Draft Background Paper for the High Level Seminar

"Accelerating Sustainable Energy for All in Landlocked Developing Countries through Innovative Partnerships"

For discussion and validation

A consolidated input by the co-organizers:
Austria, UN-OHRLLS, UNIDO, SE4ALL

I. Introduction

The 32 landlocked developing countries (LLDCs) with a total population of about 470 million face development challenges owing to their geographical disadvantage of lacking direct territorial access to the sea and their remoteness and isolation from world markets. Additional border crossings coupled with cumbersome transit procedures and inadequate infrastructure, substantially increase the total expenses for transport and other transaction costs. The LLDCs pay about double the trade costs of the transit countries for imports and exports. These high transport and trade transaction costs, diminish export profits, inflate the prices of imported inputs for manufacturing and discourage investment thereby negatively affecting overall sustainable development in LLDCs. A 2013 study conducted by UN-OHRLLS found that because of landlockedness, the level of development in the LLDCs is, on average, 20% lower than what it would be if the countries were not landlocked. This ultimately affects their capability to structurally transform toward "green" circular economies and to achieve the sustainable development goals (SDGs).

Access to energy services, energy efficiency and renewable energy, the main pillars of SDG-7, are key development enablers for sustainable development. They are also important aspects of the circular economy concept, which aims at decoupling prosperity gains from negative externalities such as climate change, environmental pollution and resource scarcity. This policy concept assists LLDCs to reduce needs for resources through cleaner production, greener products, service-based business models, extended product lifetimes, increased recycling and minimized waste. Promote the use of energy to support productivity and competitiveness of the services sector since it is of strategic importance to overcome landlockedness through its potential contribution to trade and development.

The multidimensional impact that rapid energy transition can have is all-encompassing; it is essential for alleviating poverty, improving human welfare, protecting health, empowering women and marginalized communities, protecting the planet, raising living standards, building resilience, creating jobs and achieving rapid and sustainable economic growth. For LLDCs, reliable and sustainable energy is required to support faster customs clearance, border crossing, tracking of shipment that is in transit and other trade facilitation processes that are necessary to reduce delays in border and transit procedures and formalities, thereby resulting in reduced trade

transaction costs, increased competitiveness of LLDCs and expansion of further international trade.

The LLDCs have limited productive capacities, are experiencing declining value addition in manufacturing and agriculture, and have heavy reliance on undiversified primary commodities. Energy is an important productive capacity that is necessary to support industrialization that can enable the LLDCs to achieve economic diversification, improve value addition and become more competitive in international markets for goods and services other than primary commodities. Renewable energy is also an alternative to the transportation and logistical challenges linked to delivering fuel to some LLDCs. In landlocked countries with unreliable overland trade corridors, the uninterrupted supply of fuel is critical. Alternative and renewable energy sources can help them to avoid this logistical and supply chain issue.

The Vienna Programme of Action for the LLDCs for the Decade 2014-2024 (VPoA) adopted at the Second United Nations Conference on LLDCs is a comprehensive and action-oriented development agenda to address the special needs and challenges of LLDCs in a more coherent manner. The VPoA stresses that energy infrastructure and access to affordable, reliable and renewable energy and related technologies are critically important for modernizing information and communications technology and transit systems, reducing delays and enhancing productive capacity to achieve sustained economic growth and sustainable development.

The 2030 Agenda for Sustainable Development adopted in 2015 as the overarching global development framework for the next 15 years acknowledges that the most vulnerable countries, including LLDCs deserve special attention. The 2030 Agenda calls for support towards the implementation of relevant strategies and programmes of action, including the VPoA and also indicates that the VPoA is integral to the new Agenda. Sustainable Development Goal 7 (SDG 7) calls for ensuring access to affordable, reliable, sustainable and modern energy for all by 2030. SDG 7 has a multiplier effect on the achievement of all the other SDGs.

There are important cross-links to SDG 13 on climate change mitigation and resilience and SDG-9 on building resilient infrastructure, promoting inclusive and sustainable industrial development and innovation. SDG-17 gives also an important direction to enhance "North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism".

Box 1. SDG 7 Targets and indicators

7.1: By 2030, ensure universal access to affordable, reliable and modern energy services
Indicators: Proportion of population with access to electricity; and Proportion of population with primary reliance on clean fuels and technology
7.2: By 2030, increase substantially the share of renewable energy in the global energy mix
Indicator: Renewable energy share in the total final energy consumption
7.3: By 2030, double the global rate of improvement in energy efficiency
Indicator: Energy intensity measured in terms of primary energy and GDP
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

The Sustainable Energy for All (SE4ALL) initiative was launched in 2011 by the United Nations (UN) Secretary General as a multi-stakeholder partnership between governments, the private sector, and civil society to achieve three interlinked targets by 2030: (i) universal access to modern energy services; (ii) a twofold increase in the global rate of improvement in energy efficiency; and (iii) a doubling of the share of renewable energy in the global energy mix. Countries were/are encouraged to develop Country SE4ALL Action Agenda and respective investment prospectus (es) to help guide on how the country could achieve the three goals of the SE4ALL.

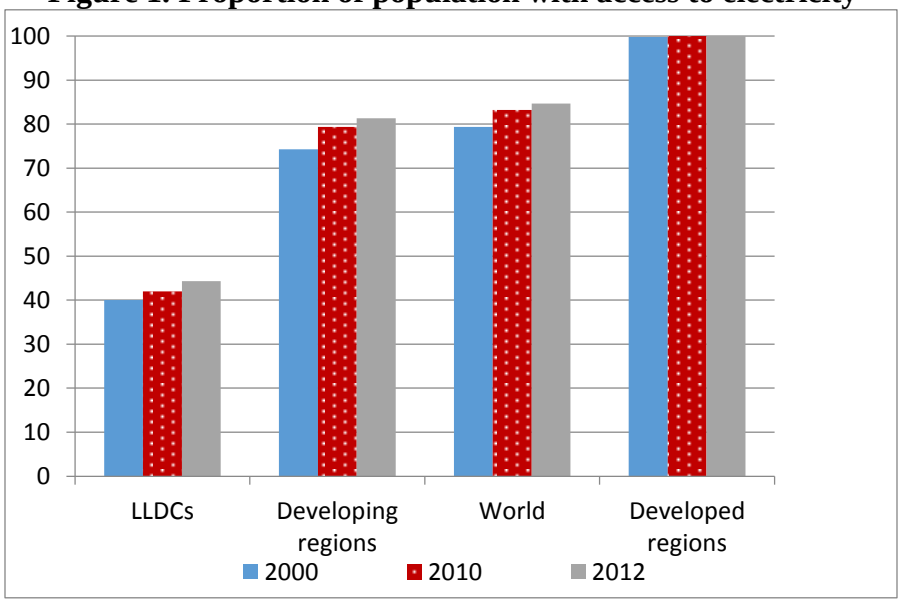
In December 2015, the Parties to the United Nations Framework Convention on Climate Change decided on the Paris agreement, charting a fundamentally new course for global climate efforts. The Parties reaffirmed their commitment to limiting temperature increase to below 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees. The agreement also established binding commitments by all parties to make "nationally determined contributions" and to pursue domestic measures aimed at achieving them. Renewable energy technologies were highlighted as a means to mitigate emissions and to adapt to the impacts of climate change.

This background paper provide highlights on the progress that has been made towards achieving sustainable energy for all at national level in the LLDCs including in improving energy access, efficiency and renewable energy. It highlights the progress using the global indicators for SDG 7. The paper identifies the key barriers and priority areas for action and highlights the implications for partnerships. Finally, it gives concrete recommendations on how to overcome barriers to be validated during the two-days high level seminar.

II. Universal access to affordable, reliable and modern energy services in LLDCs

Despite the potential that modern energy has for the development of the LLDCs, the average proportion of population having access to modern energy in the LLDCs was 44% in 2012. LLDCs have a significantly lower average level of access to electricity when compared to both developed, and developing countries and the world average as shown in Figure 1. The proportion of the population with electricity in LLDCs increased by only 10% since 2000 and there is need to intensify efforts so as to improve access to all.

Figure 1. Proportion of population with access to electricity



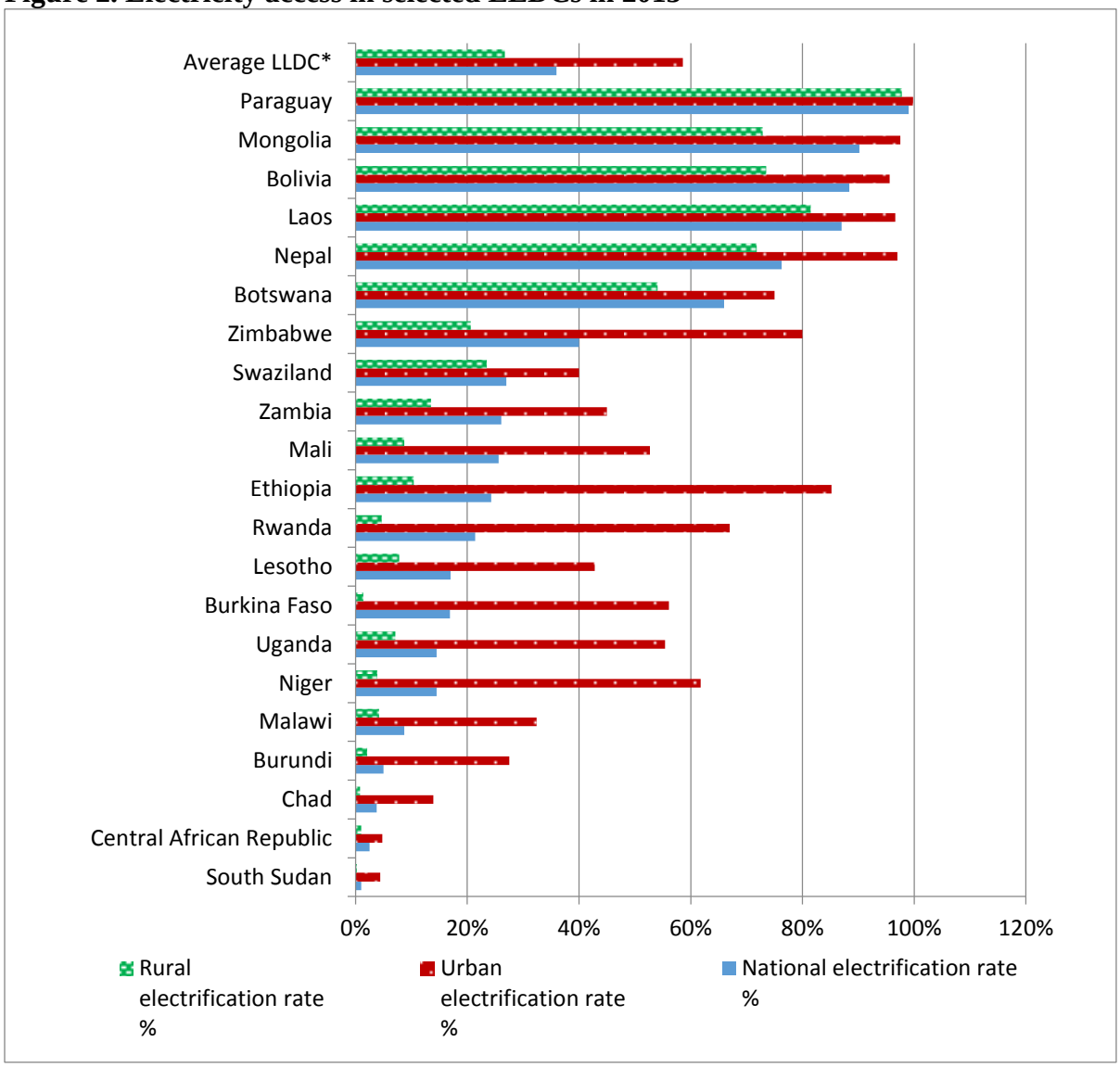
Source: UNSD SDG Indicators Global Database

Furthermore there are wide disparities between countries; with 9 countries having reached universal access, while 9 countries are trailing behind others with an access rate lower than 20% (see annex 1[1]) and the remaining 14 LLDCs lie in between.

