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The African Century: Renewable Energy Opportunities in Sub-Saharan Africa

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THE AFRICAN CENTURY: RENEWABLE ENERGY OPPORTUNITIES IN SUB-SAHARAN AFRICA

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INTRODUCTION

In an interview in late 2021, Greek Prime Minister Kyriakos Mitsotakis announced that he would no longer talk about climate change.[1] From this point on, Mitsotakis would only talk about the "climate crisis."[2] Mitsotakis is among a growing consensus of world leaders committed to tackling the climate crisis.[3] Meanwhile, in the United States, President Biden and his slim Democratic majority are working to enact the climate

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[1] Lefteris Papadimas & Deborah Kyvrikosaios, *Greek PM Says Climate Crisis Is with Us and Cost of Ignoring It 'Unimaginable'*, REUTERS (Sept. 19, 2021, 6:24 AM), https://www.reuters.com/world/europe/greek-pm-says-climate-crisis-is-with-us-cost-ignoring-it-unimaginable-2021-09-19/ [https://perma.cc/P2MD-ZYBX].

[2] *Id.*

[3] Ellen Knickmeyer & Matthew Daly, *Biden, World Leaders Push Climate Action, Vow Methane Cuts*, AP NEWS (Sept. 17, 2021), https://apnews.com/article/joe-biden-business-climate-europe-united-nations-19d5bef5d86983bbd4106e59e5c7b993 [https://perma.cc/689B-WAQW].

provisions of the Inflation Reduction Act of 2022.[4] Though concessions had to be made to receive approval from a notable holdout,[5] the bill is a major win for climate policy. Its far-reaching scope includes $30 billion in grants to aid states in their transitions to clean energy production, $20 billion pledged to support climate-smart agriculture practices, and $60 billion aimed at achieving environmental justice in disadvantaged communities.[6] Much of Asia and the European Union have similar goals for cutting carbon emissions.[7] Some nations, however, have shown more commitment to achieving these goals than others.[8]

When addressing climate change and renewable energy, western media outlets focus their attention on the policies and developments taking place in the United States, Europe, and China.[9] This is understandable because these nations consume significantly more energy than the rest of the world.[10] In 2019, 162,194 terawatt-hours ("TWh") of energy were consumed globally.[11] China was responsible for 39,361 TWh, the United States 26,291 TWh, and Europe 23,282 TWh, adding up to around half the global energy consumption.[12] As of 2021, energy consumption still largely corresponds with carbon emissions.[13] This varies country-to-country, as some—like China—utilize more renewable energy than others.[14]

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[4] Tony Romm, *House Passes Inflation Reduction Act, Sending Climate and Health Bill to Biden*, WASH. POST (Aug. 12, 2022, 5:55 PM), https://www.washingtonpost.com/us-policy/2022/08/12/inflation-reduction-act-house-vote/ [https://perma.cc/A53F-SSUV].
[5] *Id.*
[6] SENATE DEMOCRATS, SUMMARY OF THE ENERGY SECURITY AND CLIMATE CHANGE INVESTMENTS IN THE INFLATION REDUCTION ACT OF 2022, at 2–3 (2022), https://www.democrats.senate.gov/imo/media/doc/summary_of_the_energy_security_and_climate_change_investments_in_the_inflation_reduction_act_of_2022.pdf [https://perma.cc/HVJ3-PS3J].
[7] Brad Plumer & Nadja Popovich, *The U.S. Has a New Climate Goal. How Does It Stack Up Globally?*, N.Y. TIMES (Apr. 22, 2021), https://www.nytimes.com/interactive/2021/04/22/climate/new-climate-pledge.html [https://perma.cc/XGS7-NKQ3].
[8] David Vetter, *U.S. Lagging Far Behind Europe on Renewables, New Report Shows*, FORBES (Mar. 9, 2020, 1:27 PM), https://www.forbes.com/sites/davidrvetter/2020/03/09/us-lagging-far-behind-europe-on-renewables-new-report-shows [https://perma.cc/MF9Y-FW7T].
[9] Plumer & Popovich, *supra* note 7.
[10] Hannah Ritchie & Max Roser, *Energy Production and Consumption*, OUR WORLD IN DATA, https://ourworldindata.org/energy-production-consumption [https://perma.cc/Q49R-2BAD] (last visited Jan. 16, 2023).
[11] *Id.*
[12] *Id.*
[13] *Energy and the Environment Explained: Where Greenhouse Gases Come From*, U.S. ENERGY INFO. ADMIN. (June 24, 2022), https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php [https://perma.cc/G2WN-9HAQ].
[14] *See* Verity Ratcliffe, *China, U.S. Made 2020 a Record Year for Renewable Power Growth*, BLOOMBERG (Apr. 5, 2021, 4:00 AM), https://www.bloomberg.com/news/articles/2021-04

Even if the world's developed nations are able to curb their carbon emissions in the coming years, major hurdles will still exist. One such hurdle is fulfilling energy needs in urbanizing areas, like sub-Saharan Africa. Many global regions are urbanizing but none as rapidly as sub-Saharan Africa.[15] The global share of Africa's urban residents is expected to grow from 11.3% in 2010 to 20.2% by 2050.[16]

I. SUB-SAHARAN AFRICA: URBANIZATION AND ENERGY DEMAND

Urbanization, economic growth, and energy consumption are linked.[17] The rapid urbanization and economic growth of sub-Saharan Africa is a result of several factors. Birth rates are increasing significantly.[18] New technologies are proliferating across the continent, and business conditions have rapidly improved over the past few decades.[19]

Energy enables growth in both developed and developing countries.[20] The installation of long-distance energy networks delivers affordable and reliable energy to individuals and commercial enterprises, which furthers industrialization and higher living standards.[21]

Scientific studies show that urbanization and economic growth are positively correlated with energy consumption.[22] Economic growth is defined as an "increase in the production of goods and services per head of

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-05/china-u-s-made-2020-a-record-year-for-renewable-power-growth [https://perma.cc/XF9A-CJ84].

