BOSTON UNIVERSITY Global Economic Governance Initiative

GEGI WORKING PAPER 010 • 11/2016

Renewable Energy Investment in Africa and Nationally Determined Contributions (NDCs)

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ABSTRACT

The Paris Agreement marked the beginning of a new international bottom-up approach to climate change where all countries submit Nationally Determined Contributions (NDCs). Of the 54 African nations, all but Libya have submitted INDCS.[1] NDCs typically contain a combination of contributions conditional to international support and unconditional, that is, contributions that countries intend to implement regardless of international assistance. To date, and including existing plans, 28 African countries have stated an explicit unconditional cumulative contribution of at least 102 GW of renewable energy generation capacity by 2030. This represents an investment opportunity of more than USD 241 billion. While this figure equals a yearly investment equivalent to 1% of current GDP till 2030, the underlying assumption is that unconditional contributions by African countries provide a strong indication of renewable energy investments that are likely to be realized, if not surpassed. Financing over USD 241 billion of renewable energy investments in Africa is both a challenge and an opportunity for governments, the private sector, international development partners and international finance institutions. Nearly 50 multilateral funds and instruments are identified that can play a potential role in financing renewable energy in Africa for the next decade.

1 Initially submitted as "Intended Nationally Determined Contributions," INDCs become NDCs for countries that have ratified the Paris Agreement after entry into force on 4 November 2016.

Introduction

Following the Paris Agreement, *Intended Nationally Determined Contributions* (INDCs) have become the building blocks of the international climate change architecture and are likely to remain so for at least the decade to come. Renamed *Nationally Determined Contributions* (NDCs)[2] after ratification and entry into force of the Paris Agreement on 4 November 2016, NDCs outline the intended actions from a nation to respond to climate change, including mitigation, adaptation and other measures. Typically, most developing country NDCs comprise conditional contributions, contingent upon international support, and unconditional contributions that the country intends to carry out regardless.

To date, most NDC analyses have focused on the greenhouse gas (GHG) reduction potential of NDCs, as well as the potential cost of implementation of conditional contributions (UNFCCC 2016, USAid 2016). Instead, this research seeks to analyze NDCs from a sectoral investment perspective. Given that the great majority of NDCs comprise renewable energy contributions of one kind or another, many of them unconditional, NDCs contain a *de facto* roadmap of future renewable energy investment, much of which will ultimately come from the private sector. Additionally, many developing country NDCs contain rural-development and pro-poor renewable energy contributions, such as the electrification of rural areas with standalone PV systems and mini-grids, or sustainable use of biomass.

This paper analyzes the 53 Africa NDCs submitted to the UNFCCC (virtually all African countries except Libya), in order to quantify the renewable energy investment embodied in those contributions. For the countries most active in renewable energy development in Africa, the contributions contained in their NDCs have been complemented with ongoing renewable energy deployment and goals included in national plans. In this article we also identify international multidonor public funds that are active in renewable energy project finance in Africa, and highlight the importance of energy access and its inclusion in NDCs. The legal and regulatory environment, although crucial for renewable energy development in Africa, is not within the scope of this paper.

This paper is organized as follows. First there is a brief introduction to Nationally Determined Contributions with particular attention to the context, history and structure of African NDCs. Section two describes the methodology used to quantify renewable energy contributions. Section three contains a country-by-country description of renewable energy contributions included in NDCs, and quantification of those commitments in terms of capacity and investment. Table 2 summarizes the findings of this section. Section four discusses energy access in NDCs. Section five identifies multidonor public funds active in renewable energy project finance in Africa, as well as the main renewable energy finance mechanisms. Section six discusses the results from the

2 Hereafter, the term NDC shall be used throughout this paper when referring to either NDCs or INDCs.

perspectives of technology, costs, feasibility, and financing. The conclusions highlight the challenge and opportunity of NDCs for renewable energy investment in Africa and the way forward.

1. NDCs and Africa

In 2013, when the shape, form or whether there would be a Paris Agreement in 2015 was far from certain, the 19th Conference of the Parties (COP 19) of the United Nations Framework Convention on Climate Change (UNFCCC) decided to invite parties to initiate work on intended nationally determined contributions in the context of adopting an agreed outcome with legal force under the Convention applicable to all Parties by COP 21.[3]

The intended nationally determined contributions were intended as the new building blocks of international action on climate change, including developing and developed countries. They were supposed to be communicated in a manner that facilitates the clarity, transparency and understanding of the intended contributions, and contain mitigation and adaptation[4] contributions. In the case of developing countries, NDCs often contain a combination of contributions conditional to international support and unconditional, that is, contributions that countries intend to implement regardless of international assistance.

A total of 163 NDCs have been submitted at the time of writing, including those of 53 African nations. Gabon was the first African country to submit an NDC on 1 April 2015, and Angola was the last[5] on 29 November 2015.

African NDCs are very heterogeneous in terms of content, structure and format. The African NDCs' diversity reflects in part Africa's heterogeneity itself, with large differences on aspects such as economic development, country size, culture, geography and climate, emissions, resources, governance and capabilities. But it is also important to highlight that NDCs were submitted before COP 21, before the Paris Agreement was negotiated. Hence, NDCs also had a potential use as a bargaining chip in climate negotiations. As such their diversity is also partly due to different negotiation priorities and tactics from African countries. Finally, the lack of specific guidelines, methodologies and templates was another relevant factor towards heterogeneity. One of the main consequences of this heterogeneity is that NDCs are not readily comparable among countries.

This paper focuses on a sectoral contribution of African NDCs towards renewable energy. On that score, NDCs range from the very detailed, down to specific projects with technical and economic descriptions, to the very vague with generic declarations of intentions. Some have energy contributions, or for the electricity sector, or sectoral renewable energy targets. For example, the

3 UNFCCC Decision 1/CP.19

4 Adaptation was included as an element of INDCs in 2014 as per UNFCCC Decision 1/CP.20

5 While Rwanda submitted a revision to its INDC on 2 December 2015, it had already made its INDC submission previously.

Republic of Congo plans 70% renewable energy for the mining sector by 2025.

While renewable energy is generally considered a mitigation contribution, it is important to note that many countries include renewable energy components in their adaptation plans to adapt to, for example, reduced thermal efficiency of conventional power plants, water availability for hydropower and cooling, increased demand, and biomass management. African countries that have renewable energy as adaptation contributions include Nigeria, Mali, Tanzania, and Uganda.

