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*by Osob Samantar**

Introduction

The United Nations Conference on Sustainable Development ("UNCSD" or "Rio+20") Conference culminates twenty years of sustainable development. Held in Rio de Janeiro, Brazil June 20-22, 2012, the conference marks the 20th anniversary of the 1992 United Nations Conference on Environment and Development ("UNCED"), and the 10th anniversary of the 2002 World Summit on Sustainable Development ("WSSD") in Johannesburg, South Africa. Under the central theme of the green economy, both Information Communication Technology ("ICT") solutions and renewable energy will be addressed.[1] These two sectors' growth are intertwined. As developed and developing countries convene for the Rio+20 conference, they must look to progress in these integrated areas. Sub-Saharan Africa provides an arena in which to view these concepts and take stock of how new principles have evolved and are being integrated into green economies.

Approximately forty percent of the world's population without access to electricity lives in Sub-Saharan Africa.[2] Within rural Sub-Saharan Africa, around eight percent of the population has access to electricity, which is vastly disproportionate to the urban areas where roughly fifty-three percent has access to electricity.[3] As a result, many in rural Sub-Saharan Africa do not enjoy the impact of ICT solutions. The purpose of this article is to highlight the relationship between ICT solutions and greater sustainable development, discuss the access crisis in rural Sub-Saharan Africa, and recommend integration and implementation methods that governments and non-government actors may pursue within the scope of the 1992 Rio Declaration principles. This article highlights three countries: Kenya, Ghana, and Namibia, and assesses their respective green energy efforts. Lastly, this article will discuss how the Rio+20 conference presents the perfect opportunity to incorporate ICT related provisions into the final conference outcome document.

Background

ICT solutions break barriers. Access to energy leads to easier access to ICT and knowledge regarding every aspect of the global community," which in return allows citizens to find solutions to political, social, and economic challenges. Income generation is also made possible through the creation of new ICT related enterprises. Access to energy is vital to sustainable development and the construction of green economies. Moreover, there is a positive correlation between access to energy and development.[4] Although the countries in this study vary with regards to ICT development, all three face issues with access to electricity and power within their rural areas.

Take, for example, the mobile phone ICT solution that improves citizens' standard of living, helps small businesses, and connects families. In Africa, mobile phones facilitate advancements in banking, education, healthcare, agriculture, and the empowerment of women.[5] At the same time, according to the GSM Association ("GSMA")[6], by the end of 2012 there are expected to be around 165,000 mobile base stations across sub-Saharan Africa without a reliable supply of electricity.[7] This totals nearly seventy-nine percent of all base stations across sub-Saharan Africa.[8] Typically, diesel generators power these stations.[9] Sustainable and renewable energy sources can resolve problems of unreliable access to energy by replacing or supplementing existing diesel generators. These energy sources are plentiful in Sub-Saharan Africa because of favorable geographic location and terrain. Integrating them into national energy plans will help states in Sub-Saharan Africa use green economy initiatives to alleviate poverty.

Kenya

Kenya is perhaps the most advanced African country in terms of utilizing ICT solutions. Kenya is located in Eastern Africa, bordering the Indian Ocean, between Somalia and Tanzania.[10] Its population is over fourty-three million with a median age of 18.9 years.[11] At an annual growth rate of thirty percent, Kenya's ICT sector outperforms all other sectors of the economy.[12] Of the three countries, Kenya's civil society is arguably the most active. Kenya has a relatively new Constitution (ratified in 2010), strong internal macro-economic policies, and what some analysts describe as "a favorable regional environment."[13] It is also East Africa's largest economy.[14] Despite recent efforts, Kenya still faces challenges with regards to the distribution of these modern solutions. ICT infrastructure in rural Kenya requires work, with the majority of advancements concentrated in Nairobi and Mombasa.[15]

ICT solutions in Kenya are mainly mobile-based since roughly ninety-three percent of adults use mobile phones.[16] Perhaps the most popular mobile platform in Kenya is Ushahidi. First developed to map reports of post election violence in early 2008, Ushahidi was also used to monitor the 2009 Indian