[15] JAMAL SAGHIR & JENA SANTORO, CTR. FOR STRATEGIC & INT'L STUD., URBANIZATION IN SUB-SAHARAN AFRICA: MEETING CHALLENGES BY BRIDGING STAKEHOLDERS 1 (2018), https://www.csis.org/analysis/urbanization-sub-saharan-africa [https://perma.cc/P6D2-J8VT].

[16] *Id.*

[17] *See* Tahsin Bakirtas & Ahmet Gökçe Akpolat, *The Relationship Between Energy Consumption, Urbanization, and Economic Growth in New Emerging-Market Countries*, 147 ENERGY 110, 110–11 (2018).

[18] Zara Porter, *High Fertility in Sub-Saharan Africa*, POPULATION CONNECTION (July 8, 2020), https://populationconnection.org/blog/high-fertility-sub-saharan-africa [https://perma.cc/55VY-GE3X].

[19] *Why Africa Is Becoming a Bigger Player in the Global Economy*, EY AMS. (Sept. 11, 2020), https://www.ey.com/en_us/tax/why-africa-is-becoming-a-bigger-player-in-the-global-economy [https://perma.cc/9GT5-N6B3].

[20] Tade Oyewunmi & Ivie Ehanmo, *Emerging Trends in Resource-Rich Sub-Saharan Africa and a Spotlight on the Nigerian Transitional Energy Market*, 29 TUL. J. INT'L & COMP. L. 1, 3 (2021).

[21] *Id.*

[22] Bakirtas & Akpolat, *supra* note 17, at 110–11.

population over a stated period of time."[23] Since the Industrial Revolution, the production of goods and services has involved, and often required, the use of electricity.

Machines powered by electricity produce goods hundreds of times faster than human hands. The countries that benefited the most from the Industrial Revolution saw immediate growth.[24] In the last two hundred years, individuals in those countries saw their real incomes per capita increase ten to fifteen times over.[25] Such countries have utilized coal, oil, gas, and renewable energy to produce more goods and services than had been produced in prior years—thus fostering economic *growth*.[26]

Urbanization was inextricably linked to such growth.[27] As machines replaced rural farmers, individuals moved to cities to work as industrial laborers.[28] This is the process currently taking place in sub-Saharan Africa.[29]

Sub-Saharan Africa, however, has the unique opportunity to rely primarily on renewable energy in its urbanization. The world has urbanized slowly and in a piecemeal fashion. Europe and the United States urbanized during the Industrial Revolution of the nineteenth century.[30] Asia followed, urbanizing at a quicker rate in the latter half of the nineteenth and first half of the twentieth century.[31] Sub-Saharan Africa is now set to urbanize at an even more rapid pace than Asia.[32]

At the time of the West's urbanization, the dangers of atmospheric carbon were not widely known, and renewable energy as we think of it today was not utilized. Such dangers, however, were known to an extent. Svante Arrhenius, a Swedish physicist and chemist, first

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[23] *Economic Growth*, OXFORD ENG. DICTIONARY, https://dictionary.cambridge.org/us/dictionary/english/economic-growth [https://perma.cc/4VMR-LDTY] (last visited Jan. 16, 2023).
[24] Gregory Clark, *The Industrial Revolution*, *in* HANDBOOK OF ECONOMIC GROWTH 217–18 (Philippe Aghion & Steven N. Durlauf eds., 2014).
[25] *Id.* at 217.
[26] *Id.* at 218.
[27] Riccardo Di Clemente, Emanuele Strano & Michael Batty, *Urbanization and Economic Complexity*, SCI. REPS., Feb. 2021, at 1, 1.
[28] *Id.* at 4–5.
[29] SAGHIR & SANTORO, *supra* note 15, at 2.
[30] Mousumi Roy, *Asia's Role in the Four Industrial Revolutions*, 23 EDUC. ABOUT ASIA 51, 51 (2018).
[31] *Id.*
[32] *UN Report: Africa, Asia to Drive Future Urban Population Growth*, INT'L INST. FOR SUSTAINABLE DEV. (Apr. 10, 2012), http://sdg.iisd.org/news/un-report-africa-asia-to-drive-future-urban-population-growth/ [https://perma.cc/QR2E-LRNY].

speculated about the greenhouse gas effect near the end of the nineteenth century.[33] Arrhenius recognized that industrial activities brought on by the Industrial Revolution emitted carbon and set out to discover whether carbon was a gas that trapped heat.[34] He found that it did and calculated that a doubling of atmospheric carbon would increase the earth's surface temperature by eleven to fourteen degrees Fahrenheit.[35]

Another factor that positively correlates with urbanization, economic growth, and energy demand is population growth.[36] Africa's population is expected to double by 2050, rocketing from one to two billion.[37] The corresponding demand for electricity is expected to increase by 3% annually.[38]

While sub-Saharan African countries have peculiar social and economic characteristics, there are common elements that allow this Note to focus on the region as a whole.[39] This general approach can be adjusted on a country-by-country basis.[40] Some such common elements include: (1) abundant natural resources which can be converted into energy, (2) inefficient local infrastructures by which those resources can be converted into energy, (3) underinvestment in transmission and distribution networks, and (4) affordability constraints.[41]

II. POLICIES FROM AROUND THE GLOBE

There are a number of policy instruments currently being utilized by countries around the world, including in sub-Saharan Africa. These different policy instruments, or combinations of the instruments, work