For some countries, the lack of detailed information on renewable energy projects is an interesting choice. This is illustrated for example by the case of Tanzania, although it applies to others as well. Tanzania's NDC just calls for "promotion of […] renewable sources such as geothermal, wind, solar and renewable," with no further detail. However, in the SE4All Action Agenda, Tanzania states that it plans for over 3.2 GW of renewables. The Tanzanian *SE4All Investment Prospectus*,[6] submitted only two months after its INDC submission, includes details for six specific hydro, wind and geothermal projects, as well as an investment opportunity of USD 174 million for rural electrification with renewables. The reasons for such difference are probably related to negotiation tactics, as already noted, although anecdotal evidence suggests that at least in some cases there may have been issues relating to internal coordination among ministries.

2. Methodology

The main objective of this article is to quantify in monetary terms the investment opportunities associated to unconditional renewable energy contributions included in African NDCs. These are summarized in Table 2 in the next section. Given the voluntary nature of NDCs, as well as the coexistence of conditional and unconditional commitments, the underlying assumption is that unconditional commitments by African countries regarding renewable energy provide a strong indication of likely renewable energy investments.

To achieve this objective, a number of assumptions and approximations are necessary. In most cases, renewable energy contributions within NDCs are expressed in terms of capacity (MW), either as an aggregated number or detailed per technology / project. For some countries, contributions are instead expressed in terms of projected investment costs, and in some cases, both in terms of cost and capacity. In Cape Verde the contribution is expressed in terms of generated energy (GWh). Unless noted otherwise, all figures are for 2030.

In building Table 2, those contributions expressed in terms of cost or investment have been used directly, with any additional information regarding installed capacity added to the table

6 Downloaded from: http://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_IPs/Tanzania_IP_EN_Released.pdf

for illustrative purposes only. In some cases, such as in Chad, Republic of Congo, and Tunisia, the unconditional contribution is stated as a percentage of the conditional contribution. Eritrea and Niger present aggregated costs for their unconditional mitigation contributions, including renewable energy and other items. For those countries, an allocation was made based on estimated weights of mitigation measures. When needed, the following exchange rates, prevailing when NDCs were submitted were applied: 1 Euro (€) = 1.15 USD; 1 USD = 13 RAND (ZAR).

The majority of contributions, however, are expressed in capacity terms. To translate them into investment, the technology costs estimated in Table 1 have been used. These figures have been compiled mainly from the International Renewable Energy (IRENA) publications on renewable energy costs in Africa, as well as from the NDCs themselves. When national cost information was available, that was used.

Table 1: Estimated technology costs

	USD / W	**Country-specific**
Wind	2.2[+]	Angola 1.3[++],
Solar PV	2*	Angola 1.5[++],
Solar CSP	4[+++]	
Hydro	2.5	
Large Hydro	1.5[+]	Angola 1.4[++], Ethiopia 0.66[++],**,
Small Hydro	3.8[+]	Angola 4.5[++],
Geothermal	2.5[+++]	
Bioenergy	2***	Angola 3.39[++],
Unspecified Renewables	2.2	
Solar Home System <1kW	10	
Solar Mini-grid	50kW, USD 4/W*	
Household biodigester	USD 1800[a]	
Solar water heater	300	

[+] Regional average for Africa (IRENA 2015); [++] As per NDC, [+++] non-OECD average (IRENA 2015); * (IRENA 2016), **Stated cost of 6GW Grand Renaissance project is USD 4 bn, [a] from Lesotho NDC, *** (IRENA 2015)

In the case of Cape Verde, it was assumed that 880 GWh/yr would be generated from 75 MW solar PV and 150 MW wind.

Several countries include plans for energy recovery of municipal solid waste (incineration). This has not been considered a renewable energy resource for this analysis, whereas electricity generation from landfill methane recovery has been considered.

Biofuels are not considered in this analysis. While a few countries, such as Malawi, have expressed unconditional biofuel contributions, in the range of some million liters, these contributions are relatively small and lack detail regarding manufacturing capacity, infrastructure or investment.

Upon analyzing the contributions of the 53 African NDCs, it was found that several countries in the region known to be actively pursuing the deployment of significant amounts of renewable energy had not reflected their renewable energy contributions in their NDCs. This was the case for Algeria, Egypt, Ethiopia, Kenya, Morocco, Nigeria, South Africa, and Tanzania. For those countries, the information from NDCs was complemented with data from relevant official sources. Some NDCs make no clear mention of the conditionality or not of the contributions. For those cases, the country description also makes no mention as to whether contributions are conditional or not.

3. Renewable energy contributions in African NDCs

This section describes and summarizes the renewable energy contributions included in Africa's NDCs. Of the 53 submitted NDCs, all but Botswana's NDC mention renewable energy contributions, with quantitative figures in 46 of them. Mauritius, Mozambique, Sierra Leone, South Sudan, Tanzania and Zambia only include generic goals as part of their renewable energy contribution.

Table 2 below summarizes the estimated renewable energy investment and renewables capacity for 28 countries as contained in their unconditional NDC contributions or national plans.

Table 2 is followed by a country-by-country summary of the renewable energy contributions as found in NDCs submitted to the UNFCCC.[7]

7 Complemented with data from relevant official sources as explained in the methodology for Algeria, Egypt, Ethiopia, Kenya, Morocco, Nigeria, South Africa, and Tanzania.

Table 2: Country Renewable Energy Contributions and Estimated Investment

	TOTAL USD million	Total RE (MW)	PV (MW)	Hydro (MW)	Wind (MW)	Other renewable energy
Algeria	9708	4525				4010 MW solar and wind 515 MW biomass and geothermal
Angola	1194	860		760	100	
Benin	191	33	20			1 million solar PV lamps (13 MW)
Burkina Faso	918		√	√		√
Cabo Verde [e]	480	810 GWh/yr				
Chad	200		√		√	
Congo, Rep.	52		√	√		√
Djibouti	3632	1510	250		60	1200 MW geothermal
Egypt	20680	8520	220		7200	1100 MW CSP
Eritrea [e]	300					
Ethiopia	18687	14492	300	11660	1224	731 MW biomass 577 MW geothermal
Gambia	77	35				
Guinea	1635		5[e]	330	5[e]	
Kenya	23845	11150	1200	3000	1500	5450 MW geothermal 10 MW biomass
Lesotho	364					
Malawi	883	353	2	351		20 million liters biofuel 2000 solar water heaters
Mauritania	10		√			2000 PV water pumps
Morocco	24105	10090	3350	1330	4200	1210 MW CSP
Niger [e]	100					
Nigeria[1]	81570	25840	18000	5900	800	1100 MW bioenergy 1000 MW CSP
Senegal	1137	454	160	144	150	27500 biodigesters 392 hybrid mini-grids
Seychelles	191		90			
Somalia	30	15	15			
South Africa	39280	17800	8400		8400	1000 MW CSP
Tanzania	5065	3258	150	2941	100	67 MW biomass
Tunisia	792	381				
Uganda	5400	2471				
Zimbabwe	405			27		1250 biodigesters
TOTAL	**USD 241 bn**	**102 GW**	34.2	26.4	25.7	

[e] Estimated, see methodology.