There are also wide disparities between urban and rural areas with urban areas having access rates that are much higher than the rural areas as shown in Figure 2. It is important that access to modern energy is enhanced to specifically target the rural areas. In this regard it is important to scale up renewable energy which represents one of the most cost-effective solutions for off-grid areas and has a cost advantage over diesel-fired power generation. The LLDCs also require higher quantity and quality of investment in infrastructure facilities to close the rural-urban gap and to achieve universal access in sustainable energy including involving a combination of off-grid, mini-grid and decentralized grid-connected energy solutions.

[1] The average access rate for LLDCs in annex 1 and figure 1 are different because of weighting.

Figure 2. Electricity access in selected LLDCs in 2013



Source: IEA, World Energy Outlook 2015

According to the recent data by the International Energy Agency, about 300 million people in the LLDCs or two thirds of their total population rely on traditional use of biomass for cooking (see table 1). The indoor pollution resulting from biomass use kills more people, especially young children and women, than malaria and tuberculosis and HIV-AIDS combined, underscoring the urgent need for improved access to clean and modern cooking energy.

Table 1. Traditional use of biomass for cooking in selected LLDCs – 2013

Region	Population relying on traditional use of biomass millions	Percentage of population relying on traditional use of biomass %
Botswana	*1*	*37%*
Burkina Faso	*16*	*95%*
Burundi	*10*	*98%*
Central African Republic	*5*	*97%*
Chad	*12*	*95%*
Ethiopia	*89*	*95%*
Lesotho	*1*	*62%*
Malawi	*16*	*97%*
Mali	*15*	*98%*
Niger	*17*	*97%*
Rwanda	*12*	*98%*
South Sudan	*11*	*98%*
Swaziland	*1*	*61%*
Uganda	*37*	*98%*
Zambia	*12*	*82%*
Zimbabwe	*10*	*71%*
Laos	*4*	*65%*
Mongolia	*2*	*63%*
Nepal	*22*	*80%*
Bolivia	*2*	*23%*
Paraguay	*3*	*42%*
Total	*297*	*79%*

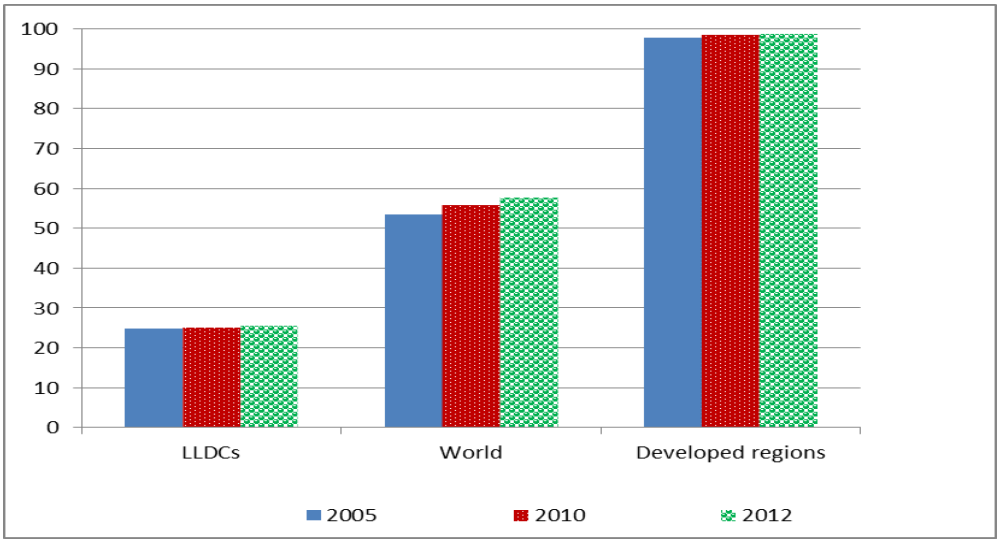
Source: IEA, World Energy Outlook 2015

With regard to the second SDG indicator on access to energy, the proportion of the LLDCs' population with access to clean fuels and technologies for cooking, such as gas and electricity is only 25.6% in 2014 – less than half the rate of the world average and about a quarter of the developed regions' average. Growth in access to clean fuels and technologies for cooking has been slow growing only from 24.8% in 2005 to 25.6% in 2014 particularly in African LLDCs (see figure 3 and annex 2). The 2016 SDG report stresses that the growth in access to clean fuels and technologies for cooking is almost exclusively confined to urban areas.

The LLDCs have been undertaking efforts to improve access to clean fuel and energy technologies including for example through rural electrification, biogas and improved cook stoves (see annex 7 for some examples). Over the period 2012–2014, the World Bank supported a project Africa Clean Cooking Energy Solutions Sub-Saharan Africa that was an enterprise-based platform to promote clean fuels and technologies (Uganda was one of the pilot countries). In East Asia between 2012 and 2015 the World Bank supported Mongolia, and Lao PDR in capacity building, policy development, knowledge sharing and institutional strengthening on clean stoves. The large-scale adoption and sustained use of clean cookstoves is constrained by

financing in terms of a lack of investment and working capital for producers, and lack of information, awareness, and cultural barriers for consumers. This underscores the importance of awareness raising; markets and preferences; technologies and standards; and innovative financing.

Figure 3. Proportion of population with primary reliance on clean fuels and technology in LLDCs



Source: UNSD SDG Indicators Global Database

III. Energy efficiency in LLDCs

Energy efficiency represents the opportunity to deliver more services for the same energy input, or the same amount of services for less energy input (REN21, 2016). Greater efficiency improvements during extraction, generation, transmission, distribution and end-use in lighting, appliances, buildings, mechanical work, transport and industry contexts frees up resources to expand access, lowers the cost of energy for consumers, and creates a surplus that allows more energy to be used for productive undertakings.

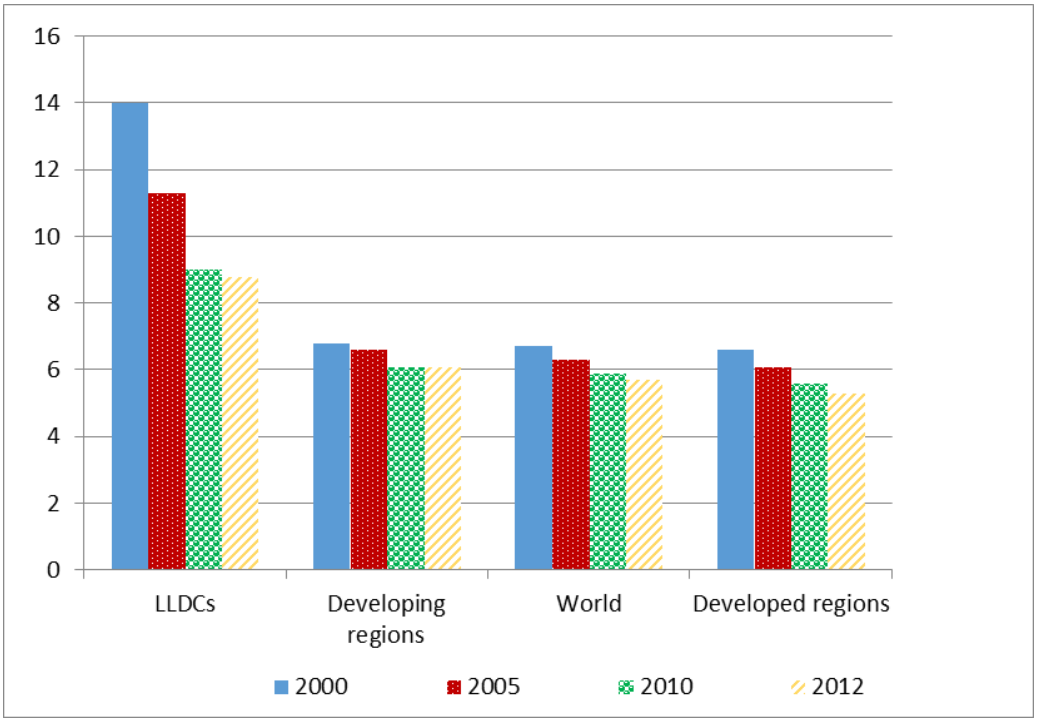
The SDG indicator to measure energy efficiency - energy intensity - calculated by dividing total primary energy supply by GDP reveals how much energy is used to produce one unit of economic output. Energy intensity in LLDCs improved from 2000 to 2012, falling from 14 megajoules per unit of GDP (2011 US dollars PPP) in 2000 to 8.8 in 2012. However the energy intensity of the LLDCs is still much higher than the world average or the average of the developing regions indicating that there is still need for more work to enhance energy efficiency (see figure 4).

Among end-use sectors at the global level, the 2016 UN SDG reports that industry was the largest contributor to reduced energy intensity, followed closely by transportation. To increase the competitiveness and productivity of industries and SMEs in LLDCs there is need to up-scale the use of energy management standards and systems (e.g. standard ISO 50001), as well as cleaner production practices. Over the past 30 years, best practices and lessons learned from UNIDOs industrial energy efficiency program and the Network for Resource Efficient and

Cleaner Production Centers (RECPnet) have demonstrated the productivity gains and viability of such measures.

For example, a Moldovan Lactis dairy products company achieved through the implementation of energy management standards an annual reduction in electricity and natural gas consumption of 4% and 22%, respectively, achieved at not cost of low cost, while maintaining the same production level.

Figure 4. Energy intensity level of primary energy (millijoules (MJ) per constant 2011 PPP GDP



Source: UNSD SDG Indicators Global Database

Energy efficiency in LLDCs has not yet reached its potential. Some of the challenges to optimizing efficiency potential involve lack of access to technologies, capacity-building and financial resources, as well as market related and institutional issues. According to REN21, 2016 in some countries, legal frameworks are not considered stable and transparent enough to trigger large-scale private investment. Subsidies for fossil fuels also continue to put renewable energy and energy efficiency projects at an economic disadvantage.

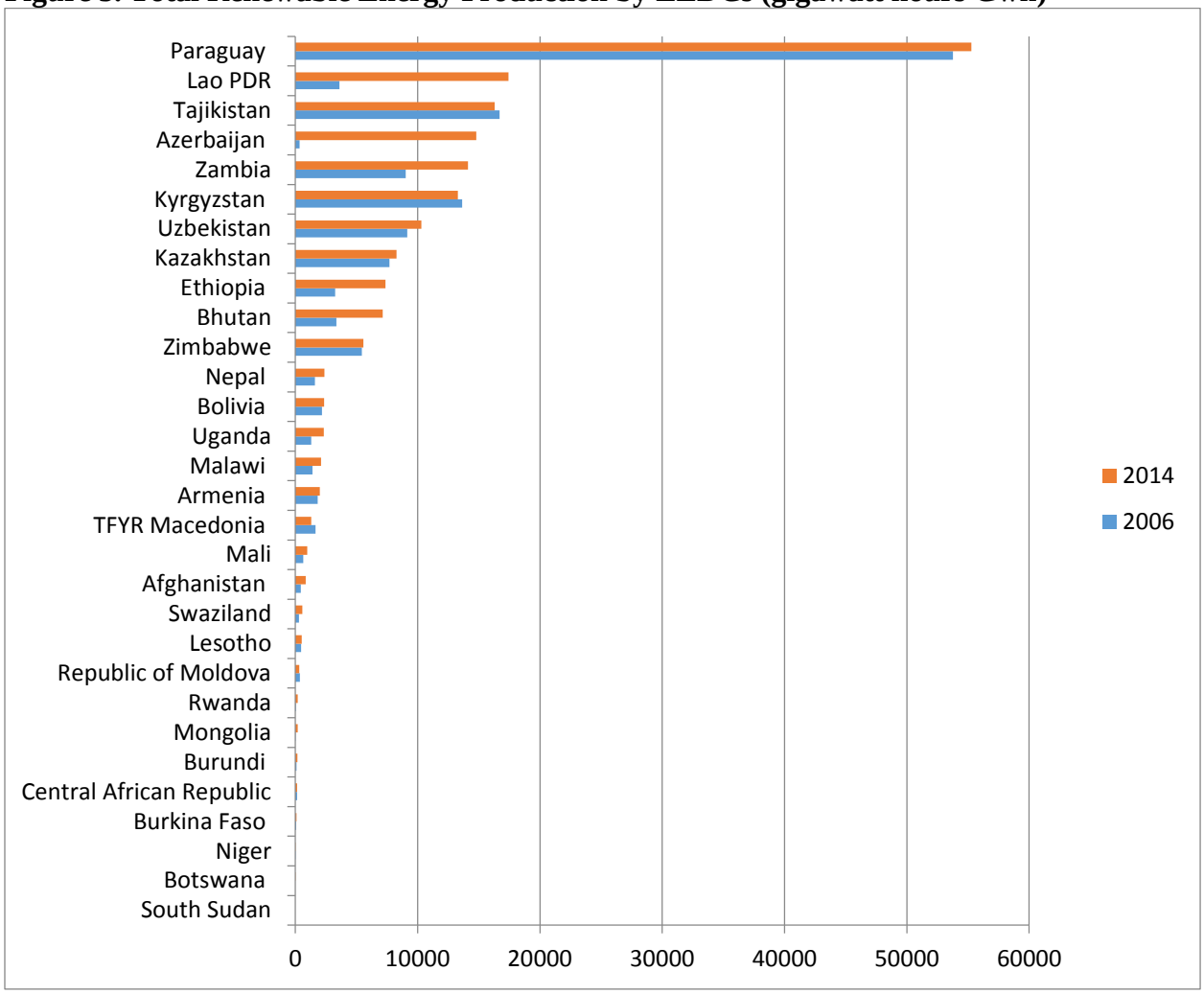
IV. Renewable energy usage in LLDCs

New and renewable sources of energy have become accepted not only as feasible and important energy supply options, but also as key resources for addressing global challenges, including universal energy access, energy security, climate change, and ultimately poverty eradication and sustainable development. According to the UNSD data on SDG 7, the share of renewable energy derived from hydropower, solid and liquid biofuels, the wind, sun, biogas, geothermal and marine sources, and waste in the LLDCs' total final energy consumption decreased, from 44.3%