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[33] Svante Arrhenius, *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground*, 41 PHIL. MAG. & J. SCI. 237, 237 (1896).
[34] Rudy M. Baum Sr., *Future Calculations: The First Climate Change Believer*, SCI. HIST. INST. (July 18, 2016), https://www.sciencehistory.org/distillations/magazine/future-calculations [https://perma.cc/3Y38-BYW6].
[35] *Id.*
[36] Bakirtas & Akpolat, *supra* note 17, at 110–11.
[37] Gregor Schwerhoff & Mouhamadou Sy, *Where the Sun Shines*, 57 INT'L MONETARY FUND, FIN. & DEV. 54, 54 (2020) [hereinafter Schwerhoff & Sy, *Where the Sun Shines*]; *see also* Gregor Schwerhoff & Mouhamadou Sy, *Financing Renewable Energy in Africa—Key Challenge of the Sustainable Development Goals*, 75 RENEWABLE & SUSTAINABLE ENERGY REVS. 393, 393–94 (2017).
[38] Schwerhoff & Sy, *Where the Sun Shines*, *supra* note 37, at 54.
[39] *See* Oyewunmi & Ehanmo, *supra* note 20, at 5.
[40] *Id.*
[41] *Id.*

to varying degrees in different countries. Countries with more wealth have a greater ability to pay the difference between the cost of producing energy with fossil fuels and the cost of producing energy with renewable sources.[42] Countries with wealthier populations have the additional advantage of knowing that their citizens will continue paying for their electricity if extra costs are passed on to them.[43]

Developed nations have been testing out policy instruments to encourage the use of renewable energy since the 1970s.[44] When encouragement failed to provide a sufficient incentive, countries have developed tariffs and more coercive measures, such as the renewable energy portfolio standard.[45] Developing countries are beginning to follow suit. By one count, over thirty developing countries have introduced one or more policy tools to encourage the proliferation of renewable energy.[46]

To best encourage the rollout of renewable energy, a country must have a clear and efficient framework, consisting of independent institutions that can regulate energy providers and consumers.[47] This is particularly important in sub-Saharan Africa, which has significant corruption concerns.[48]

A. Feed-in Tariffs

Feed-in Tariffs, or FITs, are the most popular policy instrument globally.[49] In the West, Germany has led the way in the use of FITs, instituting its first iteration of the tool in 2000.[50] FIT agreements guarantee

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[42] Ken Silverstein, *How Rich Countries Must Help Developing Economies Afford the Clean Energy Transition*, FORBES (Mar. 16, 2021), https://www.forbes.com/sites/kensilverstein/2021/03/16/can-emerging-countries-afford-to-make-the-clean-energy-transition [https://perma.cc/BEB9-28ZM].

[43] *Id.*

[44] GABRIELA ELIZONDO AZUELA & LUIZ AUGUSTO BARROSO, WORLD BANK, DESIGN AND PERFORMANCE OF POLICY INSTRUMENTS TO PROMOTE THE DEVELOPMENT OF RENEWABLE ENERGY 3 (2012) (ebook); *see also* Shahrouz Abolhosseini & Almas Heshmati, *The Main Support Mechanisms to Finance Renewable Energy Development (IZA Discussion Paper No. 8182)*, INST. FOR STUDY LAB., May 2014, at 10.

[45] *See* Abolhosseini & Heshmati, *supra* note 44, at 10.

[46] *See* AZUELA & BARROSO, *supra* note 44, at 6.

[47] *Id.* at 1.

[48] JORUM DURI, CMI U4 ANTI-CORRUPTION RES. CTR. & TRANSPARENCY INT'L, SUB-SAHARAN AFRICA: OVERVIEW OF CORRUPTION AND ANTI-CORRUPTION 2 (2020).

[49] SADIE COX & SEAN ESTERLY, NAT'L RENEWABLE ENERGY LAB'Y, FEED-IN TARIFFS: GOOD PRACTICES AND DESIGN CONSIDERATIONS 1 (2016).

[50] *The German Feed-in Tariff*, FUTUREPOLICY.ORG, https://www.futurepolicy.org/climate

a fixed price for the renewable energy producer for a set amount of time, generally a lengthy term (ten to twenty years).[51] This is attractive to investors because they know that their renewable energy investment will be paid to produce electricity for a known amount of time.[52] A recent survey of venture capitalists interested in the renewable energy sphere found that most investors viewed feed-in tariffs as the most effective policy for stimulating the renewable energy market.[53]

A primary concern for feed-in tariffs is their cost effectiveness.[54] The additional costs that accompany feed-in tariffs are borne by either energy consumers or taxpayers, or both.[55] These costs will be difficult to pass on to consumers in sub-Saharan Africa because so many individuals in that region live below the poverty line.[56] Thus, the issue of affordability remains a major hurdle in the attempt to incentivize renewable energy in sub-Saharan Africa.

Though feed-in tariffs have proved to be successful in some contexts, the policy tool largely failed to incentivize renewable energy use in South Africa.[57] South Africa established its feed-in tariff program in 2009.[58] The tariffs were intended to cover generation costs plus a 17% return on equity (after tax and indexed for inflation).[59] However, uncertainty

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-stability/renewable-energies/the-german-feed-in-tariff/ [https://perma.cc/4UME-XXGC] (last visited Jan. 16, 2023).

[51] Lucas Satterlee, *Cautious Optimism: Renewable Energy in South Africa as a Sustainable Model for the Region*, 32 J. ENV'T. L. & LITIG. 213, 230 (2017).

[52] *Id.*; *see also* Felix Mormann, *Enhancing the Investor Appeal of Renewable Energy*, 42 ENV'T L. 681, 712–13, 716–17 (2012).

[53] Mark A. Delucchi & Mark Z. Jacobson, *Providing All Global Energy with Wind, Water, and Solar Power, Part II: Reliability, System and Transmission Costs, and Policies*, 39 ENERGY POL'Y 1170, 1177 (2010); *see also* Mary Jean Burer & Rolf Wüstenhagen, *Which Renewable Energy Policy Is a Venture Capitalist's Best Friend?*, 37 ENERGY POL'Y 4997, 4997 (2009).

[54] Debashis Ghose, *Finding an Energy Power Transformer for the "Last Kilometer" Population: A Comparative Analysis of the REFIT Systems in Ghana and Tanzania*, 18 RUTGERS RACE & L. REV. 1, 1 (2017).

