris Agreement affirms the Parties' commitment to "(a) holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; (b) increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and (c) making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development." Going into effect in 2020, the Paris Agreement calls upon each country to prepare its own nationally determined contribution to achieve the overall global goals (UNFCCC, 2015).

SUSTAINABLE ENERGY FOR ALL (SEFORALL)

Launched in 2012 by the UN Secretary-General, the Sustainable Energy for All (SEforALL) initiative is a unique multi-stakeholder partnership between governments, the private sector, and civil society to advance sustainable energy goals at the national and international levels.

SEforALL was formed to raise awareness of and attract public and private commitments to work towards three objectives by 2030:

- Ensuring universal access to modern energy services;
- Doubling the share of renewable energy in the global energy mix; and
- Doubling the global rate of improvement in energy efficiency.

SEforALL encourages participating national Governments to design and implement actions to transition to a sustainable energy economy. SEforALL provides a platform and support for countries to develop Country Action Agendas to set out energy objectives and priorities, and Investment Prospectuses to promote investment in sustainable energy projects. The SEforALL Africa Hub, hosted by the African Development Bank, and the SEforALL Asia Hub, hosted by Asian Development Bank and play an important role in mobilizing LDCs to create Action Agendas and Investment Prospectuses.

To track global progress against its goals, SEforALL has developed the Global Tracking Framework, which is updated on an annual basis. As the most comprehensive repository of country-level sustainable energy data, the 2017 Global Tracking Framework data (updated through 2014) was used for this report's analysis. Through its analysis, SEforALL has identified 20 high-impact countries that represent the largest absolute energy access deficit. Collectively, these countries account for approximately 80% of the population without access to electricity and therefore represent the most significant opportunity to make rapid progress;16 out of the 20 high-impact countries are LDCs[2] (World Bank, 2017).

LEARN MORE:

Istanbul Programme of Action for the Least Developed Countries for the Decade 2011-2020 (IPoA)

Addis Ababa Action Agenda of the Third International Conference on Financing for Development

Transforming our World: The 2030 Agenda for Sustainable Development

1 - Proceedings and background materials for the UN-OHRLLS regional meetings in Asia and Africa http://unohrlls.org/event/regional-meeting-asia-pacific-ldcs-sustainable-energy/ and http://unohrlls.org/event/energy-ldc- meeting/

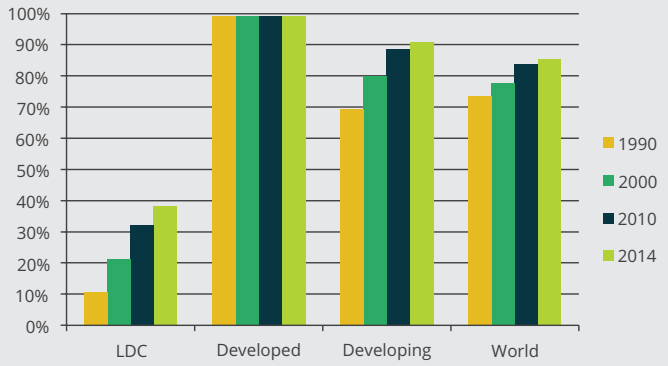
2 - SEforALL high-impact LDC countries include: Angola, Bangladesh, Burkina Faso, Chad, Democratic Republic of the Congo, Ethiopia, Madagascar, Mali, Malawi, Mozambique, Myanmar, Niger, Sudan, Tanzania, Uganda, and Zambia. High impact countries that are not LDCs are: India, Nigeria, Kenya, and the Democratic People's Republic of Korea.

IV. CURRENT ENERGY ACCESS AND ENERGY SUPPLY SITUATION IN THE LDCS

ACCESS TO MODERN ENERGY SERVICES

The LDCs have a long way to go in order to achieve universal access to modern energy by 2030 (**Figure 1**). While the average global electrification rate reached 85% in 2014, the average access to electricity across LDCs hovered at 38% and 556 million of the world's 1.06 billion people without electricity live in LDCs[3]. There has been progress in recent years, and while access to electricity increased faster between 2010 and 2014 than in the previous decade, the expansion rate is still far from what is needed to achieve universal energy access by 2030. Expanding access has been hindered by high connection costs, unreliable or unavailable grid electricity, high leakage, high operational costs that pose challenges for utilities and consumers ability to pay, and lack of investment (UN-OHRLLS, 2017).

FIGURE 1. Access to Electricity by Country Category: Percentage of Population w/Access



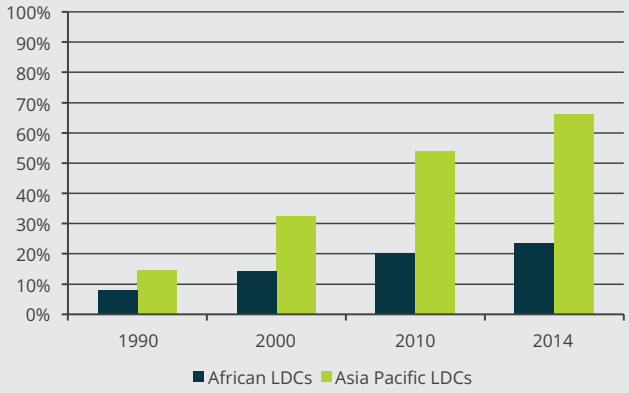
Source: 2017 Global Tracking Framework data.

While the overall rate of access in LDCs is increasing, progress among countries is anything but even. Most countries are seeing their access rates increase, but seven countries are seeing a decline (as population growth outpaces the rate of installing new connections). On the other end of the spectrum, 14 LDCs are found among the 20 fastest moving countries (countries that increased their access rates the fastest between 2012 – 2014)[4] (World Bank, 2017).

The energy access situation in the LDCs varies from a regional perspective, as well. In 2014, the Asia Pacific LDCs had reached an average electrification rate of 66%, while the rate in African LDCs[5] was much lower at 24% (as shown in **Figure 2**).

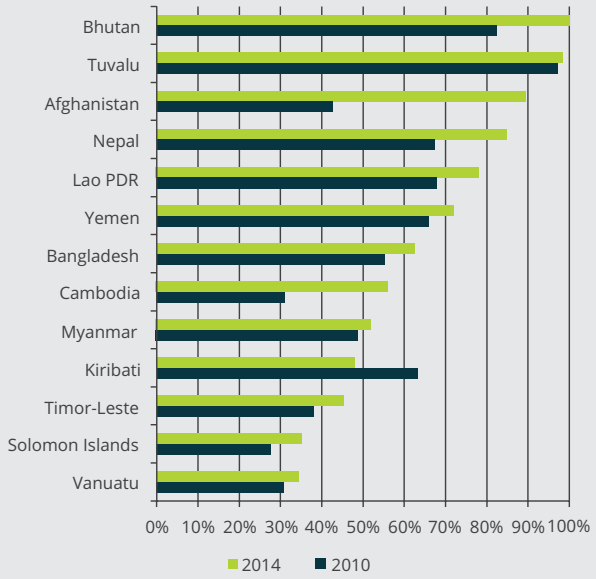
Among the Asia Pacific LDCs, expansion of electrification and deployment of renewable energy systems in Bhutan, Tuvalu, Afghanistan, Cambodia, Nepal, and Lao PDR (**Figure 3**) have experienced notable growth. In some LDCs where significant gains. have been made, engagement and buy-in by the government have been driving forces. In Afghanistan, the increase has been largely due to investment in off-grid solutions in rural areas; in 2014, 58% of rural populations relied on solar home systems, whereas only

FIGURE 2. Access to Electricity in African v. Asia Pacific LDCs: Percentage of Population w/Access



Source: 2017 Global Tracking Framework data.

FIGURE 3. Access to Electricity in Asia Pacific LDCs: Percentage of Population w/Access



Source: 2017 Global Tracking Framework data.

3 - Calculated using electrification data from the Global Tracking Framework 2017 (updated through 2014) and 2015 population data from the World Bank (retrieved from http://data.worldbank.org/indicator/SP.POP.GROW).

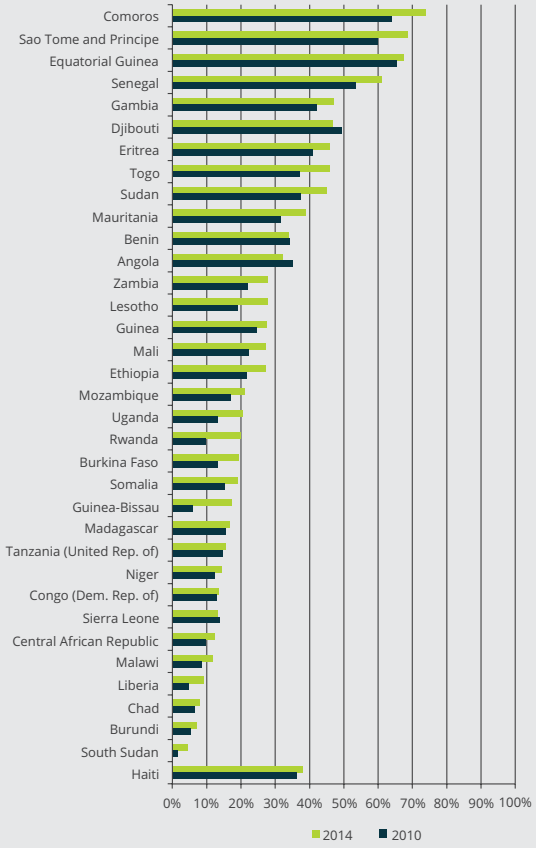
4 - SEforALL fastest moving countries in increase access in 2014 included 14 LDCs: Afghanistan, Bhutan, Cambodia, Guinea-Bissau, Lao PDR, Lesotho, Malawi, Nepal, Rwanda, Sao Tome & Principe, Sudan, Uganda, Togo, and Zambia.

5 - Throughout this report, where regional comparisons are made, Haiti is grouped with the African LDCs.

11% received electricity through the grid (World Bank, 2017). Afghanistan has abundant renewable energy resources, including solar, hydropower, wind, and biomass, and is receiving support from development partners to build the institutional, technical, and financial capacity to develop these resources (GiZ, 2014). In Cambodia the government established the Strategy and Plan for Development of Rural Electrification in 2011 to achieve 52% household electrification by 2020 and 70% by 2030, primarily through grid extension. In Lao PDR, household electrification increased from one-sixth to two-thirds between 1995 and 2013, much of which was due to the government's inclusion of rural electrification in its National Growth and Poverty Eradication Strategy for 2006 – 2010. The Government of Lao PDR supported this plan by dedicating adequate public funds, adjusting tariffs and providing subsidies to ensure affordability (UN-OHRLLS, 2017).

Although a few of the African LDCs are backsliding (Angola, Benin, Djibouti, and Sierra Leone) as population growth outpaces electrification rates, most are increasing the rates of access to electricity. Countries that have recently made significant gains in expanding electricity access (increasing access by over 8% points between 2010 and 2014) include: Comoros, Sao Tome and Principe, Guinea-Bissau, Rwanda, and Togo (**Figure 4**). In Lesotho and Ethiopia, where access rates have also increased notably, significant revenue has been generated for the government, and the sector has received investment to expand energy supply and improve efficiency of its operations. Ethiopia has increased its sustainable energy supply with diverse renewable energy resources, including wind and geothermal energy, and the country is exporting electricity to neighbouring Djibouti and Sudan, with agreements to start exporting to Kenya and South Sudan, as well (UN-OHRLLS, 2016).

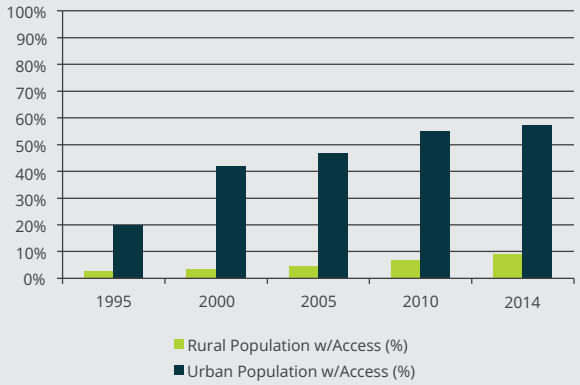
FIGURE 4. Access to Electricity in African LDCs: Percentage of Population w/Access



Source: 2017 Global Tracking Framework data.

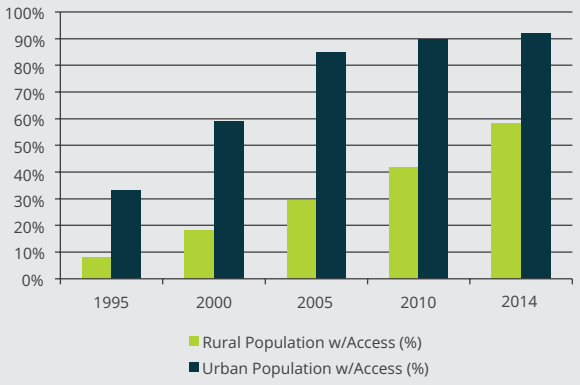
Within the LDCs, access to electricity tends to be far greater in urban areas than in rural areas, in 2014, on average, 69% of the urban population had electricity access, compared to only 26% of rural populations and access is expanding only slightly faster in rural areas. With a significant portion (68.5%)[6] of the LDC population living in rural areas and a steep urban-rural electrification gap, closing this gap in LDCs will require a higher level of investment in infrastructure, including a combination of off-grid / mini-grid and decentralized grid-connected solutions to reach more remote populations. The gap between urban and rural populations is more extreme in Africa, where 57% of urban populations and 9% of rural populations have electricity (**Figure 5**), than in Asia Pacific LDCs, where 92% of urban and 58% of rural populations had access to electricity by 2014 (**Figure 6**). Asia Pacific LDCs are seeing electrification increasing at a faster rate in rural areas, where approximately 69% of the population resides, than in urban areas, which is helping to close the urban-rural

FIGURE 5. Rural v. Urban Access to Electricity in African LDCs



Source: 2017 Global Tracking Framework data.

FIGURE 6. Rural v. Urban Access to Electricity Asia Pacific LDCs



Source: 2017 Global Tracking Framework data.

gap. African LDCs are facing the dual challenges of high population growth and urbanization rates. The average population growth rate in African LDCs is high, at an average of 2.7%[7], and the proportion of the population living in urban areas in Sub-Saharan Africa (not restricted to LDCs) is projected to increase from 38% in 2010 to 52% in 2040, which will strain overstretched grid infrastructure in need of repair and increase the likelihood that urban energy poverty will increase, unless adequate efforts are made to keep up with projected energy demand (Scott, 2015).

Among the countries that are geographically isolated the average electrification rates were comparable, with an average electrification rate of 31% in landlocked LDCs and 38% in SIDS LDCs. Within the group of landlocked LDCs, however, one end of the spectrum included six countries (Burundi, Central African Republic, Chad, Malawi, Niger, and South Sudan) with an electrification rate under 15%, and the other end was marked by Bhutan, with an electrification rate of 100%. Oil exporting LDCs are slightly ahead the average electrification rate for all African LDCs (at 26%), and despite abundant energy resources in these countries, the majority of the population still lives in energy poverty.

Another challenge particularly pronounced in LDCs is limited access to and use of clean cooking fuels and technologies. The average rate of access to clean cooking fuels and technologies in 2014 in the African LDCs was 8.6%, while in Asia Pacific LDCs it was 16.5%, both markedly lower than the average rate in developing countries. Of the 86% of the LDC population relying on traditional cooking methods / fuels, women, who typically bear the burden of collecting fuelwood and cooking, are disproportionately affected. Inhalation of carbon monoxide and particulate matter from traditional biomass stoves is linked to approximately 4 million premature deaths each year (primarily in women and children), reducing exposure to these health risks can be achieved by switching to clean fuels (e.g. LPG) or cleaner / improved cookstoves.[8]

Box 1: Expanding electricity access through grid and off-grid solutions

Current challenges to expanding access in LDCs include a large rural population living far from the grid, and operational inefficiencies and expensive oil-based electricity generation increasing the cost of power, which both reduces revenues for utility companies and reduces affordability for customers (UN-OHRLLS, 2016). Identifying the optimal (and most cost-effective) energy access solutions to reach a community depends largely on distance from the existing grid. For those living relatively close to reliable grid infrastructure (generally in urban and peri-urban setting), extending the grid is typically the most efficient; for remote / rural areas that are far from the grid, solar home systems are most economical and feasible; and for those living in densely populated communities somewhere in between, mini-grid connections may be their best option (Ngoepe et al, 2016). The International Energy Association (IEA) proposes that grid extension is the most appropriate option for all urban areas and approximately 30% of rural areas in the Asia Pacific region—leaving a large portion of the population for off-grid solutions (UN-OHRLLS, 2017). In Sub-Saharan Africa, the IEA estimates that of the population without electricity, approximately 48% would be best served by grid extension, 34% would be best served by mini-grids, and 18% would be best connected to stand alone systems (Scott, 2015). With projected increases in population and the likely slow pace of grid extension, the proportion estimated to be best served by mini-grids and off-grid systems would be even higher—and, fortunately, innovations in technology (resulting in falling prices), distribution, and commercial models have made these solutions more economically viable.

ENERGY EFFICIENCY

The SEforALL and SDG energy efficiency goal is to double the global rate of improvement by 2030 and LDCs can contribute significantly to this goal. Increasing energy efficiency means that the same output can be delivered with less energy input, which makes energy more accessible for consumers and frees up resources to expand energy access. The primary measure of energy efficiency is energy intensity, which measures how much energy is required to produce a unit of economic output, and is calculated by dividing the total amount of energy supply (in megajoules) by GDP (measured as PPP in USD). A lower ratio reflects higher efficiency (i.e., less energy is needed to produce one unit of economic output). Energy efficiency investments generate multiple benefits, including greater energy security, economic growth, social development, and environmental sustainability (World Bank, 2017).

Increases in energy efficiency can be driven by the use of different technologies or structural change towards sectors that use less energy per unit of output. In 2014, the global average for energy intensity was 5.36; and the average in LDCs was higher at 5.76. The gains were mainly driven by industry and transport, whereas agriculture and services, which are more relevant for most LDCs, only experienced small improvements in energy efficiency. One crucial factor in increasing energy efficiency in LDCs is the improvement of transmission and distribution systems. Trends in transmission and distribution losses vary widely across countries and have been increasing in low-income countries, reaching 15.8% in 2014 (World Bank, 2017).

Energy intensity varies widely among LDCs. The highest energy intensity in 2014 (of all countries for which data is available) was reported for Somalia (40.07) followed by Liberia (24.02) and the Democratic Republic of the Congo (22.59). At the other end of the spectrum is South Sudan (1.28). Mali, which is well-known for its success in developing isolated mini-grids, also has an energy intensity of less than 2 (PwC, 2016). Other LDCs that are well ahead of the global average include Chad (2.79), Afghanistan (2.64) and Lao PDR (2.30), which are rich in hydropower resources, are also ahead of the global

6 - Based on 2015 World Development Indicators, retrieved from: http://wdi.worldbank.org/table/3.12#

7 - Based on 2015 World Bank Population data, retrieved from: www.data.worldbank.org/indicator/SP.POP.GROW

8 - While cleaner cooking fuels / technologies is not a focus of this report, it should be noted that efforts to expand access and uptake would have significant impacts on Sustainable Development Goals for affordable and clean energy and gender equality, and many others.

average. Of the 20 fast-moving countries with respect to improving energy efficiency are Sierra Leone and Ethiopia. In Ethiopia energy intensity declined from 30.63 in 1990 to 14.60 in 2014. Improvements in energy intensity of oil producing countries can be partly attributed to changes in global oil prices, boosting their GDP (World Bank, 2017).

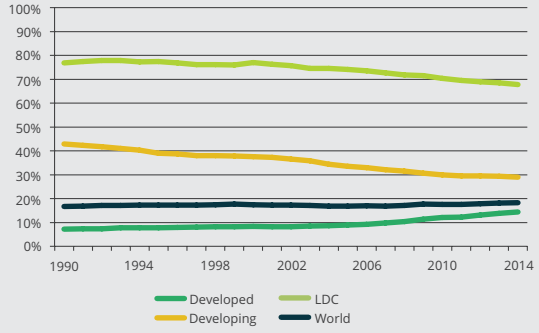
Improving energy intensity in these countries would make them more attractive for private sector activity, but greater private sector involvement and technological innovation is a necessity for driving such improvements in these markets

SUSTAINABLE ENERGY

In the context of the SEforAll goal to double the share of renewable energy in the global energy mix, LDCs are already contributing significantly. However, this is largely due to traditional use of biomass, which has negative health, gender, and environmental consequences.