in 2000 to 29.2% in 2012. There has been a general decrease in the proportion of renewable energy consumption in 23 LLDCs over the period 2000-2012. Globally the share of renewable energy in total final energy consumption increased from 17.4 per cent in 2000 to 18.1 per cent in 2012. Globally, the technologies making the largest contribution have been hydropower, wind and solar energy; together they account for 73 per cent of the total increase in modern renewable energy between 2010 and 2012. Total renewable energy production has been on the increase in some LLDCs as shown in figure 5, with 7 countries producing more than 10 000 Gwh in 2014.

The major source of renewable energy in LLDCs is hydropower followed by bio-energy, solar and wind energy as detailed in annex 6. Some LLDCs have rich hydropower potential including: large hydroelectric dams, run-of-the-river systems, and small hydro stations. Some LLDCs like Paraguay and Bhutan are producing electricity for export using hydro-power. LLDCs have great potential for solar energy production because of length of daytime, weather, climate condition, and geographical location. While some efforts have been made to utilize solar energy, much more can be done.

Figure 5. Total Renewable Energy Production by LLDCs (gigawatt hours Gwh)



Source: IRENA, 2016

Wind energy is relatively underdeveloped compared to other energy sources globally and LLDCs have relatively few installations of wind power plants. Ethiopia and Mongolia produce higher level of wind energy when compared to the other LLDCs (see annex 6). Ethiopia is one of the largest wind energy producers among LLDCs. In May 2015, the Adama Wind Farm II which was implemented by Chinese companies opened, and its 153 MW capacity made it the largest wind farm in sub-Saharan Africa, and the latest of three giant wind farms (Eaglestone Securities, 2015). Mongolia also has high potential to produce wind energy. All regions of Mongolia are influenced by the westerly jet stream, a high-speed ribbon of air several kilometers above sea level (Elliott, 2001). The LLDCs also have potential to produce geothermal energy. Some LLDCs such as Zambia, Malawi, Uganda, Ethiopia, and Macedonia are located in the hottest known geothermal region where volcanic and seismic activities occur frequently, and they have high potential to produce geothermal energy. Currently only Ethiopia is producing geothermal energy.

The bioenergy share in total global primary energy consumption has remained steady since before the year 2000, at around 10% (REN21, 2015). Most of this energy is used for lighting, cooking, or heating in household in developing countries. The LLDCs producing larger amounts of bio-energy include Swaziland, Uganda, Azerbaijan, Zimbabwe and Bolivia. The Economic Community of West African States (ECOWAS) developed a plan to get bioenergy from appropriate crops such as sweet sorghum, jatropha, cassava, or cashew which flourish in a specific climate. For example, jatropha is well cultivated in tropical and subtropical regions, and Mali and Burkina Faso are focus areas to generate bioenergy using jatropha crop. Jatropha has a high oil content which is versatile in use, but it needs optimal condition to grow (ECREEE, 2012).

The trends in renewable energy technology costs have been falling in particular solar and wind power, have made projects viable in resource-rich developing and emerging. The global weighted average levelised cost of electricity (LCOE) of projects commissioned in 2015 was around USD 0.06/kWh for biomass, USD 0.08/kWh for geothermal, USD 0.05/kWh for hydro and USD 0.06/kWh for onshore wind and that these technologies compete head-to-head with fossil fuels, which have costs of between USD 0.045/kWh and USD 0.14/kWh (REN21, 2016). Solar photovoltaic has also experienced significant cost reductions. Between 2010 and 2015, the global weighted average LCOE of utility-scale (>1 MW) solar photovoltaic fell by almost 60%, driven primarily by reductions in module costs of around three quarters during this period. In 2015, the most competitive utility scale solar PV projects were regularly delivering electricity for just USD 0.08/kWh, without financial support, compared to a range of USD 0.045/kWh to USD 0.14/kWh for new fossil fuel power (excluding health and carbon emission costs) (REN21, 2016).

In the lead up to the 2015 UNFCCC 21st Conference of the Parties (COP21 countries outlined their own concrete post-2020 mitigation commitments under Intended Nationally Determined Contributions (INDCs). Some LLDCs indicated national intentions to increase renewable energy technology and set targets as shown in table 2.

Table 2. Targets for Renewable Power installed Capacity and/or Generation

Country	Technology and Target
Armenia	Hydropower (small-scale) 377 MW by 2020; 397 MW by 2025 Geothermal power 50 MW by 2020; 100 MW by 2025 Solar PV 40 MW by 2020; 80 MW by 2025 Wind power 50 MW
Azerbaijan	Electricity 1 GW by 2020
Bhutan	Electricity 20 MW by 2025 Bio-power from solid biomass 5 MW by 2025 Solar PV 5 MW by 2025 Wind power 5 MW by 2025
Bolivia	Electricity 160 MW renewable energy
Burundi	Bio-power from solid biomass 4 MW Hydropower 212 MW Solar PV 40 MW Wind power 10 MW
Ethiopia	Bio-power from bagasse 103.5 MW (no date) Geothermal power 75 MW by 2015; 450 MW by 2018; 1 GW by 2030 Hydropower 10.6 GW (>90% large-scale) by 2015; 22 GW by 2030
Kazakhstan	Electricity 1.04 GWh by 2020
Lesotho	Electricity 260 MW by 2030
Macedonia	Bio-power from solid biomass 50 GWh by 2020 Bio-power from biogas 20 GWh by 2020 Hydropower (small-scale) 216 GWh by 2020 Solar PV 14 GWh by 2020 Wind power 300 GWh by 2020
Malawi	Hydropower 346.5 MW by 2014
Rwanda	Biogas power 300 MW by 2017 Geothermal power 310 MW by 2017 Hydropower 340 MW by 2017 Hydropower (small-scale) 42 MW by 2015 Electricity (off-grid) 5 MW by 2017
Tajikistan	Hydropower (small-scale) 100 MW by 2020
Uganda	Bio-power from organic MSW5 30 MW by 2017 Geothermal power 45 MW by 2017 Hydropower (large-scale) 1.2 GW by 2017 Hydropower (mini- and micro-scale) 85 MW by 2017 Solar PV (solar home systems) 700 kW by 2017

Source: REN 21 2016.

On the policy front, the LLDCs have made some progress to support of renewable energy and energy efficiency. As shown in table 3, more than half of the LLDCs have strategies outlining their priorities in renewable energy technology, and have adopted renewable energy targets. Since renewable energy strategies and targets are vital for unleashing the full potential of energy for development, it is important for countries that have not yet done so to develop national renewable energy strategies that support the development of the necessary infrastructure, institutions and regulatory framework.

Most regulatory support policies in the LLDCs exist in the power sector, where feed-in tariffs are the most commonly used, followed by tendering. The forms of fiscal incentives and public financing that the LLDCs utilize most are the reductions in sales, energy, VAT or other taxes and the public investment, loans or grants.

Table 3. Renewable Energy Support Policies in LLDCs

COUNTRY		REGULATORY POLICIES				FISCAL INCENTIVES AND PUBLIC FINANCING			
	Renewable energy targets	Feed-in tariff/ premium payment	Transport obligation /mandate	Tradable REC	Tendering	Capital subsidy grant, or rebate	Investment or production tax credits	Reductions in sales, energy, VAT or other taxes	Public investment, loans or grants
Afghanistan	..								
Armenia	○	○							
Azerbaijan	○								○
Bhutan	..								
Bolivia	..								
Botswana	○					○		○	
Burkina Faso					○		○	○	
Burundi	..								
Central African Rep.	..								
Chad	..								
Ethiopia	○		○					○	○
Kazakhstan	○	○		○		○			
Kyrgyzstan						○		○	
Lao PDR	..								
Lesotho	R				○	○	○		○
Malawi	R		○					○	○
Mali	○		○					○	○
Mongolia	R	○			○			★	
Nepal	○	○		○	○	○	○	○	○
Niger	R							○	
Paraguay	★		○					○	
Republic of Moldova	○	○							○
Rwanda	○	○			○		○	○	○
South Sudan	..								
Swaziland	..								
Tajikistan	○	○						○	○
TFYR Macedonia	○	○							
Turkmenistan	..								

Uganda	R	○			○	○		○	○
Uzbekistan					○				
Zambia						○		○	○
Zimbabwe	○		○					○	○

Source: REN 21, 2016

Notes: RPS: Renewable Portfolio Standards REC: Renewable Energy Certificate

○: Existing national (could also include subnational) ★: New (one or more policies of this type)

R: Revised (one or more policies of this type) ..: Data are not available

One of the major challenges to production of renewable electricity generation is lack of adequate financial resources. The initial construction cost for energy infrastructure and plants is considerably high. Countries are faced with the challenge of finding ways of addressing the energy for development and climate change in a balanced manner whilst as they strive to achieve SDG7. Some LLDCs have experienced capacity constraints in policy formulation and of regulatory institutions. Adequate data and information is also important to support the development and effective implementation, monitoring and evaluation of supportive policies.

V. Existing barriers for sustainable energy in LLDCs

As already mentioned, many LLDCs have introduced targets to scale up renewable energy and energy efficiency markets and climate mitigation throughout the next decades. However, the implementation of these commitments is hindered by a bundle of interrelated barriers, which need to be addressed (e.g. policy and regulatory, technical, financial, human and institutional capacity, knowledge, awareness, investment and business). During the High Level Seminar potential strategies to overcome these barriers in LLDCs will be discussed.

General Barriers

Despite the potential contribution of renewable energy and energy efficiency technologies and services to resolving some of the energy challenges in LLDCs, markets for these technologies and services remain largely underdeveloped. This is mainly due to unfavorable market environment and bottlenecks that are faced by the different market players.

- **Inadequate project development and implementation expertise:** Within LLDCs, several energy projects have failed/stalled on account of a range of issues relating to environmental, social, technical, and/or financial factors. For example, assistance (human resource, technical, legal, financial, administrative) in developing RE/EE solicitations understanding and evaluating RE and EE proposals is required so that the best proposals are chosen to meet the specific needs of the individual country and/or region.

- **Lack of regional technical coordination, implementation and harmonization capacities:** The institutional capacities on regional level need an urgent strengthening. The current situation tends to support donor driven approaches and agenda setting. There is a need for a stronger use of local implementing systems (e.g. procurement) and experts (e.g. consultants, companies).

- **There is a need for a regional coordination:** This could have a range of applications ranging from knowledge transfer between countries to electricity transfer between countries to promote regional energy security. In addition, timely implementation of RE and EE initiatives could be supported by coordinating best practice approaches and highlighting scope for rapid implementation, where such opportunities exist. That is, established frameworks focusing on electricity generation, transmission and distribution need to be established at the regional level so that individual countries can take advantage of combined opportunities for exploiting RE/EE potentials and improving economies of scale.

- **Low grid stability:** The reliability of some power systems in LLDCs is low due to lack of investments in the generation, transmission and distribution networks. Adding intermittent sources of energy, as is the case of the majority of RE sources such as solar and wind, could contribute to further interruptions in the grid when the power plants are not able to meet the demand.