[55] *Id.*; *see also* Fan Zhang, *How Fit Are Feed-in Tariff Policies?*, WORLD BANK BLOGS (July 26, 2012), http://blogs.worldbank.org/energy/how-fit-are-feed-tariff-policies [https://perma.cc/48JN-XX29].

[56] Marta Schoch & Christopher Lakner, *The Number of Poor People Continues to Rise in Sub-Saharan Africa, Despite a Slow Decline in the Poverty Rate*, WORLD BANK BLOGS (Dec. 16, 2020), https://blogs.worldbank.org/opendata/number-poor-people-continues-rise-sub-saharan-africa-despite-slow-decline-poverty-rate [https://perma.cc/X32U-UELU].

[57] Anton Eberhard & Tomas Kåberger, *Renewable Energy Auctions in South Africa Outshine Feed-in Tariffs*, 4 ENERGY SCI. & ENG'G 190, 190 (2016).

[58] *Id.* at 191.

[59] *Id.*

surrounding the nature of the procurement and licensing processes loomed.[60] Ultimately, South Africa replaced the feed-in tariffs with an auction program, which turned out to be far more successful.[61]

B. Reverse Auctions

Reverse auctions are a policy instrument wherein the state holds an auction with the prize going not to the highest bidder but to the lowest.[62] The state invites renewable energy providers to the auction, sets a high starting bid—a price for which the government will pay that provider for each kWh of electricity—and lowers the price until there is only one bidder remaining.[63] That renewable energy provider then agrees to provide electricity via renewable resources for the price at which the auction ended.[64] That provider and the government then enter into a long-term contract, which is favorable because a long-term contract reduces risk and provides certainty that the energy provided will be sold.[65] This system provides a significant incentive for renewable energy providers to reduce costs, as that will enable them to offer lower prices and win the auction.

Competitive tenders are very similar to reverse auctions. Tender in this context refers to the process in which governments take bids for projects, generally sizeable ones like energy or defense.[66] Governments engaging in competitive tenders will weigh both price and non-price factors in making a determination, whereas reverse auctions consider price alone.[67]

South Africa has attempted to utilize both feed-in tariffs and reverse auctions, with the latter proving far more successful.[68] South Africa's auction program, called the Renewable Energy Independent

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[60] *Id.*
[61] *Id.* at 193.
[62] Satterlee, *supra* note 51, at 231.
[63] *Id.*
[64] *Id.*
[65] *See* Harald Winkler, *Renewable Energy Policy in South Africa: Policy Options for Renewable Energy*, 33 ENERGY POL'Y 27, 35 (2005).
[66] Will Kenton, *Tender in Finance Definition: How It Works, with Example*, INVESTOPEDIA, https://www.investopedia.com/terms/t/tender.asp [https://perma.cc/MTX4-8877] (July 4, 2022).
[67] ANTON EBERHARD, WORLD BANK GRP., FEED-IN TARIFFS OR AUCTIONS? PROCURING RENEWABLE ENERGY SUPPLY IN SOUTH AFRICA 7 (2013).
[68] *Id.* at 1.

Power Procurement Program, began in 2011 and initially envisioned five rounds of bidding wherein 3,625 megawatts ("MW") of power would be procured (bid on) by the government.[69] MW are used to measure the output of a power plant or the amount of electricity consumed in a city.[70] A typical coal power plant is about 600 MW.[71] The auctions were held simultaneously, and independent power producers ("IPPs") could bid for more than one project and for more than one technology.[72] Each project had to provide at least 1 MW and upper limits were set for each technology: 75 MW for a solar photovoltaic project, 100 MW for a concentrated solar project, and 140 MW for a wind project.[73] Concentrated solar power uses the heat emanating from the sun to produce energy.[74] On the other hand, photovoltaic ("PV") solar energy directly converts the sun's light into energy.[75]

After "winning" auctions, IPPs sign a contract with Eskom, South Africa's energy utility.[76] Through Eskom, the power generated by IPPs is distributed to electricity consumers.[77] The agreements are backed by the South African government, which commits to paying IPPs even in the event of Eskom's default.[78]

To participate in these auctions, IPPs submit bids that are assessed by South African government officials and energy experts.[79] Bid evaluation involves two steps.[80] First, bids need to satisfy certain minimum threshold requirements in six areas: environment, land, commercial

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[69] *Id.* at 2, 4.
[70] *How is Electricity Measured?*, UNION CONCERNED SCIENTISTS (Oct. 22, 2013), https://www.ucsusa.org/resources/how-electricity-measured [https://perma.cc/W7FZ-BAPJ].
[71] *Id.*
[72] EBERHARD, *supra* note 67, at 2.
[73] *Id.*
[74] Rikki Allessandra Suarez, *Concentrated Solar Power (CSP) Vs. Photovoltaic (PV): An In-Depth Comparison*, SOLAR FEEDS (Oct. 4, 2021, 10:42 PM), https://www.solarfeeds.com/mag/csp-and-pv-differences-comparison/ [https://perma.cc/XGZ4-9MYZ] (explaining that concentrated solar power converts light into energy by concentrating the sun's energy with various reflectors, which in turn drives a heat engine and then an electric generator).
[75] *Id.* Photovoltaic solar works as follows: solar PV cells absorb light; the light then knocks electrons loose. *Id.* The loose electrons create a current, which is captured and transferred into wires, thus creating a DC (direct electric) current. *Id.* This DC current is then converted to AC and distributed onto the power network. *Id.*
[76] EBERHARD, *supra* note 67, at 1, 3.
[77] *Id.* at 1, 4.
[78] *Id.* at 4.
[79] *Id.* at 3.
[80] *Id.* at 2.

and legal, economic development, financial, and technical.[81] For example, bidders have the financial requirement of submitting bank letters indicating that their project financing is locked in.[82] Understandably, the South African government is concerned with guaranteeing the execution of procured projects.[83] This also has the effect of outsourcing due diligence to the banks that are financially backing these projects—i.e., banks have the job of assessing the viability of projects before such projects are ever presented to the government.[84]