Expanding modern energy access globally, and especially for a rapidly growing global population, in a climate-friendly way requires significant investment in development and deployment of low-carbon renewable energy sources, in a cost-effective manner. Across LDCs, the share of sustainable energy (including traditional and modern use of renewables) of total final energy consumption (TFEC) was 67.8%, which is significantly higher than the global average of 18.33% (**Figure 7**). The majority (56.5%) of the renewable energy produced and consumed in LDCs, however, is traditional use of solid biofuels; modern renewables (including modern use of solid biofuels, hydropower, wind, solar, geothermal, biogas, etc.) comprise the remaining 9.3%. **Figure 8** shows the breakdown of modern v. traditional use of renewable energy sources across LDCs and broader geographic regions. Across African LDCs, the renewables share of TFEC is significantly higher (78%) than in their Asia Pacific

FIGURE 7. Renewables Share of Total Final Energy Consumption (TFEC) (%) by Country Category

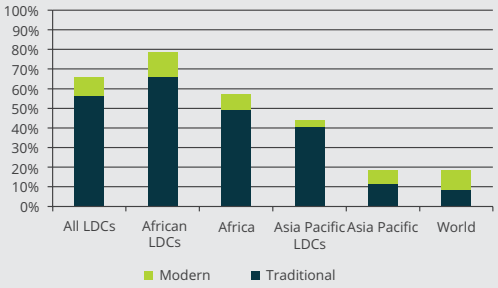


Source: 2017 Global Tracking Framework data.

counterparts (44%), and the percentage attributed to modern renewables is also higher, 12.6% in African LDCs compared to 3.7% in Asia Pacific LDCs. In both regions, modern use of biomass is the largest source of modern renewable energy, but hydropower is not far behind in Asia Pacific LDCs (World Bank, 2017).

Several Asia Pacific LDCs are rich in water resources, and Bhutan, Lao

FIGURE 8. Traditional v. Modern Renewables (% of Total Final Energy Consumption)

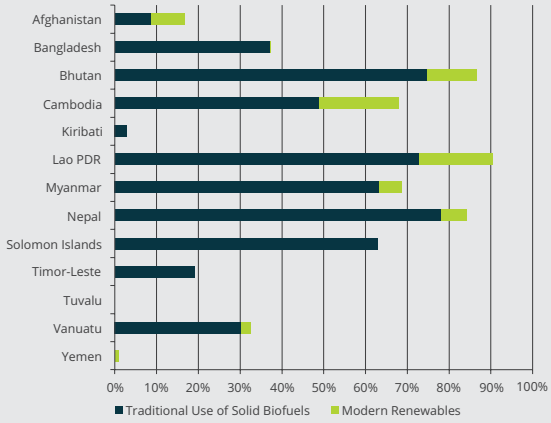


Source: 2017 Global Tracking Framework data.

PDR, Myanmar, and Nepal have all successfully tapped into their hydropower potential. With the effects of climate change, and subsequent reductions in water flow, hydropower may prove to be an unstable source of energy. Remarkably, Bhutan has seen its power sector become the primary contributor to government revenue: domestic consumption needs are met, and yet 70% of power generated is exported to India each year, making it South Asia's only energy exporter (World Energy Council, 2013). Majority of the power exported is under a bilateral agreement between the Government of Bhutan and Government of India. In Myanmar, increases in hydropower contributed to more than tripling renewable energy output from 2004 to 2014. Myanmar's national electrification plan also factors in technologies / solutions needed to reach remote populations by providing assistance for mini-grid and solar home systems where the grid is not an option. **Figures 9** and **10**, show the percentages of total final energy consumption (TFEC) in the LDCs from traditional and modern renewable energy sources, excluding hydropower larger than 50MW. **Figure 9** shows which countries in Asia are most reliant on traditional use of solid biofuels, and those that are increasing energy output from modern renewable sources.

In African LDCs, the deployment of renewable energy is high (**Figure 10**), but the vast majority of this is due to traditional use of solid

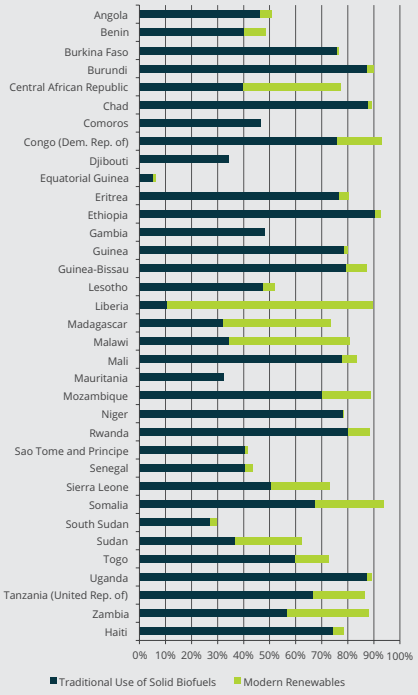
FIGURE 9. Traditional and Modern Renewable Energy Use in Asia Pacific LDCs (% of TFEC)



Source: 2017 Global Tracking Framework data.

Note: Excluding hydropower larger than 50MW

FIGURE 10. Traditional and Modern Renewable Energy Use in African LDCs and Haiti (% of TFEC)



Source: 2017 Global Tracking Framework data.

Note: Excluding hydropower larger than 50MW

biofuels (as the average portion of the population without access to clean cooking fuels and technologies was 91.4% in 2014). Several countries, however, are making substantial gains in the modern renewables portion of their energy portfolios. The Central African Republic, Liberia, Madagascar, Malawi, Sierra Leone, Somalia, Sudan, and Zambia all draw more than 20% of their energy from modern renewable sources. After modern use of solid biofuels, hydropower provides the largest quantity of sustainable energy, with Angola, the Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Sudan, and Zambia being the top producers. Sub-Saharan Africa (including, but extending beyond the LDCs) has considerable hydropower potential, and it is estimated that only 10% of this has been developed. Tapping into these resources in an environmentally and socially responsible manner would make a significant contribution to sustainable energy supply (World Bank, 2017a).

In the SIDS LDCs, a shift towards renewable energy options would allow them to reduce their vulnerability to volatility in oil prices and supply disruptions, but they face natural limitations due to their remote location and smaller and dispersed populations. Renewable energy generation is not as diverse as in other (larger) countries, and can be costly to exploit, due to the need transport all equipment (including spare parts) over long distances to reach the most remote islands. Despite the lack of low cost renewable energy sources, some SIDS have set ambitious renewable energy targets. Tuvalu, for example, set a target to achieve 100% renewable energy by 2020, even though the renewables share of TFEC was only 5% in 2015 (Dornan, 2015). The Solomon Islands set a goal of 50% renewable energy by 2015, and Kiribati aims to achieve 45% renewable in urban areas and 60% in rural areas by 2025. In 2014, the share of modern renewables of TFEC for both countries stood at 0%. Across SIDS, the most promising renewable energy resource is solar, with some potential for hydropower, wind, or biomass in certain locations, yet these resources are relatively costly to develop and compete for scarce space. Due to the high cost and unattractive returns for investors, as well as institutional constraints, renewable energy projects in SIDS have been driven / financed primarily by development partners rather than the private sector (Dornan, 2015).

Uptake of renewable energy has been slower in the oil producing and landlocked LDCs, as well. Across oil-producing African LDCs, the renewables share of TFEC is lower than the average across all African LDCs, and the share attributed to modern renewables is significantly lower, which is not surprising in light of energy sector policies and resources focused on the exploitation of oil resources. Angola is the largest oil exporter of the LDCs. The country is a member of SEforALL and has drafted a renewable energy strategy, focusing largely on deployment of improved cooking fuels / technologies and development of modern renewable energy sources for electricity generation. However, the country's policies and current infrastructure remain heavily oriented around diesel (Sustainable Energy for All, 2015).

In landlocked LDCs, increasing the share of modern renewables could have a more profound impact on productivity gains and economic growth, but the progress has been slow in many of them. On average, the renewables share of TFEC is higher than the LDC average (at 67.8%). Several landlocked LDCs have made significant strides in the development of modern renewable energy sources. In Africa, the Central African Republic, Malawi, and Zambia have made investments in biofuels production and hydropower, and in the landlocked Asian LDCs, for example, Bhutan and Afghanistan, hydropower development has produced the greatest gains (World Bank, 2017). In oil importing landlocked LDCs, such as Burkina Faso and Burundi, successfully scaling up renewable energy is a critical component of making progress towards universal energy access. This would both reduce dependence on fossil fuel-based electricity generation (and vulnerability to oil price volatility) and should incorporate off-grid technologies that can reach rural populations (IRENA, 2016).

Photo: *Burkina Faso.* Rigobert Bayala/Flickr.

V. SUSTAINABLE ENERGY FINANCING FLOWS TO LDCS

The following section provides an overview of sustainable energy investment flows, markets, investors, initiatives, and project types across LDCs. Financing in sustainable energy has been uneven and insufficient to close the energy gap by 2030 in the LDCs. There are, however, signs of progress and growing international and investor support. The examples provided throughout this section illustrate the diversity of solutions deployed to meet sustainable energy goals in different contexts, and, importantly, highlight the creative and evolving combinations of financing models and partners that are needed to drive them forward.

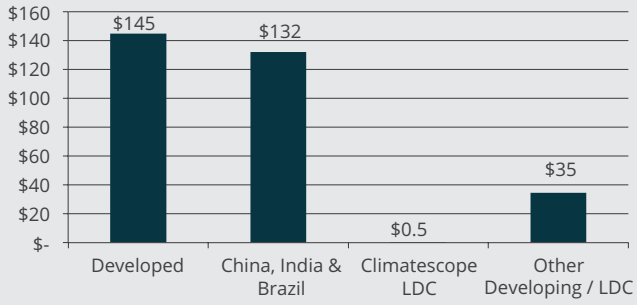
INVESTMENT TRENDS IN THE LDCS

Accelerating sustainable energy investment and deployment in LDCs will require substantial attention to creating a more attractive, navigable, and secure environment for potential investors. Official development assistance and concessional financing are cornerstones of investments in LDCs, but the investment needed for universal energy access, far outstrips what public resources can provide.

SUSTAINABLE ENERGY PROJECT INVESTMENTS IN LDCS ARE MARGINAL IN COMPARISON WITH SIMILAR INVESTMENTS MADE IN DEVELOPED AND DEVELOPING COUNTRIES

The big increase that the world is seeing in the deployment of large-scale renewable energy and energy efficiency installations is not currently reaching the LDCs. In fact, the investments in LDCs—in the 15 countries where there is comprehensive, reliable data from Bloomberg's New Energy Finance Climatescope report (BNEF, 2016)[9] —made up less than 0.2% of BNEF's calculated global market sustainable energy investment in 2015. This means that $528 million out of a global $312 billion is invested in the 15 LDCs featured in the BNEF report. In fact, roughly 87% of sustainable energy investment was made in developed economies along with China, India and Brazil; another 12% was channeled to non-LDC developing economies. The share of global investment into sustainable energy differs significantly by economy type, as shown in the chart below (**Figure 11**).

FIGURE 11. Global New Investment in Sustainable Energy; By Type of Economy, 2015, $billion



Source: Bloomberg New Energy Finance (2016).

Using the figures above, and assuming that the 15 LDCs covered in BNEF Climatescope (where there is reliable data) are representative of LDCs as a whole, dividing $0.5 billion (2015 investment estimate from BNEF for 15 LDCs) by the 550 million people living in those countries represents annual sustainable energy investment of just $.90 per person. For reference, this is on par with (or likely less than) what a liter of kerosene costs, which might last a very low income family several days to a few weeks and, needless to say, is insufficient investment to ignite a transformation of the LDCs' energy sectors.

According to data from the Oil Change International/Sierra Club report (OCI/Sierra Club, 2016) there is a slightly different, but still largely consistent picture. In that data, Development Finance Institutions (DFIs) committed $1.2 billion to sustainable energy access projects and programmes across all LDCs from 2011-2015. From the OCI/Sierra Club sample set of DFIs, this represents less than 10% of their total energy project spending ($12.8 billion) around the globe.

WITHIN THE LDCS, SUSTAINABLE ENERGY INVESTMENTS ARE HIGHLY UNEVEN

Looking at the 2010-2015 period, the BNEF data shows that 12 out of the 15 LDCs included in their study received some investment in sustainable energy, with wide variation between countries and year-on-year (BNEF, 2016). Ethiopia is shown leading, by far, in terms of investment flow, accounting for more than 45% of the total, while other countries such as Democratic Republic of the Congo, Malawi, and Haiti did not register any appreciable investment over the six-year time period in this study (**Table 1**).

Development Finance Institution (DFI)[10] programme support and investment into LDCs for sustainable energy can also be characterized as markedly uneven. From 2011-2015, OCI/Sierra Club (2016) found that only 14 LDCs received DFI support for sustainable energy access projects. Bangladesh and Uganda were the largest recipients, with cumulative sums of $405 million and $350 million, respectively, during that five-year period. **Table 2** shows the breakdown of financing, year by year, for each of the 14 LDCs that were included in their report, clearly illustrating the uneven investment flows from the DFIs.

9 - Note that large hydropower, greater than 50 MW, is excluded from the BNEF Climatescope dataset referenced above.

10 - National and international development finance institutions (DFIs) are specialised development banks or subsidiaries set up to support private sector development in developing countries. They are usually majority-owned by national governments and source their capital from national or international development funds or benefit from government guarantees.

Table 1: Sustainable Energy Investment in Select LDCs, 2010-2015, $M

	2010	2011	2012	2013	2014	2015	Total Sustainable Energy Investments 2010-2015
Bangladesh		$26.0					$26.0
Democratic Republic of the Congo							
Ethiopia	$75.1	$123.9	$351.8	$840.6		$108.0	$1,499.4
Haiti							
Liberia	$38.3			$97.7			$136.0
Malawi							
Mozambique				$2.1			$2.1
Myanmar		$64.0					$64.0
Nepal	$35.2	$10.5		$1.6	$49.8		$97.1
Rwanda		$91.5	$5.8	$36.1	$23.7		$157.2
Senegal						$58.5	$58.5
Sierra Leone		$365.1	$6.7		$9.6		$381.4
Uganda	$7.1		$33.6		$10.2	$231.1	$282.0
United Republic of Tanzania	$64.7	$6.4	$4.2		$49.2	$130.1	$254.6
Zambia	$190.7	$53.7					$244.4
Total	***$411.0***	***$741.1***	***$402.1***	***$1,086.2***	***$142.5***	***$527.8***	***$3,310.8***

Source: Bloomberg New Energy Finance, 2015.

Table 2: Recipients of Development Finance for Sustainable Energy Access, 2011-2015

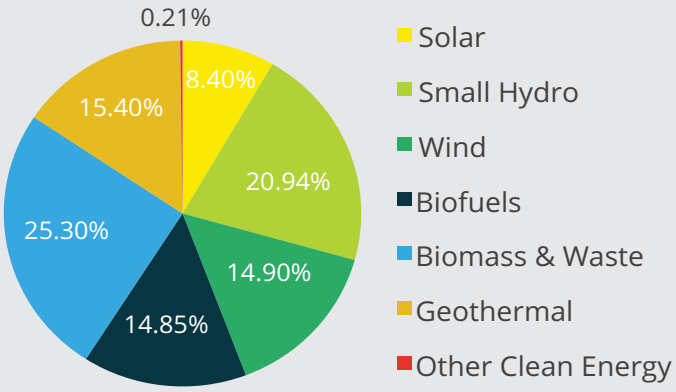
Country	2011	2012	2013	2014	2015	Cumulative
Afghanistan	$43,000,000	$3,000,000				$46,000,000
Bangladesh		$172,000,000	$155,000,000	$78,400,000		$405,400,000
Burkina Faso				$64,440,000		$64,440,000
Ethiopia		$40,000,000				$40,000,000
Haiti	$760,000				$900,000	$1,660,000
Mali				$25,000,000		$25,000,000
Nepal		$2,500,000		$180,500,000		$183,000,000
Rwanda			$9,000,000	$400,000		$9,400,000
Senegal	$800,000					$800,000
Tanzania				$50,379,107		$50,379,107
Uganda	$2,573,357	$39,384,927		$160,000,000	$148,400,000	$350,358,284
Vanuatu		$750,000				$750,000
Yemen				$20,000,000		$20,000,000
Zambia	$20,000,000					$20,000,000
Total	***$67,133,357***	***$257,634,927***	***$164,000,000***	***$579,119,107***	***$149,300,000***	***$1,217,187,391***

Source: OCI/Sierra Club, 2016.

LDC INVESTMENT REVEALS A MORE BALANCED ENERGY MIX THAN GLOBAL TRENDS

Solar and wind projects have made up the majority of sustainable energy investments globally from 2010-2015, according to BNEF, reaching a high in 2015, when solar and wind (combined) represented 94% of new investments. However, in the 15 Climatescope-featured LDCs in the BNEF data, the trend does not hold (**Figure 12**). Over a quarter of sustainable energy investments in BNEF Climatescope-featured LDCs has gone to biomass and waste-to-energy ($807 million), while small hydropower has received almost 21% ($669 million) of investments. Wind, biofuels and geothermal each received around 15% of clean energy investments (between $474-$494 million). Solar, surprisingly, only captured 8.4% ($268 million) of investments in the 15 LDCs. Clearly, the types of sustainable energy investments in the Climatescope LDCs do not have a proportional correlation with global investment percentages that focused primarily on solar and wind.

FIGURE 12. Clean Energy Investment % By Sector in Climatescope LDC countries, 2010-2015



Source: Bloomberg New Energy Finance (2016).

Box 2: A note on global renewable energy investment

In 2016, global renewable energy investment declined by 23% to $241.6 million, yet the amount of new renewable capacity installed increased from 127.5GW in 2015 to a record 138.GW in 2016, the primary reason for which was the declining cost for solar and onshore and offshore wind. (FS-UNEP, 2017).

Figure 13, below, shows the trend in global renewable energy investment since 2011 as calculated by FS-UNEP. The annual investment figures have fluctuated between $234 billion and $312 billion. Since the start of the Istanbul Programme of Action in 2011, over $1.6 trillion has been committed to sustainable energy projects around the world, but only small share of this has found its way to least developed countries.

Possible reasons for the increased sectoral diversity in LDCs include increased public sector and donor-driven involvement in projects, smaller project sizes, and the difficulties LDC national grids have in connecting intermittent generation capacity from renewables. Only in the East African LDCs of Ethiopia, Tanzania and Uganda does the Climatescope data reflect project activity in four clean energy sectors; five other LDCs' investments were limited to just one sector, meaning sector diversity is not a trait inherent to each of the LDCs but rather LDCs as an aggregated bloc.

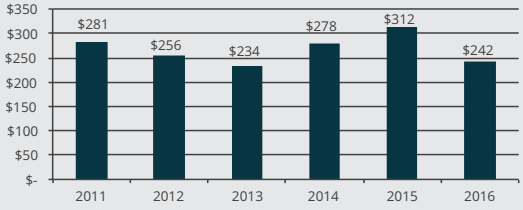
DFI SUPPORT FOR SUSTAINABLE ENERGY AND ENERGY ACCESS IS HIGHLY SIGNIFICANT RELATIVE TO OVERALL INVESTMENT FLOWS, BUT STILL INSUFFICIENT IN SCALE

In countries where the private sector is reluctant to participate and national budgets are constrained, funding from DFIs plays an outsized role. Within the LDCs, OCI/Sierra Club (2016) determined that $4.4 billion was invested into general energy projects by DFIs from 2011-2015, of which only $1.1 billion targeted sustainable energy access, signifying that more than 70% of projects either did not have a sustainable energy and/or energy access focus. Table 3, below, presents a snapshot of three large multilaterals that play a significant role in development projects in LDCs.

The track record of the AfDB, in **Table 3**, merits explanation. Only $2.6 million of AfDB's $650 million for energy access funding for LDCs over 2011-2015 (i.e. less than half a percent) was classified by OCI/Sierra Club (2016) as sustainable energy using their methodology; much of the energy access funding flowed to large hydropower and transmission projects and the researchers encountered a number of difficulties in finding adequate documentation to classify every project in the AfDB portfolio. However, with the announcement in 2016 of AfDB's New Deal on Energy for Africa programme, that is described below, it is expected that more explicit focus will be given to sustainable energy access projects.

Lastly, DFI's allocated $850 million of funding into non-access, sustainable energy projects in LDCs, which are classified as projects that do not immediately create new connections to electricity or increase energy access for the poor, but may lay the groundwork for future projects. The World Bank Group, AfDB, and ADB funding totaled $501 million of the overall $850 million for non-access projects. Examples of non-access sustainable energy projects include helping Mozambique to develop their climate change development policy or conducting a geothermal feasibility study in Djibouti.

FIGURE 13. Global Renewable Energy Investment 2011-2015, $ billion



Source: FS-UNEP Centre, from: UN Environment & Bloomberg New Energy Finance (2016).

Table 3: Select Development Finance Institution Support for Energy Access 2011-2015

	World Bank Group (WB)	African Development Bank (AfDB)	Asian Development Bank (ADB)
Total Energy Funding	$29B	$4.7B	$17.3B
Total Energy Access Funding* (includes fossil fuels)	$4B	$1.4B	$2.9B
Total Energy Access Funding in LDCs	$2.9B	$650M	$940M
Energy Access Funding for LDCs as % of Total Energy Access Portfolio	73%	46%	32%
Total Sustainable Energy Access Funding in LDCs**	$856M	$2.6M	$224M
Total Sustainable Energy Access Funding as % of Total Energy Access Funding for LDCs	30%	<1%***	24%
Sustainable Energy Non-Access Projects** in LDCs, 2011-2015**	$365M	$25M	$111M

*The total energy access designation includes project funding for new electricity connections to underserved areas, improved cooking services for poor households, service to community institutions serving the poor, off-grid solutions, etc. This includes grid extension based on fossil fuel sources.