- **Subsidies to fossil fuels:** One of the key constraints to investments in renewable energy and energy efficiency is the biased subsidies to fossil fuels. The existence of mechanisms such as the fuel surcharge also reduces the attractiveness of RE projects to the utilities.

- **Low electrification rates:** Efforts to electrify peri-urban and rural areas need to be significantly scaled-up in order to tackle low electrification rates. Besides availability of finance, the lack of regulatory framework to allow private businesses such as RE services companies to operate in this market is also seen as a barrier. It is also important to link these mechanisms with other access-to-energy programmes (e.g. rural electrification and efficient cooking stoves).

2. Knowledge and Awareness Barriers

- **Stakeholders/General public sometimes do not possess sufficient RE&EE knowledge** and awareness to make informed decisions. As such, there is a definite need for advocacy, awareness raising, information dissemination and stakeholder engagement efforts.

- **Incomplete and decentralized regional data collection, compilation and analysis:** Within a number of LLDCs there are a few entities, which collect energy sector data. However, such data collection efforts are decentralised and in some cases pertinent data is yet to be collected on a consistent basis and disaggregated by sex. These efforts need to be coordinated at a regional level so that relevant comparisons, possible collaborative ventures and assistance support between and among countries can be identified and implemented. That is, there is a need for energy information compilation, energy statistics and analysis to facilitate strategic planning and effective decision-making at the country, sub-regional and regional levels.

- **There is also a lack of institutionalized memory on sustainable energy projects and issues.** Many activities are implemented on a project basis and after closure of the project

the knowledge and lessons learned are lost. There is a need for a regional information hub which keeps record of the lessons learned and knowledge.

- **Lack of feasibility studies for RE and EE assessments:** There is sometimes a greater focus on political matters, instead of technical issues, and this, in some cases, leads to the requisite studies not being (properly) conducted. In some instances, data is not communicated or disseminated widely to key stakeholders, regular regional policy and project manager staff meetings are not held, all of which can negatively impact RE/EE project development.

Policy Barriers

- **Absence of an enabling framework:** While there are existing draft or final energy policies, there is a noticeable deficiency as it relates to clear sustainable energy action plans/road maps and supporting policies/legislation that would be expected to provide the enabling environment for development of RE and EE projects. For example, the lack of policies or guidelines and the revision of electrical codes and legislation pertaining to RE interconnection, wheeling, net-billing, net-metering and appropriate incentive structures have stymied RE and EE development in several countries.

- **Inadequately defined policy targets:** In some cases, it is felt that some policy goals and targets were set without proper and complete analysis, consultation and collaboration with key stakeholders. Some of these policies may need to be refined to ensure that the defined targets are achievable and actionable. Moreover, policies are mostly not gender sensitive. In some cases, additional studies, e.g., grid impact and stability studies may be required to ensure that policy targets and action plans are attainable and sustainable.

Market Barriers

The RE/EE market in many LLDCs is nascent or emerging and a range of support mechanisms are required to promote growth and investment within the market. The specific needs of individual countries as it pertains to the development of a RE/EE market/industry are summarized as follows:

- **RE/EE Market structure not (fully) defined:** For many countries, the scope/potential of the RE/EE market has not been properly defined. There is little or no data to suggest how the individual markets and the collective regional market can grow. As such, there is a need for market definition and sustainability guidelines. For example, it is necessary to understand the scope for the development of local facilities/institutions to manufacture, assemble, recycle and repair RE&EE equipment.

- **Inadequate support mechanisms for increasing the market share of renewable energy and energy efficiency:** In some countries, RE and EE potentials remain largely unexploited and untapped. This is on account of several reasons relating to location of the resources, investment costs, lack of technical expertise etc. However, in many instances it is on account of the fact that market drivers are lacking. For example, tariffs for RE

projects are sometimes too low, discouraging market growth. In other instances there are caps on RE addition to the grid, even in the absence of grid dynamic impact studies.

- There are **weak or no minimum energy performance standards** for new buildings, building renovations, appliances, lights, air conditioning and refrigeration, vehicles, etc. This leads to the construction of building where investments are based on initial costs, not operating or life-cycle costs.

- **Local companies and industry are currently not taking sufficiently advantage** of the growing sustainable energy market and job opportunities. There is a need for strengthening the capacities of the local private sector and to promote entrepreneurship. Women stay underrepresented in the energy sector.

- **Limited data is available for linkage industries/sectors**, such as agriculture, transport, food storage, etc. which tend to be large energy users. Limited baseline studies have been carried out in most energy using industry sectors within the region. Some organisations and government departments have conducted some research; however, a lot of the data has not been collated, updated or acted upon.

- **Metering**: There was a good understanding of the different forms of metering, but only a few countries seemed to be addressing/ implementing any such activities to date.

Finance Barriers

Financing is a critical issue in LLDCs, as governments typically do not have the financial resources to develop and implement RE/EE projects. Therefore, private sector interests/external investors are expected to drive RE/EE initiatives. Several RE/EE projects to date have been stalled/postponed on account of a lack of available financing. The specific needs of the individual countries as it relates to financing were outlined as:

- **Inadequate low-interest and innovative financing programs:** Business loans for the development of RE/EE projects sometimes have high interest charges, which tend to be viewed as prohibitive for small, medium sized businesses. There is a definite need for low-interest financing mechanisms, “Pay as you Save Programs” and other innovative financial mechanisms and incentives for small and large enterprises operating/seeking to develop RE/EE projects. Specific barriers for women entrepreneurs to access credit will also need to be taken into account and addressed by new financing mechanisms.

- **Inadequate financial policies:** Policy and regulation needs to be developed to provide financial incentives for RE and EE initiatives. This will help to stimulate growth and investment within the industry.

- **Apprehension in making new investments:** The economic slowdown and the increase in frequency of extreme climate events (e.g. hurricanes and floods), have led to some business owners/backers holding back on potential RE&EE investments.

Capacity Barriers

Regional capacity, particularly as it relates to development of RE/EE projects is sometimes limited. As such, external capacity, in the form of imported labour, is usually brought on to support project implementation. One of the concerns with this type of arrangement is that knowledge transfer is typically very limited and so local capacity is not enhanced or developed. The capacity gaps/barriers can be outlined as:

- **Lack of technical capacity to formulate and enforce policies:** The technical capacity in some LLDCs is confined to the staff of the electric utilities. In some instances, governments and regulators lack the resources to formulate consistent sustainable energy policies and regulations in line with the local environment and social aspects. This is frequently due to the limited number of persons in these institutions but also because of their technical skills.

- **Limited existing local capacity in both the public and private sector** to develop and sustain local RE and EE technologies: In many cases, personnel needs to be trained/retrained in order to effectively implement projects. There is a need for continuous training and development to upgrade staff skills and capabilities.

- **Brain drain:** Local trained human resources may migrate (outside the region) to seek better opportunities. There is a need for programmes focused on succession planning that minimizes attrition rates and engender capacity retention.

- **Limited local educational/training programmes:** Although the number of industry-relevant and industry-specific certification and degree programmes has increased in recent years, there is still a need to improve/expand such programmes in keeping with industry feedback.

- **The distinct differences in the geographical, environmental, cultural and social aspects** in LLDC regions make it difficult to create a one-size-fits-all approach.

Table 4: Capacity Requirements of Various Stakeholder Groups

Stakeholder group	Capacity needs
Policy makers in the renewable energy and energy efficiency sectors and the energy sector in general.	▪ Developing and operationalizing coherent, comprehensive and evidence-based policies, laws and regulations that create a level playing field for RE&EE technologies ▪ Implementing rural energy planning ▪ Negotiating power purchase agreement (PPAs) with independent power producers (IPPs) and setting viable feed-in tariffs ▪ Integrating environmental and social strategies in the formulation of country action plans ▪ Strengthen the capacities to appraise sustainable projects and establish standard approval procedures which particularly consider potential negative social and environmental impacts

	of projects (e.g. environmental impact assessments, standards for hydro power planning).
Policy makers from non-energy sectors like agriculture, health, water, private sector, transport sectors etc.	▪ Basic design of renewable energy systems ▪ Integrating gender sensitive renewable energy components and EE measures into their sectors
Entrepreneurs, project developers, equipment manufacturers, consultants and industry support bodies	▪ Development of vocational and higher education courses adapted to the RE&EE requirements and languages of the region ▪ Certification for conducting energy audits ▪ Identifying, developing and packaging a pipeline of potential RE&EE investment projects ▪ Negotiating viable power purchase agreement with investors ▪ Preparing quality business plans that are consistent with existing financing mechanisms ▪ Mobilizing and structuring investments in RE&EE projects ▪ Adoption of a climate change-based resilience approaching the development and implementation of energy sector plans and projects
Utilities	▪ Ability to tender RE&EE projects ▪ Negotiate power purchase agreements (PPAs) ▪ Integrate RE generation in the grid
Recipients/buyers of energy services and technologies	▪ Willingness and ability to pay for the services or technologies ▪ Ability to assess the energy implications or costs in daily choices and decisions such as selecting electric equipment

Technology Barriers

In LLDCs, there are significant technology gaps, particularly as it relates to the use of advanced energy technologies. Maintenance of equipment is another area for which assistance is required, as some countries do not have a good history of repair and maintaining equipment. Additional gaps/barriers include:

- **Need for demonstration projects:** Demonstration projects are needed to highlight the benefits of EE & RE technologies not yet being used on a large scale. This is to be supported by capacity development. There is need for adapted solutions reflecting the reality of the respective LLDC.

- **Need for technology and knowledge transfer:** Technical knowledge and capacity transfer within and between countries is necessary so that individuals embarking on new RE/EE initiatives can learn from those who have already successfully implemented such projects. That is, south-south and north-south technology and knowledge transfer is required to spur growth and development.

- **Presence in the market of low quality equipment** can lead to a negative uptake of RE technologies, and interviews in some countries confirm that this is the case. Consumers need to be educated regarding the options when purchasing equipment. It is also urgent to address waste management issues of the equipment when they reach the end of their life. There is a lack of certification of equipment such as the Lighting Africa programme from World Bank which tests and certifies off-grid lighting products.

- **Grid Readiness:** The infrastructure for integrating RE into the existing grids is seen as an area of need. This would include having an updated map of all connections, substations, capacity levels, evacuations of electricity levels at said subs stations. And, a grid that can feed back information to the grid operator and at the same time be adaptable. The readiness of the grid would also support the uptake of electric vehicles, where it was seen in most countries as a desirable need.

Gender Participation Gaps

The energy sector in most of the LLDCs, specifically for highly technical occupations, tends to be comprised of primarily males. This is a reflection of enrolment rates within applicable educational programmes at universities and other training institutions. In terms of gender participation gaps, there is a real need for initiatives that target females and that help to remove the perception that the energy-sector jobs are primarily for males. Moreover, with a growing demand for sustainable energy, it is expected that there will be a need for trained labour to fulfil the demand for experienced and skilled technicians at various levels, capable of designing, developing, installing, operating, and maintaining, and managing RE&EE projects. This represents an opportunity to foster the participation of women in this nascent sector by entering the labour force and by helping them become entrepreneurs/creating new businesses.

VI. Sustainable energy industrial value creation and innovation in LLDCs (SDG 9)

A weakly developed domestic sustainable energy manufacturing and servicing industry has become a major bottleneck for the further uptake of sustainable energy markets and the implementation of the INDCs in LLDCs. In contrast to fossil fuel based solutions (e.g. diesel generators), the supply and logistical chains for sustainable energy solutions remain underdeveloped and products and services are either not available or lack of quality. Quality issues and the perception that solutions are not mature have been a backdrop for various renewable energy technologies in different parts of the world (e.g. solar thermal, PV). Moreover, the lack of a domestic industry has led to severe sustainability and maintenance issues in various LLDCs (e.g. mini-grids).

Countries have introduced a number of policies and regulatory frameworks to promote sustainable energies. However, many of those do not consider sufficiently domestic value creation and the strengthening of industrial capacities in the sector. Therefore, the domestic value and job creation effects along the value chain of sustainable energy investments (manufacturing and distribution, project planning and development, construction and installation, operation and maintenance, decommissioning and recycling) remains often very limited. Equipment and

services continue to be imported. This is further catalyzed by export-driven donor programs, with lack of business and sustainability models.