Algeria's contribution is conditional. It has the target of reaching 27% renewable electricity. Under a yearly 3% electricity demand growth scenario, this translates to about 28.3 TWh of renewable electricity, roughly 57 times Algeria's current renewable energy generation of 388 GWh. The

Algerian Programme for the development of Renewable Energy[8] has the goal of 4.5 GW by 2020, including 4010 MW of solar and wind and 515 MW of biomass cogeneration and geothermal.

Angola has an unconditional contribution of 860 MW of renewables, including 760 MW of large hydro (Cambambe I repowering and Cambambe II) and 100 MW of wind (Tombwa Wind Farm). Under conditional mitigation contributions, Angola identifies 69 specific renewable energy projects amounting to 8491 MW of installed capacity. These include 681 MW of wind, 438 MW of solar, 640 MW of biomass and 6732 MW hydro, for a total estimated investment of USD 11.4 billion. It is interesting to note that Angola considers investments of USD 1.4/W for large-scale hydro, USD 4.5/W for small hydro, USD 1.3 /W for onshore wind, USD 1.5/w for PV solar, and USD 3.39/kW for biomass. Angola also plans on installing 100 MW of solar PV for rural electrification, at an estimated cost of USD 100 million.

Benin's unconditional contributions include 20 MW of solar PV, at an estimated cost of USD 40 million, and 1 million solar PV lamps, at an estimated cost of USD 151 million. Benin's conditional contributions include an additional 20 MW of solar PV at USD 40 million, and 240 MW of hydro at USD 892 million.

Botswana makes no mention of renewable energy in its NDC.

Burkina Faso's unconditional contributions include USD 938 million worth of investments in renewable energy generation, including 18 specific hydro and solar projects, as well as biodigesters. Conditional contributions include USD 175 million worth of hydro, solar, wind and bioenergy investments, and 25000 biodigesters at an estimated cost of USD 137 million.

Burundi's unconditional contribution includes developing three hydro power plants to achieve 35% electrification. Cost estimates and power capacity are unspecified. Conditional contributions include hydro, rural electrification with solar PV and biogas.

Cabo Verde's unconditional contribution includes 30% renewable electricity by 2025, up from current 25%. With an estimated consumption of 2700 GWh/yr in 2025, this equates to 810 GWh/yr.

Cameroon's contribution is conditional. It has the target of reaching 25% renewable electricity by 2035. This includes 284 MW of hydro, biomass and solar projects.

Central African Republic's contribution is conditional. It includes the development of 312 MW of hydro (Dimoli, Lobaye and La Kotto) at an estimated cost of USD 1007 million, and of the solar PV Bangui plant, at an estimated cost of USD 110 million.

8 http://www.energy.gov.dz/francais/index.php?page=energies-nouvelles-renouvelables-et-maitrise-de-l-energie

Chad's unconditional contributions include 10% investment of its conditional contributions. Chad has the objective of 750 GWh/yr of renewable electricity, of which 500 GWh would be hydro imported from Cameroon (requiring a USD 600 million transmission line) and the rest would include 200 GWh/yr from solar (140 MW) and 50 GWh/yr from wind, for an estimated respective cost of USD 2024 million and USD 138 million. Chad also considers developing renewable energies for the agriculture and pastoral sectors at a cost of USD 22 million.

Comoros' contribution is conditional and includes 14 MW of solar PV, 14 MW of geothermal, and hydro.

The Republic of Congo's unconditional commitments include € 45 million worth of hydropower, biomass generation and solar PV lanterns. Its conditional contribution includes 85% renewable electricity by 2025 and € 230 million in renewable energy investments.

The Democratic Republic of Congo's contribution is conditional. It includes USD 2 billion for hydropower and USD 240 million for biomass.

Côte d'Ivoire's contribution is conditional and includes a 42% renewable electricity mix by 2030 of 26% hydro and 16% other renewables, including biomass, biogas and solar PV. Estimated cost is USD 13.3 billion.[9]

Djibouti's unconditional contribution includes 1200 MW of geothermal by 2030 (Lake Assal, Lake Abbé and North Goubet) and, by 2025, 250 MW of solar power (Petit Bara, Ali Sabieh and Goubet) and 60 MW of Wind (Goubet).

Egypt's NDC defines "increased use of renewable energy as an alternative to non-renewable energy sources" as one of the five pillars of mitigation policies. Egypt's National Strategy or the electric power based on diversifying energy sources of production, rationalizing the use of energy and expanding use of renewable energy sources aims at 20% renewable electricity by 2020,[10] by developing 8.5 GW of renewables, including 7.2 GW of wind, 220 MW of solar PV, and 1100 MW of CSP.[11]

Equatorial Guinea's contribution is conditional and it includes hydro development in the Wele river,[12] as well as 8 MW of small-hydro (Musola, Riaba and Bikomo). It also includes electrification of remote islands with solar, wind and ocean energy.

Eritrea's unconditional contribution includes USD 393 million toward mitigation by 2030, which

9 Original figure 8000 billion FCFA. Conversion used 1USD = 600 FCFA

10 http://www.nrea.gov.eg/english1.html

11 http://www.rcreee.org/sites/default/files/egypt_fact_sheet_re_print.pdf

12 Estimated at 200MW from press reports

includes a target of 70% renewable electricity from wind, solar and geothermal by 2030. Total mitigation cost is estimated at USD 1086 million.

Ethiopia notes in its NDC its USD 4 billion investment on the Grand Renaissance Dam of 6 GW. As an adaptation measure, it also plans to expand geothermal, wind and solar generation to minimize the impact of drought on power generation. Ethiopia's 2016 *Second Growth and Transformation Plan (GTP II)* [13] plans for an additional 14.5 GW renewables by 2020, including 11.6 GW[14] of hydro 1.2 GW of wind, 731 MW of biomass, 577 MW of geothermal, and 300 MW of solar.

Gabon's contribution includes reaching 80% of renewable electricity by 2025 through the development of 510 MW of hydro (Grand Poubara I, Fe II, Impératrice, Dibwangui, Ngoulmendjim, and Grand Poubara II). It also envisages solar electrification of rural villages. There is no breakout of Gabon's conditional and unconditional contributions.

The Gambia has an unconditional contribution of solar, wind and hydro estimated at 35 MW[15] by 2025, as well as the use of renewables for light, communications, health facilities, and water pumping. The Gambia's conditional contribution includes an estimated additional 50 MW[16] of solar, wind and hydro power.

Ghana's unconditional contributions do not include renewable energy. Ghana's conditional contributions include small-medium hydro (150-300 MW), solar PV (50-150 MW) and wind (50-150 MW), as well as 55 100-kW mini-grids and 200000 solar rooftop systems. The cost of Ghana's renewable energy contributions is estimated at USD 2214 million.