**Sustainable energy access funding projects are those determined to have increased energy access for the poor and include the following renewable sources: biomass, biofuels, geothermal, small hydropower, solar, wave and wind.

*** This number appears so low because of the $650M AfDB committed to energy access in LDCs, roughly $150M of that was for large hydropower and the balance (about $500M) mostly went to projects with large transmission components; neither of these project types were classified by OCI as "sustainable energy."

**** Sustainable energy non-access projects themselves do not directly lead to increased energy access. Instead they may include feasibility studies or support for government policy in sustainable energy.

Source: Oil Change International Shift the Subsidies database (2016).

PROMISING FINANCING INITIATIVES THAT WILL BENEFIT THE LDCS CONTINUE TO TAKE SHAPE LDCS CONTINUE TO TAKE SHAPE

Although the financing allocated to sustainable energy development in the LDCs is far from proportionate to the need that exists, there are several promising international initiatives in place or on the horizon described below and a snapshot of recent investments in LDCs are shown in **Box 3**.

- The African Development Bank (AfDB)'s **New Deal on Energy for Africa**, seeks to achieve universal access to energy in Africa by 2025 by coordinating and mobilizing private and public sector investments. Over the next five years AfDB has committed to double the amount of money it spends on energy investments from $6 billion to $12 billion. The aim is to bring other development finance institutions and donors on board to increase their funding commitments for increasing investments in the power sector. There is both an on-grid goal of creating 30 million more connections and an off-grid goal of creating 75 million off-grid connections. The AfDB also aims to increase access to clean cooking for 130 million households.

- **Facility for Energy Inclusion (FEI)** is a $500 million pan-African renewable energy access debt fund for off-grid, mini-grid and small scale IPP projects under $30 million that is being led by the AfDB. So far, AfDB has approved a $100 million financing package ($50 million equity and $50 million debt) to create the fund, and they are still identifying funders for the remaining USD 400 million. The FEI aims to operate on a commercial basis, while tackling the barrier of high transaction costs faced by small scale projects and increasing the flow of capital to the energy sector.

- **Power Africa** is a US-led initiative, with close collaboration from the AfDB, started in 2013 to support development of sustainable power in Africa. One of the key goals of this initiative was to persuade the private sector to help co-finance energy projects in the region. By 2016, Power Africa reported more than $40 billion in private sector commitments, though critics point out many of these were already in advanced stages prior to Power Africa's involvement and shouldn't be counted as actual leverage.[11] Power Africa explicitly includes an off-grid component (called "Beyond the Grid") and an online project tracking tool,[12] both laudable programme features, and despite its slow start appears to have a diverse and promising pipeline of projects to tackle before the 2030 deadline, including solar and wind projects in Benin, Malawi, Burkina Faso, Chad, Djibouti, Madagascar, Mozambique, Lesotho, Ethiopia, and Tanzania. Notably Guinea and Tanzania are both among the top five Power Africa countries; both in terms of number of projects proposed and installed capacity.

11 - https://www.cgdev.org/publication/grading-power-africa

12 - https://www.usaid.gov/power-africa/newsletter/jan2016/powerafrica-tracking-tool

- **Africa Renewable Energy Initiative** has a key objective to add an additional 10 GW of renewable energy in Sub-Saharan Africa by 2020 and 300 GW by 2030. The initiative has committed approximately $2.7 billion in Sub-Saharan Africa for the period of 2014-2020. This includes a 25MW solar plant in Benin, a 13MW and 30MW solar power station in Niger and a 30MW solar power station in Chad.[13]

- The **Electrification Financing Initiative (ElectriFI)**, a joint project between the European Commission and the European Development Finance Institutions, supplies risk capital ranging from EUR 0.5 to 10 million per transaction in the form of development finance, debt, equity, and guarantees. It seeks to leverage private sector investment through a complementary financing approach whereby ElectriFI assumes riskier, but aligned, positions in projects. Though projects in all LDCs are eligible, to date only two transactions have been completed, both with US-based companies, one a solar utility model in Haiti and another 5 MW solar plant in Tanzania.

- The Climate Investment Fund's $839 million **Scaling up Renewable Energy Programme (SREP)** is supporting renewable energy solutions in 27 of the world's poorest countries, including 20 LDCs, to achieve sustainable energy access for all. The funding for SREP, comprised of OECD country contributions held in trust by the World Bank Group, is primarily channelled through five multilateral development banks and aims to help low-income countries use new economic opportunities to increase energy access through renewable energy use. Some LDCs have been successful in securing funding through SREP. Vanuatu, for example, will be using $14 million from SREP to work towards achieving its 100% energy access target articulated in their National Energy Roadmap. This investment targets 80% of the approximately 22,000 off-grid population in Vanuatu, which would significantly increase energy access from about 27% to 90%. The investment plan is developed by Vanuatu government, Asian Development Bank and World Bank and is expecting another $20.2 million of co-financing.[14] There are also other SREP projects in varying stages with Kiribati and the Solomon Islands.

- **The LDC Renewable Energy and Energy Efficiency Initiative (REEI)** for Sustainable Development was launched at COP22 in Marrakech in 2016. The initiative is part of the Global Partnership on Renewable Energy and Energy Efficiency and aims to scale up provision of renewable energy and to promote energy efficiency in LDCs, and to support LDCs to access existing global initiatives. A preparatory / mapping phase is planned for 2017 – 2020, with full implementation and rapid scaling of renewable energy in LDCs targeted for 2020 – 2030 (LDC Climate, 2016).

- The **Asian Development Bank** has been active in financing clean energy since 2007 through the Clean Energy Financing Partnership Facility (CEFPF) that includes several investment funds focused on clean energy, carbon capture and storage, and climate change. The ADB reported that in 2016 the CEFPF was able to leverage $2.1 billion in clean energy investments using both concessional and grant financing for technical assistance for capacity building activities aimed to enhance capability building and leverage financing in renewable energy (ADB, 2017). A new fund that is under development, focusing on SIDS in the Asia Pacific region, should be also noted. It will finance renewable energy projects in the Pacific's eleven smallest, most isolated countries with a combined population of around 1.5 million. In addition, ADB participates in the Climate Investment Fund (CIF), which is the largest source of co-financing for ADB's climate change programme. As of 2016, ADB noted that it is involved in 21 investment plans in 18 countries with a regional plan for the Pacific. Of those countries, five are LDCs (Bangladesh, Cambodia, Lao PDR, Nepal, and Vanuatu).

- **Global Environment Facility** is an important instrument in financing sustainable development given its ability to connect different international environmental conventions while addressing the root causes and drivers of environmental degradation. GEF also contributed to expanding energy access in developing countries including the LDCs. In the GEF focal area strategy on climate change mitigation, there is a window to promote expedited and flexible programming for clean energy access projects in SIDS and LDCs (GEF, 2016). There is also the Least Developed Countries Fund (LDCF), addressing the special needs of the LDCs under the United Nations Framework on Climate Change for adaption projects as well as the Special Climate Change Fund (SCCF) that is focused on support for all developing countries for primarily adaptation projects, but there is also a financing window for mitigation projects that includes energy. The GEF Secretariat has reported that the demand for LDCF resources continues to exceed the funds available for new approvals. As at March 31, 2017, the funds available for new funding decisions amounted to US$62.2 million; whereas resources amounting to US$156.1 million were sought for 24 full-sized projects that had been technically cleared (OHRLLS, 2017).

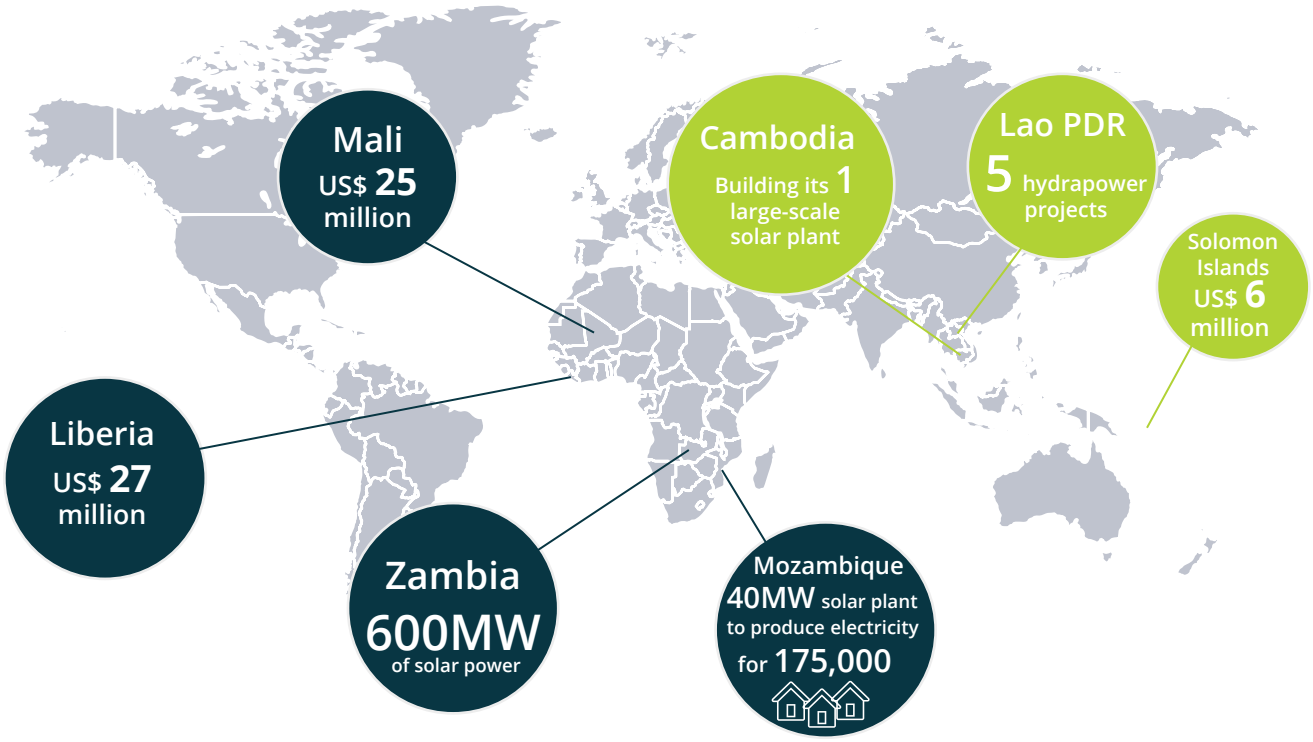
- The **Climate Vulnerable Forum (CVF)** is a global partnership of 48 countries, including many LDCs that are disproportionately affected by the consequences of global warming. These countries are committed to actively seek a firm and urgent resolution to the current intensification of climate change, domestically and internationally. At COP22 in Marrakech in 2016, the CVF demonstrated leadership on climate change mitigation by agreeing to 100% renewable energy power production between 2030 and 2050. It is important to track progress of CVF and ensure that investments are happening in the LDCs as well as in larger developing countries.

13 - http://africa.solarenergyevents.com/2017/03/07/eu-funding-large-scale-solar-projects-in-benin-niger-nigeria-and-chad/

14 - https://www-cif.climateinvestmentfunds.org/country/vanuatu

Box 3: Notable recent sustainable energy projects in LDCs

- **Zambia** announced in 2016 the auctioning of 600MW of solar through a programme designed by the International Finance Corporation called "Scaling Solar" (described in detail a case study).
- **Mozambique** announced in 2016 its first large-scale solar plant, a 40MW plant estimated to produce electricity for 175,000 households was financed by a group of private financiers on the equity side along with a debt investment from IFC.
- **Cambodia** is progressing with its first large scale, 10 MW, solar PV plant, financed by the ADB in conjunction with a private sector financial institution and also a concessional loan from the Canadian Climate Fund.
- Since 2010, **Lao PDR** witnessed the completion of as least five hydropower projects larger than 50 MW, with three more under construction. These have been partially financed by companies and banks in Thailand and Vietnam, where power is exported. Smaller hydropower projects are also progressing, for example the 36 MW Nam Beng, a $72 million project financed primarily by the China National Electric Equipment Corp.
- In 2016, **Liberia** secured a $27 million financing agreement to build a mini-hydropower power plant that would connect 50,000 people to the grid, and also benefit an additional 100,000 people who would gain access to solar home systems and lanterns.
- In 2016, **Mali** had a $25 million, 33 MW solar PV plant approved for debt financing by AfDB through SREP.
- In 2016, **the Solomon Islands** received a $6 million grant for a solar power plant from ADB via SREP.



THE IMPORTANCE OF SOUTH-SOUTH COOPERATION IN INVESTMENT FLOWS IN THE LDCS IS INCREASING

With South-South cooperation, LDCs can benefit from market opening, access to modern energy technologies, and access to capital. South-South cooperation can lead to more investments from regional development finance institutions, training, education, knowledge sharing, and employment, as is already happening in Asia and is beginning to be seen in African LDCs.

Moreover, policy coordination and cooperation between countries can play a key role in building strong economic ties and transparency. With South-South cooperation, there has been increased investments in energy infrastructure projects that can lead to economic and social development in the LDCs. One example that is presented in the case study in the **Annex II** of this report, highlights China's support to the expansion of medium and large scale hydropower -- in Southeast Asia, including LDCs (e.g., Cambodia, Lao PDR and Myanmar), and also in Central Asia and Sub-Saharan Africa.

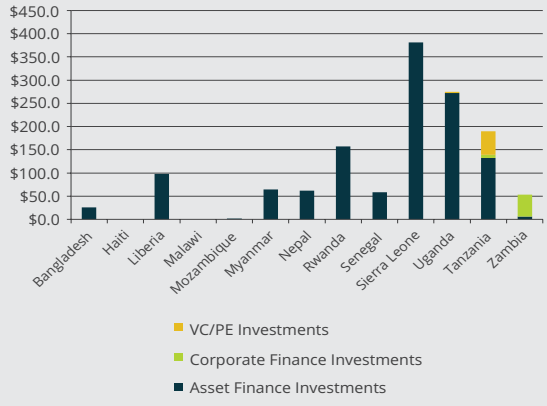
MEDIUM-TO-LARGE AND/OR GRID-TIED PROJECTS

The predominant models for financing medium- to large-scale sustainable energy projects in LDCs have traditionally been through bi- and multi-lateral development banks (using a combination of grants and concessional loans) along with national budgets. In the case of large hydropower[15], generally considered renewable but not always sustainable, it is thought of as a more mature and established least cost generation option and thus is occasionally able to benefit from more mature and/or market based financing arrangements as compared to other renewables. The role of official export credit with large hydropower has been very prominent, especially with contractors from China, but also with other countries where strong bilateral relationships exist. What has been most limited in the LDC context is the role of private project finance, including owners' equity and commercial debt. Without mobilizing this component, development aid and national budgets will remain insufficient to meet agreed-to sustainable energy supply and access goals.

The BNEF Climatescope data (2016), which is focused on energy projects larger than 1 MW, can offer only partial insights into the sources and types of financing for medium-to-large scale projects to date. For many projects, this information is not available, which highlights the need for more detailed data on the source and type of funds to better understand the investment opportunities. For instance, of the $3.2 billion invested in LDC clean energy projects from 2010-2015, only $365 million could be accurately categorized by BNEF (2016) as either 1) loans, grants, grant programmes, or 2) local investments. Local investment accounts for only a small fraction of the total investment (~20%).

As for type of funds flowing to sustainable energy projects in LDCs, BNEF Climatescope offers useful, but still limited, information. It classifies investment types according to: 1) asset finance, 2) corporate finance, and 3) venture capital/private equity. Of the $3.2 billion invested into LDCs from 2010-2015, it was possible to classify $1.4 billion by BNEF according to investment type, with asset finance clearly leading the way.

FIGURE 14. Investments Fund Sources in Select LDCs, 2011-2015, $ million



Source: Bloomberg New Energy Finance.

Though an incomplete dataset, the data provided by BNEF strongly suggests that most sustainable energy project investment in LDCs originates externally and is composed primarily of asset finance. Unfortunately, neither of these observations provides the granular level of detail desired by policy planners and investors alike. What follows, then, are some general statements regarding the most potentially impactful sources and types of financing into this sector in the LDCs.

PRIVATE FINANCING

It is difficult to find examples of sustainable energy projects in LDCs wholly financed by the private sector. Large scale, private sector participation is generally conditioned on either government subsidy/incentive payments (for instance, see the case studies in **Annex II** on LPG subsidies in Senegal and Uganda's REFiT structure) or joint participation by development finance institutions, either in the form of direct lending, or via credit enhancement measures.

Exclusively private financing of medium scale sustainable energy projects is most likely to occur in LDCs in the context of inside-the-fence, or captive generation, projects when there is a confluence of factors. These factors include: substantial economic savings to the company as a result of sustainable energy switching; strong host company/off-taker balance sheets, often with a large foreign direct investment (FDI) component; and, relative lack of regulatory barriers concerning energy production for one's own use (i.e. interconnection, utility PPAs, wheeling agreements, distribution licenses, etc. are not applicable).

One relatively recent and interesting example of a private sector-led attempt to develop geothermal resources in an island LDC context is illustrative. The project was linked to, and partially sponsored by, a commercial gold mining company, which was seeking to reduce its energy expenditures. It was also dependent on grid interconnection and all the attendant risks and planning/regulatory hurdles (see case study in **Annex II** on geothermal in the Solomon Islands and Vanuatu).

BLENDING OF CAPITAL: USING PUBLIC SECTOR FINANCE TO ATTRACT PRIVATE FINANCE

Public sector finance has become arguably "smarter" over the last decades, seeking ever more inventive and effective ways to extend its leverage and multiply its ultimate impact by mobilizing private sector participation. This blended capital trend has become evident in the LDCs as well, though attempts at doing so have been differently calibrated (i.e., degrees of concessionality, selection of available financial tools, etc.) compared with efforts in other developing countries, where financial and sustainable energy markets are often more mature.

Strategies for capital blending, as an instrument of governments and development organizations, can be broadly classified into two categories: public sector investment into energy projects/transactions and ancillary support for transaction development. Investment occurs

15 - Note that large hydropower, greater than 50 MW, is excluded from the BNEF Climatescope dataset referenced above.

along a spectrum ranging from 1) directly providing financing to single projects (i.e., via loans, mezzanine products and equity, inclusive of grants); 2) leading or participating in strategic co-investment opportunities (whether through Special Purpose Vehicles (SPVs) or not); and 3) by investing in managed funds. Ancillary transaction support includes the provision of guarantees, insurance, currency hedging, subsidies, and technical assistance (described in more detail below). Both strategies, investment and transaction support, work to attract private capital by boosting private returns and/or mitigating risk. For example, investment participation at concessional rates can provide room in the project's financial profile for increased returns to other owners and lenders. Co-investment and fund structures can reduce transaction costs for lenders and project sponsors, also raising eventual returns.

Grants and concessional loans still appear to be the cornerstones of sustainable energy financing in LDCs, though it cannot be determined exactly what percent they make up of all financing flows. Though in LDCs some grants are still being used for capital expenditures, grant components of development aid packages are also focusing on early stage, pre-development costs like feasibility studies, and transaction advice in efforts to attract private sector participation. Concessional lenders to LDC projects are often, but not always, seeking out and accepting the participation of co-investors who may have return expectations, which are closer to commercial rates. It is common to see grants, concessional and semi-concessional loans combined with owners' equity to complete sustainable energy projects in LDCs.

Many public finance approaches in LDCs have focused on risk mitigation and channeling support to those aspects of project development that are not easily nor affordably addressed by the private sector. This includes paying for common risk mitigation tools such as guarantees, insurance, and currency hedging. DFI-funded and structured guarantee mechanisms can cover specific energy sector risks such as off-taker liquidity risk, termination risk, carbon delivery, (to name a few) and insurance for climate/weather-related production risks, other delivery risks and natural disasters. They can also address LDC business environments more broadly, covering general political and macroeconomic risk. Guarantees can be structured in numerous ways (first loss, loss reserve, pari passu, and on a transaction or portfolio basis) and, when successful, are efficient at mobilizing private capital by providing comfort to lenders and investors, especially in non-recourse, project finance settings. Also, the reputation of some public sector institutions and the strength of their underwriting and compliance departments can reduce the perception of risk. Notably though, all of the aforementioned risk mitigation tools are often priced higher for sustainable energy projects in LDCs compared to other developing countries, and have been used less extensively in these settings. To help identify the barriers and associated risks, which can hold back private sector investment in renewable energy, UNDP has developed a decision-making framework to identify and compare different public interventions that can either reduce, transfer or compensate for risk (Waissbein, et. al, 2013).

Additional approaches by public finance entities to entice private sector participation include linking subsidy payments to sustainable energy power generation. In the case of medium- to large-scale projects, this has taken the form of carbon credits or feed-in tariffs/ premiums, the purpose of which is to make transactions more attractive to developers and investors. The Ugandan GETFiT example (described in a case study in **Annex II**) included a DFI-funded top-up subsidy payment in addition to the national tariff. This allowed a front-loaded subsidy to further boost projects' return expectations and helped attract investors. Uganda may well be the only LDC currently with a feed-in tariff; Mozambique published one in 2014, but has yet to implement it. Similar efforts, but using public finance to support sustainable energy prices in one-off PPAs (versus nation-wide feed-in tariff policies), may also exist but are not easily identifiable. Carbon finance efforts, currently uncertain because of the collapse of the carbon markets, theoretically provide pathways to output-based financing mechanisms, but in practice, LDC projects received proportionally very little benefit from such schemes.