In addition to assessing project viability at the outset, the procurement agreements include an elaborate system of rewards and penalties ensuring that the project is carried out in a timely manner.[85] Performance credits or penalties are assessed quarterly.[86] If penalties reach a certain threshold over a number of quarters, the IPP could lose its contract.[87] For land requirements, the board reviews items such as tenure, lease registration, and proof of land use applications.[88] For environmental requirements, the board reviews approvals.[89] Commercial review includes the project structure and the bidders' acceptance of the purchase agreement with Eskom.[90] Technical specifications are different for each technology.[91] Wind power bidders, for example, must show twelve months of wind data for the designated site.[92]

The second step of evaluation, where IPPs have the opportunity to beat each other out, assesses both price (given 70% weight) and economic development factors (30% weight).[93] Considered for the latter were "job creation, local content, ownership, management control, preferential procurement, enterprise development, and socioeconomic development."[94]

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[81] *Id.*
[82] ANTON EBERHARD, JOEL KOLKER & JAMES LEIGLAND, WORLD BANK GRP., SOUTH AFRICA'S RENEWABLE ENERGY IPP PROCUREMENT PROGRAM: SUCCESS FACTORS AND LESSONS 11 (2014).
[83] *Id.*
[84] *Id.*
[85] *Id.* at 25.
[86] *Id.*
[87] *Id.*
[88] EBERHARD ET AL., *supra* note 82, at 13.
[89] *Id.*
[90] *Id.*
[91] *Id.*
[92] *Id.*
[93] ANTON EBERHARD, WIKUS KRUGER & DENNIS VOLK, INT'L RENEWABLE ENERGY AGENCY ("IRENA"), RENEWABLE ENERGY AUCTIONS: CASES FROM SOUTH-AFRICA 24 (2018).
[94] EBERHARD, *supra* note 67, at 3.

A first round of bidding occurred in 2011.[95] Because not enough projects were ready to meet the minimum requirements set out in the first step of the process, all bidders that met the criteria were awarded contracts.[96] In other words, due to lack of competition, bidding prices did not fall as low as the government may have hoped.[97] In this first round, IPPs bid to supply 1416 MW combined, with the first project producing power by late 2013.[98] More IPPs had sufficiently prepared for the second round of bidding, taking place in 2011 to 2012, and thus the process was more competitive. Local content terms similarly improved.[99] Local content is the value brought to the local economy as a result of a project being carried out there, such as the hiring of local workers or the usage of local tools, machinery, or goods in implementing the project.[100] These trends continued in subsequent rounds.[101] In addition to increased competition in South African auctions, factors such as falling prices for renewable energy equipment globally, ongoing innovation, and economies of scale have allowed South Africans to get electricity from renewable energy providers at increasingly low prices.[102] For example, solar panel prices have dropped 90% since 2009 and wind turbine prices have dropped around 60% since 2010.[103] Finally, transaction costs continue to fall each round as repeat contenders become more familiar with the bidding framework.[104]

C. Renewable Portfolio Standards

The Renewable Portfolio Standard ("RPS") is a common policy tool and is often used alongside feed-in tariffs.[105] Whereas feed-in tariffs are priced-based, RPSs are quantity-based.[106] RPSs requires utility companies

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[95] *Id.* at 2.
[96] *Id.* at 3.
[97] *Id.*
[98] EBERHARD ET AL., *supra* note 82, at 1.
[99] *Id.*
[100] NAT. RES. GOVERNANCE INST., LOCAL CONTENT: STRENGTHENING THE LOCAL ECONOMY AND WORKFORCE 1 (2015), https://resourcegovernance.org/sites/default/files/nrgi_Local-Content.pdf [https://perma.cc/A73Y-T4GT].
[101] *See* EBERHARD ET AL., *supra* note 82, at 1.
[102] *Id.* at 18.
[103] *Costs*, INT'L RENEWABLE ENERGY AGENCY, https://www.irena.org/costs [https://perma.cc/L5EC-9YYL] (last visited Jan. 16, 2023).
[104] *See* EBERHARD ET AL., *supra* note 82, at 18.
[105] *See* Abolhosseini & Heshmati, *supra* note 44, at 10.
[106] *Id.*

to generate a certain percentage of the electricity they provide with renewable energy sources.[107] RPSs are not widely used in developed countries due to their unpopularity. Recent analyses accounting for price, volume, and risk have shown that the competitive tools, such as feed-in tariffs and auctions, are more effective than quota instruments such as the RPS.[108]

D. Tax Incentives

Another tool ill-suited for sub-Saharan governments is that of tax incentives. Governments, usually those of developed nations, use taxation to increase renewable energy output in two distinct ways. First, governments give tax breaks to renewable energy producers in order to incentivize innovation in that area, and second, governments tax fossil-fuel production and use to reflect their environmental costs.[109] Developed nations have utilized carbon taxes since the 1990s, but as of 2011, no developing country has adopted the tool.[110] In sub-Saharan Africa, carbon taxation makes little logical sense for two reasons. First, compared to developed nations, there are very few significant carbon emitters in sub-Saharan Africa.[111] Accordingly, the few major emitters in the region would be punished despite most of the world's atmospheric carbon coming from emitters like the United States, Europe, and China.[112] Second, energy utilities in sub-Saharan Africa are already saddled with debt, and shrinking their profits with taxes would create further hurdles in their attempt to provide widespread energy.[113]

III. SOCIO-ECONOMIC FACTORS TO CONSIDER

Sub-Saharan Africa is a unique region. Due to a wide variety of socio-economic factors, different parts of the world have industrialized

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[107] *Id.*
[108] *See* AZUELA & BARROSO, *supra* note 44, at 4.
[109] *See* Delucchi & Jacobson, *supra* note 53, at 1177.
[110] *See* AZUELA & BARROSO, *supra* note 44, at 4.
[111] Charlie Lawrie, Diana Szpotowicz & Giovanni Occhiali, *No 'Green Bullet'—Should Carbon Taxes Be Introduced in Sub-Saharan Africa?*, INT'L CTR. TAX & DEV. (Sept. 3, 2021), https://www.ictd.ac/blog/no-green-bullet-carbon-taxes-sub-saharan-africa/ [https://perma.cc/35DC-H6DZ].
[112] *Id.*
[113] *Id.*

quicker than others. Similarly, policy tools and incentives that work in some areas will not work as well in other areas. Below are some of the major factors that officials and scholars must consider in assessing the viability of renewable energy policy instruments in sub-Saharan Africa.