Guinea's contribution includes 30% renewable energy in the energy mix (including biomass), as well as development of 1650 MW of hydro and 47 MW of solar and wind. The cost of these renewable energy contributions, combined with energy efficiency measures, is estimated USD 8179 million, of which Guinea has raised 20% (USD 1635 million).

Guinea Bissau's contribution is conditional and it includes 80% renewable energy in the energy mix by 2030, including hydro, solar PV and wind.

Kenya's NDC aims at the "expansion in geothermal, solar and wind energy production, other renewables, and clean energy options." As defined in its 2016 Action Agenda[17] Kenya plans on developing 5,5 GW of geothermal, 3 GW of hydro, 1.5 GW of wind and 1.2 GW of Solar PV by 2030.

13 http://dagethiopia.org/new//docstation/com_content.article/100/gtpii__english_translation__final__june_21_2016.pdf
14 GTP II calls for 13817 MW of hydro, of which 2157 MW are already installed.
15 Contribution stated as 78.5 ktCO2eq
16 Originally stated as 121.7 ktCO2eq
17 http://www.se4all.org/sites/default/files/Kenya_AA_EN_Released.pdf

Lesotho's contribution includes 200 MW of renewables: 40 MW of solar by 2018, 35 MW of wind by 2017, and 125 MW of hydro by 2025. Lesotho's unconditional contribution includes USD 364 million worth of investments in renewables, including USD 10 million for rural stand-alone systems and mini-grids. Lesotho's conditional contribution includes USD 957 million worth of investments in overall renewable energy sources as well as specific hydro and wind projects. It also notes 60000 household-size biodigesters at a cost of USD 108 million.

Liberia's contribution is conditional. It includes 30% of renewable electricity and 10% of renewable energy in the primary energy matrix by 2030. It contemplates a 30 MW biomass project and 3.5% biofuels by 2030.

Madagascar's contribution is conditional. It includes increasing renewable electricity from 35% to 79% by 2030.

Malawi's unconditional contribution includes 351 MW of hydro, 20000 solar PV systems, 2000 solar water heaters and 20 million liters of biofuels (bioethanol and biodiesel). Malawi's conditional contributions include 800 MW of hydro by 2020, 50000 solar PV systems, 20000 solar water heaters, 60 million liters of biofuel, and 240 MW of landfill gas power generation.

Mali's contributions include by 2020 two hydro projects (Manantali II and Kénié) worth USD 315 million, and USD 7.2 million worth of rural electrification with renewables by 2020. It also includes a further USD 252 million for large-scale renewables.

Mauritania's unconditional contribution includes rural electrification and 2000 solar water pumps.

Mauritius' contribution is conditional and it includes an unspecified expansion in solar, wind, biomass and other renewable energy sources.

Morocco's contribution includes 42% renewable electricity (14% solar, 14% wind and 14% hydro) by 2020 and 50% by 2025 and 52% by 2030. To meet these targets Morocco plans on developing 10 GW of renewables, including 4560 MW of solar PV, 4200 MW of wind and 1130 MW of hydro by 2030.[18]

Mozambique's contribution makes no explicit mention of renewables contributions.

Namibia's contribution includes increasing renewable electricity from 33% to 70% by 2030 with hydro, solar and wind projects, including Ruacana (hydro) and investments in rural electrification through the government Solar Revolving Fund.

Niger's unconditional contribution includes solar PV for electrification and water pumping. Niger's

18 http://www.mem.gov.ma/SiteAssets/Dicsours/Discours2016/Intervention27Mai16.pdf

overall unconditional mitigation contribution is USD 827 million.

Nigeria's unconditional contribution includes deploying 13 GW of solar PV for rural electrification. While no mention is made in Nigeria's NDC regarding grid-connected renewables, the *National Renewable Energy Action Plans* (ICREEE 2016) plans for a total of 13.8 GW by 2030 representing 45% of installed capacity, up from 960 MW in 2010. These include, 5 GW solar[19] PV, 4.7 GW large hydro, 1.2 GW small hydro, 1.1 GW bioenergy, 1 GW CSP, and 0.8 GW wind.

Rwanda's contribution includes 100 solar mini-grids totaling 9.4 MW, 35000 household-scale and 15 large-scale biodigesters, and an unspecified amount of large-scale solar and hydro development.

Sao Tome and Principe's contribution is conditional. It includes reaching 47% of renewable electricity through the development of 12 MW of solar PV and 13 MW of hydro.

Senegal's unconditional contribution includes 454 MW of renewable energy (160 MW solar PV, 150 MW wind and 144 MW hydro). It also includes 392 mini-grids (hybrid PV/diesel) and 27500 biodigesters. Senegal's conditional contribution includes an additional 665 MW of renewable energy (200 MW wind, 200 MW solar, 55 MW hydro, 50 MW biomass, 55 MW CSP, 115 MW biomass co-generation), as well as 5000 solar mini-grids and 49000 biodigesters.

Seychelles has an unconditional target of 15% renewable electricity by 2030, to be met mostly through the development of 90 MW of solar PV at an estimated cost of USD 191 million. Seychelles conditional target includes an additional 15.7 MW of solar, at an estimated cost of USD 29 million, to meet demand from electric vehicles. It also plans for 80% of household water heating by 2035.

Sierra Leone's contribution is conditional. It calls for the uptake of renewable energy sources (solar, wind, hydro and biomass) particularly in the rural areas.

Somalia's contribution notes 15 MW of solar under development in Mogadishu. Somalia's conditional contribution includes 4.6 MW of hydropower (Fanoole Dam) at an estimated cost of USD 17 million.

South Africa's contribution notes the procurement of 5243 MW of renewable energy projects, with private investment totaling approximately USD 16 billion, with another 6300 MW under consideration. As per the *2010-2030 Integrated Resource Plan (IRP)*, [20] South Africa aims to develop 17.8 GW of renewables by 2030, including 8.4 GW of solar PV, 8.4 GW of wind, and 1 GW of solar CSP. 6276 MW are expected to have reached financial close and or be at different stages of development by the end of 2016.

19 Reportedly USD 2.5 billion of PPAs for solar PV were signed in July 2016 http://www.vanguardngr.com/2016/07/solar-power-devt-investors-commit-2-5bn-14-projects/

20 http://www.doe-irp.co.za/content/IRP2010_updatea.pdf

South Sudan's contribution is conditional. It includes de development of hydro at the Fulla Rapids and solar and wind projects.

Sudan's contribution includes a target of 20% renewable electricity by 2030 with 1000 MW of wind energy, 1000 MW of solar PV, 100 MW of solar CSP, 80 MW of biomass, 300 MW of geothermal, and 50 MW of small hydro. It also includes 1.1 million solar home systems. The estimated cost for this contribution is USD 4.3 billion, of which Sudan is already implementing an unspecified amount.