Box 4: Green bonds: A potential solution on the horizon

Governments in LDCs struggling to raise capital from debt markets for infrastructure projects may benefit of green bonds, which were created to fund projects with positive environmental and/or climate benefits.

From 2012 to 2015, the annual value of issued green bonds globally rose from $3 billion to $44 billion, expected to reach $75 billion by the end of 2016. The World Bank is one of the issuers of green bonds and as of June 30, 2016, it had issued 125 green bonds in 18 currencies to promote the transition to low-carbon and carbon resilient growth in client countries targeting climate change mitigation and adaptation.

Green bonds are often issued by municipalities. As more and more of the world's population moves to urban areas, it increasingly makes sense to tackle infrastructure and climate change mitigation at the municipal level. According to the Climate Policy Initiative (CPI), as of 2016, Johannesburg, South Africa was the only developing country city to ever issue a green bond. However, CPI outlined a number of ways that developing country cities may be able to access these types of debt markets in the future, through over collateralization, use of guarantee instruments, signing an institutional anchor investor such as a DFI, or working indirectly through more credit-worthy 3rd parties such as affiliated public agencies, utilities, or banks. This last possibility may be a particularly attractive one for cities in LDCs.

In short, additional work is needed to pilot green bonds, study the results, de-risk them, and refine the design and implementation, though they could hold promise in the future.

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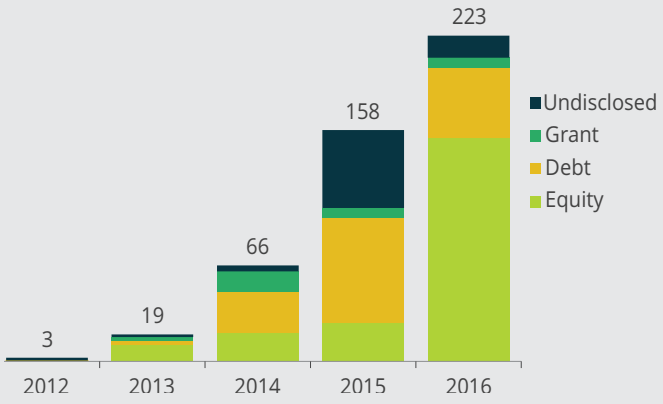
DISTRIBUTED GENERATION

The off-grid industry (including micro- and mini-grids) is growing significantly and is now attracting public and private capital from foundations, impact investors, government development finance, for-profit finance and strategic corporations, but overall investment flows are still inadequate relative to the size of the energy access problem. As nearly 70% of the population in LDCs lives in rural areas, often more readily served by distributed generation technologies, enabling investment in the off-grid market in those countries is of heightened importance. Unfortunately, even less data is available for the off-grid market segment than for the larger sustainable energy projects and programmes. This is due to the rapidly changing nature of the industry and technology, fragmentation of market participants, and small transaction sizes as well as more generally limited institutional capacities in the statistical systems of the LDCs. The best available data that exists has been collected for the off-grid solar sector, with calculated investment totals being driven by the high profile, dynamically growing solar PV companies, most with international operations and an incorporated PAYGO approach.

OFF-GRID SOLAR PV AND FINANCING APPROACHES

Globally, investment in the off-grid solar industry reached a cumulative total of $511 million from 2008 to 2015 (Bloomberg New Energy Finance and Lighting Global, 2016). Pay-as-you-go (PAYGO) companies have attracted the most investment so far, followed by specialized funds and investment vehicles focused on this sector. **Figure 15** below shows how quickly the PAYGO investments have increased globally year-on-year. Compared to the more general sustainable energy investment/funding flows captured by BNEF in Climatescope (2016) and OCI/Sierra club (2016), which showed no discernable trends over five years, investments in the PAYGO sub-sector reveal a clear acceleration. Many of the PAYGO companies are operating in developing countries, including some LDCs, however it was not possible to identify how much of their market is accounted for in the LDCs.

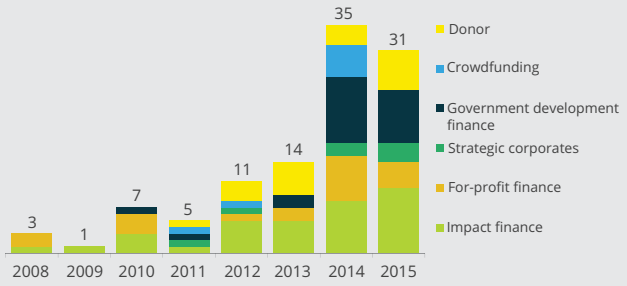
FIGURE 15. Investments in PAYGO solar companies, $million



Source: Bloomberg New Energy Finance.

In the period through 2012, the bulk of investments came in the form of equity and non-diluting grants (i.e. grants that don't reduce previous equity holders' stakes), since most companies were in early stages and could attract only high risk-tolerant capital from donors and social impact funds. Once these companies were able to demonstrate that their business models worked (and provide an operational track record), investor confidence grew and began to attract more debt transactions in 2014 and 2015. In 2016, Off-Grid Electric, Mobisol, BBOXX and Nova Lumos each raised individual equity funds of $18 million, and notably, three out of these four companies have operations in LDCs. This infusion of equity last year suggests that PAYGO is on its way to becoming commercial, but cannot be declared fully commercial yet. While commercial capital is now coming in, much capital is still raised from development banks and impact investment (often themselves capitalized by DFIs).

FIGURE 16. Number of investors engaging in at least one investment round in off-grid solar



Source: Bloomberg New Energy Finance.

Note: "Donor" financing refers to non-profit organisations such as foundations or other grant-giving institution. Public/government-sponsored international donor capital is listed as "Government development finance."

Within the past few years, intermediary investment vehicles have emerged for the off-grid sector, including specialized debt providers and impact funds focused on off-grid, and they have found ample opportunity to work with entrepreneurs in LDCs, playing a critical role in growing the sector. Typically, these companies, which include SunFunder and Energy Access Ventures, provide debt financing to off-grid solar companies. SunFunder, having made $25 million in investments already, recently announced a $21 million "beyond the grid" solar fund which they plan to grow to $50 million.[16] A $34 million working capital fund managed by ResponsAbility (with projects in East African LDCs), in partnership with the IFC and Shell Foundation, provides loans to fund inventory and supply chain management needs to off-grid solar companies.

The proliferation of investors participating in the off-grid solar sector tracks with the overall amounts invested, revealing a maturing financial market. **Figure 16**, also shows the presence of for-profit financial actors dating back to 2008 and the overall broad diversity of financier types.

16 - https://www.lightingglobal.org/wp-content/uploads/2016/03/20160301_OffGridSolarTrendsReport-1.pdf

A variety of corporations have also invested in the off-grid solar industry, typically working through their venture capital arms to back off-grid projects or to invest in solar financing firms. Schneider Electric, for example, invests in SunFunder, and SolarCity has invested $7 million in Off-Grid Electric (a solar company based in Tanzania). Orange, a telecommunications provider, is working on a project with a French renewable energy company to deploy 1,000 solar kits in Senegal, Ivory Coast and Cameroon. These companies invest primarily so they can stay close to emerging industry innovations and trends, and to assess whether off-grid solar may play a more strategic role in their own companies' expansion in the future.

Given that the off-grid solar industry is estimated to be valued at $3.1 billion by 2020 (Bloomberg New Energy Finance, 2016) there is ample investment opportunity if the barriers, such as access to working capital at affordable rates, can be addressed. Fortunately for LDCs, these barriers do notall have to be addressed locally; the international nature of many of the solar companies means that some major (but certainly not all) financing challenges can be solved at the corporate level and then filter down into multiple LDC markets. There are actions that LDC governments can take to welcome off-grid solar companies to their countries. Rwanda, for example, has partnered with a number of companies to serve as rural electric utilities, targeting a quarter million installations by 2018. In general, having a robust telecom and mobile money infrastructure, low import duties on PV equipment, and a favorable business environment have been sufficient to develop local enterprises or attract foreign direct investment from international ones.

OTHER OFF-GRID TECHNOLOGIES AND INVESTMENT MODELS

Compared to the solar off-grid sector, other off-grid technologies (e.g., biomass, biogas, solar thermal, micro-hydropower, LPG, wind, and biofuels) are attracting far less attention from private sector investors and continuing to rely predominantly on support from national budgets, DFIs, philanthropic organizations and impact investors. These other off-grid technologies are used in a range of applications, including household energy, mini grids, and commercial/productive use models. Though in the case of mini grids, PV is also commonly used, either alone or in hybrid combinations, and remote metering and mobile payments (features of PAYGO) are becoming increasingly prevalent for all mini grid technology types. Mini-grids are becoming more appealing to investors because market entry is sometimes easier with larger systems, serving more customers with ties to income generation. In biogas and micro-hydropower Nepal has led to breakthroughs in how to efficiently connect policies, technologies, and financing to expand access to energy in rural areas, with a particular emphasis on the engagement of the local private sector. These are more fully described in the Nepal case study in the **Annex II**.

These other distributed energy solutions often benefit from many of the same financing vehicles and windows that off-grid solar companies (especially PAYGO) have exploited, including development grants, challenge grants, business plan competitions, "social" or "soft" loans and equity, and more. For a time, carbon monetization was also a key driver of investment flows, especially for cookstove companies, but collapsing carbon prices have stalled carbon finance flows. Without the PAYGO component, for many of these technologies/models, serious attention also had to be given to creating consumer financing arrangements to address affordability constraints, including the provision of wholesale funds to 3rd party microfinance institutions (MFIs), portfolio guarantees, and refinance options.

The majority of the private sector distributed generation companies in LDCs are locally based and owned. With the exception of Liquefied Petroleum Gas (LPG), where multinational petroleum companies can be operating side by side with local marketers, as well as international manufacturers of improved cookstoves and mini grid system components, most of the sector is driven by local companies. Especially for small-scale local enterprises that continue to face real difficulties accessing finance from local or international financial institutions, it is fair to assume that significant portions of the capital originated from their own savings, contributions from friends and family, and retained earnings (sometimes from non-energy related side ventures). A real gap still persists at the level of local entrepreneurs and enterprises, situated between the micro scale energy businesses assisted through well-established MFI channels and personal empowerment programmes (and now micro energy consignment models) and the larger scale, break-out stars of the social enterprise sector that tend to be more possessing venture capital-worthy polish and business pitches. This class of companies in LDCs, often too small to be cost-effectively reached directly by large national and international institutions, will continue to require a host of finance and technical assistance providers offering intermediation and aggregation services. An example of such intermediation and aggregation is provided in the below box on SME-RE in Cambodia.

Box 5: Using the project developer as an entry point for aggregation

SME Renewable Energy Ltd. is a Cambodian medium-sized enterprise that sells industrial rice husk gasifier technology to mills, brick makers, ice factories and others. An international impact investor intermediary, E+Co, began extending financing of $1.2 million, primarily sourced from large DFIs, to SME-RE in 2004. E+Co used an incremental, learning-by-doing approach that included an equity investment, a working capital loan, several one-off loans to SME-RE's customers, and finally a customer finance facility. The experience gained in financing the early gasifier installations increased E+Co's comfort with the transactions, and follow-on transactions were larger, quicker to execute, and had much lower origination and administrative costs. Importantly, SME-RE offered a proven technology, replicable business model, and retained the ability to repossess systems in the case of customer non-payment. Partly based on the success of SME-RE, E+Co pursued a strategy in its Asian offices of identifying promising developers and using their project portfolios to quickly build up and aggregate investment pipeline.

DATA CHALLENGES

In examining sustainable energy investment flows to LDCs, very little publicly accessible, well-organized data is available, presenting a major hurdle for analysis and policy-making. It is outside the scope of this report to research, compile and analyze primary data; instead this report has been drafted using a variety of more approximate approaches, including:

- A review of select LDCs within larger investment and finance data sets and sector specific (e.g. off-grid solar, hydropower) investment reviews; and
- Anecdotal evidence from single countries regarding investment flows.

As referenced in the sections above, the two highest quality datasets currently available are Climatescope, compiled by Bloomberg New Energy Finance (BNEF) research group, and the energy project databases of multilateral development banks, compiled by Oil Change International (OCI) for the Sierra Club (entitled "Shifting the Subsidies"). These two datasets come from opposite perspectives: BNEF begins at the project level and works its way back to lenders and investors while OCI/Sierra Club starts with a specific category of lender and examines the full portfolio for each one. Each provides important insights, but also possesses limitations within the context of this report, as summarized in **Box 6**.

Currently, there is a push by market research leaders to expand country coverage in their data collection. SEforAll has commissioned an 8-month comprehensive study that would provide additional sustainable energy investment data for LDCs, scheduled to be completed later in 2017, and BNEF intends to add more LDCs to its database as it accesses more funding for this effort.

Box 6: Comparison of the BNEF Climatescope and OCI/Sierra Club Shifting the Subsidies Databases

BNEF Climatescope 2016: A report on clean energy investment flows, policy, and business conditions in 58 emerging economies.

- **Focus:** Includes all sustainable energy technologies; counts only project level financing, timeframe is 2010-2015
- **Advantages:** Covers investment flows from development banks, private finance, and host country governments; also includes assessments of clean energy-specific policy/regulatory environments for each country covered.
- **Disadvantages:** Only 15 LDCs are included in the dataset; only projects larger than 1 MW are included; actual project level data is proprietary and publication of financing sources is obscured

OCI/Sierra Club annual study, "Still Failing to Solve Energy Poverty": A report on international public finance for distributed clean energy using project databases from more than two dozen international finance institutions.

- **Focus:** Includes only those sustainable energy projects that have an energy access component; counts project and programme level financing; timeframe is 2011-2015.
- **Advantages:** More extensive country coverage than Climatescope; specific funders can be identified and compared. All LDCs are included in the analysis.
- **Disadvantages:** No insight provided on other equity, commercial lending, or host country contributions leveraged

Given the design differences in the two datasets, it is unsurprising that they sometimes reveal opposite trends in various LDCs, for example Bangladesh and Ethiopia. In Bangladesh, BNEF reports $26 million of clean energy investments from 2011-2015, whereas OCI/Sierra Club reports over $405 million in development finance for sustainable energy access during the same time frame (likely due to the fact that OCI/Sierra Club includes a wider range of systems sizes, including small-scale, with a range of approaches, while BNEF considers only projects larger than 1 MW). In the case of Ethiopia, the numbers are reversed; BNEF reported $1.4 billion in public and private clean energy investment (2011-2015) while the OCI/Sierra club dataset found only $40 million originating from DFIs during this time (likely due to the fact that most of the projects accounted for in the BNEF dataset were not focused on energy access.

Photo: *Lesotho.* Solar Electric Light Fund (SELF)/Flickr.

DEPLOYING SUSTAINABLE ENERGY PROJECTS IN THE LDCS

PROJECT DEVELOPMENT CYCLE IN LDCS

There are a number of financial, technical, and policy hurdles that must be dealt with in expanding access to energy.

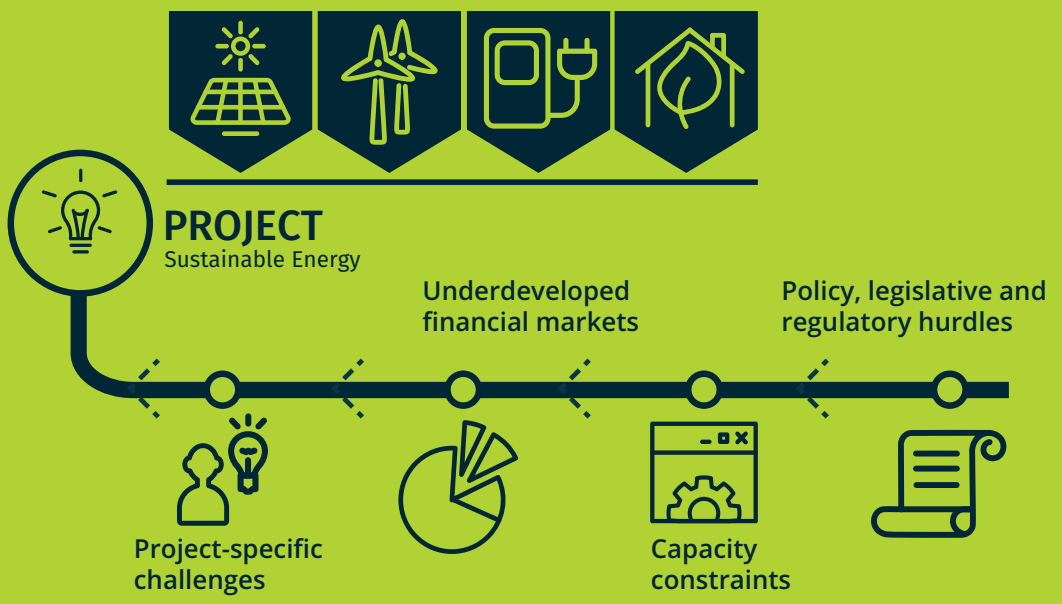


Photo: *Bangladesh.* ILO in Asia and the Pacific/Flickr.

VI. FINANCING CHALLENGES IN LDCS

LDCs rarely benefit from larger financing schemes to the same extent that other, more prosperous developing countries do, because of the smaller project size, less well developed financial markets, capacity constraints, and challenging policies and regulations. These factors make it difficult for the LDCs to tackle their energy challenges in a way that taps into the potential of the private sector and the formal capital markets.

PROJECT-SPECIFIC CHALLENGES

In the project development cycle in LDCs, there are a number of financial, technical, and policy hurdles that must be dealt with in expanding access to energy. These relate to the specific characteristics of the project, where it is located, financial viability, and the overall experience base in planning and deploying sustainable energy projects in the LDCs.

1. **Capital costs** for modern energy systems in LDCs are typically higher than in more developed economies. For decentralized options, this is because of the smaller number of suppliers in the market, the less well developed distribution channels and infrastructure, and more dispersed and smaller market hubs. With smaller projects and lower volumes of products being moved in the market, the upfront capital costs can become more of a challenge for developers. On the customer side, the upfront costs could be a serious hurdle, and without access to consumer finance, the developer will naturally have a smaller market and one that is focused only on more wealthy customers. In addition, as LDCs move from markets dominated by entry level products (like solar lanterns and improved cookstoves), to sales of larger household systems and micro-grids, it will be important to consider ways to deal with the higher capital costs. For grid-tied projects, the relatively more modest size of installations can also impede economies of scale and drive up capital costs proportionally. For both energy systems both large and small, landlocked LDCs face special challenges with regards to transportation logistics and costs, which must ultimately also be capitalized.

2. **Development and payback timelines** of projects in LDCs typically have higher up front expenditures that require easy access to affordable capital in order to be successful. When investors and development partners consider the risks in LDCs due to political uncertainties, regulatory constraints, and market instabilities, the cost of capital can be much higher and, as a result of higher perceived risk, there are generally higher return expectations. These conditions can prevent the realization of promising energy access projects from the market.

3. **Track records** for sustainable energy projects in LDCs are limited when compared to more mature markets in developing countries. The cumulative investment in LDCs is still very small, and the number of investors with a risk appetite for working in the LDCs is also very small. The limited experience and low quality data on the investment flows in the LDCs creates a lack of accurate and detailed information that is necessary to increase the comfort level of project developers, financiers, and development agencies.

4. **On-grid technical issues** in LDCs are more pronounced as compared to developing countries overall. The condition and capacity of the centralized grids in a number of LDCs limits the size and options of adding renewable energy capacity. For example, the amount of intermittent generating capacity from renewable energy that can be technically feasible may be limited, and therefore prospects for economies of scale are more unlikely. Or, resource-rich sites may be prohibitively far from interconnection with the grid. In both cases, expensive transmission and distribution system upgrades are needed in conjunction with added renewable energy capacity. Lastly, project development in LDCs is hampered by the limited amount of resource mapping assessments performed to date, as compared to other developing country markets, adding yet another expensive technical barrier to investment in larger, grid-tied sustainable energy generation.

5. **Off-grid, distributed generation technical challenges** in LDCs related to the lack of adoption and enforcement of product quality standards and equipment maintenance arrangements for sustainable energy projects can create an investment hurdle. Investors may be reluctant to enter the off-grid market if there are not assurances from the developer that high quality products with the necessary service and maintenance infrastructure are in place, which are important for ensuring sales, growing the market and protecting their reputation. Retail lenders, like microfinance institutions, providing end-user finance, can also be impacted if loans are made to their customers through unscrupulous product vendors selling poor quality products, causing the loan portfolio to collapse. This is one of the reasons why end-user finance offered in LDCs usually either involves a strong programmatic approach that provides quality control for product standards or integrated product-finance solutions like PAYGO.