A. Emerging Markets and Financing

This factor is closely related to corruption. Sub-Saharan governments may be unable to acquire capital from outside investors because investors have concerns about corruption,[114] namely whether their money will actually be used for the renewable energy projects in which they are investing. Experts agree that financing is the greatest hurdle to overcome in providing sub-Saharan Africa with electricity.[115] While financing is a challenge for both fossil fuels and renewable energy, fossil fuel facilities are much cheaper to build than renewable energy facilities.[116] However, fossil fuel facilities are expensive to maintain, as they require continued purchases of fuel.[117] On the other hand, renewable energy facilities are inexpensive to operate but have a high installation cost, which has to be financed up front.[118]

One way that sub-Saharan governments can free up capital is by eliminating fossil fuel subsidies.[119] These subsidies are estimated to constitute 5.6% of sub-Saharan Africa's gross domestic product.[120] Fossil fuel subsidies take two forms. Production subsidies are tax breaks or direct payments intended to reduce the costs of turning oil or coal into usable energy.[121] Consumption subsidies involve the act of fixing fuel prices, which keeps fuel affordable for the end user.[122]

One suitable financing option for low-income nations is microfinancing.[123] Microfinancing wields potential to provide a robust bottom-up

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[114] Alexander Rene, Kirsten Mayer & Amanda Raad, *Minimising Corruption Risks in African Investment Opportunities*, FINANCIER WORLDWIDE MAG. (Oct. 1, 2022), https://www.financierworldwide.com/minimising-corruption-risks-in-african-investment-opportunities/#.Yzhnt9gpDIU [https://perma.cc/5PPU-J9LK].
[115] *See* Schwerhoff & Sy, *Where the Sun Shines*, *supra* note 37, at 57.
[116] *Id.*
[117] *Id.*
[118] *Id.*
[119] *Id.*
[120] *Id.*
[121] Jocelyn Timperley, *Why Fossil Fuel Subsidies Are So Hard to Kill*, NATURE (Oct. 21, 2021), https://www.nature.com/articles/d41586-021-02847-2 [https://perma.cc/SQ8D-D5ZD].
[122] *Id.*
[123] *See* Ghose, *supra* note 54, at 3.

approach to creating a decentralized renewable energy network, as opposed to seeking large sums from outside investors.[124] With money from microfinance institutions, low-income individuals can set up their own solar energy generators. Though microfinance institutions are initially funded by donors, they often grow to be self-sustaining.[125]

The two sub-Saharan African nations of Ghana and Tanzania currently have microfinance systems in place.[126] Ghana has attracted private investors to provide cash flow, while Tanzania conducts its microfinancing through its leading commercial banks.[127] Both programs are relatively new and likely will require state aid in the form of subsidies and tax benefits to succeed.[128]

Use of independent power producers, which operate alongside state-run utilities, has proven to be an effective method of providing energy in sub-Saharan countries.[129] IPPs are at the heart of South Africa's auction system and have been used in Nigeria and Kenya since the 1990s.[130] The decentralized format of IPPs works well in sub-Saharan Africa because there are so many hard-to-reach rural areas.[131] This method of providing energy is more efficient than having a single grid that attempts to reach the entire population.[132]

One source estimates that if around 120 billion USD were provided annually, reliable electricity for all of sub-Saharan Africa would be achieved by 2040.[133] Investors, however, will not invest this capital unless they know sufficient infrastructure exists to secure their money. Institutions will need to deal with commercial and corruption risks to ensure that investors have a chance at a decent return on their capital.[134]

B. Abundance of Natural Resources

In terms of its ability to harness energy through its natural resources, sub-Saharan Africa has major advantages over other areas of

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[124] *Id.*
[125] *Id.* at 23.
[126] *Id.* at 25–26.
[127] *Id.* at 27.
[128] *Id.*
[129] ANTON EBERHARD & KATHARINE NAWAL GRATWICK, IPPS IN SUB-SAHARAN AFRICA: DETERMINANTS OF SUCCESS 2–3 (2010).
[130] *Id.* at 2, 6.
[131] Ghose, *supra* note 54, at 3.
[132] *Id.* at 9.
[133] INT'L ENERGY AGENCY, AFRICA ENERGY OUTLOOK 2019, at 192 (2019), https://www.iea.org/reports/africa-energy-outlook-2019 [https://perma.cc/B5DH-F8VY].
[134] *See* Oyewunmi & Ehanmo, *supra* note 20, at 6.

the globe.[135] Many experts agree that wind and solar power harness more potential than other forms of renewable energy, such as hydropower (which is widely utilized in several African countries) and geothermal energy.[136] Currently, Africa only has about 1% of the global installed solar energy capacity.[137] Almost all of sub-Saharan Africa wields more potential for solar power production than all of Europe and much of North America.[138] In Ethiopia, just 0.005% of the country's land area could provide electricity (via solar power) for all existing needs.[139] Even greater potential exists southwest of Ethiopia, in Angola, Namibia, and South Africa.[140] South Africa has already begun tapping into this potential and is leading the region in renewable energy generation.[141] South Africa experienced a 329% increase in renewable energy investment in 2015, making it one of the fastest growing renewable energy programs in the world.[142] Much of this is due to their innovative auction program.[143]