According to UNIDO, there is need to better interlink sustainable energy demand-side with supplier-side support mechanisms and incentive schemes to maximize local benefits along the sustainable energy value chain. Existing governmental sustainable energy promotion programs need a parallel supplier-side oriented support stream. To create an enabling business environment for sustainable energy companies and start-ups (e.g. Energy service companies (ESCOs), Renewable Energy Service Companies (RESCOs), manufacturing, planning, installation and operation) there is also need for improved coherence between energy, industrial, human resource, research, innovation and export policies and support instruments. Cross-sectoral approaches need to facilitate the mainstreaming of sustainable energy solutions into key industries (e.g. agro-business, tourism, fishery, construction, transport).

Innovation and entrepreneurship in the sustainable energy sector are grounded in the application of scientific research. Science and technology is a major catalyst for the creation of innovative products and services. Most LLDCs are ranked very low on the Global Innovation Index. More has to be done to create the enabling environment necessary to support the commercialisation of adapted innovations and the subsequent growth in entrepreneurship and micro, small and medium-sized enterprises.

There is the need for a stronger link between applied science and sustainable energy service and manufacturing companies. Innovation and entrepreneurial activities need a right mix of education and training, research and development, applied science and technology, as well as financing. The promotion of sustainable energy markets requires training of many different stakeholders in different sectors on various skills (e.g. plumbers, architects, engineers, financiers, policy makers, farmers, consultants). Innovation happens in several entities like private sector industry, academia and universities, technology start-ups and research labs. However, collaboration and knowledge transfer between these entities is often rare, due to the different nature of drivers for each. There is need to build networks between SMEs, industrial clusters, national ministries, academia, industrial associations.

Without a considerable strengthening of the domestic sustainable energy manufacturing and servicing industry and innovation chain in LLDCs it will be difficult to achieve the envisaged transformational change in the energy sector. To ensure local value creation there is need for a critical mass of domestic energy entrepreneurs, companies and private sector groups. In many countries, the sustainable energy sector is considered as a future growth sector, which offers business and employment opportunities particularly for Small and Medium Sized Enterprises (SMEs). SMEs create jobs and are essential for the overall development of the economy, accounting for 99% of the number of businesses worldwide. They show great potential as instruments for economic growth and development through increased productivity, enterprise creation and employment rates.

These findings and priorities are in line with the G20 Initiative on Supporting Industrialization in Africa and Least Developed Countries (LDCs), which was launched at the G20 Summit in

Hangzhou, China on 4-5 September 2016.[2] The G20 members welcomed the UNIDO report, Industrialization in Africa and Least Developed Countries: Boosting growth, creating jobs, promoting inclusiveness and sustainability and followed the policy recommendations. The G20 initiative includes the promotion of investment in "sustainable and secure energy, renewables and energy efficiency, and sustainable and resilient infrastructure and industries in Africa and LDCs", in line with the 2030 Agenda and Paris Agreement's objectives and the countries' Nationally Determined Contributions.

VII. Conclusion and Suggested Recommendations for achieving sustainable energy for all in LLDCs

LLDCs have disadvantages related to their geography which make them incur high trade costs thereby restricting their competitiveness and trade activity on the international markets. They also have structural constraints related to their limited ability to trade that include high trading costs, limited productive capacities, declining value addition in manufacturing and agriculture, and heavy reliance on undiversified primary commodities.

Sustainable energy can act as a multiplier for economic growth in LLDCs by improving trade facilitation, making supply chains more efficient, financial transactions faster, accelerating the flow of goods and services across national borders, and boosting productivity in all sectors resulting in higher output, diversified economic base and structural transformation. Affordable, reliable and sustainable energy services are critical for ending extreme poverty, creation of decent jobs, development of businesses and improved access to health and education. Each country's transition to a sustainable energy sector involves a unique mix of resource opportunities and challenges and should be designed to meet its unique needs.

Sustainable energy is also an important aspect of the circular economy concept. The policy concept assists LLDCs to reduce needs for resources through cleaner production, greener products, service-based business models, extended product lifetimes, increased recycling and minimized waste.

Detailed recommendations for the outcome matrix:

The implementation of the VPoA and 2030 Agenda need to be implemented in a coherent manner to foster the synergies for the optimal benefit of the LLDCs and in order to ensure that no one is left behind. The following recommendations will be validated and expanded during the High Level seminar to support sustainable energy for all in the LLDCs and address existing barriers.

1. **A greater effort is needed to strengthen synergies of the three goals of Sustainable Energy for All**: access, energy efficiency and renewable energy. A fragmented approach to the three key sub-goals of SDG 7 (and SE4All) is an obstacle to building linkages to other key SDGs such as health, food, water, gender, industry, and others. A well performing and efficient energy system strengthens the opportunity to provide energy

[3] Global Network of Regional Sustainable Energy Centers (GN-SEC), http://www.se4allnetwork.org

access to those now deprived of affordable and reliable energy. Renewable energy is not only a major source of energy access to those living in isolated rural areas but also a contributor to the much needed transformation of energy systems for addressing climate change, health and energy security. Provision of modern energy access, including electricity and clean cooking fuels, will also inter alia: increase productive capacity and economic growth; provide better health outcomes through reductions in both indoor and outdoor air pollution, and greater provision and access to health services; raise education standards, and help mitigate the impacts of climate change. In fact, there are very few areas in the sustainable development agenda where sustainable energy will not play a significant role.

2. **Enhance sub-regional, south-south and triangular cooperation (SDG-17) -** Regional organizations and utility organizations (e.g. power pools) are encouraged to strengthen sub-regional and regional energy infrastructure development projects and overall coordination and coherence. There is strong need for enhancing the technical capacities of regional organizations to support Member States effectively in addressing the barriers for sustainable energy markets, industries and innovation. Regional cooperation is an important tool to reach the needed economies of scales to attract investments and empower domestic "green energy" entrepreneurs to participate in regional and global manufacturing and servicing value chains. There is need for targeted regional support to assist LLDCs in attracting and absorbing international climate finance (e.g. GEF and GCF) earmarked for the implementation of the INDCs. The increasing number of national and international-led programs and projects requires strong technical agenda-setting, coordination and coherence on sub-regional level. Triangular cooperation can play a potential role in providing foreign direct investment flows that contribute to the advancement of sustainable energy for all in LLDCs, as well as cooperation in the transfer of appropriate technology. In this context, to complement the financial activities of regional development banks in the sector, the global network of regional sustainable energy centers will be further consolidated by UNIDO in partnership with the respective regional organizations and international support.[3] A network platform to allow exchange on common sustainable energy issues and programs between the centers will be created. The expansion of the network of centers to other LLDC regions, such as the Himalaya-Hindukush or Central Asia is encouraged. This is in line with SDG-17 which aims at enhancing "North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms".

3. **Accelerate policy processes to achieve SDG-7 and SDG-13 on energy access, renewable energy and energy efficiency and climate change mitigation and resilience -** LLDCs that have not yet done so should consider developing sustainable energy for all Action Agenda (AA) and respective investment prospectus (IP) to help guide on how the country could achieve the three goals of the SE4ALL. The AA should include national and subnational energy policies and action plans based on individual national circumstances and development aspirations. The policies should reflect an

[3] Global Network of Regional Sustainable Energy Centers (GN-SEC), http://www.se4allnetwork.org

appropriate energy mix to meet developmental needs, including through increased use of renewable energy sources and other low-emission technologies, the more efficient use of energy and greater reliance on advanced energy technologies, including cleaner fossil fuel technologies, and the sustainable use of traditional energy resources. To increase the effectiveness and assure local ownership, the development and implementation of AAs and IPs will be coordinated on sub-regional level by the regional organizations and communities and will be closely linked to the INDC process. In this context, the good practice established in ECOWAS[4] will be replicated in partnership with the regional development banks and regional sustainable energy centers. The regional centers can play an important complementary role to the regional SE4ALL hubs, located at the regional development banks, by addressing "soft barriers".[5]

4. **Build resilient sustainable energy infrastructure, promote inclusive industrial development and foster innovation in LLDCs (SDG-9) –** Universal access to sustainable energy services requires scaling up and maintenance of centralized and decentralized energy infrastructure. In the case of rural and remote areas, where grid extension turns out to be no competitive option, alternative decentralized renewable energy (hybrid) solutions will be applied. However, a weakly developed domestic sustainable energy manufacturing and servicing industry has become a major bottleneck for the further uptake and sustainability of decentralized renewable energy markets in many LLDCs. It could be very helpful if the G20 Initiative on Supporting Industrialization in Africa and Least Developed Countries (LDCs) could be extended to all the LLDCs as this could strengthen the domestic sustainable energy manufacturing and servicing capacities of the LLDCs. UNIDO is requested to increase its programmatic effort to support LLDCs in strengthening domestic energy entrepreneurs and innovation through targeted supplier side support complementary to demand-side stimulating activities. UNIDO is requested to increase its programmatic effort to support LLDCs in strengthening domestic energy entrepreneurs and innovation through targeted supplier side support complementary to demand-side stimulating activities. The areas of renewable energy (hybrid) mini-grids and cooking solutions were identified as key area with high potential for domestic value creation. With this approach, UNIDO addresses a major growth barrier for sustainable energy markets, reduces negative environmental externalities (GHG, local pollution) and promotes value and job creation simultaneously.

5. The following **priority activities for the promotion of domestic sustainable energy servicing and manufacturing industries in LLDCs** were identified: (a) strengthening sustainable energy value creation and innovation polices, as well as institutional coordination, (b) promoting investments and partnerships with international companies, cluster-building and regional market access; and (c) strengthening capacities and knowledge management; (d) use the sub-regional level as accelerator for creating business opportunities and spin-offs. The establishment of technology clusters or industrial parks could be an interesting option in some LLDCs. By combining their

[4] Regionally coordinated approach to implement the ECOWAS Renewable Energy Policy (EREP), ECOWAS Energy Efficiency Policy (EEEP) and SE4ALL Action Agenda through National Action Plans and Investment Prospectuses, led by ECREEE with support of international partners (e.g. AfDB, SE4All, UNIDO, EU).
[5] In line with the new SE4ALL Strategic Framework for Results 2016 to 2021

knowledge, financial resources and contacts, they can improve their export potential and reduce costs and risks. Clusters may use the same suppliers of raw materials, cater to the same markets and clients, share the same territory, infrastructure and services, as well as face common challenges. Cluster building is a tool to upgrade productive capacities, increase access to international markets and generate innovation spin-offs. In this context, innovative multilateral, public-private partnerships such as the CTI Private Financing Advisory Network (PFAN) and GEF Clean Tech Programme to promote sustainable energy businesses and innovation should be strengthened. Given that informal and formal small and medium enterprises (SMEs) are the backbone of broad-based economic growth, it is crucial to ensure energy access for micro, small and medium enterprises. It is also important to create income-generating and entrepreneur opportunities in the energy sector; and applying innovative financial approaches, such as microfinance to energy services. There is need to increase the cleaner production capacities of domestic private sector.

6. **Enabling environments** – Many of the LLDCs have adopted sustainable energy targets in the context of the INDCs or other policy documents. However, the implementation of these commitments lacks behind due to manifold barriers. LLDCs are encouraged to create and support enabling environments that facilitate public and private sector investment in relevant and needed cleaner energy technologies. LLDCs should improve coherence between energy, industrial, human resource, research, innovation and export policies and support instruments. Cross-sectoral approaches need to facilitate the mainstreaming of sustainable energy solutions into key industries (e.g. agro-business, tourism, fishery, construction, transport). National policy processes should take advantage of regional processes. The experience in Europe and West Africa has demonstrated, that regional policies and implementation processes can be an important tool to accelerate the development and implementation of national policies and standards.

7. **Improved energy efficiency** - It is important for LLDCs to implement energy efficiency measures in urban planning, buildings and transportation, and in the production of goods and services and the design of products and promote incentives in favor of, and removing disincentives to, energy efficiency. To increase the competitiveness and productivity of industries and SMEs in LLDCs there is need to up-scale the use of energy management standards and systems (e.g. standard ISO 50001), as well as cleaner production practices. This is in line with the SE4ALL Industrial Energy Efficiency Accelerator and the international campaign of the Clean Energy Ministerial, which aim at 50,001 global certifications to International Organization for Standardization (ISO) 50001 by 2020. Sub-regional cooperation could play an important role in up-scaling the dissemination of such standards.