Swaziland's contribution is conditional. It includes doubling renewable energy in the energy mix by 2030, from 16% to 32%. It also includes a 10% bioethanol blend by 2030.

Tanzania's contribution intends to promote renewable sources such as geothermal, wind, solar and renewable biomass. In its 2015 *SE4All Action Agenda*, Tanzania plans for 3.3 GW of renewables by 2030, including 2941 MW of large hydro, 150 MW of solar, 100 MW of wind and 67 MW of biomass.

Togo's contribution is conditional. It includes a target of 4% renewable electricity and the development of hybrid mini-grids, for an estimated cost of USD 70 million.

Tunisia's contribution includes a 30% renewable electricity target by 2030 (up from 4%), to be reached by 3815 MW including 1755 MW of wind, 1610 MW of solar PV and 540 MW of CSP, for an estimated cost of USD 7.9 billion. Tunisia's contribution also aims at tripling solar water heating to reach 220m^2 of collector per 1000 inhabitants by 2030. Tunisia's unconditional contribution includes 10% of its contribution.

Uganda's unconditional contribution includes 2471 MW of renewable energy by 2030 (hydro, solar, biomass and geothermal), with an estimated cost of USD 5.4 billion over the next 10 years.

Zambia's contribution includes biomass electricity generation, off-grid mini-hydro, solar and wind, as well as biofuels and biodigesters. Zambia's unconditional contribution for both adaptation and mitigation is estimated at USD 15 billion.

Zimbabwe's unconditional contribution includes 27 MW of mini-hydro and 1250 biodigesters (50-80 m^3) by 2030, as well as USD 300 million towards the Kariba hydro power increase of 384 MW (with a total cost estimated at USD 1.5 billion). Zimbabwe's conditional contribution includes USD 5 billion for hydro, USD 3 billion for off-grid solar PV, USD 1.23 billion for solar water heaters, USD 100 million for bioethanol.

4. Energy Access in the NDCs

This paper focuses on investment opportunities for renewable energy, which are largely for grid-connected projects, chiefly solar, hydro, wind, geothermal and modern biomass. As such, energy access contributions other than off-grid electrification with renewables have not been quantified. Nonetheless, it is important to underscore that nearly all analyzed INDCs contain sustainable energy access measures for rural and underserved areas.

Access to modern, sustainable energy is a *sine qua non* for human development, yet 1.1 billion people have no access to electricity, while 2.9 billion cook with polluting, inefficient fuels such as firewood.[21] Electrification rates in sub-Saharan Africa were 35% in 2012 (IRENA 2016). In many African countries there is a widespread use of traditional biomass (e.g. firewood, charcoal) for cooking and other thermal uses. The impacts include from human security, health, poverty and land degradation, to name a few.

The importance of energy access has led, among others, to the establishment of *Sustainable Energy for All*, and is recognized internationally in the UN 2030 Agenda for Sustainable Development through SDG-7 "Ensure access to affordable, reliable, sustainable and modern energy for all."

The energy access contributions found in African NDCs primarily encompass traditional biomass and electrification. Often those measures are included in the adaptation component, as a means to increase resiliency and preparedness.

Contributions on sustainable use of biomass include measures affecting demand, such as improved cookstoves and fuel substitution, and production, such as sustainable forestry practices and land restoration. Contributions regarding charcoal and improved cookstoves have been identified in the NDCs of Angola, Benin, Burkina Faso, Central African Republic, Comoros, Côte d'Ivoire, Gambia, Guinea, Lesotho, Liberia, Madagascar, Malawi, Rwanda, Senegal, South Sudan, Somalia, Swaziland, Togo, Uganda, and Zimbabwe. It is important to note that the use of traditional biomass in many African countries is not only rooted on poverty or cultural tradition (often houses with modern gas appliances still have an "outdoor" kitchen). There is also an economic incentive as well, as in many instances the marginal costs of charcoal are lower than those of modern fuels.

Regarding electrification, it is noteworthy that at least 20 African NDCs make explicit mention to rural electrification with solar PV, be it through mini-grids, solar home systems and solar lamps. With an unconditional commitment of 13GW off-grid solar, Nigeria stands on a league of its own. But other countries have significant contributions as well, such as Angola's 100 MW of off-grid solar, Sudan's one million solar home systems or Benin's one million solar lamps. Some countries

21 SE4all – www.se4all.org

include energy access financing for individuals, such as Namibia's Solar Revolving Fund.[22]

Other less frequent energy access contributions include household level biodigesters and solar water heaters. Lesotho, Senegal, Rwanda and Burkina Faso have plans respectively for 60000, 49000, 35000, and 25000 household level biodigesters. Tunisia and Zimbabwe have measures for solar water heating.

5. Existing options for renewable energy financing in Africa

Access to finance is key to the deployment of renewable energy to meet both NDCs and SDG7. While it is expected that most of the investment necessary will come from private sources, there is a clear role for the public sector. In addition to providing policy and regulations, strengthening institutional capacity and good governance, and providing enabling environments, the public sector can directly incentivize private investment by leveraging public funds through financing mechanisms. Such mechanisms include, for example, grants, preferential loans, syndicated loans guarantees, equity, export credits, pre-investment finance, currency hedging, insurance, and carbon finance, to name a few. Most renewable energy projects in Africa take advantage of not one, but a combination of many public and private finance mechanisms and sources, including national and international. This can be clearly illustrated with the case study of the Turkana 310 MW wind project in Kenya, described in *Box 1*.

22 http://www.mme.gov.na/energy/srf/

Box 1: Financing of the Turkana Wind Project

At an estimated cost of € 662 million, its financing involved a large array of public and private players. **Equity** was provided by private developers, private investors, equipment manufacturers, a capital management fund, and the National Development Funds of Norway (Norfund), Denmark (IFU) and Finland (Finnfund). The lead arrangers of the **syndicated loan** included the African Development Bank (AfDB) and two private banks (Nedbank and Standard Bank from South Africa). Senior debt included **loans** from the following public entities: AfDB, the European Investment Bank (EIB), Dutch Development Agency (FMO), Interact Climate Change Facility (ICCF), Proparco (France Development Agency), US Overseas Private Investment Corporation (OPIC) and the Eastern and Southern African Trade and Development Bank (PTA Bank). It also included private lenders, both with and without **credit guarantees** from export agencies, and an "ethical banking" private lender. **Mezzanine finance** was provided by German Investment Corporation (DEG), East African Development Bank (EADB), PTA Bank and AfDB. **Preferred equity** was provided by a private broker. The project is based on a 20-year power purchase agreement (PPA) with the public utility KPLC, with a **partial risk guarantee** from the AfDB. **Contract insurance** was provided by the African Trade Insurance Agency (ATI), a multilateral African export credit agency specialized in political risk and trade credit risk insurance products. **Carbon finance** included CDM accreditation, with revenues to be shared between the Government of Kenya and a Trust Fund for CSR and local development, which was part of the negotiations to permit the project. Developers sought to increase carbon finance by pursuing Gold Standard accreditation.