C. Corruption Concerns

Corruption and inefficient governance are perennial problems in developing countries.[144] This affects renewable energy development because corruption wields the potential to be most damaging where large amounts of money are involved, including large-scale renewable energy projects. Corruption further impedes renewable energy development

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[135] Alphonse Niyibizi, *SWOT Analysis for Renewable Energy in Africa: Challenges and Prospects*, 6 RENEWABLE ENERGY L. & POL'Y REV. 276, 276 (2015).
[136] Ghose, *supra* note 54, at 4.
[137] *See* Oyewunmi & Ehanmo, *supra* note 20, at 8.
[138] *Solar Photovoltaic Power Potential by Country*, WORLD BANK (July 23, 2020), https://www.worldbank.org/en/topic/energy/publication/solar-photovoltaic-power-potential-by-country [https://perma.cc/K4FF-JTK2].
[139] *Id.*
[140] *Id.*
[141] IRENA, AFRICA 2030: ROADMAP FOR A RENEWABLE ENERGY FUTURE 14 (2015), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_Africa_2030_REmap_2015_low-res.pdf [https://perma.cc/5XLC-R6QJ].
[142] Nishtha Chugh, *In South Africa, Nuclear Energy Is Becoming a Dirty Word*, FORBES (Dec. 13, 2016, 8:37 AM), https://www.forbes.com/sites/nishthachugh/2016/12/13/in-south-africa-nuclear-energy-is-becoming-a-dirty-word/?sh=6ef51f653bdc [https://perma.cc/2DBV-ZVNA].
[143] *See supra* Section II.B.
[144] Omoh Gabriel, *Weak Governance, Corruption Are Problems in Developing, Developed Countries—Navin Girishankar*, VANGUARD (Sept. 5, 2011), https://www.vanguardngr.com/2011/09/weak-governance-corruption-are-problems-in-developing-developed-countries-navin-girishankar/ [https://perma.cc/8B96-ZSZE].

because investors know that their money is less likely to go toward the target investment.

Corruption also has the potential to make the money going to projects less efficient because corrupt politicians and project leaders may choose inappropriate projects or project locations, basing their choices off of bribes instead of legitimate cost-benefit analyses.[145] Further, corruption threatens existing infrastructure, as corrupt politicians might prefer to receive bribes for the construction of new projects rather than maintain otherwise adequate existing facilities.[146]

The most common form of corruption that occurs, in sub-Saharan Africa and globally, is bribery.[147] In very few countries is bribery actually illegal.[148] In some countries, it is so prevalent that companies cannot win government contracts without first paying a bribe.[149] Large companies in these countries must allocate bribe money into their annual budgets.[150] Bribes often come as a percentage-based commission of a project's total value.[151] For a public official who knows there is a small chance of being caught and an even smaller chance of being punished,[152] commissions on large projects are naturally tempting. Additionally, the percentage-based commission will incentivize the public official receiving the bribe to increase the size of a project, even when doing so will not benefit the public.[153]

In recent years, methods have been established to accurately assess the level of corruption in particular nations and governments.[154] Along with this, scholars have created increasingly viable methods of mitigating corruption.[155] A potential solution to bureaucratic corruption is to increase wages, such that government officials have less need (and incentive) to

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[145] ANITA SOBJÁK, OECD GLOB. ANTI-CORRUPTION & INTEGRITY F., CORRUPTION RISKS IN INFRASTRUCTURE INVESTMENTS IN SUB-SAHARAN AFRICA 7 (2018).
[146] *Id.* at 6; *see also* JILL WELLS, CMI U4 ANTI-CORRUPTION RES. CTR., CORRUPTION IN THE CONSTRUCTION OF PUBLIC INFRASTRUCTURE: CRITICAL ISSUES IN PROJECT PREPARATION 1, 8, 11, 18 (2015).
[147] *See* SOBJÁK, *supra* note 145, at 5.
[148] *Id.* at 3.
[149] *Id.*
[150] *Id.*
[151] OECD DEV. CTR., CORRUPTION IN THE EXTRACTIVE VALUE CHAIN: TYPOLOGY OF RISKS, MITIGATION MEASURES AND INCENTIVES 45 (2016), https://www.oecd.org/dev/Corruption-in-the-extractive-value-chain.pdf [https://perma.cc/5KX6-L7SA].
[152] THEODORE R. LYMAN, THOMAS W. FLETCHER & JOHN A. GARDINER, U.S. DEP'T OF JUST., PREVENTION, DETECTION, AND CORRECTION OF CORRUPTION IN LOCAL GOVERNMENT 5 (1978).
[153] SOBJÁK, *supra* note 145, at 9, 12.
[154] Benjamin A. Olken & Rohini Pande, *Corruption in Developing Countries*, 4 ANN. REV. ECON. 479, 501–02, 504 (2012).
[155] *Id.* at 501, 503–05.

accept bribes.[156] Studies show that this approach has mixed results, however. For example, a study of thirty-one low-income countries found that a doubling of government wages (relative to manufacturing wages) only results in an 8.33% reduction in corruption.[157]

Greater monitoring is another option for decreasing corruption. The primary problem with this approach, however, is that the officials tasked with monitoring are themselves corruptible. Thus, the end result of hiring officials to monitor is a net increase in the number of individuals benefitting from corruption.[158] Additionally, auditing or monitoring officials, even when these audits are themselves honest, does not necessarily result in decreased corruption because audits cannot always detect the corruption at hand.[159] Even when audits do detect issues, evidence is often not strong enough to pursue criminal penalties for bureaucratic wrongdoers.[160] Nevertheless, audits necessarily will increase the expected cost of crime by increasing the probability of being caught.[161] In a study of government-built roads in Indonesia, groups that knew they were being audited were found to be 30% less corrupt than the control group, which knew it only had a 4% chance of being audited.[162]