8. **Sustainable cities and sub-national jurisdictions** are emerging as key platforms for sustainable energy and climate action in LLDCs, but these will be fully successful only to the extent that they are strongly supported and linked to national strategies and policies. Sub-regional cooperation between cities on sustainable energy issues will be an important aspect of the way forward.

9. The **nexus between energy, climate, transport, food, water, health and circular economy** is inseparable and essential contributor to social progress and human well-being. It needs to be approached in an integrated manner for adequate solutions. No longer can governments and policymakers afford to focus policies and resources on single issues or single-sector issues. Integrated strategies and solutions are needed to meet multiple objectives simultaneously. Given that energy is central to every economic, environmental, security and developmental issue today, promoting and deploying sustainable energy solutions within a framework of integrated policy options will be a prerequisite for achieving inclusive sustainable development within planetary boundaries. Providing sustainable energy solutions to meet multiple objectives such as climate change mitigation, eliminating energy poverty, increasing productive capacity, etc., will also have significant impacts (both positive and negative), for water, food, security and health. In turn, each of these sectors will impact (again both positively and negatively) the energy sector. There is a growing and urgent need for research aimed at understanding these complex interactions to ensure the most effective solutions are deployed and that limited resources are invested effectively and efficiently in LLDCs and in general. Moreover, sustainable energy is an important aspect of the circular economy concept. The policy concept assists LLDCs to reduce needs for resources through cleaner production, greener products, service-based business models, extended product lifetimes, increased recycling and minimized waste. In this context, important initiatives, such as the Network for Resource Efficient and Cleaner Production Centers (RECPnet) to LLDCs should be expanded.

10. **Improved energy data collection and management –** The development and implementation of sustainable energy policies and investments in LLDCs needs a considerable strengthening of domestic capacities to collect and manage reliable energy statistics, indicators, bankable investment data and reports at all levels – national, regional and global. In this context, the ECOWAS Observatory for Renewable Energy and Energy Efficiency (ECOWREX) will be expanded to other LLDCs regions in Africa and beyond. The domestic ownership in the regularly updated regional renewable energy and energy efficiency data reports will be increased and interlinked with regional/national capacity building activities on data collection and management.

11. **Capacity building –** Development partners are encouraged to strengthen capacity-building, including education and training, certification and in developing national and local capacities to implement and monitor the results of energy access policies and programmes. This includes the strengthening of the institutional capacities of regional organizations and communities. To avoid duplication of efforts and efficient use of domestic and international resources, the sub-regional level will play an important role in defining the training needs and priority areas of intervention. The use of innovative regional train the trainer approaches is encouraged.

12. **Improved sustainable energy use to promote trade facilitation -** LLDCs and transit countries are encouraged to enhance the role of energy to facilitate trade in conjunction with harmonization of customs systems and documentation. Energy provision should be made reliable so as to eliminate any delays at the borders and in transit.

13. **Promote the use of renewable energy as an alternative to the transportation and logistical challenges linked to delivering fuel to some LLDCs**. This is particularly important for LLDCs that have unreliable overland trade corridors. Alternative and renewable energy sources can help address this logistical and supply chain issue while at the same time addressing climate change.

14. **Sustainable energy and women's empowerment are mutually reinforcing goals.** The empowerment of women to become agents of sustainable energy will be key to achieving truly inclusive and sustainable development in LLDCs. Energy poverty impacts women disproportionately especially due to domestic dependence on biofuels, traditional gender roles, and the related health problems. In addition to addressing such energy poverty challenges, evidence shows that access to sustainable energy can provide opportunities for women's economic empowerment and advance gender equality. For women to be key agents of sustainable energy, they need to be empowered and fully engaged at all levels of decision making processes. Therefore, SDG 5 on women's empowerment and SDG 7 on sustainable energy must be tackled jointly through an integrated approach that promotes women's transformational roles in providing innovative energy solutions. Sustainable energy is the golden thread connecting the sustainable development agenda with climate action; gender equality should be the intertwining thread that weaves all components stronger together. Increased financing and policy action are required to accelerate gender mainstreaming of energy interventions, and women's empowerment through sustainable energy solutions. Availability of gender disaggregated indicators will be important for monitoring and evaluating all sustainable energy initiatives. Sub-regional cooperation could play an important role in promoting gender mainstreaming. In this context, the ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN)[6] will be expanded to other regions in Africa.

15. **Support from Bilateral and multilateral development partners -** Bilateral and multilateral development partners are encouraged to increase their technical and financial assistance to support sustainable energy for all in LLDCs. They are encouraged to increase capital flows for the implementation of sustainable energy projects in LLDCs on renewable energy and energy efficiency and to support the Aid for Trade initiative, giving special consideration to the requirements of LLDCs. Governments of developed countries are encouraged to take further action to mobilize the provision of technology transfer on concessional and preferential terms and the diffusion of new and existing environmentally sound technologies to developing countries including LLDCs, as set out in the Addis Ababa Action Agenda and the Johannesburg Plan of Implementation, and highlight the importance of integrating sustainable energy needs of LLDCs in the Technology Facilitation Mechanism;

16. **United Nations, International, Regional and Sub-regional organizations**
Organizations of the United Nations system, and other international organizations, the Regional Development Banks, and Regional Economic Communities, are invited to provide more and better targeted technical assistance and technology transfer to support accelerated universal access, renewable energy and energy efficiency development in

[6] http://ecowgen.ecreee.org/

LLDCs including capacity building on optimal policy, regulatory and financial frameworks for energy service provision. International and regional organizations in particular OHRLLS, UNIDO, UNCTAD, UNDP and the International Think Tank for LLDCs, Regional Banks and others should provide LLDCs with technical assistance on how to enhance the role of energy to lower trading costs, boost trade, and stimulate structural transformation. They should also promote pooling of knowledge, sharing of best practices and advising on new technologies.

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Annex 1. Proportion of population with access to electricity %

Country	1990	2000	2010	2012
Afghanistan	34.6	37.5	41.0	43.0
Armenia	94.3	98.0	99.8	100.0
Azerbaijan	93.1	96.0	99.5	100.0
Burundi	0.1	3.9	5.3	6.5
Burkina Faso	6.1	6.9	13.1	13.1
Bolivia (Plurinational State of)	67.0	66.0	80.2	90.5
Bhutan	65.6	68.5	72.0	75.6
Botswana	36.7	39.6	43.1	53.2
Central African Republic	3.0	6.0	9.5	10.8
Ethiopia	10.0	12.7	23.0	26.6
Kazakhstan	94.2	97.0	100.0	100.0
Kyrgyzstan	97.2	100.0	100.0	100.0
Lao People's Democratic Republic	51.5	46.3	66.0	70.0
Lesotho	6.4	5.0	17.0	20.6
Republic of Moldova	92.2	95.1	98.6	100.0
The former Yugoslav Republic of Macedonia	92.6	95.5	99.0	100.0
Mali	12.0	16.7	16.6	25.6
Mongolia	79.8	82.7	86.2	89.8
Malawi	3.2	4.8	8.7	9.8
Niger	6.2	6.7	9.3	14.4
Nepal	69.9	72.8	76.3	76.3
Paraguay	86.0	93.3	97.0	98.2
Rwanda	2.3	6.2	10.8	18.0
South Sudan			1.5	5.1
Swaziland	28.8	31.7	35.2	42.0
Chad	0.1	2.3	3.5	6.4
Tajikistan	94.9	99.0	100.0	100.0
Turkmenistan	95.2	99.6	100.0	100.0
Uganda	6.8	8.6	14.6	18.2
Uzbekistan	96.9	99.7	100.0	100.0
Zambia	13.3	17.4	18.5	22.1
Zimbabwe	28.1	34.2	36.9	40.5
LLDCs Average	47.4	50.0	52.6	55.5

Source: UNSD SDG Indicators Global Database

Annex 2. Proportion of population with primary reliance on clean fuels and technology in LLDCs

Country	2005	2010	2012	2014
Afghanistan	21	19	18.1	17.3
Armenia	88.8	95	95	>95
Azerbaijan	80.4	89.7	93.4	>95
Burundi	<5	<5	<5	<5
Burkina Faso	<5	6	6.5	7
Bolivia (Plurinational State of)	69.5	74.9	77.1	79.3
Bhutan	49	59.6	63.8	68
Botswana	52	57.8	60.2	62.5
Central African Republic	<5	<5	<5	<5
Ethiopia	<5	<5	<5	<5
Kazakhstan	86.5	89.5	90.7	91.8
Kyrgyzstan	66.9	72.2	74.3	76.4
Lao People's Democratic Republic	<5	<5	<5	<5
Lesotho	23.9	28.3	30	31.8
Republic of Moldova	86.8	90.5	92	93.5
The former Yugoslav Republic of Macedonia	60.9	61.2	61.4	61.5
Mali	<5	<5	<5	<5
Mongolia	29.2	30.7	31.3	31.9
Malawi	<5	<5	<5	<5
Niger	<5	<5	<5	<5
Nepal	14	20.7	23.4	26.1
Paraguay	49.4	57.4	60.6	63.8
Rwanda	<5	<5	<5	<5
South Sudan	<5	<5	<5	<5
Swaziland	30.1	33	34.2	35.3
Chad	<5	<5	<5	<5
Tajikistan	66	69.2	70.4	71.7
Turkmenistan	>95	>95	>95	>95
Uganda	<5	<5	<5	<5
Uzbekistan	84.3	87.6	89	90.3
Zambia	14.3	15.3	15.7	16.1
Zimbabwe	29.5	30.5	30.9	31.3

Source: UNSD SDG Indicators Global Database

Annex 3. Renewable energy share in the total final energy consumption

Country or Area	2000	2005	2006	2007	2008	2009	2010	2011	2012
Afghanistan	59.5	40.3	37.3	33.8	21.4	18.0	15.2	10.8	
Armenia	7.2	6.5	7.7	7.0	6.4	7.8	9.4	8.0	6.57
Azerbaijan	2.1	3.4	2.9	3.8	3.1	3.3	4.5	3.6	2.85
Burundi	93.5	97.3	96.8	96.9	96.8	96.9	96.9	96.7	
Burkina Faso	86.5	86.5	84.6	82.4	83.0	83.8	83.7	80.0	
Bolivia (Plurinational State of)	41.6	43.2	42.3	41.6	39.8	39.3	33.5	32.7	27.99
Bhutan	95.5	91.8	92.1	92.4	92.1	92.8	91.4	90.0	
Botswana	36.1	30.5	29.4	27.1	26.5	27.6	24.1	24.5	23.85
Central African Republic	85.9	86.0	85.1	81.2	80.9	80.9	79.8	78.4	
Ethiopia	96.0	95.1	94.8	94.4	94.4	94.5	94.4	94.0	93.49
Kazakhstan	2.5	2.1	2.1	1.8	1.2	1.3	1.4	1.4	1.36
Kyrgyzstan	35.2	28.0	27.8	24.5	22.1	24.7	25.6	26.0	22.48
Lao People's Democratic Republic	91.2	90.2	90.1	89.8	87.5	87.3	87.5	86.5	
Lesotho	100.0	5.4	5.3	5.3	4.2	4.2	4.1	4.2	
Republic of Moldova	5.7	4.3	5.0	4.5	4.9	4.8	4.2	4.4	4.67
The former Yugoslav Republic of Macedonia	19.4	16.6	17.9	13.4	14.7	18.4	22.6	17.8	16.47
Mali	85.6	86.2	85.7	85.3	85.0	84.4	83.9	83.9	
Mongolia	5.7	5.7	5.0	5.3	5.1	4.9	3.8	3.5	3.22
Malawi	76.9	82.7	82.3	82.5	80.3	81.4	78.7	79.2	
Niger	93.9	90.6	89.7	87.1	86.1	82.8	80.1	81.3	
Nepal	88.3	89.5	91.3	91.3	90.5	88.9	87.3	87.0	84.72
Paraguay	70.4	68.8	67.3	66.8	68.0	66.4	64.3	63.1	62.68
Rwanda	89.3	89.2	90.6	90.3	90.6	90.5	90.7	86.8	
Swaziland	46.8	39.1	38.1	37.8	37.5	39.0	39.4	39.5	
Chad	97.8	91.7	91.8	90.7	90.1	91.1	90.8	90.6	
Tajikistan	62.4	63.7	61.6	53.8	54.6	60.6	62.1	60.3	57.97
Turkmenistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Uganda	94.5	92.9	92.4	91.8	91.1	91.5	91.1	90.3	
Uzbekistan	1.2	1.9	1.9	1.4	2.3	2.2	2.6	2.2	2.37
Zambia	89.9	89.3	90.0	92.8	92.0	91.8	91.8	90.5	88.15
Zimbabwe	69.3	80.1	78.3	77.4	81.1	79.6	77.8	75.8	75.6