Source: Lake Turkana Wind Power Project (LTWP) Seminar on Sustainable Energy Investments in Africa Copenhagen, 24-25 June 2014, UNFCCC

At the national level, National Development Banks (NDBs) can play a role in financing renewables. Mention of the following NDBs is made in the analyzed NDCs: Development Bank of Southern Africa (South Africa); National Investment Bank Ghana; Agricultural Development Bank of Ghana; National Development Bank of Botswana; Rwanda Development Bank; Uganda Development Bank; and Banco Nacional de Investimento, Mozambique.

Several countries note in their NDCs the establishment of dedicated climate/green funds at the national level, such as the Kenya Climate Fund, the Mali Climate Fund, the South African Green Fund, and the National Climate Change Fund of The Gambia, as part of their strategy to finance climate change action. Some countries also have national renewable energy funds, or even technology-specific funds, such as Namibia's Solar Revolving Fund.

Table 3 below lists over 45 public international finance mechanisms active or available for financing renewable energy projects in Africa. *Table 3* refers only to multilateral funds with at least three or more international parties. As such it does not include other important sources of finance, as seen from the Turkana Wind project example above, such as national climate and development funds, private equity funds, pension funds, national development banks (NDBs), export credit agencies,

charities and philanthropy, and national-level specific climate and energy funds. Finance through risk mitigation organizations such as MIGA and ATI-ACA are included in the table.

A key question remains, what can the UNFCCC parties, multilateral development institutions, individual parties and private firms and NGOs do to accelerate the expansion of renewable energy investment in Africa? One area of great interest and relevance is determining the most effective and efficient ways to leverage public funds to incentivize private finance. There is a dearth of methodologies and quantitative analysis regarding *leverage ratios* (the ratio of how much private investment is incentivized by public funds) for the renewable energy sector in Africa, with some reported figures ranging an order of magnitude. Transparency in existing project finance by all involved actors, as well as additional research, methodological and analytical work on the subject by think tanks and multilateral institutions would be a positive development.

Acronym	Name	Contributor(s)	African Scope	Link
AACB	African Association of Central Banks			http://www.aacb.org/
ACTC	Africa Climate Technology Centre	GEF	Sub Saharan	http://www.african-ctc.net/
ACUMEN	Acumen Fund		Kenya, Uganda, Tanzania, Rwanda, Ethiopia, Burundi, South Sudan, Ghana, and Nigeria	http://acumen.org/
ADF	African Development Fund			http://www.afdb.org/en/about-us/corporate-information/african-development-fund-adf/
AEGF	Africa Energy Guarantee Facility	EU, EIB,		http://www.eib.org/projects/pipeline/2012/20120168.htm
AfDB-CIF	Climate Investment Funds	CIF	Africa	http://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/climate-investment-funds-cif/
AREF	African Renewable Energy Fund	PPP	Sub-Saharan Africa minus South Africa	http://www.berkeley-energy.com/ http://www.eib.org/infocentre/press/releases/all/2015/2015-200-development-banks-confirm-multi-million-dollar-backing-for-african-renewable-energy-fund.htm
ATI-ACA	African Trade Insurance Agency		Benin, Burundi, DRC, Kenya, Madagascar, Malawi, Rwanda, Tanzania, Uganda, Zambia	http://www.ati-aca.org/
BADEA	Arab Bank for Economic Development in Africa			http://www.badea.org/
BEAC	Bank of Central African States		Cameroun, Centrafrique, Congo, Gabon, Guinee Equatoriale, Tchad	www.beac.int
BCEAO	Central Bank of West African States		Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, Togo	www.bceao.int
BOAD	West African Development Bank		West Africa	www.boad.org
CTF	Clean Technology Fund	CIF	Algeria, Egypt, Libya, Morocco, Nigeria, South Africa, Tunisia	http://www-cif.climateinvestmentfunds.org/fund/clean-technology-fund
EADB	East African Development Bank	Kenya, Tanzania, Uganda, Rwanda, MDBs, Development Agencies	East Africa	eadb.org
EAIF	Emerging Africa Infrastructure Fund	PPP	Sub-Saharan Africa	www.eaif.com

Acronym	Name	Contributor(s)	African Scope	Link
EBID	ECOWAS Bank for Investment and Development			www.bidc-ebid.org
EBRD - SEMED	European Bank for Reconstruction and Development		North Africa	http://www.ebrd.com/news/2015/ebrd-earmarks-us-250-million-for-private-sector-renewables-in-semed.html
EDF	European Development Fund			
EEP S&EA	Energy and Environment Partnership	Finland, Denmark, UK	Eastern and Southern Africa	http://eepafrica.org/
EIB	European Investment Bank			www.eib.org
ElectriFI	Electrification Financing Initiative	EIB, EC	Sub-Saharan Africa	http://www.electrifi.org/
EU-AITF	EU-Africa Infrastructure Trust Fund	COFIDES, Lux-Development, AFD, EIB, OeEB, SIMEST, KfW, AfDB, SOFID, BIO, FINNFUND, PIDG		http://www.eu-africa-infrastructure-tf.net/
FISEA	Proparco FISEA	PROPARCO (France) , AFD	Sub-Saharan	http://www.proparco.fr/lang/en/Accueil_PROPARCO/fisea-proparco
GCF	Green Climate Fund			http://www.greenclimate.fund/home
GEF	Global Environment Facility			www.thegef.org
GCPF	Global Climate Partnership Fund	PPP		http://www.gcpf.lu/
GEEREF	Global Energy Efficiency and Renewable Energy Fund	PPP		http://geeref.com
GRMF	Geothermal Risk Mitigation Facility	AU, EU-AITF, KfW, DfID	East Africa	http://www.grmf-eastafrica.org/
GroFin SGB	GroFin SGB Fund	PPP	Nigeria, Ghana, Zambia, Egypt, South Africa, Kenya, Tanzania, Rwanda, Uganda	www.grofin.com
	GuarantCo	PPP	Sub-Saharan Africa	www.guarantco.com
ICCF	Interact Climate Change Facility	EIB + 11 European Development Agencies		www.edfi.be/about/iccf.html
ICIEC	The Islamic Corporation for the Insurance of Investment and Export Credit	43 member states from Central Asia/Europe, Sub-Saharan Africa, MENA and Asia.	Algeria, Benin, Burkina Faso, Cameroun, Comoros, Cote d'Ivoire, Djibouti, Egypt, Gabon, Gambia, Guinea, Libya, Mali, Mauritania, Morocco, Mozambique, Niger, Nigeria, Senegal, Uganda, Tunisia	www.iciec.com
IFAD	International Fund for Agricultural Development			www.ifad.org
IFC	International Finance Corporation			www.ifc.org