6. **Off-takers** in the LDCs that are buying renewable energy generated power from a project developer may not always be well equipped to negotiate and follow through on the implementation and purchasing arrangements. Moreover, the credit worthiness of many off-takers, in many cases vertically integrated state-owned utilities, often acts an impediment to project investment. The utilities may lack the political incentives and/or autonomy to achieve cost recovery and are then perceived as adding default or liquidity risk to investment transactions (see the below box on how Nepal addressed this issue). The investment challenges typically also come with challenges related to contract negotiation around

Box 7: Example from Nepal: Demand management as a key to unlocking investment? Improving the financial position of the main off-takeron

One of the root causes hindering Nepal's development of its vast hydropower resources was the financial position/credit worthiness and management capacity of the primary off-taker, the Nepal Electricity Authority (NEA). From 2008-2014, close to 150 PPAs were executed for 2,000 MW, but only 100 MW came online. Often, very unfavorable terms were offered to IPPs (compared to NEA projects), including rupee-denominated contracts with poor escalation clauses, and take-and-pay provisions. Then in 2014, NEA announced a moratorium on PPAs with new projects realizing it was overcommitted, with no way to evacuate wet season surplus to India, but ironically NEA was still in the throes of years-long load shedding, often 12 and sometimes up to 20 hours, in most parts of the country. NEA deficits were ballooning and creating an ominous liability for the Government as a whole. NEA's balance sheet showed an accumulated loss of NRP 37 billion in 2016, despite the government writing down a NRP 27 billion in only 2011.

Then, in October of 2016, in spite of damage suffered to the country's infrastructure during the 2015 earthquake, the load shedding started to decline dramatically. The government shifted to a strong focus on demand management, and load shedding ceased in the capital within weeks followed by rolling out uninterrupted service to other areas. Peak shedding ended by April 2017, transforming the electricity sector in Nepal. By optimizing power plant operations and ending corrupt, round-the-clock electricity sales to select industries with dedicated feeders, the NEA freed up enough power to reduce the Kathmandu's reliance on inefficient inverter systems, which in a virtuous circle freed more power to eliminate load shedding in other areas. All industries now have a predictable 20 hours of power per day, leading to increased productivity and economic growth.

Despite this monumental shift in the electricity sector in Nepal, there are still numerous hurdles facing IPP projects with management of the bidding and procurement process as well as land use issues. However, if the government continues on the present course, the NEA expects to return the balance sheet to black within two years and will be much better positioned to negotiate and stand behind the types of bankable agreements needed to attract investment, meet future domestic demand, and generate critical export earnings.

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terms, price structure, licenses, easements, environmental concerns, and social/gender impacts, all adding to risk and expense for the project. In the case where the energy purchaser (the off-taker) is a household or small business, there are limited ways for prospective financiers to measure the credit worthiness of the customer, and this can constrain the market. However, with the advent of PAYGO platforms that can easily collect data on customers' credit history as well as new credit scoring techniques being developed for these markets, there could be breakthroughs on the horizon.

UNDERDEVELOPED FINANCIAL MARKETS

Capital mismatch occurs more frequently with sustainable energy projects than conventional energy, especially considering the types of financial instruments, the terms and amount of finance available in LDCs.

1. **Borrowing rates tend to be higher and tenors shorter** for investments in LDCs than what is demanded by the projected cash flows of sustainable energy projects, due to their high upfront costs (covered in the first bullet in section A, above). Local currency debt in LDCs is notoriously expensive for financing sustainable energy projects, small and large, beyond the shortest of timescales, and foreign denominated loans carries either currency risk or hedging costs. The small amounts of private equity potentially available for these markets often migrate towards projects with returns higher than what renewable energy projects can offer. Most commercial capital available to LDCs is more oriented towards the short term projects. Long term capital, such as pension funds, is equally not tempted by the risk/return profile of renewable energy investments--low risk adjusted returns over a longer time horizon--in LDC environments. It should be noted that this is perceived high risk, which may not be a fair assessment.

2. **Lack of exits into secondary markets and through securitization** limit the options for dealing with the issue detailed above. Pathways to refinancing in LDCs are severely limited, as are options for bundling many smaller transactions together. Sustainable energy projects are generally smaller than their conventional energy counterparts and many of sustainable energy transactions requiring financing are at the household or community level.

3. **Market/political risks** limit the willingness to engage in non-recourse financing. In what are viewed as stable, predictable environments, the financing tools and approaches associated with project finance have been extraordinarily beneficial to the renewable energy sector in terms of unlocking capital flows, even if structuring such arrangements incurs its own costs. In contexts viewed as riskier, as in the LDCs, many more project backers are unwilling to forgo recourse to the primary sponsor in the event of market or political turmoil, either

severely curtailing the numbers of such projects that can be undertaken or making them altogether unattractive.

4. **Limited understanding of off-grid projects among financiers** prevents many potential deals from getting a second look, or gets them immediately classified as donor projects requiring high levels of subsidization. There is a general lack of familiarity from the investor side into the LDCs in terms of the customers, the energy needs, the financing solutions, and the tremendous market opportunity. Persistent misconceptions continue to plague the off-grid energy access sector, such as that the poor and/or rural customers cannot afford modern energy, they cannot and will not properly maintain the energy systems, or they do not have the capacity to create profitable businesses in their communities. Turning the tide of development finance institutions, commercial banks, microfinance institutions, and the large number of social investors, to consider new approaches that fit the context of the investment climate of the LDCs and recognize the potential to grow the off-grid sector is a daunting challenge. It is likely going to require a mix of different solutions, and the financing to go along with it.

CAPACITY CONSTRAINTS

Human capacity and skills are needed throughout the sustainable energy investment "ecosystem." While a small portion of this encompasses high level awareness and appreciation for sustainable energy development, the bulk of it is transactional and calls for the ability to repeatedly execute investment, market, and regulatory transactions.

1. **Limited funds and human capacity for detailed scoping, planning, resource mapping, market and pre-feasibility studies** is a serious challenge in LDCs. These business preparation activities are rarely borne by the private sector, but they have a crucial role, and tend to be expensive, especially when external technical experts must be engaged. Building local capacity to perform such tasks and creating a repository of high quality and evidence-based project information removes one initial hurdle to investment. In addition to the paucity of data on technical opportunities for renewable energy development in LDCs, this report has also found very little systematically compiled data on market opportunities, previous renewable energy projects, or regulatory regimes that would help alleviate investors uncertainties and unease with renewable energy investments in the LDCs.

2. **Limited capacity for managing pre-investment/ pre-proposal processes** can hinder the ability of LDCs to attract investors who are looking for transparent rules of engagement, identification of risks, and assurances that economic incentives are aligned. Challenges can include limited local experience in designing of tender requirements, delimitating geographic concessions, tariff modelling, organizing bidder meetings and preparation, drafting of template agreements, developing negotiating strategies, etc. Getting these pre-investment steps "right" is very important but time-intensive, especially as a host country explores a new sub-sector, programme type, or contracting mechanism. Creating smooth, transparent, and speedy processes can be helped through technical assistance programmes, not only with North-South, but importantly also South-South cooperation.

3. **Limited abilities of local developers to prepare proposals to the standards of international financiers** can either result in cumbersome and expensive delays as negotiations proceed back and forth or, in the worst case, can cause developers in LDCs to fail outright bidding in tenders and competitions. Proposals require significant and rigorous documentation, persuasive reasoning and financial modelling, thorough risk assessment, and must be presented in language familiar to financial backers. Furthermore, requests for resources must be reasonable and aligned with investors' overall portfolio objectives. The time, cost, and expertise required to prepare convincing proposals and deliver them to the right audiences is beyond the reach of many local developers, yet this capability is critical for building pipelines of bankable projects, thereby signalling to investors that sufficient deal flow exists to justify the costs associated with entering a new market (i.e. due diligence and administrative costs can eventually be driven down through replication and/or aggregation).

POLICY, LEGISLATIVE AND REGULATORY HURDLES

Despite limited national budgets and many competing priorities, LDCs need to prioritize sustainable energy projects and programmes with increased political commitment and leadership in the sector to bring investors and donors. The primary goal should be to dismantle policy and regulatory roadblocks that disadvantage the sustainable energy sector and provide equitable treatment vis-à-vis competition from conventional energy.

1. **National policies to promote sustainable energy** are not consistently in place across all of the LDCs. According to the IEA database, only about a dozen LDCs have nationally adopted policies, strategies or policy support documents pertaining to sustainable energy. Bangladesh, Ethiopia, Senegal, Uganda, and Tanzania are all notable for having dedicated renewable energy policies and/or multiple sectoral instruments such as tax-based mechanisms, producer frameworks, and national financing schemes. Once officially elevated as national policy, sustainable energy initiatives can come under consideration to receive comparable support to that enjoyed by the conventional energy sector in terms of explicit and implicit subsidies. In a similar vein, once off-grid solutions are recognized as a policy priority, it becomes easier to argue they receive support analogous to the way grid connections are implicitly supported for

end users. As such, the inclusion of sustainable energy in national policy documents are important precursors (but not sufficient by themselves) to help pave the way to more level playing fields for potential investors and must be followed by adequate budget allocations.

2. **Regulatory frameworks** in the LDCs specifically governing the expansion of sustainable energy projects are often cumbersome and opaque. Regulatory delays, often not ill-intentioned but resulting from limited experience with renewable energy projects/products or from bureaucratic inefficiencies, have an outsized impact on renewable energy projects returns in LDCs because of their slim margins and sensitive timelines. Typically, the suite of regulatory provisions, forms, and processes are not standardized and are not straightforward. Contracting requirements and processes for financial closure (e.g., permitting, land access, environmental assessments, and social impacts) are not always fully mapped out, and this can lead to unanticipated costs and expectations that are not met. Unpredictability is particularly threatening to sustainable energy projects, for instance, a project developer accruing interest during construction while waiting for a social/environmental permit or a small scale importer with goods stuck in at the port because a customs official is notsure which types of products qualify for duty exemptions. For example, IMF (2015) estimates that about 40 percent of the potential value of public investment are lost to inefficiencies in the investment process in LDCs. In contrast, the efficiency gap is 30 percent for an average of 134 countries and is lower for emerging markets (27 per cent) and advanced economies (13 per cent).

3. **Policies related to foreign direct investment (FDI), which represent an important pathway for sustainable energy investment, still present challenges**. While FDI flows to LDCs have increased significantly over the past years, they declined by 13 per cent in 2016 to US $38 billion from US$ 44 billion in 2015 (OHRLLS, 2017). However, FDI flows to LDCs account only for 2 per cent of world FDI and 5 per cent of FDI to developing countries. FDI inflows are still dominated by a few mineral and oil extracting countries, despite a declining trend (UN-OHRLLS, 2017). A majority of LDCs have significantly liberalized their investment policies. Many of them have signed at least one (and some more than 30) bilateral investment treaties; are part of a regional trade agreements with FDI provisions; and have established agencies for investment promotion. However, there are still policy hurdles limiting FDI, for example, restricting participation in the power sector, prohibiting land ownership by foreign nationals or having high thresholds for local ownership and participation. In addition, FDI is highly concentrated in a few countries and more focused in extractive industries over sustainable energy.

HUMAN CAPACITY AND SKILLS ARE NEEDED THROUGHOUT THE SUSTAINABLE ENERGY INVESTMENT "ECOSYSTEM."

Building local capacity to perform such tasks and creating a repository of high quality and evidence-based project information removes one initial hurdle to investment.

Creating smooth, transparent, and speedy processes can be helped through technical assistance programmes, not only with North-South, but importantly also South-South cooperation.

Requests for resources must be reasonable and aligned with investors' overall portfolio objectives.

Photo: *Solomon Islands.* New Zealand Ministry of Foreign Affairs and Trade.

Photo: *Mozambique.* Rob Mills, ESMAP World Bank/Flickr.

Photo: *South Africa.* Trevor Samson, IFC Infrastructure/Flickr.

VII. RECOMMENDATIONS FOR UNLOCKING INVESTMENT IN LDCS

In order to achieve Sustainable Development Goal 7, it is necessary for all players to come to the table and focus on the needs and opportunities in the LDCs. The United Nations plays the role of bringing together governments and financial institutions to help leverage private sector engagement, and there a range of strategies to help make this happen more efficiently in the LDCs. Financing must be available for various types of projects, as the energy targets will not be met by only expanding the electricity grid because rural areas will be left unserved as well as for project preparation. Financing at a range of scales that follows the evolution of the business or project — from start-up (i.e., seed capital) to ongoing operations (i.e., working capital), to long term growth and replication (e.g., scale-up capital) — is important in hitting the targets for universal energy access.

GENERAL PRINCIPLES

Based on research, interviews and selected case studies, some general guidelines for maximizing the mobilization of private finance, and the efficiency and effectiveness of public sector finance, are introduced below. Following **these general principles will increase the probability of success in sustainable energy programmes.**

ALWAYS TRACK LEVERAGE:

Any public sector or DFI funding should make an attempt to estimate, the amounts of other public and private financing it mobilized, using a published methodology. The sources and types of funds along the financing spectrum, from ODA to full commercial investment, should be tracked, monitored and reported on during the lifetime of the investment. With a great deal of public investment leveraging many other sources of investment and donor capital in LDCs, it is important to measure and assess how efficiently that money is being put to use (e.g. to what degree have capital blending and crowding-in strategies been effective) as well as looking at the ability to replicate and scale up the investment.

ADOPT A RISK MANAGEMENT MINDSET:

Financial inflows to LDCs are more likely when project proponents, whether host governments, DFIs, or private sponsors, view every proposal through a risk management lens to identify and manage risks so that returns and results are in line with investor expectations. It is important to anticipate and proactively address uncertainties and volatilities through a range of risk management approaches, including investor education, credit enhancements, alternative structuring, insurance, currency hedging, and others. This is especially important for investors that are unfamiliar with the LDC context.

AGGREGATE PROJECTS WHEN POSSIBLE:

Meeting the energy needs in LDCs with a more commercial approach often entails working with smaller transaction sizes, whether that's daily payments from PAYGO solar customers or smaller IPPs. To handle the higher relative transaction costs from this, bundling many smaller, similar deals into a portfolio is a good option. This allows for spreading the risk over a portfolio of smaller companies and also packaging a larger deal for investors. Where aggregation has worked well at the end-user level, the challenge must still be solved at larger project levels where standardization and replicability have proven to be more difficult to achieve.

AGGREGATE CAPITAL WHEN POSSIBLE:

In addition to aggregating smaller projects in a portfolio, if deal or programme transaction sizes exceed the investment appetites of single investors (i.e., a development bank or impact investor), syndication-type strategies for capital aggregation can help to reduce transaction costs for project proponents. DFIs can often use their unique priorities, exclusions, return and exit expectations, and monitoring/reporting frameworks as the starting point from which to build bespoke investment portfolios. However, a different approach that involves finding or creating ready-made building blocks of investment portfolios could open up even more opportunities to more types of investors interested in different investment vehicles with risk/return/timeline/impact characteristics of their aggregate holdings. Finally, the use of online platforms to aid with market making and aggregation on both the project pipeline and investor sides should be considered.

EMBRACE CAPITAL BLENDING:

The inclusion of concessionary capital in projects can sometimes boost returns enough to attract tranches of commercial capital that otherwise would not have cleared their hurdle rate. Specifically, in the LDCs the linking of public and/or philanthropic funds with other sources of commercial and public sector capital can help increase leverage; can bring technical insights for project preparation, deal structuring and monitoring; and can potentially create higher returns for the investors. This strategy is known as "blended finance," and is used widely in energy infrastructure investments; led by different development investment facilities in Africa and Asia that blend grants with long-term loans. This strategy works well when project sponsors and lenders are fully transparent with one another.

DEPLOY SUBSIDIES TO THE WEAKEST LINK IN THE TRANSACTION CHAIN:

Subsidies have been reformed in recent years to apply them in a way that does not distort the market or limit entry of the private sector. Careful analysis is always needed to determine which part(s) of the entire energy value chain are the weakest and where subsidies should be deployed. Applying the subsidy at discrete points avoids distorting otherwise functioning areas of the market and can reduce the overall levels of subsidization needed. This principle is key in the LDC context, perhaps more so than others, because ODA and national revenues are a finite resource and therefore subsidies need to be used judiciously in order to maximize their impact and sustainability.

BUILD ENERGY ACCESS "ECOSYSTEMS":

Sustainable energy investment doesn't happen in isolation. A host of professional service providers, civil servants, technology suppliers,

lenders, marketers, and others all work in concert to deploy investment capital. The energy access ecosystem approach was pioneered by SELCO-India, an innovative solar company based in Bangalore, India, to bring together different dimensions of finance, capacity building, infrastructure, technology, and policies to plan, design and implement projects. In the context of LDCs, with weak and uncertain market fundamentals, it is necessary to consider how the ecosystem can be used to create a strong business and policy environment to expand access to energy through investments in local enterprises and corporations. The ecosystem approach provides a new paradigm to consider for development in the LDCs.

LEARN BY DOING:

Learning by doing is often the best way to build proficiency. Local entrepreneurs, equity investors, commercial lenders, regulators all build their knowledge and skills by executing transactions. The sustainable energy investment pipeline in the LDCs is still quite small. The first transactions are charting new territory and are time intensive, but know-how and building on experience gained and trust with implementation partners throughout the ecosystem will attract increased capital. Exchange of best practices and lessons learnt among LDCs remains crucial in this process. There will be a chance to learn more about what works when additional track record is built in this area.

TAKE A PHASED INVESTMENT APPROACH:

Large renewable energy projects often stall for years, even decades, in LDCs due to various issues, including regulatory hurdles, financing gaps and escalation of risks. It has been shown that breaking the project into a series of phases, though it may appear more expensive on paper, is usually more cost effective once the time value of money is considered. Smart phasing of projects lessens lenders'/investors' initial exposure, shortens development timelines, allows companies to start generating cash sooner, and builds track records. This principle is equally applicable to river basin development – smaller hydropower projects are easier to execute than one giant one – as it is to retailing renewables to households.

INVESTMENT OPPORTUNITIES FOR THE PRIVATE SECTORS

One noticeable gap in the exhaustive literature on financing sustainable energy is the absence of a distinction between LDCs and developing countries more broadly. There are numerous reports detailing market trends and opportunities in developing countries, but very limited attention given specifically to the LDCs. This section examines those sustainable energy investment opportunities that are either unique to or especially pronounced in LDCs. While every country will have to determine its specific overall mix of strategies, below are some **general investment principles that are particularly relevant to LDCs and to engaging the private sector**.

ABILITY TO PAY:

While a large share of the population in LDCs lives in poverty, inferring across-the-board low expenditures for the energy sector is misleading for two reasons: 1) energy is such a fundamentally important component to other human activity that it takes precedence over many other purchases, and 2) dirty/traditional energy is generally more expensive per unit than clean/modern forms (e.g., daily purchase of kerosene or charcoal, diesel-based electricity generation are costly).

The private sector actors that have been successful in low income markets have extended lower levelized-cost-of-energy options to poor customers in a way that matched their previous cash outlays. That is, they focused on affordability for customers by offering finance tailored to their situation. The end result was often the transformation of [dirty] fuel expenditures into [clean] local asset ownership, unlocking previously non-existent savings for sustainable energy investment.

The populations of LDCs, and especially LDCs that are also SIDS, have some of the highest energy costs in the world. Subsidies can mask this for segments of the population, but the cost must ultimately be borne by the government, in the national budgets, and it is not a sustainable, long-term solution. The amount and composition of present LDC energy expenditures, public and private, should remain at the forefront of the discussion as the greatest investment rationale for sustainable energy fuel switching.

COMMODITY-LINKED RENEWABLE ENERGY DEVELOPMENT:

While another hallmark of LDCs is over dependence on commodity exports, this too can be viewed in a more positive light; notably as potential pathways to clean energy development and technology transfer. Many commodity sectors linked with agriculture and forestry generate valuable waste streams geographically concentrated enough to support on-site power generation at various scales (e.g. Ethiopia's sugar sector, Cambodia's rice mills). Other sectors without viable waste-to-energy options have still been found willing to invest in renewable energy options to supply their operations with either more affordable or more reliable power.

Pursuing renewable energy projects linked to a country's commodity trade can often solve the problem of finding a credit-worthy off-taker with sufficient energy demands. Even in LDCs, select industries can have balance sheets strong enough to pursue such projects, or represent credit risks amenable to FDI-funded special vehicles and BOT/BOOT agreements.[17] The commodity production itself sometimes has been used as collateral and held in escrow. Occasionally, these projects are able to supply surpluses to the national grid or to local communities. In either of the cases, they still move the country towards important development goals, possibly including building local know-how, producing demonstration effects, establishing a regulatory track record, and relieving pressure on the grid and foreign exchange reserves. In LDCs, commodity-linked renewable energy development may be one of the lowest hanging fruits for encouraging private sector energy investment.

17 - Build–operate–transfer (BOT) or build–own–operate–transfer (BOOT) is a form of project financing where a developer receives a concession from the private or public sector to finance, design, construct, and operate a project. At the end of the concession agreement, the facility will be then transferred to the public administration.

TRANSBOUNDARY PROJECTS INVOLVING SOUTH-SOUTH COOPERATION IN REGIONAL POWER POOLS:

As South-South cooperation has become increasingly important as a percentage of investment flows and technology transfer to LDCs, the prospects for regional power sector development are looking brighter. Continued efforts to strengthen regional power pools in Sub-Saharan Africa and Asia strive to address grid stability issues, supply constraints, and efficiency through cross-border trading. LDCs, though not the SIDS, may be able to attract increasing investment from neighbouring countries through these channels.