Source: UNSD SDG Indicators Global Database

Annex 4. Energy intensity level of primary energy (millijoules (MJ) per constant 2011 PPP GDP[7])

Country	2000	2005	2006	2007	2008	2009	2010	2011	2012
Afghanistan		1.4	1.6	1.6	2.3	2.8	3.1	4.0	4.6
Armenia	9.4	6.6	5.9	5.8	5.7	5.8	5.4	5.6	5.8
Azerbaijan	13.2	8.3	6.1	4.5	4.4	3.6	3.4	3.6	3.9
Burundi	11.7	15.5	15.0	14.5	14.1	13.8	13.5	13.3	13.0
Burkina Faso	6.8	7.7	7.3	7.9	8.0	7.8	7.4	7.3	7.0
Bolivia (Plurinational State of)	6.6	6.2	7.2	5.9	5.9	6.0	5.9	5.8	6.0
Bhutan	21.9	16.2	15.5	13.8	13.7	13.1	12.6	11.9	11.8
Botswana	4.2	3.7	3.5	3.3	3.4	3.4	3.5	3.2	3.1
Central African Republic	9.1	8.0	7.5	8.5	8.2	7.5	7.2	7.1	7.2
Ethiopia	30.0	25.6	23.8	22.0	20.8	19.9	18.6	17.7	17.0
Kazakhstan	10.3	9.0	9.8	9.7	9.9	8.9	9.1	9.4	8.7
Kyrgyzstan	9.6	8.8	8.4	9.0	8.9	7.9	7.6	8.6	10.8
Lao People's Democratic Republic	5.7	4.6	4.3	3.6	3.4	3.2	3.1	2.8	2.6
Lesotho	7.2	11.0	10.8	10.4	12.0	11.8	11.6	11.1	11.0
Republic of Moldova	14.3	12.3	11.6	11.0	10.1	10.2	10.2	9.4	9.3
The former Yugoslav Republic of Macedonia	6.0	5.9	5.8	5.7	5.4	5.1	5.0	5.3	5.1
Mali	4.7	3.7	3.5	3.5	3.4	3.3	3.2	3.2	3.3
Mongolia	10.7	8.6	8.8	8.5	7.8	8.2	8.2	7.3	7.1
Malawi	13.8	13.3	13.1	12.3	11.8	10.7	10.5	10.1	10.2
Niger	11.6	8.1	7.0	6.6	5.6	6.3	6.2	6.8	6.3
Nepal	9.3	8.9	8.6	8.4	8.2	8.1	8.0	8.0	7.3
Paraguay	5.0	4.7	4.6	4.5	4.4	4.7	4.5	4.3	4.5
Rwanda	8.6	8.8	8.5	8.2	7.6	7.5	7.3	6.0	5.6
Swaziland	8.7	7.5	8.2	8.1	8.2	7.8	7.7	7.9	7.8
Chad	8.0	4.3	4.3	4.3	4.3	4.2	3.7	3.8	3.6
Tajikistan	12.3	8.4	8.1	8.0	7.1	5.9	5.7	5.3	5.1
Turkmenistan	25.9	26.0	24.0	24.6	21.7	18.0	18.8	17.8	16.6
Uganda	15.7	12.6	11.7	11.1	10.5	10.0	9.7	9.2	9.1
Uzbekistan	34.8	24.7	23.5	21.3	20.4	16.8	15.1	15.3	14.4
Zambia	12.3	11.3	11.0	10.3	10.1	9.8	9.4	9.2	9.0
Zimbabwe	13.3	18.8	19.8	20.0	22.4	21.4	19.6	18.0	17.5

Source: UNSD SDG Indicators Global Database

[7] A **nominal** measure of **GDP** does not account for changes in the relative purchasing power of a good across time; it ignores inflation and deflation. **Purchasing power parity** (**PPP**) compares how many goods and services an exchange-rate-adjusted unit of money can purchase in different countries.

Annex 5. Renewable Energy Production in LLDCs

COUNTRY	RENEWABLE ENERGY	PRODUCTION (GWh)								
		2006	2007	2008	2009	2010	2011	2012	2013	2014
Afghanistan	Hydropower	458	458	486	715	693	548	647	746	836
	Solar Energy								1	1
Armenia	Hydropower	1,825	1,853	1,797	2,019	2,556	2,489	2,322	2,173	1,992
	Wind Energy		3	2	4	7	3	4	4	4
	Solar Energy	0	0	0	0	0	0	0	0	0
	Bioenergy	..								
Azerbaijan	Hydropower	342	8,230	9,104	9,103	9,457	10,592	12,153	13,262	14,614
	Wind Energy				2	1			1	2
	Solar Energy		0	0	0	0	0	0	1	1
	Bioenergy								134	174
Bhutan	Hydropower	3,355	6,422	7,158	6,923	7,328	7,067	6,826	7,550	7,147
	Solar Energy	0	0	0	0	0	0	0	0	0
Bolivia	Hydropower	2,131	2,294	2,280	2,264	2,151	2,324	2,322	2,515	2,233
	Wind Energy					0	0	0	0	8
	Solar Energy									0
	Bioenergy	50	64	89	105	102	113	114	140	116
Botswana	Solar Energy							2	2	2
Burkina Faso	Hydropower	81	111	136	132	118	82	97	106	90
	Solar Energy	2	2	3	4	5	8	8	9	10
	Bioenergy	..								
Burundi	Hydropower	93	117	112	117	124	128	139	138	161
	Solar Energy	0	0	1	1	1	1	2	3	3
Cent African Rep	Hydropower	140	137	137	136	135	147	150	155	155
	Solar Energy	0	0	0	0	0	0	0	0	0
Chad	..									
Ethiopia	Hydropower	3,259	3,385	3,296	3,524	4,931	6,262	7,388	8,338	6,817
	Wind Energy						29	192	356	526
	Geothermal			14	24	18	8	16	17	17
Kazakhstan	Hydropower	7,700	8,200	7,400	6,800	8,022	7,900	7,600	7,731	8,263
	Wind Energy							4	5	13
	Solar Energy								1	1
Kyrgyzstan	Hydropower	13,653	14,004	10,759	10,098	11,255	14,309	14,179	13,097	13,298
Lao PDR	Hydropower	3,609	3,370	3,678	3,384	13,470	13,503	15,642	15,659	17,434
	Solar Energy							0	0	0
	Bioenergy								5	5
Lesotho	Hydropower	483	509	505	507	502	491	490	520	525
	Solar Energy								0	0
Malawi	Hydropower	1,346	1,373	1,608	1,754	1,833	1,912	1,901	1,831	2,054
	Solar Energy	0	0	0	1	1	3	3	6	6
	Bioenergy	44	45	49	46	45	45	50	52	51
Mali	Hydropower	650	658	666	851	695	727	783	978	974
	Solar Energy	1	2	2	2	3	3	6	8	8

Mongolia	Hydropower	4	4	5	20	35	53	52	64	69
	Wind Energy	1	1	1	1	1	1	1	53	125
	Solar Energy								1	1
Nepal	Hydropower	1,599	1,788	1,837	1,882	2,152	2,163	2,401	2,292	2,321
	Solar Energy	8	9	11	12	17	23	30	38	48
Niger	Solar Energy	2	2	2	2	3	4	6	7	8
Paraguay	Hydropower	53,773	53,714	55,455	54,939	54,065	57,624	60,232	60,378	55,276
Republic of Moldova	Hydropower	377	377	389	358	407	352	269	310	312
	Wind Energy								1	1
	Solar Energy								0	1
Rwanda	Hydropower	38	42	72	99	112	149	182	148	194
	Solar Energy	0	0	0	0	0	0	0	0	13
	Bioenergy	1	2	1	2	2	2	2	2	2
South Sudan	Solar Energy							0	0	0
Swaziland	Hydropower	159	174	163	248	290	337	275	243	244
	Solar Energy	0	0	0	0	1	1	1	1	1
	Bioenergy	151	155	142	125	178	259	285	276	320
Tajikistan	Hydropower	16,700	17,114	15,800	15,900	16,400	16,200	16,900	17,071	16,312
TFYR Macedonia	Hydropower	1,649	1,009	840	1,271	2,432	1,433	1,040	1,584	1,207
	Wind Energy									71
	Solar Energy					0	1	3	9	14
Turkmenistan	..									
Uganda	Hydropower	1,239	1,412	1,467	1,281	1,605	1,691	1,725	1,946	2,013
	Solar Energy	8	12	18	22	23	26	27	29	31
	Bioenergy	49	47	55	66	156	125	160	192	282
Uzbekistan	Hydropower	9,160	6,400	11,360	9,330	10,846	10,240	11,210	11,560	10,310
	Solar Energy								1	1
Zambia	Hydropower	8,984	9,732	9,801	10,364	10,435	11,483	12,351	13,282	14,043
	Solar Energy	1	1	2	2	2	2	2	2	3
	Bioenergy	39	39	34	54	64	63	67	66	71
Zimbabwe	Hydropower	5,311	5,384	5,707	5,458	5,800	5,202	5,388	4,983	5,403
	Solar Energy	1	2	2	2	3	4	5	6	7
	Bioenergy	126	126	126	130	130	148	158	173	148

Source: IRENA, 2016

Notes:1. Figures between 0 and 0.5 are shown as "0".

2.Data of Chad and Turkmenistan are not available, shown as "..".

Annex 6. Distributed Renewable Energy Markets and Installed Capacities in LLDCs: Examples

COUNTRY	TECHNOLOGY/ SYSTEM	CAPACITY ADDED IN 2014	CUMULATIVE AT END-2014	ADDITIONAL INFORMATION (including programme, financing partner and project developer)
Bhutan	Biogas systems	581 units	1,420 units (2013)	Implemented by SNV under an ADB-funded project
Bolivia	Solar PV (pico)	260 units	260 units	Implemented under the EnDev Programme
	Solar lanterns		5,705 units	Implemented under the Household and Social PV Systems Global Partnership Output Based Aid (EDAU-GPOBA)
	Biogas systems		500 units	Implemented under the EnDev Programme
	Improved cookstoves		44,400 units	Implemented under the EnDev Programme
Burkina Faso	Solar home systems	159 kW_p	342 kW_p	- 3,365 people electrified - Installed by ARE members (FRES)
	Solar lamps	3,000 units	3,325 units	Implemented under the SNV-funded Pico PV for Africa Project
	Solar PV (pico)	21,352 units		Implemented under a joint GOGLA and World Bank project
	Hybrid mini-grid (PV/diesel)		45 kW_p	- Three hybrid PV-diesel mini-grid projects, each with an installed capacity of 15 kW_p (as of July 2014)
	Biogas digesters	1,448 units	5,462 units	- 4,741 households - Implemented by SNV/HIVOS under the African Biogas Partnership Programme funded by the Directorate General for International Cooperation, Netherlands
	Improved cookstoves	24,500 units	124,700 units	Implemented under the EnDev Programme
	Improved cookstoves	845 units	966 units	- For productive use in agricultural SMEs - Implemented under the SNV-funded
Burundi	Solar lanterns	250 units	500 units	Consolidated at country level
	Solar PV (pico)	5,300 units	9,800 units	Implemented under the EnDev Programme
	Improved cookstoves	900 units	1,700 units	Implemented under the EnDev Programme
Ethiopia	Solar PV		5 MW	- 60% installed for rural telecom applications, 20% for water pumping, and 20% for solar home systems