Acronym	Name	Contributor(s)	African Scope	Link
ISDB	Islamic Development Bank			www.isdb.org
LDCF	Least Developed Countries Fund			http://fiftrustee.worldbank.org/Pages/ldcf.aspx
LMSC	Lereko Metier Sustainable Capital fund	IFC, South Africa PIC, private	Southern Africa	http://www.metier.co.za/index.php/Private-Equity/sustainable-capital-practice.html
MIGA	Multilateral Investment Guarantee Agency			www.miga.org
NDB	New Development Bank		South Africa	www.ndb.int
NeCF	Nordic Environment Finance Corporation (NEFCO) Carbon Fund	PPP		http://www.nefco.org/work-us/our-services/climate-funds/nefco-carbon-fund
	Power Africa	USAid, MDBs, IGOs, other countries		https://www.usaid.gov/powerafrica
PTA Bank	Eastern and Southern African Trade and Development Bank			http://www.ptabank.org/
PIDG	Private Infrastructure Development Group	ADA-BMF, ADB, AECID, DFAT,DFID/DECC, DGIS, IFC/World Bank, Irish Aid, KfW,MFA, Norad,SECO,Sida		http://www.pidg.org/
SCF -CIF	Strategic Climate Fund - CIF	CIF		https://www-cif.climateinvestmentfunds.org/fund/strategic-climate-fund
SEFA	Sustainable Energy Fund for Africa	Denmark, Italy, UK, US, AFDB	Africa	http://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/sustainable-energy-fund-for-africa/
SME	Catalyst Private Equity East Africa Fund	IGOs, IFIs	East Africa	http://www.catalystprincipal.com/fund/
SREP	Scaling up Renewable Energy Program	CIF, SCF	Benin, Ethiopia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Rwanda, Sierra Leone, Tanzania, Uganda, Zambia	https://www-cif.climateinvestmentfunds.org/fund/scaling-renewable-energy-program
UNDP	UN Development Programme			http://www.undp.org/
UNICEF	UN Children's Fund			www.unicef.org

6. Discussion

From a **technology** perspective, the most salient finding is the prominence of **solar energy** in Africa's energy future. With plans for over 34 GW of solar PV and 3 GW of CSP, solar energy is perceived as the number one technology for Africa's future electricity capacity plans, followed by hydro and wind at over 26 GW and 25 GW respectively. The interest in solar energy is not concentrated on some countries and in terms of cumulative generation capacity. On the contrary, almost all NDCs contemplate solar energy, while there is more variance for interest in other technologies. The interest in solar includes large and small scale, on and off-grid. Solar mini-grids and solar home systems seem to be the new norm for off-grid electrification. *Table 4* below provides a breakdown of renewable energy capacity contributions by technology.

Table 4: Renewable Energy Planned Capacity Additions in Africa by Technology

Technology	MW
Solar PV	34160
Hydro	26443
Wind	25739
Geothermal	7427
CSP	3310
Biomass	1123

While interest in hydropower was to be expected given that it is a mature technology with a large untapped potential in Africa and numerous projects at different stages of development, including some at the GW-scale, the interest for solar and wind is a testament on how fast these technologies have evolved and how far cost-reduction has reached. However due to their intermittency they also warrant the co-development of strong, reliable and well operated grid infrastructures. Wind development is mostly concentrated in areas of high resource and access to load centers. In some cases, like the Turkana Wind project previously described in *Box 1*, the construction of new transmission has be possible given an exceptional wind resource.

Other resources, such as geothermal energy, elicit an interest mostly regionally localized in East Africa (Kenya, Ethiopia and Djibouti) where there is a known resource and demonstrated experience. An interesting case is biomass. Despite Africa's vast biomass productivity, plans for biomass electricity generation stand at a meager 1.1 GW. For biomass plants to be viable, the long-term availability of a steady fuel supply at competitive prices needs to be secured. Given the large-scale production and consumption of charcoal and traditional biomass for cooking and other thermal uses, this may be a factor in the availability of commercial biomass for electricity generation. As noted earlier, nearly all NDCs have contributions relating to substitution or more sustainable use of traditional biomass.

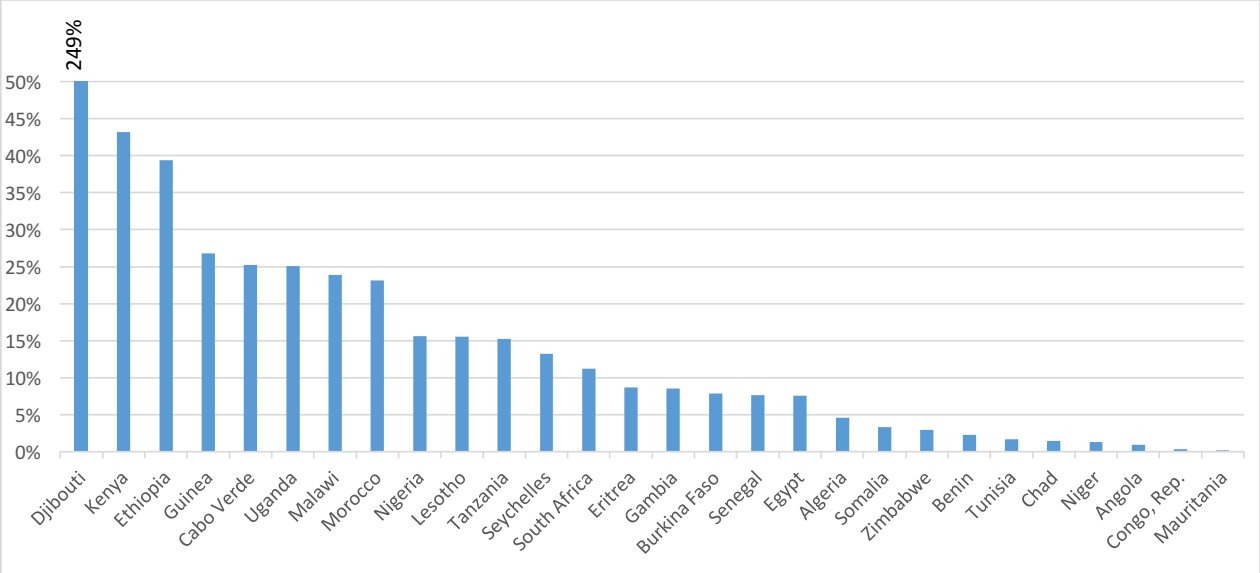
The ambitiousness of Africa's renewable energy contributions confirms and is based upon a

trend increasingly evident over the last few years: the steep decline of **renewable energy costs** (IRENA 2015, 2016). Nearly as important as the costs themselves, is the perception of the costs by policymakers. For example, Zambia's successful tender of solar energy at USD 60.2/MWh in early 2016 brought home to African policy-makers a new array of energy possibilities at prices unthought-of before. This will lead without a doubt to unrealistic expectations in some cases. But, more importantly, as the fact of the tremendous cost-reduction experienced by renewable energy technologies sinks in, countries may realize that more is doable at the same cost. As such, we may see a shift of renewable energy contributions from conditional to unconditional in the next generation of NDCs, expected by 2020.