TECHNOLOGY-ENABLED CONSUMER FINANCE TAILORED TO THE NEEDS OF POOR AND/OR RURAL POPULATIONS:

A breakthrough for LDCs has been the willingness of PAYGO companies to not only sell products, but also invest heavily in retail distribution networks. The PAYGO model – for solar home kits as well as mini-grid remote monitoring, metering and payment collections – is directly responding to many of the challenges faced most acutely by LDCs. Rwanda is embracing the model, signing agreements with PAYGO providers to serve as a type of rural electric utility. International capital of many types – DFI loans, impact investment, and even commercial debt – is reaching LDC markets via these PAYGO providers, even if many of them are headquartered abroad, and the trend seems poised to expand with a large second wave of companies just entering the market.

ACTION RECOMMENDATIONS FOR LDC GOVERNMENTS

The challenge for LDC governments is to dramatically scale up access to energy with the limited resources at their disposal. This entails efficient administration of local budgets, attracting both public and private investment, and leveraging those resources to the utmost, while mobilizing the private sector to supply sustainable energy to all people in the LDCs.

As seen earlier in this report, both DFI resource flows and private sector investment are distributed exceedingly unevenly throughout the LDCs. Some countries receive more attention from the private sector and international donor community because of their natural resource endowments, their geographic location, or their historical bilateral relationships. But none of these variables are within a government's ability to control. The other major variables to consider include – for development finance institutions – the reliability and strength of local institutions (which increase a programme's probability of success) and – for the private sector – sustainable energy incentives and the ease of transacting business, with the latter being arguably more important than the former.

LDCs trying to accelerate investment flows in sustainable energy, need to start to build a solid foundation that addresses macro-level issues such as inclusive growth, market reforms, progressive trade and investment policies, and employment. Strengthening these fundamentals in the LDCs will be a good strategy for attracting development finance; channeling that finance into a public-private partnership; creating an opportunity to develop market players, building capacity and a track record for regulators; and then gradually refocusing donor support as the market matures seeking to supplant it with larger volumes of private financing flows.

CULTIVATE AND EMPOWER AN INSTITUTIONAL CHAMPION:

Each country needs at least one capable and committed institutional champion to expand access to sustainable energy. A champion

Table 4: List of PAYGO Companies Operating in LDCs

Company	Countries of Operation
m-Kopa	Tanzania, Uganda
Mobisol	Tanzania, Rwanda
Off-Grid Electric	Tanzania
Azuri	Rwanda
Sun Transfer	Ethiopia
SolarNow	Uganda
Easy Solar	Sierra Leone
KamWorks	Cambodia
Fenix International	Uganda
Bboxx	Mauritania, Senegal, Sierra Leone, Burkina Faso, South Sudan, Ethiopia, Tanzania, Rwanda, Democratic Republic of Congo, Zambia,
Sun King	50+ countries globally (not all LDCs)
d.Light	60+ countries globally (not all LDCs)

can lead by example by creating and executing a vision for energy development. Examples (referred to in the case studies in the **Annex II**) include entities as diverse as the Alternative Energy Promotion Centre in Nepal, the Infrastructure Development Corporation in Bangladesh, and the Electricity Regulatory Authority in Uganda. In each of these contexts, those institutions acted as strong counterparties to DFIs, channeling multiple funding commitments to a single vision of development and providing a firm public counterpart for the public-private partnership. In each case, the national institution inspired confidence (and ultimately ended up attracting more funding) with its professional management, transparency, and insistence on creating a rules-based programme/policy environment conducive to enterprise-centered renewable energy development.

WITH THE INSTITUTIONAL CHAMPION, EMBRACE A NATIONAL-LEVEL PLAN:

National planning is most effective when it originates locally, driven by local counterparts. Ideally, the institutional and individual champions not only become committed to the plan but also are providing critical leadership for it. The plan must be fine-tuned to be in line with expectations of the national stakeholders, and be viewed as credible by DFIs and key private sector players. Importantly, the planning should provide entry points (e.g., via standard funding windows, replicable agreements, etc.) for future donors, investors, and private actors to engage at later stages as they are encouraged by the success of the programme. It is also necessary to align energy sector budget allocations to support energy access investments to demonstrate national commitment to investors and donors.

PRACTICE RESPONSIVE REGULATORY REFORM:

Stable and predictable regulatory environments, including general business conditions and energy specific regulations, cannot be emphasized enough in expanding energy access. As important as getting regulatory reform right, tailoring the regulations to the specific conditions of the renewable energy sector in the country is also necessary. There will not be a one-size-fits-all set of regulations, but rather incremental and well thought out incentives and legislative measures. A responsive regulatory regime that can react quickly to problems and opportunities that arise, handled in concert with the institutional champion (and potentially the governmental agency under which it falls) is beneficial to sector expansion, boosting investor confidence, and unlocking financial flows.

DEFINE ENGAGEMENT TERMS:

The lack of donor coordination and the fragmentation of the sustainable energy space in LDCs sometimes present additional challenges. Programmes need to be well managed and well supported by both the donors and LDC governments, otherwise it may do little to expand sustainable energy access, build in-country experience, or strengthen the country's reputation for ease of doing business. Plans should be considered in light of how efficiently local resources are used and whether leadership talent in the country is being deployed. Critically, donor involvement needs to contribute to and follow a credible plan for how it will leverage additional resources (including the amount of funds mobilized), particularly in the private sector, and initiate virtuous cycles of economically sustainable market activity.

GENDER LEAPFROGGING:

The lack of existing sustainable energy infrastructure in LDCs presents a fresh opportunity to build the sector in a gender-inclusive way, taking advantage of the talents of the full population, and avoiding some of the male-dominated structures that have already been replicated in the energy sector in more developed countries. Women are impacted differently by energy planning and projects, and there are still serious gaps in that gender is not addressed in a systematic fashion, disaggregated data is not readily available, deep-seated social and cultural norms exist, and gender analysis efforts are mainly relegated to smaller household energy and energy access domains. With the expansion of investment flows into the LDCs there is the possibility to increase the employment of women in the sector, to create a more productive and diverse workforce, to empower women and girls to get a technical or business degree, and realize other benefits in education, health, and nutrition for families. At the point of introducing new technology, and with the right support, it may be easier to "rebrand" certain tasks or vocations as gender inclusive, from the household level on up.

REPLICATE BUSINESS/INVESTMENT/PROGRAMME MODELS:

There are many successful examples and inspiration to draw on to expand the pipeline of sustainable energy projects in LDCs. Most of the success stories presented in this report represent local adaptations of financing techniques that originated elsewhere. For example, Ugandan feed-in tariffs and Zambian auctions had worked previously in OECD countries; PAYGO's off balance sheet financing and IDCOL's refinancing in Bangladesh were established techniques simply applied to new sectors; and the Nepal biogas subsidy programme and end-user financing model has been replicated in numerous other countries. Financing arrangements and creative transaction structures that were employed several years ago in other markets can be copied and adapted, however with the benefit of a much shorter learning curve. It is important to keep in mind that to successfully replicate models, it is necessary to 1) understand each country's own circumstances context to select appropriate models from the range of examples, and 2) know which aspects of the model will require local adaptation.

ACTION RECOMMENDATIONS FOR DEVELOPMENT FINANCE INSTITUTIONS AND PARTNERS

Development partners have a critical role to play in expanding access in LDCs and helping complete the transition to a sustainable energy future, and much work is already being done. Development partners can offer a range of different types of support to accelerate a sustainable energy transition, including early stage finance, a convening power with investors, risk management products, and propagating best and innovative practices between different markets. Development partners are frequently in the position of either providing sustainable energy finance directly to LDCs or being the catalyst for unlocking other financing sources to build the sector.

ALIGN INVESTMENT PORTFOLIOS WITH LDC NEEDS AND REALITIES:

DFIs play a major role in investing in the sustainable energy sector, but LDCs are still a small share of their portfolio. As shown in Table 3, the World Bank, AfDB and ADB, together invested $50 billion over 2011-2015 in energy projects, of which only $4.4 billion was invested in LDCs for energy access projects, highlighting the misalignment between the current investments in the sector by these major players and the urgent needs in the LDCs. In order to meet the goals set in the IPoA and Sustainable Development Goal 7, prioritizing investments in LDCs as part of the DFIs' entire operations will be required. Portfolio metrics that must be seriously considered and monitored by DFIs include the proportion of sustainable to traditional energy, the allocation of resources between LDCs and other developing countries, and the relative emphasis accorded to grid, mini-grid and off-grid initiatives. Whereas the IEA has very specific recommendations about the global grid/mini-grid/off-grid allocation, portfolio targets and guidance tailored to the opportunities in the LDCs need to be developed. In addition, investments in modern cooking transition also must be tracked in LDCs and aligned with the basic and strategic energy needs of each country's entire population. Too often disproportionate spending on electrification at the expense of cooking reflects deep-seated gender inequalities.

ENGAGE THE PRIVATE SECTOR IN LIGHT OF LDC CONTEXT:

The development landscape is littered with unsuccessful attempts to promote sustainable energy in a purely market-based fashion. Funds have been raised for dedicated private sector financing windows, but never dispersed for "lack of deal flow" when what was really needed was increased assistance for project preparation. Sustainable energy loan guarantees have been put in place, but never utilized because of prohibitive collateral requirements. Interest rate buy-downs were offered to end-user finance providers but remained untapped by consumers because of a dearth of reliable equipment suppliers. These were all well intentioned efforts to bring commercial sponsors and banks to the sector while stretching the leverage ratio of aid funding beyond what could be achieved with a grant or interest-free loan. Private sector investment stalled in markets that were not sufficiently prepared and the programmes themselves were not designed to address these additional barriers. Such market-based approaches can work well in LDCs, but only when designed in a holistic fashion, with measures in place to prepare projects, create incentives, and offer affordable financing.

LINK UP WITH PRODUCTIVE USE/VALUE ADD/ DIVERSIFICATION INITIATIVES:

Since energy is integral to so many other development priorities in LDCs (e.g., clean water, gender equality, improved education, access to healthcare, and climate change), there is an opportunity to increase development finance flows to sustainable energy efforts aligned with other sectors. With access to reliable and modern energy, a transformation can take place to increase and strengthen the delivery of a wide array of services in the LDCs that will lead to economic, social and environmental goals. For example, many DFI-funded programmes in health, agriculture, ICT, value-chain/market development, and other sectors likely have – or could benefit from the addition of – energy services, and this could be the entry point for increased investment flows to the LDCs. A harmonization of planning, approaches, incentives, and reliance on a network of local energy service providers is an opportunity to strengthen investment in sustainable energy.

ASSIST IN THE COLLECTION OF COMPREHENSIVE, HIGH QUALITY DATA ON FINANCING FLOWS TO LDCS:

LDCs governments, development partners, project sponsors, and other investors would all benefit greatly from having more detailed, comprehensive data on the state of the energy access investment space, including public and private financing flows in all LDCs. This type of data does not currently exist, presenting a major hurdle for analysis and policy-making. Such information could also inform international advocacy efforts; it could be used in academic settings to gauge the relative effectiveness of varying approaches; and it could be used by market participants to benchmark and spot trends and opportunities. In particular, a database which included information not only about project design specifications and closed financing deals, but medium to long-term outcomes could offer insight into whether LDC environments, and particular sub-sectors within them, really represent the additional level of risk that financial markets price into them.

VIII. CONCLUSIONS

The situation in LDCs, which often pairs low economic productivity with high demographic growth, requires massive private sector participation in order to provide sustainable energy access to all people. National budgets and traditional utility and grid-extension models of development won't suffice alone in reaching the large number of underserved individuals in LDCs - thus other approaches are needed. At the same time, LDCs' current less mature financial markets and weaker regulatory environments are such that significant international and domestic public support is required in order to catalyze private investment flows.

A number of countries have made significant progress since 2011 in increasing electrification rates, expanding electricity generation from renewables, implementing effective sustainable energy promotion programmes, and attracting financial resources. These are all noteworthy trends, while LDCs continue to benefit from declining prices for renewable energy systems, especially solar PV and wind, mitigating at least one significant barrier to financing. PAYGO solutions addressing affordability for mini grids and household solar also show promising and swift penetration into LDC markets, and their accompanying financing models are evolving to permit broader participation by both public and private sources of capital. Lastly, the number of impact investors continues to grow, giving some project sponsors in LDCs access to more varied types of blended capital, better suited to their circumstances, and also intermediation services.

The primary challenge for LDCs is to rapidly step up a sustainable energy transition so that considerable progress can be made towards achieving the national targets and international goals, such as those in the IPoA and the 2030 Agenda, to which LDCs have committed themselves. These international agreements provide the platform from which to launch national and regional programmes that are in line with the best practices, the experience base, and innovation that is happening around the world. Through this, LDCs can benefit from the increased visibility and outreach with financial institutions (commercial, development, and multilateral) as well as incentives; and risk mitigation funding can be brought to bear on the challenges facing the LDCs.

Many LDCs present a value proposition for investors, project developers, multilateral and regional development agencies to accelerate the transition to sustainable energy options and foster growth of the sector. To accelerate this energy transition, additional sources of financing and tailored programmes for LDCs are needed. It is the responsibility of LDC governments to take necessary actions to shift funding priorities and design enabling policies to promote investments in the energy sector. Whereas development finance institutions, development partners and the private sector will have to play a large role in providing the capital, mitigating risk, and building the market for high quality and affordable energy products. **There is a role to play for all of these actors in unlocking investment in LDCs, and in order to do this, a number of actions are recommended:**

Photo: *Benin.* Solar Electric Light Fund (SELF)/Flickr.

LEAST DEVELOPED COUNTRIES

- Identify a strong local institution to work in tandem with DFIs to lead in the development and implementation of the project or programme with a clear, transparent and well managed approach;
- Create a national plan that brings together DFIs, the private sector and national stakeholders that will align energy sector budget allocations to support energy access investments;
- Enact regulatory reforms that are consistent and predictable for DFIs and the private sector to adhere to in accelerating the transition to sustainable energy by expanding the sector, boosting investor confidence, and unlocking financial flows;
- Define and support terms of engagement for donors and LDC governments to build a track record and begin to build a conducive business climate that draws on in-country talent and leadership;
- Adopt a gender inclusive strategy for unlocking investment in the energy sector in the LDCs that includes the talents of both men and women. Donors, investors and development agencies will be looking to governments to provide the necessary conditions for gender and social inclusion across the energy value chain; and
- Adapt proven business and investment models to the LDCs context to leverage the experience and lessons in unlocking investment in the sector.

Sustainable energy is a key development enabler and essential to achieving the 2030 Agenda as well as the Paris Climate Change Agreement. It is in everyone's interest that the least developed countries can make rapid progress in energy access. All stakeholders, including bilateral donors, international organisations, development finance institutions, private sector and civil society, need to join their forces to support the efforts of the LDCs in accelerating energy access.

Photo: *Nepal.* Asian Development Bank/Flickr.

DEVELOPMENT FINANCE INSTITUTIONS AND PARTNERS

- Increase the funding allocated to sustainable energy in LDCs as this will have an impact across different sectors, including most of the SDGs and accelerate poverty eradication and structural transformation;
- Create investment portfolios that capitalize on the opportunities for sustainable energy transition in the LDCs by taking a more proactive approach in offering early stage finance, outreach to investors, providing risk management products, and propagating best and innovative practices between different markets;
- Structure investments in a way that enhance country level ownership and political leadership to ensure long term sustainability;
- Invest in support for developing market-based approaches to bring in the private sector, including support for project preparation, loan guarantees, interest rate buy-downs, incentives for sustainable energy development, and affordable financing;
- Create cross-sectoral linkages between sustainable energy and other development priorities in LDCs (e.g., clean water, gender equality, improved education, access to healthcare, and climate change) to increase development finance flows that have the potential for higher impact and harmonized planning; and
- Support the development of a comprehensive and accurate set of data on public and private financing flows in the LDCs to assist governments, development partners, project sponsors, and other investors in expanding the number and quality of sustainable energy access projects and programmes.

Photo: *Bangladesh.* ILO in Asia and the Pacific/Flickr.

PRIVATE SECTOR

- Translate the high prices that people in LDCs are generally paying for poor quality energy into purchases of sustainable energy systems and an expansion of the market;
- Pursue renewable energy power projects linked to LDCs commodity exports, where industries can have strong balance sheets and low credit risk to encourage private sector energy investment;
- Develop transboundary projects for regional power sector development to capitalize on opportunities for South-South cooperation in addressing energy supply constraints, efficiency, and grid stability; and
- Leverage breakthroughs being made in mobile payment systems for energy (e.g., PAYGO) to reach markets in LDCs in a way that provides reliable monitoring, metering, and collections

IX. ANNEXES

ANNEX I

Table 1: LDC Energy Access

Country Name	Percentage of Population with Access to Electricity					Urban v. Rural Electricity Access		Primary Energy Intensity			
	1990	2000	2012	2014	Annualized Rate of Increase (2012-2014)	Urban Population Access Rate (2014)	Rural Population Access Rate (2014)	1990	2012	2014	Annualized Rate of Increase (2012-2014)
Afghanistan		0.16	69.10	89.50	13.81	98.70	87.80	1.88	2.98	2.64	-5.88
Angola	47.83	41.79	33.88	32.00	-2.81	51.00	3.00	4.61	3.86	3.65	-2.76
Bangladesh	7.58	32.00	59.48	62.40	2.43	90.70	51.40	3.90	3.30	3.13	-2.61
Benin	7.23	20.58	38.40	34.10	-5.77	57.59	16.00	9.55	9.03	8.74	-1.62
Bhutan		32.05	91.50	100.00	4.54	100.00	95.98	30.02	11.56	11.06	-2.19
Burkina Faso	2.75	9.20	16.28	19.20	8.58	58.00	3.00	12.92	6.17	5.95	-1.80
Burundi	1.45	3.94	6.50	7.00	3.77	52.10	2.00	9.79	7.93	7.83	-0.63
Cambodia		16.60	40.90	56.10	17.12	96.90	49.20	14.28	5.83	5.59	-2.08
Central African Republic	0.40	6.00	11.31	12.33	4.39	26.32	3.10	11.19	5.47	8.87	27.34
Chad		2.94	7.23	8.02	5.32	20.15	4.53	6.78	3.01	2.79	-3.72
Comoros	14.42	39.43	69.30	73.76	3.17	96.10	64.99	3.35	4.64	4.66	0.22
Democratic Republic of the Congo		6.70	15.40	13.50	-6.37	42.00	0.40	11.14	24.32	22.59	-3.62
Djibouti	63.36	56.72	48.09	46.73	-1.43	57.41	10.42	3.53	4.42	4.13	-3.34
Equatorial Guinea	54.83	60.43	66.48	67.56	0.81	100.00	44.84	12.66	2.61	2.63	0.38
Eritrea	17.06	29.34	43.41	45.83	2.74	100.00	7.18		4.81	4.95	1.44
Ethiopia		12.70	24.07	27.20	6.30	91.98	12.20	30.63	16.69	14.60	-6.47
Gambia	16.77	34.30	44.65	47.21	2.82	71.00	12.96	4.77	4.52	4.62	1.10
Guinea	8.83	16.96	26.20	27.64	2.71	68.51	3.96	15.51	10.61	10.17	-2.10
Guinea-Bissau			11.63	17.20	21.61	33.10	4.00	12.63	12.36	12.38	0.08
Haiti	28.44	33.70	37.90	37.94	0.05	53.31	17.19	4.39	10.46	9.95	-2.47
Kiribati	95.15	75.83	51.98	48.08	-3.83	80.78	22.20	3.12	5.01	4.83	-1.81

Country Name	Percentage of Population with Access to Electricity					Urban v. Rural Electricity Access		Primary Energy Intensity			
	1990	2000	2012	2014	Annualized Rate of Increase (2012-2014)	Urban Population Access Rate (2014)	Rural Population Access Rate (2014)	1990	2012	2014	Annualized Rate of Increase (2012-2014)
Lao People's Democratic Republic	17.69	43.14	73.03	78.09	3.40	94.71	68.10	8.05	2.51	2.30	-4.27
Lesotho		0.41	23.18	27.80	9.52	61.50	11.80	17.43	11.75	11.02	-3.16
Liberia			6.94	9.14	14.74	16.78	1.71	20.69	25.55	24.02	-3.04
Madagascar	10.55	13.45	16.28	16.82	1.66	28.52	10.67	4.44	5.15	5.18	0.29
Malawi	1.90	4.80	7.40	11.90	26.81	46.10	4.70	9.14	5.96	5.46	-4.29
Mali		10.37	25.60	27.29	3.25	51.33	11.83	5.69	2.04	1.96	-1.98
Mauritania	2.18	17.26	34.71	38.80	5.73	76.90	2.30	4.01	3.82	3.50	-4.28
Mozambique		6.95	19.12	21.22	5.35	53.73	5.97	49.44	17.31	16.58	-2.13
Myanmar	41.32	45.89	50.71	52.00	1.27	85.50	49.00	14.89	3.10	3.24	2.23
Nepal		27.24	75.62	84.90	5.96	97.70	81.70	10.79	7.27	7.67	2.71
Niger	2.95	7.97	14.40	14.31	-0.31	53.48	5.44	6.58	6.23	7.01	6.08
Rwanda		6.20	12.81	19.80	24.30	71.80	9.10	5.73	5.69	5.34	-3.12
Sao Tome and Principe	42.48	52.90	57.90	68.60	8.85	75.80	54.80	5.71	5.00	4.61	-3.98
Senegal	19.55	36.81	56.87	61.00	3.57	85.00	32.70	5.04	5.60	5.10	-4.57
Sierra Leone	18.36	16.46	13.51	13.10	-1.55	31.56	1.01	9.32	6.72	5.73	-7.66
Solomon Islands		9.52	31.40	35.11	5.75	39.36	33.93	9.40	5.47	5.33	-1.29
Somalia		5.64	17.08	19.06	5.64	31.31	11.20	23.57	41.94	40.07	-2.25
South Sudan			3.56	4.53	12.78	8.39	3.65		1.37	1.28	-3.34
Sudan	32.80	34.60	38.15	44.90	8.49	76.30	31.70	9.85	4.18	4.11	-0.84
Timor-Leste	8.61	24.22	42.29	45.38	3.58	63.04	37.02		2.19	3.00	17.04
Togo		16.97	41.09	45.70	5.46	83.20	16.30	10.34	15.14	14.53	-2.04
Tuvalu	90.66	94.23	97.67	98.53	0.44	99.44	97.23	3.45	3.69	3.70	0.14
Uganda	2.96	8.38	14.22	20.40	19.79	51.40	10.30	20.88	7.51	7.03	-3.25
United Republic of Tanzania	5.33	9.85	15.30	15.50	0.65	41.16	4.03	11.18	9.14	8.54	-3.34
Vanuatu	12.97	22.22	32.66	34.47	2.74	100.00	11.54	3.13	3.69	4.30	7.95
Yemen	35.17	50.82	68.95	72.04	2.22	97.35	58.99	2.59	2.79	3.33	9.25
Zambia	13.90	16.70	23.17	27.90	9.72	61.50	3.80	12.08	7.58	7.40	-1.19
Average	***10.56***	***21.26***	***35.35***	***38.32***	***4.77***	***69.20***	***26.14***	***9.36***	***5.96***	***5.76***	

Source: 2017 Global Tracking Framework data.