	Solar PV (pico)	44,300 units	71,700 units	Implemented under the EnDev Programme
	Solar PV (pico)	580,930 units		Implemented under a joint GOGLA and World Bank project
	Solar water pumping		15 units (2012)	Implemented by Plan International under the ACP–EU Energy Facility
	Solar lanterns		9,000 units	Installed by ARE members
	Solar powerpacks		500 kWp	- 1,500 people electrified - Installed by the ARE network
	Solar home systems	1,600 units	3,200 units	Implemented under the EnDev Programme
	Solar home systems		500 units	Installed by ARE members systems
	Biogas digesters	1,465 units	10,678 units	- 3,136 households from 2012 to 2014 - Implemented by SNV/HIVOS under the DGIS-funded Africa Biogas Partnership
	Improved cookstoves	15,100 units	352,200 units	Implemented under the EnDev Programme
	Improved cookstoves	3,200 units	3,200 units	Implemented under the SNV-funded Integrated Renewable Energy Services
	Improved cookstoves	19,046 units	32,246 units	- 32,246 households - Implemented under a project funded by OPEC Fund for International Development (OFID) and SNV
Lao PDR	Biogas systems		2,888 units	Implemented by SNV under a DGIS-funded project
Lesotho	Solar home systems		1,537 units	Implemented under the Lesotho Renewable Energy Based Rural Electrification Programme (closed in
Malawi	Solar water heaters		1,500 units	Implemented under the EnDev Programme
	Isolated home systems		700 kW_p	- Off-grid units that range from 20 kW to 240 kW
	Improved cookstoves	10,200 units	14,400 units	- Solar home systems and mini-grid providing electricity to 6,314 people - Installed by ARE members
Mali	Solar PV		13 units	- Off-grid units that range from 20 kW to 240 kW - Consolidated at country level
	Solar PV		902 kW_p	- Solar home systems and mini-grid providing electricity to 6,314 people - Installed by ARE members
	Solar PV		2 units	- Off-grid systems installed in schools - Implemented under a Plan

	Solar PV (pico)	700 units	1,800 units	Implemented under the EnDev Programme
	Solar lamps	2,275 units	2,867 units	Implemented under an SNV-funded project
	Solar water heating systems		3 kW_p	Implemented under a Plan International project
	Solar kiosks	9 kW_p	30 units	Recharging stations implemented by Plan International under the ACP-EU Energy Facility Programme
	Solar home systems	86 kW_p	280 kW_p	- 2,286 systems installed - Installed by FRES
	Isolated home systems		216 kW_p	Consolidated at country level
	Mini-grids (solar)		622 kW_p	Installed by FRES
	Hybrid mini-grid (PV/diesel)		2.1 MW	- 21 hybrid mini-grids installed - Consolidated at country level
	Improved cookstoves	17,529 units	25,459 units	- Domestic and productive stoves - Implemented under the SNV-funded
	Improved cookstoves		3,100 units	Implemented under a Plan International project
Mongolia	Solar PV		100,000 households	Implemented under the 100,000 Solar Ger project
Nepal	Mini-grid (hydro)	500 kW_p	600 kW_p	Implemented under the EnDev Programme
	Hybrid mini-grid (solar and wind)	7 kW_p		- 5 kW_p from wind turbines and 2 kW_p from solar PV
	Biogas systems	35,108 units	70,526 units	- 70,526 households - Implemented by SNV under the DGIS-funded Biogas Program
	Improved cookstoves	19,046 units	32,246 units	- 32,246 households - Implemented under a project funded by OPEC Fund for International
Niger	Solar PV		4 MW	Consolidated at country level
	Solar lamps	7,600 units		Implemented under an SNV-funded project
	Mini-grid (solar)		27.5 kW_p	- 105 households electrified and electricity for productive use - Implemented by Plan International
Rwanda	Solar PV (pico)	80,111 units		Implemented under a joint GOGLA and World Bank project
	Solar home systems	400 kW_p		- 4,000 installations; 21,200 people electrified

	Mini-grid (hydro)		1,000 kW_p	Implemented under the EnDev Programme
	Hybrid mini-grid (PV/diesel)		50 units	- 50 minigrids of 3–6 kW_p for health care centres
	Biogas systems	200 units	1,700 units	Implemented under the EnDev Programme
	Improved cookstoves	24,769 units	24,769 units	- Clay-based, efficient Canarumwe stoves - Implemented by SNV under the World
Uganda	Solar PV (pico)	5,900 units	14,000 units	Implemented under the EnDev Programme
	Solar PV (pico)	70,022 units		Implemented under a joint GOGLA and World Bank project
	Solar kits	200 units	200 units	Implemented by Oolux under a REPIC co-funded project
	Solar kits	130 units	130 units	Implemented by Oolux under a SYMPHASIS co-funded project
	Solar home systems	600 units	1,700 units	Implemented under the EnDev Programme
	Solar home systems	114 kW_p	544 kW_p	- 3,482 people electrified - Installed by ARE members (FRES)
	Isolated home systems		400 kW_p	- 15,000 systems installed - Consolidated at country level
	Hybrid mini-grid		5 kW_p	Consolidated at country level
	Improved cookstoves	5,200 units	12,400 units	Implemented under the EnDev Programme
	Improved cookstoves	3,847 units	3,847 units	Implemented under the SNV-funded International Renewable Energy Services
	Biogas digesters	527 units	5,695 units	- 3,793 households - Implemented by SNV/HIVOS under the
Zimbabwe	Solar powerpacks		550 kW_p	- 1,650 residents electrified - Installed by ARE members
	Solar lamps	25,000 units	25,803 units	Implemented under an SNV-funded project

Source: REN 21, 2015

Annex 7. Selected Examples on Energy Efficiency in LLDCs

COUNTRY	ENERGY EFFICIENCY
Armenia	According to the National Program on Energy Saving and Renewable Energy (ESRE) supported by USAID, the potential for energy efficiency (EE) savings in Armenia is large, including 40% in building sector, 35-40% in food industry, while optimization of lighting was estimated to save 475 million kWh over the next 10 years. The Commercialization of Energy Efficiency Program (CEEP) was implemented by Advanced Engineering Associates International (AEIA) from 2007-2010, with the overall budget of around US$3 million to facilitate private provision of long-term financing for energy efficiency projects and to implement a limited number of socially-oriented energy efficiency projects.
Azerbaijan	The Azerbaijani Government has adopted the State Programme for the Development of the Fuel and Energy Sector (2005–2015), which targets the reduction of losses and prevention of theft and the inefficient use of energy in order to cover the electric power and natural gas demands. It is stated that full payment of the cost of the electricity and natural gas consumed is one of the factors that would ensure the efficient use of these resources. Although the government sets the targets for an energy efficient economy, there is no law or secondary legislation specific to EE activities.
Bhutan	Bhutan has one of the highest per-capita electricity consumptions in South Asia, at 1,174 kWh in 2005. Per-capita energy consumption was 0.62 toe in 2005. The government has recognised the need for energy efficiency in Bhutan's energy sector, and improvements in efficiency and energy conservation standards for the building sector are being promoted by the government, particularly in terms of lighting and ventilation.
Bolivia	Energy Efficiency levels are relatively good in Bolivia, an example is the saving of about 100 megawatts (MW) from the use of energy-saving light bulbs following a 2008 campaign to replace traditional incandescent bulbs.
Botswana	The scale-up of the public transport system as an alternative to using private cars presents opportunities for an efficient urban transport system in Botswana. This thinking permeates the draft Botswana Integrated Transport Policy. The options vary from the sophisticated rapid bus transport system to elementary changes such as dedicated lanes for mini buses and increased signage (at bus stops) depicting which bus-route passes where. With signage integrated with branding and advertisement, these can be done through private sector with no costs to the municipalities. The National Development Plan for 2010-2016 targets decentralising some transport functions to local authorities to allow for increased focus on such elements as non-motorized transport. In the area of energy efficiency, the Government of Botswana, with the support of the World Bank, is developing an energy efficiency strategy. The exercise started in November 2015 and six goals have been set. The goals are (a) improving the availability of information and awareness of potential benefits of energy efficiency; (b) building capacity and improving coordination around energy efficiency in key institutions; (c) promoting energy efficiency in new and existing housing; (d) promoting energy efficiency in new and existing government buildings and institutions; (e) promoting energy efficiency in new and existing industrial facilities;

	and (f) keeping local institutions informed of local, regional and international developments regarding the feasibility of implementing different energy efficiency incentives.
Burkina Faso	With household energy needs predominantly being met with traditional biomass fuels, the potential for efficiency in the residential sector is high. The construction and sale of energy-efficient stoves for cooking has been successful in reducing biomass demand, a project run by German Technical Assistance (GTZ) and Foyers Améliorés au Burkina Faso (FAFASO). Energy efficiency projects have also been run in the beer brewing sector, financed by the Global Environmental Facility (GEF).
Lesotho	As laid out in Lesotho Energy Policy (2015-2025), government will promote energy efficient practices and equipment in all sectors of the economy. Strategies: a) Implement demand side management programmes and projects b) Introduce a metering system and tariff structure that will support energy efficiency and demand side management c) Discourage the use of intensive energy use devices and promote the use of energy efficient technologies d) Carry-out dissemination campaigns on wise use of energy e) Promote the adoption of renewable energy technologies that reduce total end-use electricity consumption f) Implement energy efficiency programmes in buildings g) Introduce incentives to support energy efficiency programmes and activities h) Support applied research and development in energy efficiency programmes and activities i) Develop specific principles for the policy statement
Tajikistan	A new Law on energy efficiency and energy saving was adopted on 19 September 2013. The law stipulates the legal and organisational framework for energy efficiency and provides for the introduction of energy efficiency materials, appliances and technologies. The law has provisions for introducing mandatory energy audits, establishing procurement procedures that incorporate criteria on energy efficiency, and requirements for energy use in buildings and household appliances, etc. Currently, Government financing is not available for energy efficiency activities and projects in Tajikistan. The establishment of the National Energy Efficiency Fund envisaged in the new Law on energy efficiency and energy saving energy; furthermore, this framework is expected to be capitalised with the support of donors and international financial institutions as well as with national budget allocations.
Uganda	The Promotion of Renewable Energy and Energy Efficiency Programme (PREEEP) is a key project by the Ministry of Energy and Mines in collaboration with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), to promote energy efficiency and renewable energy. The government is also promoting the use of energy saving bulbs by distributing approximately 800,000 of them to low-income households. The Energy Advisory Project, also funded through the GTZ, aims to provide energy users with information about energy efficiency, as well as promote the use of efficient equipment and appliances in manufacturing and at home, and assess the benefits that improved efficiency could have on the transport and agricultural sectors, particularly in terms of maintenance of fleet vehicles and auditing of agricultural businesses. Efficiency standards-setting is another goal of the project. The Energy

	Advisory Project goals have recently been incorporated into the PREEEP, and as such continue to be pursued. The government, under the recently-implemented Renewable Energy and Energy Efficiency Policy, acknowledges a number of key areas where energy efficiency could be improved, by the policy's goal date of 2017. These include increasing solar water heater installations to 30,000 m2, and implementing industrial energy auditing and the dissemination of efficient equipment to industries.
Zimbabwe	Through the draft national energy policy, the government plans to ensure efficient utilization of energy resources. The International Energy Initiative has previously run programs to promote the efficient use of energy, most notably the Zimbabwe Energy Efficiency Project (ZEEP). Under ZEEP, industrial efficiency has been increased and efforts were undertaken to produce government standards for efficient appliances and equipment, for example, lighting, water heaters and refrigerators. Transmission and distribution losses in the country are considerably lower than in many African nations, standing at approximately 11%. Demand-side efficiency could be further encouraged in the country, as electricity tariffs remain amongst the lowest in Africa, at roughly US$ 0.06/kWh, due to heavy subsidies. The low non-technical losses in the transmission and distribution system have been attributed to the exceptionally low power tariffs.

Source: Clean Energy Info Portal-Reegle, 2016, The World Bank, 2009

Annex 8. Public Renewable Energy Finance Flows (USD million) in LLDCs

COUNTRY	2009	2010	2011	2012	2013	2014
Afghanistan	2	8		3		
Armenia				25	25	24
Azerbaijan	..					
Bhutan					105	121
Bolivia	101				96	74
Botswana	..					
Burkina Faso					30	32
Burundi					46	217
Central African Republic	..					
Chad	..					
Ethiopia		60				190
Kazakhstan				96	91	79
Kyrgyzstan						110
Lao PDR	40				57	287
Lesotho						15
Malawi	..					
Mali	85	34	2	1	25	1
Mongolia				76		
Nepal				3	414	261
Niger						1
Paraguay	..					
Republic of Moldova			93			
Rwanda					211	13
South Sudan	..					
Swaziland						1
Tajikistan					136	50
TFYR Macedonia	..					
Turkmenistan	..					
Uganda	150		3		31	160
Uzbekistan					110	
Zambia				158		242
Zimbabwe	..					

Source: IRENA, 2016

Notes: This table presents an overview of investment transactions for renewable energies from selected public financial institutions.