A word of caution is necessary, though. While the cost of renewable energy technology, particularly solar, is likely to continue declining over the next few years, this is far from guaranteed. Some countries plan indeed for very low technology costs. For example, South Africa estimates costs of USD 1.2/W for wind and USD 1.48/W for Solar PV. Sudan prices its nearly 3 GW conditional contribution, of mostly solar and wind, at less than USD 1.5/W. As experienced with wind power technology some years ago, even if the long trend of downward prices continues, there may be instances where technology can face price spikes or supply shortages over a given period.

This research has calculated that planned renewable energy investments in Africa up to 2030 amount to at least USD 241 billion. But, is the proposed renewable energy **investment feasible**? While this is a very large amount, it is important to put it into context. USD 241 billion represent 13% of the combined GDP of the 28 countries under consideration in 2013. Annualized over the 15 years of the contribution period, it represents less than 1% of annual GDP, not even taking into consideration economic growth or the fact that renewable energy deployment tends to follow exponential curves and thus be back loaded. *Figure 1* below shows the planned investments over 15 years as a function of the country 2013 GDP.

Figure 1: Renewable Energy Investment until 2030 as % of 2013 GDP



Sources: Elaborated from own data and GDP data from World Bank

Roughly five tiers can be identified regarding the ambitiousness of renewable energy investment plans relative to national GDP. On the first tier, which could be named "unrealistic," we can observe that Djibouti is clearly off-the-chart and is unlikely to follow through with its contributions without significant assistance.[23] On the second tier are Kenya and Ethiopia, with proposed investments around 40% of their current GDP. Both countries plan to invest heavily in renewables as a key strategy towards industrialization. However, there are concerns on whether such countries will be able to maintain such investment levels, equivalent to 2.5-3% of current GDP per year over 15 years. The third tier, including Morocco, also signals very ambitious renewables plans, although with yearly renewable energy investments in the yearly 1.5% of GDP range. The next tier, including the major economies in the continent, Nigeria and South Africa, has yearly renewable energy investment in the yearly 0.8-1% range. While still very ambitious, these investments are likely feasible from an economic point of view. The rest of the countries, including large economies such as Egypt and Algeria plan on yearly investments of 0.6% or less of current GDP.

7. Conclusion: The way forward

The NDCs analyzed in this paper are the first generation of NDCs. They were prepared before the Paris Agreement was reached, without specific guidelines or methodologies, and with a plausible role as a negotiation tool in the UNFCCC process.

Countries are expected to submit their next NDC by 2020, which in practical terms means we can

23 While the unconditional contributions of geothermal, solar and wind expressed in Djibouti's NDC are unlikely to be met without external assistance, Djibouti could claim 100% clean electricity if two proposed grid connections with Ethiopia are built.

expect the second generation of NDCs to be submitted from late 2019 to early 2020,[24] in about three years and a half time. Crucially, the Paris Agreement has a "ratchet" mechanism, where successive NDCs will represent a progression beyond the Party's existing NDC and reflect its "highest possible ambition."[25] The plans identified in this paper for 102 GW of renewable energy capacity in Africa by 2030 are ambitious. But, are they the highest possible ambition? Already today, for example, the Africa Renewable Energy Initiative (AREI[26]) under the African Union aims for 300 GW of renewable energy capacity by 2030. This could be partly explained by the fact that many countries have developed renewable energy capacity targets, in part as their contribution to the SE4All 2030 objectives that seem to have not been considered in the NDCs elaboration process.

With the Paris Agreement entering into force in a record time, the future direction of the UNFCCC is clearer, as is the significance of NDCs. Besides tools for climate change negotiation, NDCs can be understood as a multipurpose instrument. NDCs establish the benchmark against which countries will measure themselves for years to come, signaling both willingness and needs to implement climate action. At the sectorial level, NDCs can further strengthen government policy and goals, for example regarding renewable energy targets and financial commitments. If they provide sufficient detail, NDCs can serve as investment roadmaps, signaling to investors and finance institutions where and what to look for.

Next-generation NDCs can be expected to be much more focused and homogeneous, informed by guidance, methodologies and theoretical background being produced by the UNFCCC and numerous organizations, think tanks, etc. (see for example WRI/UNDP 2016). Declining costs and cumulative experience are likely to increase even more the prominence of renewable energy as a mitigation option (and to a lesser level adaptation as well). As recently underlined by the International Renewable Energy Agency (IRENA), renewables and solar PV in particular, are poised to boom in Africa thanks to declining costs.[27]

One aspect that is missing from both this analysis and most NDCs themselves, however, is the legal and regulatory framework necessary to create an enabling environment that attracts investment. This is a crucial element for the upscaling and massive deployment of renewable energy capacity in Africa. Whether and how it will be included in future NDCs remains an open question.

In concluding, it seems clear that importance of renewable energy in Africa is poised to increase over the next decade, possibly drastically, opening investment opportunities in the range of the hundreds of billions of US dollars. The roles that national and international public and private

24 Decision 1/CP.21 para 21-23

25 Paris Agreement, Art. 4.3

26 Africa Renewable Energy Initiative - http://www.arei.org/

27 IRENA (2016) *Solar PV in Africa: Costs and Markets*

finance institutions play in financing those investments is likely to mark the pace and intensity of renewable energy deployment, although more research is needed to better understand how public finance incentivizes private investment in renewables. NDCs can help the process by providing *de facto* investment maps, as well as strengthening national renewable energy plans and potentially attracting climate finance. Given, however, the fast pace of renewable energy developments as compared to the multi-year time-frames of climate change negotiations, there is also the possibility that, at least regarding renewable energy, NDCs become more of an status report than a driver. To find out, we will have to wait until the next generation of NDCs is presented in 2020. By then, the renewable energy landscape in Africa may have evolved significantly.

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NDC Factsheets

PBL Climate Pledge NDC tool

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Sustainable Energy for All (SE4All) Africa Hub

UNFCCC interim NDC Registry

WRI NDC Resources Web Page

Climate Action Tracker

C2ES

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