Table 2: LDC Share of Renewable Energy

Country Name	Share in Total Final Energy Consumption (%)										
	Renewable Energy			Solid Biofuels							
	1990	2012	2014	Traditional Use (Solid Biofuels)	Modern Use (Solid Biofuels)	Hydro	Liquid Biofuels	Wind	Solar	Geothermal	Other (biogas, renewable waste, marine
Afghanistan	15.92	13.97	16.75	8.82	0.00	7.93	0.00	0.00	0.00	0.00	0.00
Angola	72.26	52.25	50.8	46.35	1.12	3.33	0.00	0.00	0.00	0.00	0.00
Bangladesh	71.66	38.63	37.49	37.26	0.00	0.18	0.00	0.00	0.04	0.00	0.00
Benin	93.7	51.08	48.6	40.45	8.15	0.00	0.00	0.00	0.00	0.00	0.00
Bhutan	95.9	87.85	86.66	74.81	0.15	11.70	0.00	0.00	0.00	0.00	0.00
Burkina Faso	93.16	77.62	76.48	75.72	0.45	0.30	0.00	0.00	0.00	0.00	0.00
Burundi	95.2	93.96	90.05	87.66	0.99	1.40	0.00	0.00	0.00	0.00	0.00
Cambodia	0	68.31	67.95	48.95	15.10	3.90	0.00	0.00	0.01	0.00	0.00
Central African Republic	93.49	78.02	77.19	39.57	34.75	2.87	0.00	0.00	0.00	0.00	0.00
Chad	98.16	90.65	89.24	87.97	1.27	0.00	0.00	0.00	0.00	0.00	0.00
Comoros	49.84	48.01	46.49	46.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Democratic Republic of the Congo	92.05	95.53	92.87	75.96	13.75	3.15	0.00	0.00	0.00	0.00	0.00
Djibouti	26.59	34.07	34.15	34.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equatorial Guinea	84.71	6	6.38	5.54	0.00	0.84	0.00	0.00	0.00	0.00	0.00
Eritrea	0	80.15	80.3	76.53	3.75	0.00	0.00	0.00	0.03	0.00	0.00
Ethiopia	96.64	93.76	92.72	90.46	0.83	1.36	0.01	0.06	0.00	0.00	0.00
Gambia	61.44	49.83	48.06	48.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Guinea	89.3	78.45	80.01	78.66	0.35	1.00	0.00	0.00	0.00	0.00	0.00
Guinea-Bissau	88.58	87.61	87.06	79.34	7.72	0.00	0.00	0.00	0.00	0.00	0.00
Haiti	81.12	83.16	78.39	74.36	3.94	0.10	0.00	0.00	0.00	0.00	0.00
Kiribati	5.77	2.84	2.95	2.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lao People's Democratic Republic	94.93	88.28	90.34	72.85	0.00	16.65	0.00	0.00	0.84	0.00	0.00
Lesotho	52.03	52.32	51.82	47.37	0.00	4.44	0.00	0.00	0.00	0.00	0.00
Liberia	88.24	85.85	89.82	10.80	79.02	0.00	0.00	0.00	0.00	0.00	0.00
Madagascar	85.91	76.7	73.56	32.19	39.36	2.01	0.00	0.00	0.00	0.00	0.00
Malawi	84.03	81.16	80.58	34.37	37.11	9.10	0.00	0.00	0.00	0.00	0.00
Mali	88.15	85.14	83.56	77.98	2.11	3.47	0.00	0.00	0.00	0.00	0.00
Mauritania	47	31.84	32.58	32.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Country Name	Share in Total Final Energy Consumption (%)										
	Renewable Energy			Solid Biofuels							
	1990	2012	2014	Traditional Use (Solid Biofuels)	Modern Use (Solid Biofuels)	Hydro	Liquid Biofuels	Wind	Solar	Geothermal	Other (biogas, renewable waste, marine
Mozambique	93.1	90.82	88.85	70.43	8.81	9.62	0.00	0.00	0.00	0.00	0.00
Myanmar	90.91	78.95	68.52	63.21	2.09	3.22	0.00	0.00	0.00	0.00	0.00
Nepal	95.12	84.7	84.38	78.19	0.87	2.90	0.00	0.00	0.00	0.00	2.41
Niger	0	72.73	78.13	78.11	0.00	0.00	0.00	0.00	0.02	0.00	0.00
Rwanda	84.27	89.03	88.45	80.26	7.40	0.79	0.00	0.00	0.00	0.00	0.00
Sao Tome and Principe	71.48	41.45	41.6	40.59	0.00	1.01	0.00	0.00	0.00	0.00	0.00
Senegal	55.55	50.37	43.3	40.56	1.81	0.92	0.00	0.00	0.01	0.00	0.00
Sierra Leone	93.92	78.43	73.05	50.71	21.99	0.35	0.00	0.00	0.00	0.00	0.00
Solomon Islands	59.01	63.53	62.96	62.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Somalia	91.88	93.75	93.86	67.58	26.28	0.00	0.00	0.00	0.00	0.00	0.00
South Sudan	0	30.2	29.83	27.38	2.42	0.00	0.00	0.00	0.03	0.00	0.00
Sudan	73.27	59.82	62.42	36.96	19.02	6.44	0.00	0.00	0.00	0.00	0.00
Timor-Leste	0	25.08	19	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Togo	78.7	72.74	72.83	59.86	9.00	3.97	0.00	0.00	0.00	0.00	0.00
Tuvalu	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uganda	96.04	91.36	89.22	87.53	0.00	1.68	0.00	0.00	0.00	0.00	0.00
United Republic of Tanzania	94.78	86.35	86.67	66.92	18.91	0.83	0.00	0.00	0.01	0.00	0.00
Vanuatu	24.16	40.3	32.43	30.24	0.00	0.86	0.93	0.37	0.02	0.00	0.00
Yemen	2.15	1.33	1.06	0.00	1.06	0.00	0.00	0.00	0.00	0.00	0.00
Zambia	82.98	88.63	88.09	56.91	19.95	11.23	0.00	0.00	0.00	0.00	0.00
Average	***76.83***	***69.01***	***67.76***	***57.92***	***7.25***	***2.49***	***0.00***	***0.01***	***0.01***	***0.00***	***0.07***

Source: 2017 Global Tracking Framework data.

ANNEX II

SELECTED CASE STUDIES FOR EXPANDING SUSTAINABLE ENERGY ACCESS

A series of **8 case studies** from LDCs around the world are presented below to highlight different approaches and business models for expanding access to sustainable energy. Unique features and challenges are highlighted to help guide policymakers, investors, and project developers as they aim to expand investment in LDCs.

90% IN DAKAR

SENEGAL

Cultural shift has taken place and according to upper end estimates 90% of households in Dakar use LPG

50 MW PROJECTS

ZAMBIA

In only 9 months, Zambia tendered two 50 MW PV projects, received auction bids from multiple reputable international companies, and selected two companies at record low prices.

250,000 BIOGAS PLANTS

NEPAL

The Biogas Support Programme supported the creation of more than 100 local biogas construction companies and the installation of 250,000 biogas plants.

4 MILLION HOME SYSTEMS

BANGLADESH

By 2016, IDCOL had financed over 4 million solar home systems serving 18+ million people, making it the largest off-grid solar programme in the world.

300 HYDRO PROJECTS

CHINA

In 2012, there were at least 300 hydropower projects in 70 countries with Chinese involvement, either as contractors, developers or financiers.

A SOLAR PV FINANCING MODELS MATURE INTO OFF-BALANCE SHEET VEHICLES

EAST AFRICA

The advent of Pay-as-You-Go (PAYGO) solar home systems, the combination of their extension of credit to consumers, remote collections, and data-heavy platforms, is opening the way to rapid scale-up of off-grid solar by moving financing opportunities off the balance sheets of the technology suppliers. In a way, this is the same basic tactic used in IDCOL's successful refinancing strategy in Bangladesh (see case study in this section), but the technology advances of the PAYGO model have made it even more friction-free and open to a variety of actors. The first generation of PAYGO companies (i.e. M-Kopa, Mobisol, Bboxx, Off-Grid Electric, Nova Lumos) have together raised over $360 Million in capital, a portion of which has been trained on LDC markets in Africa. However, the future financing requirements for continued growth are immense, far outstripping the ability of the companies' balance sheets to support it and in many cases exceeding individual lender/investor comfort with ticket sizes.

Both Off-Grid Electric, initially operating in Tanzania and Rwanda, and Bboxx, getting its start in the Kenyan and Rwandan markets, closed on deals in late 2015 that would shift their receivables into non-recourse, structured debt vehicles. Off-Grid Electric raised USD 45 million from Ceniarth, Packard Foundation and USAID, while Bboxx issued a more modest USD 500,000 note, secured with 2,5000 customer sales contracts with a 2.5-year maturity and 21% interest rate denominated in Kenyan Shillings, to Oikocredit. Both of these investments were in addition to earlier stage debt and equity rounds, but held important promise as a scalable strategy to ramp up the asset-heavy sales of solar systems, in part drawing inspiration from the US solar bond market and the first such issuance by SolarCity in 2013.

SolarNow, a company operating in Uganda, also began financing receivables in 2016 through a special purpose vehicle with the help of a USD 2 Million facility provided by SunFunder. After a year of trial and error, SolarNow and SunFunder are creating a second SPV permitting the participation of multiple financiers following a syndication strategy, though such arrangements as applied to the decentralized renewables space in LDCs are in a nascent stage.

B IDCOL'S SOLAR HOME PROGRAMME, A SUCCESSFUL ACT 1 IN SEARCH OF ACT 2

BANGLADESH

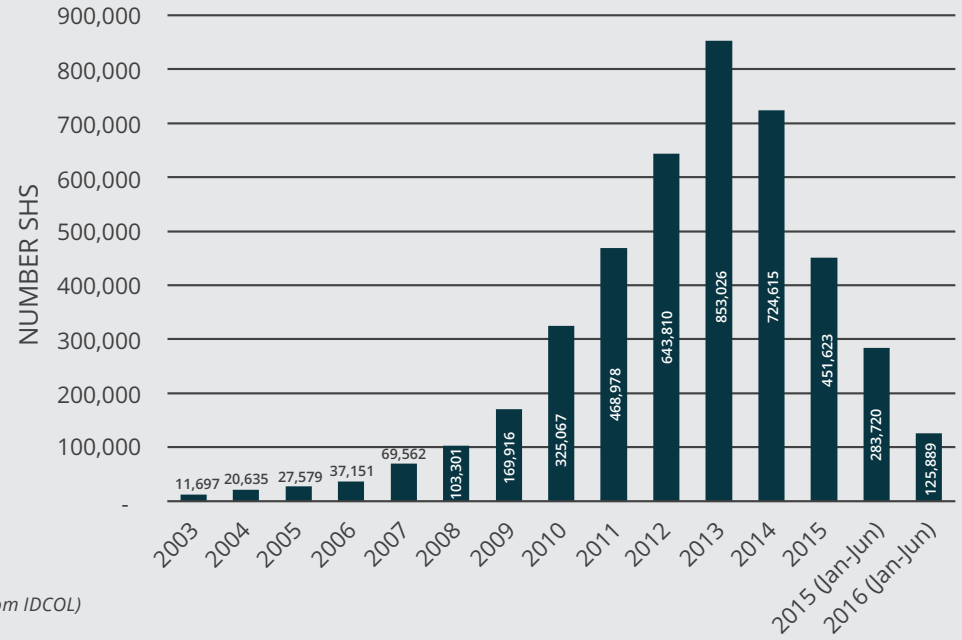
Since 2003 the Infrastructure Development Company Ltd. (IDCOL), a government-owned, privately managed, non-banking financial company in Bangladesh, has served as a single conduit directing substantial financing flows to the off-grid/rural solar market, USD 600 M in development finance loans and USD 96 M in grants, raised from multiple partners. By 2016, it had financed over 4 million solar home systems serving 18+ million people, making it the largest off-grid solar programme in the world.

IDCOL works with a network of 56 partner organizations responsible for selling and installing solar PV systems, establishing and enforcing standards, providing training, channeling subsidies, and providing refinance to create liquidity in the market. This public-private partnership has succeeded in reaching scale through a combination of long term financial commitments; a clearly enforced set of rules for engagement concerning technology, finance, and policy; and demand-driven, enterprise-based delivery of goods and services.

Entering the 15th year now, the operating assumptions of the solar programme have recently been thrown into question with the rapid successes in expanding grid connectivity; the advent of PAYGO technologies (as of March 2017, mandated by the IDCOL programme); and the sustained declines in solar PV pricing. IDCOL-financed sales peaked in 2013, then met with a sharp decline at the same time the government Rural Electrification Board (REB) quintupled its connection pace; the REB is now connecting 100,000 customers to the grid each month, with a target to reach 300,000 per month and achieve universal electrification by 2018. IDCOL is now considering how, in its "second act," to integrate decentralized solar technologies into the grid, replace the most remote applications (such as diesel water pumping), and serve the much smaller customer segment for which rooftop solar will continue to be attractive.

While replicating the exact IDCOL model in other LDCs may not be realistic, its organizing principles are entirely transferable to other contexts where national governments are seeking to promote decentralized sustainable energy solutions with the help of the international donor community. These principles include: 1) enterprise-based delivery philosophy; 2) efficient intermediation throughout

FIGURE 1. : IDCOL-financed SHS Installed



Source: Parvez, 2016 (From IDCOL)

the value chain, from manufacturers/importers, to installers, to customers; 3) providing a holistic package of business support services, tailored financial products, technology standards, and supportive policy; 4) sound and transparent management structures encouraging predictable, rules-based behavior; and 5) gradual reduction, as the market matures, in percentages of "soft" support, transitioning to larger, closer-to-commercial capital inflows.

C FINANCING BIOGAS AND OFF-GRID MICRO-HYDROPOWER THROUGH PUBLIC-PRIVATE PARTNERSHIP

NEPAL

Nepal's success in promoting off-grid biogas and hydropower was the product of multi-decadal, multi-funder, multi-stakeholder efforts. In both cases, the government, through the Alternative Energy Promotion Center (AEPC), provided a key coordinating role standardizing technology, providing technical assistance/capacity building, and channeling outside (mostly donor) finance in a coherent way. The result was the development of two local, private sector initiatives selling, constructing, and maintaining these two technologies at a scale rarely seen in LDC environments. Below is a short description of the biogas and micro-hydropower programmes in Nepal and the role of the private sector.

Biogas: The Government of Nepal's promotion of biogas dates back to the 1970s and has involved channeling numerous types and sources of finance to the sector via public-private partnerships. Gobar Gas Co., the first biogas company, was established in 1977 as a joint venture with, among others, the government-owned Agricultural Development Bank, which also provided consumer loans for biogas digesters at 6% interest. In 1992, the Biogas Support Programme/Partnership (BSP) was launched with the Government of Nepal, and the programme was eventually incorporated 20 years later into the 5-year National Rural and Renewable Energy Programme. The BSP supported the creation of more than 100 local biogas construction companies and the installation of 250,000 biogas plants. It received grants, national budget support, carbon revenues as Nepal's first CDM project, and World Bank output-based aid (OBA). In return, BSP (via the Alternative Energy Promotion Centre, AEPC) provided wholesale finance to more than 250 participating microfinance institutions, administered capital subsidies based on the size and location of the plant, performed rigorous quality control, and generally regulated the sector.

Nepal's biogas promotion efforts are remarkable for their longevity and scale, the degree to which it supported local enterprise creation and enforced quality standards, and the success with which it was able to blend sources of funding. In LDCs where biogas was an option, the Nepal programme provided a well-tested blueprint for engaging and empowering the local private sector in a way that leverages public sector support. The BSP was replicated in Asian LDCs Bangladesh, Cambodia, Lao PDR in 2006, and in African LDCs Rwanda, Ethiopia, Tanzania, Burkina Faso, and Uganda at various points between 2007 and 2009.

Micro-hydropower: Since the 1970s, Nepal has generated some of the global best practices in small and micro-hydropower development, with 40+ small power plants, 1,300+ mini hydropower projects used for rural electrification (combined capacity of 24 MW), and 1,600+ pico installations (combined capacity of 3.7 MW). The government, via the Alternative Energy Promotion Centre under the direction of the Ministry for Science, Technology, and Environment, has played a central role in the development of hydropower-based rural mini grids working as the implementing partner in numerous donor-funded programmes. Typically, AEPC's programmes involve employing a tiered, per kW capital subsidy that covered the bulk of the electrical and mechanical works, and assisting directly with community mobilization and mini grid governance issues. Success factors included the ability to deploy indigenous technology and local manufacturing to drive down costs and eliciting significant community buy-in and contribution with civil works. Current, interrelated dilemmas the programme is dealing with involve reducing capital subsidies; the technical and managerial interface between mini grids and the unpredictable expansion of the national grid; and how to increase plant load factors with more productive use applications. By solving this trio of issues, it is hoped that mini grids and their interconnections in Nepal, with the help of more market-oriented development finance (e.g., guarantees, refinance, rate buy-downs, etc.) will become increasingly bankable, eventually attracting significant 3rd party investment flows.

D HIGH HOPES DASHED FOR PRIVATE SECTOR-LED GEOTHERMAL

SOLOMON ISLANDS AND VANUATU

Flagship Australian geothermal developer GeoDynamics (ASX:GDY) began work in 2012 on projects in the Solomon Islands and Vanuatu, two LDCs in the Western Pacific. A 20-30 MW project was planned on Savo Island in the Solomon Islands that would have supplied power to a gold mine and satisfied 100% of the capital, Honaira's, demand via undersea cable; another 12 MW project in the Takara community of Vanuatu was also planned. The preliminary analyses indicated that geothermal resources were not only available but highly competitive, given the prohibitively high cost of electricity, primarily from diesel.

In both projects, GeoDynamics entered into joint venture agreements, paid for and completed feasibility studies, secured necessary prospecting and surface access licenses, conducted social and environmental assessments and received development consent. However, in 2015 the projects were cancelled, just before drilling the geothermal wells was set to start. Global oil prices were in a freefall and both island nations had turned their attention to coping with the aftermath of cyclone damage, making fuel switching a lesser priority and stalling the final negotiations. GeoDynamics wound down its efforts in the Pacific Islands and shortly thereafter withdrew from the Australian geothermal market too, choosing to refocus its activities in other renewables and rebrand itself as ReNu (ASX:RNE).

It's worth noting that the developers considered these ground breaking projects in LDCs commercially viable and invested significant time and resources in the projects' development. They were put together without the benefit of PPAs, low-cost development finance, or subsidized de-risking measures. Though ultimately unsuccessful, it was a hopeful sign of progress for private investment flows into LDCs for sustainable energy.

E CHINESE HYDROPOWER DEVELOPMENT COOPERATION IN SOUTHEAST ASIA AND BEYOND

SOUTHEAST ASIA

China announced in 2000 a policy to expand opportunities abroad for infrastructure development. This launched China's expansion into international hydropower development, notably first in Southeast Asia, including LDCs there, and also in Central Asia and Sub-Saharan Africa. State-owned engineering and construction company Sinohydro, and others, with strong support from the country's Exim Bank, applied their domestic expertise in the sector into an unprecedented number of medium and large scale hydropower developments in LDCs, notably Cambodia, Laos PDR, and Myanmar, where in some cases electricity was imported back into China.