A novel monitoring approach is that of grassroots monitoring. This could consist of either town or village accountability meetings, which aim at decentralizing the control over projects, or through the distribution of anonymous comment forms, which allow community members to air their grievances without fear of retribution by local officials.[163] The former method was found to be effective at preventing theft of wages by officials.[164] The latter was found to be generally effective, but only when the forms were not distributed by the local officials themselves (because, given the opportunity, officials distributed complaint forms to members of the community unlikely to lodge complaints against them).[165]

A study of a village government in Indonesia revealed that grassroots monitoring efforts are surprisingly cost-effective.[166] Though it is

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[156] *Id.* at 497.
[157] *Id.*
[158] *Id.* at 498.
[159] *Id.*
[160] Olken & Pande, *supra* note 154, at 498.
[161] *Id.*
[162] *Id.*
[163] *Id.*
[164] *Id.*
[165] *Id.* at 498–99.
[166] Benjamin A. Olken, *Monitoring Corruption: Evidence from a Field Experiment in Indonesia*, 115 J. POL. ECON. 200, 242–43 (2007).

certain to vary, the study found that the approximate costs of the audit—measured by the wages paid to locals performing the auditing plus the time cost of their labor—consistently outweighed the estimated amount of money saved as a result of having a less corrupt government.[167]

Greater access to information is another proven method of reducing corruption.[168] This is especially pertinent in sub-Saharan Africa, where access to technology is spreading rapidly. Digital access, including the internet and mobile technology, can be used to spread news of corrupt practices.[169] This has already proven to be true in practice. In Indonesia in the 1990s, journalists reported on the government's corrupt practices on web-based journals, and although only a small portion of the nation had internet access, the increased transparency ultimately aided in the government's dismantling in 1998.[170]

Finally, several methods relating to the elections of public officials have been shown to mitigate corruption. Performance of a legitimate audit just prior to elections, for example, was effective at rooting out corrupt officials, who were then less likely to be re-elected.[171] The prospect of re-election itself has a strong correlation with corruption.[172] A survey of corruption among mayors found that mayors in their second (and final) term were much more likely to accept bribes (among other forms of corruption) than those in their first term (who were facing a re-election bid).[173] Term limits are also effective at mitigating corruption.[174] The absence of term limits presents public officials with the opportunity of entrenching themselves in their positions and developing long-term relationships with private entities.[175]

IV. PROPOSED SOLUTIONS

Academic studies on the viability of different policy instruments for different countries recognize the disparity between developed and

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[167] *Id.*
[168] *Id.* at 202, 233.
[169] Cassandra E. DiRienzo, Jayoti Das, Kathryn T. Cort & John Burbridge Jr., *Corruption and the Role of Information*, 38 J. INT'L BUS. STUD. 320, 322 (2004).
[170] *Id.*
[171] Olken, *supra* note 166, at 226, 244.
[172] *Id.*
[173] *Id.*
[174] *Id.*
[175] *Id.*

developing countries. It thus follows that analytical tools designed for developed countries may not reach the same results for developing countries.[176] Differences that must be accounted for include economic transitions, significant income inequality, and informal economies.[177] The term 'informal economy' refers to the diverse set of economic activity, jobs, and workers that are not regulated or protected by the state.[178] Ninety-two percent of workers in sub-Saharan Africa (excluding South Africa) are employed informally.[179] Adopting the renewable energy policy tools made for developed countries will produce bias, if not properly adjusted for developing countries.[180]

Reverse auctions would be the most effective policy tool, given their proven worth in South Africa and the known shortcomings of other tools.[181] Renewable energy portfolios are particularly ill-suited for sub-Saharan Africa.[182] When resources are limited and electricity is scarce, it is difficult to force countries to limit their methods of acquiring energy. Sub-Saharan African countries would be better off acquiring energy where they can, with light nudges toward renewable sources, as the other tools provide.

CONCLUSION

The coming of urbanization and economic growth in Africa, particularly sub-Saharan Africa, presents exciting opportunities and challenges. Maintaining a low carbon footprint while rapidly expanding access to electricity is one such challenge. Countries with widespread electricity access, such as the United States, China, and European Union member states are currently formulating plans to move from reliance on

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[176] M. Indra al Irsyad, Anthony Basco Halog, Rabindra Nepal & Deddy Koesrindartoto, *Selecting Tools for Renewable Energy Analysis in Developing Countries: An Expanded Review*, 5 FRONTIERS ENERGY RSCH., no. 34, 2017, at 1, 2.
[177] *Id.*
[178] *Informal Economy*, WOMEN IN INFORMAL EMP.: GLOBALIZING & ORG. ("WIEGO"), https://www.wiego.org/informal-economy [https://perma.cc/A2F5-WSU5] (last visited Jan. 16, 2023).
[179] *Statistical Picture*, WIEGO, https://www.wiego.org/statistical-picture [https://perma.cc/2LDW-A8JC] (last visited Jan. 16, 2023); *see also* MIKE ROGAN, WIEGO, INFORMAL WORKERS IN URBAN SOUTH AFRICA: A STATISTICAL SNAPSHOT 1 (2019).
[180] *See* Irsyad et al., *supra* note 176, at 1, 2.
[181] *Supra* Part II.
[182] Remco Fischer, Jenny Lopez & Sunyoung Suh, *Barriers and Drivers to Renewable Energy Investment in Sub-Saharan Africa*, 2 J. ENV'T INVESTING 54, 54–56 (2011).

fossil fuels to renewable energy.[183] However, developing countries, such as those in sub-Saharan Africa, Pacific Island nations, and southeast Asian nations face the more difficult challenge of balancing growth with limiting carbon emissions. Though the mountain is steep and the hurdles abundant, this Note's author is confident they will rise to the challenge.

[183] *China Has a Clear Pathway to Build a More Sustainable, Secure and Inclusive Energy Future*, IEA (Sept. 29, 2021), https://www.iea.org/news/china-has-a-clear-pathway-to-build-a-more-sustainable-secure-and-inclusive-energy-future [https://perma.cc/S64U-8K23].