By one estimate, in 2012 there were at least 300 hydropower projects in 70 countries with Chinese involvement, either as contractors, developers or financiers. In 2013, the "One Belt, One Road" initiative lent further support by linking Chinese diplomacy, aid, infrastructure development, and trade agreements. This initiative saw the creation of the Chinese-led Asia Infrastructure and Investment Bank (AIIB) and a $40B Silk Road fund, which complemented the work of the Exim Bank and China Development Bank in financing hydropower projects, helping China become more competitive in the sector.

The scale of these efforts is significant within the context of overall hydropower development. For example, in 2016, six of the seven large hydropower projects in Cambodia, representing half of the country's generation capacity, were entirely financed by Chinese firms. Also, the IEA estimates Chinese contractors were responsible for 30% of additional generating capacity in Sub-Saharan Africa from 2010 to 2015, with 49% of this being hydropower and 7% other renewables. In the same time period, Chinese power sector financing in Sub-Saharan Africa amounted to USD 13 Billion, or roughly a fifth of all investments.

Until recently, the dominant model of engagement relied heavily on Chinese contractors with Chinese state financiers, underwriting projects on the basis of sovereign credit, with sometimes weaker social and environmental safeguards than prevailing international norms would allow. However, there are signs that positive change is happening in the LDCs. Now, well established project finance methodologies are becoming more prevalent; companies are increasingly interested in operating and service agreements; companies are adhering to better social and ecological practices; and LDC governments have in some instances been able to strengthen their negotiating stances. As the larger hydropower projects are either completed, or cancelled (due to negative social and environmental impacts), there are indications that Chinese public sector finance, directed towards (predominantly state-owned) Chinese companies, is increasingly also pursuing smaller hydropower projects and other renewables in LDCs.

F GLOBAL ENERGY TRANSFER FOR FEED-IN TARIFFS (GET FIT)

UGANDA

Started in 2013, the EUR 90 Million Uganda GET FiT programme funded by European donors and implemented by the Government of Uganda (GoU), the Electricity Regulatory Agency (ERA), and KfW (Germany), seeks to develop a portfolio of small scale, grid-tied renewable energy (solar PV, hydropower, and bagasse) projects. There are currently 17 projects totaling 157 MW in the GET Fit portfolio. Of the 17 approved projects, 11 have reached financial closure so far; 30 MW have already been commissioned, 86 MW are under construction, and 41 MW are still in the pipeline. The programme combines financial and technical assistance in the form of: A) a top-up payment, additional to Uganda's Renewable Energy Feed in Tariff (REFiT), B) a partial guarantee from the World Bank covering off-taker liquidity events and termination compensation, and C) technical assistance in grid planning, tariff modelling, auctions, due diligence, development of agreement templates, and negotiations. According to the programme's 2016 annual report, GET FiT has about a 1:4 leverage ratio of programme support to total investment, and the public-private financing split is 57% to 43%, respectively.

The GET FiT top-up payment amount is fixed for hydropower, bagasse and variable for PV to cover any spread between the fixed tariff and the PV auction price. The supplementary tariff, a form of results-based aid, is based on 20 years of projected generation but payable up

front, half at commercial inception and half over the first five years of operation, in order to improve projects' cash flow and bankability, since renewable energy projects suffer notoriously from longer payback periods.

The GET FiT Uganda programme met with several delays along the way, largely related to working out a number legal / regulatory issues and solidifying credible plans for interconnection (additional donor funding eventually had to be sourced for this aspect of the project). Uganda already had a relatively attractive power sector for investment, fully unbundled with an independent regulator, but its BNEF Climatescope ranking for clean energy investment climate and policies advanced substantially during the GET FiT project to 7th out of 55 developing countries (2nd in Sub-Saharan Africa, after South Africa), reflecting the progress made in streamlining its regulatory environment. Based on the experience in Uganda, the GET FiT programme is considering replication in other LDCs, which has the potential to start transforming the sector. A series of market assessments were done in 2016, and currently Zambia is underway with the design and launch of a GET Fit programme, most likely with small hydropower and biomass. Other countries in serious consideration are Mozambique, Vietnam, and Ghana.

G SETTING AN AUCTION PRICE RECORD FOR GRID-TIED SOLAR IN SUB-SAHARAN AFRICA

ZAMBIA

In July 2015, Zambia became the first country to engage in the IFC's Scaling Solar programme, which assists governments in procuring grid-tied solar capacity via auctions. The Scaling Solar Programme aims to fast track privately developed, competitively priced solar by offering a holistic package of support in preparation for auctions. This includes technical assistance on site selection and grid management, a comprehensive suite of bankable agreement templates, and finance and risk management products attached to the tender and available to any winner. In only nine months, Zambia tendered two 50 MW PV projects, received auction bids from multiple reputable international companies, and selected two companies at record low prices for sub-Saharan Africa of USD .0602/kWh and USD .0784/kWh. Importantly, the six cent bid by French company Neoen (in partnership with First Solar and with the Zambian Public Industrial Development Corporation taking a 20% stake) didn't include escalation over the 25-year term, so it actually represents a much lower cost of power. In 2017, Zambia and the World Bank Group decided to proceed with an additional 200-500 MW of tendered solar projects. Despite the overall positive results in Zambia, there were challenges including a 6-month delay in getting the PPA for the first plant approved and signed, along with institutional turmoil at ZESCO, the public electric utility. Other LDCs now participating in the programme are Senegal, Madagascar and Ethiopia.

While promising, it is still too early to judge the ultimate success and financial sustainability of the Scaling Solar programme. There is likely an implicit subsidy stemming from the financing terms and risk mitigation package offered by the IFC to qualified bidders, but the effect of this on the final auction price has not, to the author's knowledge, been quantified. It does suggest, however, that Scaling Solar bids should not be viewed as benchmarks for similar countries without some degree of qualification.

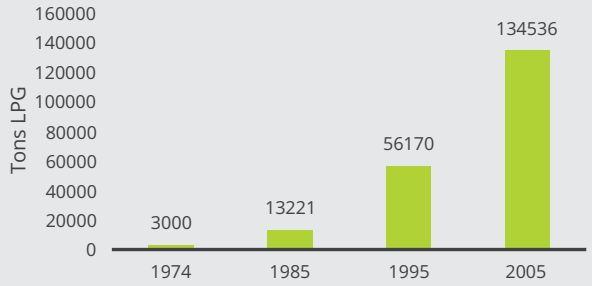
H DESPITE CRITICISM, DID A 30-YEAR LPG SUBSIDY PERMANENTLY TRANSFORM THE MARKET?

SENEGAL

In the 1970s Senegal initiated a policy to encourage the use of LPG for cooking to combat deforestation and desertification. The policy included at various times the removal of duties and VAT on equipment and the adoption of a uniform fuel pricing structure for the smaller sized cylinders (2.7 kg and 6 kg) used domestically. Over the next 30 years, Senegalese consumption gradually grew until it reached the highest level in Sub-Saharan Africa calculated on both a per capita and per unit of GDP basis. Senegal still remains at the top of the region in terms of LPG consumption per capita.

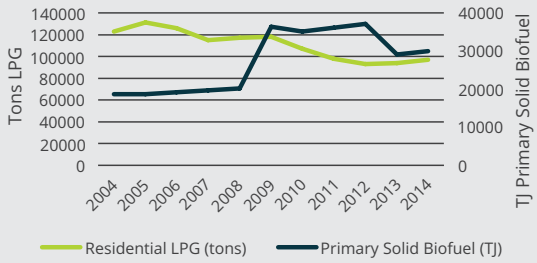
As LPG adoption continued to increase, and political pressure mounted to keep cylinder refill prices low (even as global oil prices skyrocketed), the fiscal weight of the subsidy became challenging for the government to manage. As early as the late 1990s, partial efforts were made to phase out the subsidies, under pressure from the IMF, and around 2011 or 2012, the LPG prices appeared to have returned

FIGURE 2. : Senegal LPG Consumption



Source: Dafrallah, 2009 (From Système d'Information Enérgetique Du Sénégal, 2006)

FIGURE 3. : Senegal Fuel Consumption



Source: IEA (2015)

to market levels. Around this time the importation of LPG was liberalized, breaking the state-owned monopoly, and, after a sharp dip in sales, the government removed the VAT in an effort to restore demand. This period was accompanied by a spike in the return to charcoal use, evidence of which can be seen in the chart below, as households switched fuels and altered their fuel stacking strategies.

From a high in 2005, country-wide consumption has indeed fallen, partly due to supply constraints, partly as a result of price deregulation, partly due to the decrease in leakage to neighboring countries, but it has by no means collapsed. While no readily available data appears on the price elasticity of LPG in Senegal, anecdotally there seems to be agreement that a cultural shift has indeed taken place, at least for urban households (upper end estimates suggest that 90% of households in Dakar used LPG) and especially upper and upper-middle class ones.

Senegal's LPG promotion programme (including regulatory framework for standards), favorable tax treatment, and fuel subsidies resulted in three large multinationals, Mobil, Total, and Shell, entering the market and, by 2000, these companies accounted for the bulk of cylinder sales, inland distribution, and maintenance and filling. 2011 report for the World Bank (Matthews & Zeissig) found that of the big three companies, only Total was still active, along with five other distributors. At the time of this writing in 2017, of the six distributors identified in 2011, Total and a locally owned corporation, Touba Gaz, are still active today; a third was acquired by Puma Energy in 2012 and continued LPG sales; and no trace could be found of the other three companies (though they had the smallest market shares in 2011). Based on the limited information available, the subsidy withdrawal appears correlated with some degree of exiting from the market and reduction in investment levels.

Data was not available on the all-in public cost of Senegal's LPG promotion programme in terms of direct outlays, foregone tax revenues, and cross-subsidies, nor is there data on the overall amounts invested by LPG supply companies. Also, it is not clear to what extent the benefits of the programme extended to the customers versus being captured by distributors and upstream actors. This data would indeed help to evaluate whether the government's support, was ultimately worth the price in terms of its ability to attract private sector investment, maintain the LPG market post-subsidy, permanently shift some cultural practices, and reduce unsustainable charcoal use. That said, in 2014, Senegal still remained at the top of the region in terms of consumption of LPG per capita (much higher than Kenya and South Africa, and tied with Ghana despite having less than 60% of Ghana's GDP per capita), demonstrating that modern cooking options are an important part of the energy mix in this LDC. The Senegal case shows the importance of long-term government commitment to facilitate the building of a market that attracts private sector players bringing modern energy to their citizens, but raises questions about the sustainability, efficiency and targeting of subsidy support in this particular case. For example, a 2008 IMF report criticized the programme because the top 40% of households were capturing 61% of the benefit while the bottom 40% of households, only 19%.

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For a detailed list of references and the online version please scan QR code or visit our website at:

http://unohrlls.org/promoting-investment-energy-access-ldcs2017-/

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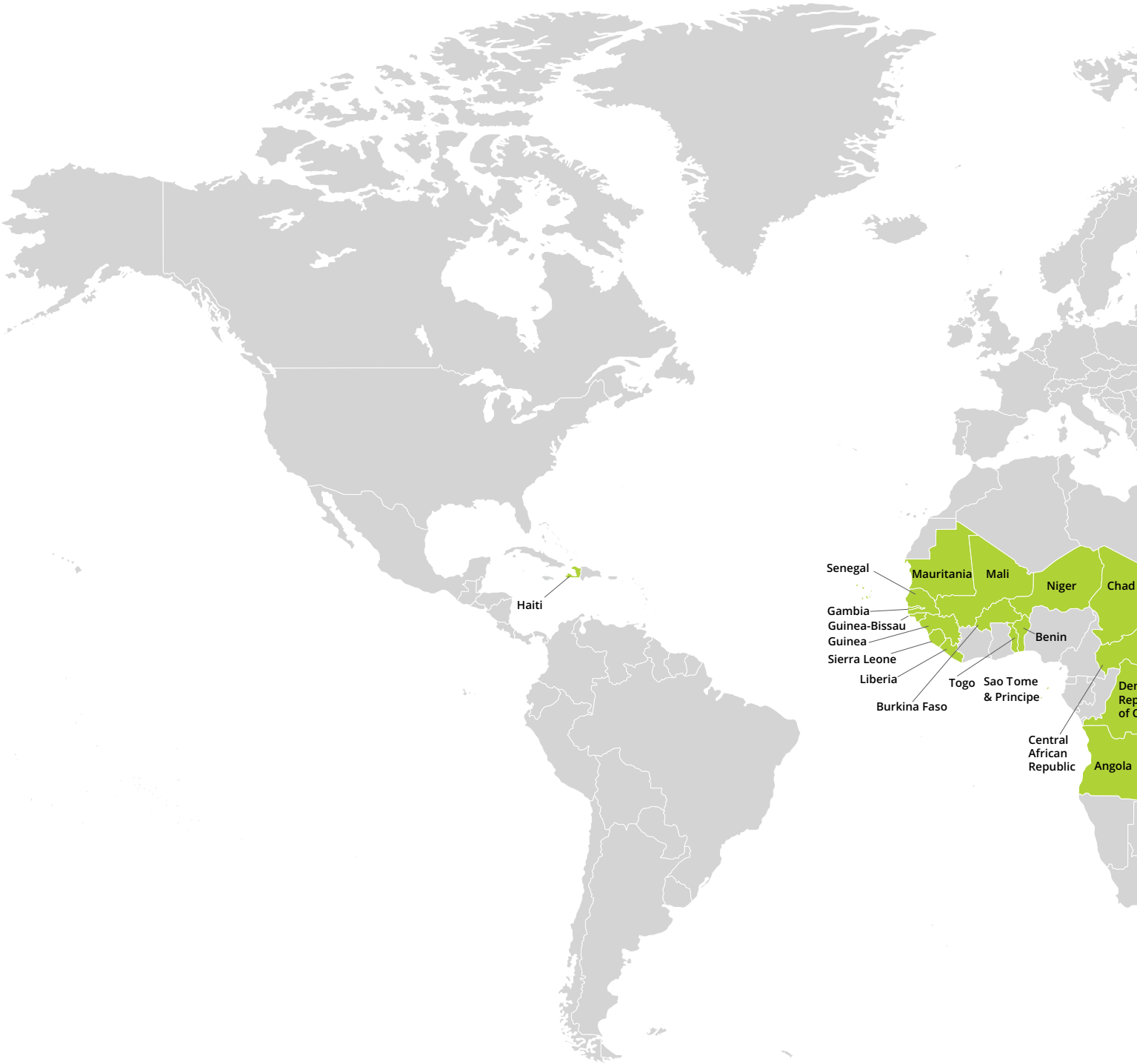

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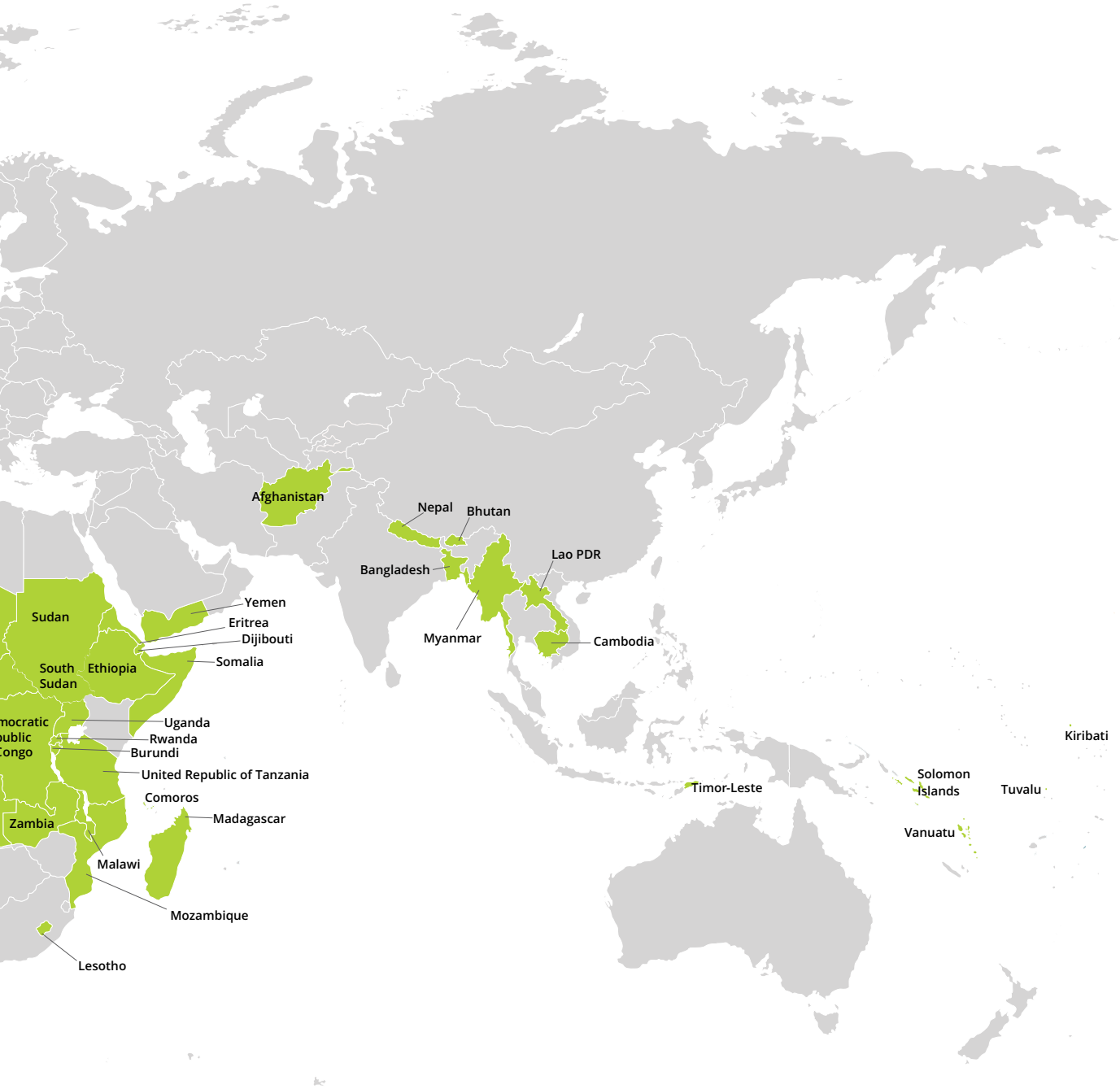

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Legend

Least Developed Country

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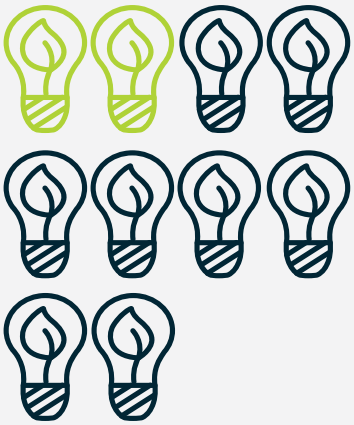
DID YOU KNOW?

- Sudan
- Somalia
- Central African Republic
- Sierra Leone
- Liberia
- Zambia
- Malawi
- Madagascar

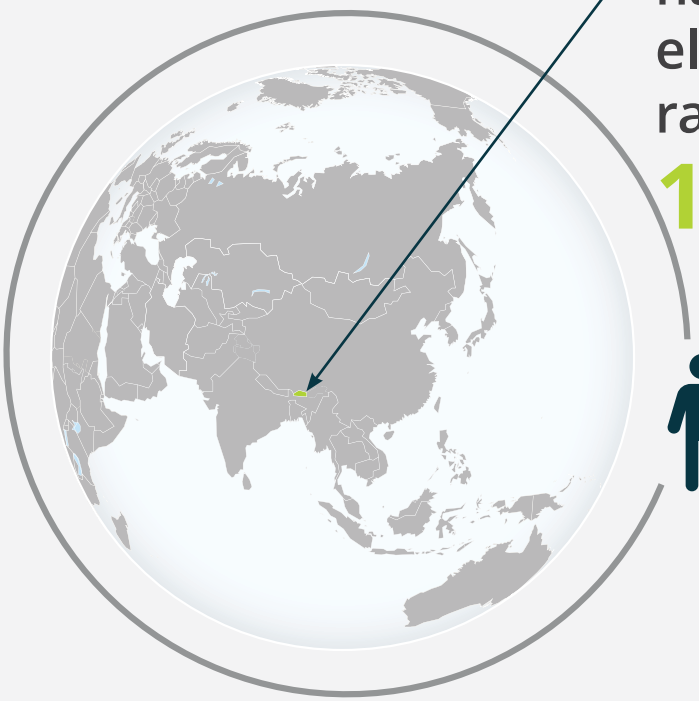
draw more than **20%** of their energy from **modern renewable sources**



Tuvalu set a target to achieve

renewable energy by 2020

Bhutan
has reached
electrification
rate of
100%



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556 million of the world's 1.06 billion people without electricity live in LDCs

Only **38%** of the LDCs population have access to electricity

In **15** LDCs access to electricity in rural areas is below **5%**

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