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elections; track violence in Gaza; map the Gulf of Mexico oil spill; and even monitor emergency response to the earthquake in Haiti.[17] Kenya also has a mobile money transfer service, M-Pesa, which provides banking access to rural citizens that lack access to traditional brick-and-mortar banks.[18] Since 2007, M-Pesa has transferred roughly $1.8 billion, which equals 5 percent of the country's GDP.[19] Agriculture is a source of employment for roughly seventy percent of the population in Kenya[20] and M-Farm solutions allow farmers to use a combination of crowd-sourcing and mobile alerts to identify sale patterns, predict the weather, and stay knowledgeable on other economically viable crops.[21] Even Community Health Workers offer educational lessons on reproductive health and newborn care via mobile applications.[22]

Several factors have forced Kenya's national emphasis on renewable energy and green economy initiatives. Kenya imports most of its fossil fuels.[23] Unlike other states in the South, Kenya is not rich in energy sources like coal and nuclear power.[24] Therefore, in many ways Kenya is constrained in the energy sector. About eighty percent of the population lives in rural areas and about ninety percent of Kenya's rural population lacks reliable access to electricity.[25] Kenya's investment in renewable energy is still in its initial stages. Thus, the amount of electricity being generated currently by renewable energy sources is far less than the potential amount.[26]

In 2004, Kenya inaugurated its E-Government Strategy to "improve service delivery, transform government operations, and promote democracy."[27] Much of this integrates Principle Ten of the 1992 Rio Declaration, in that the government sought to expand public access to government information.[28] In the same year, the Communication Commission of Kenya also funded a Universal Access Report to analyze ICTs in rural areas of Kenya.[29] The report estimated the rural population in Kenya at 18.6 million and found little to no research and development geared towards the needs of this population.[30]

Ghana

Ghana is located in Western Africa and borders the Gulf of Guinea, between Cote D'Ivoire and Togo. [31] Ghana's population is over 25 million, with a median age of 21.4 years. [32] Ghana is making strides in telecommunications. Although Ghana has not reached the level of sophistication of Kenya, it is ahead of Namibia in ICT. Ghana was one of the first African states to "liberalize" its telecommunications sector.[33] As a result, Ghana remains aggressive in incorporating ICTs in the health, education, and agriculture sectors.[34] Predictions also indicate that competition in Ghana's ICT market is set to intensify as more landing rights have been granted to two new submarine cables.[35] However, the environmental impact of these cables has not yet been assessed and the government has not accounted for the possible electronic waste that could result.

Although most discussions about mobile applications only refer to Kenyan products, Ghana's application providers are equally advanced. For example, applications allow individuals to check the authenticity of drugs through SMS messaging.[36] In healthcare, the Mobile Technology for Community Health initiative developed two mobile applications, 'Mobile Midwife' and 'Nurses' that provide training for nurses, alerts to remind women of important check-ups, educational resources, call centers to assist with monitoring, and a data collection mechanism.[37] Following Kenya's example, social activists and bloggers in Ghana plan on monitoring and reporting on the December 2012 elections, which will be the first time Ghana's citizens are engaged in this fashion.[38]

Ghana's ICT for education initiatives is some of the most advanced in Sub-Saharan Africa. ICT supported educational mechanisms are used in Ghana to ensure students are competitive in the global economy. GARNET, Ghana's national research and education network ("REN") creates integrated learning, teaching, and research among all public and private institutions in Ghana.[39] These programs fully integrate the notion that creativity will forge and mobilize global partnerships to "achieve development for all," which integrates Principle Twenty-One of the 1992 Rio Declaration.[40]

ICT solutions in Ghana also assist in creating sustainable livelihoods in the agricultural sector.[41] For instance, in the cashew industry, farmers use software solutions as part of a joint project created by SAP, a German based, multi-billion dollar software and programming company, and the African Cashew Initiative.[42] Through the SAP application, cashew unions get access to farmer contact data, loading information, buying data, and market information.[43] The application directly connects farmers to wholesalers and retailers, and ultimately helps them increase their incomes.[44]

Ghana has the potential to quickly "catch-up" in the ICT sector. Ghana's mobile penetration rate is 85.5 percent.[45] The government in Ghana also incorporated an emphasis on ICT solutions as a central piece to their long-term development strategy.[46] Yet, a recent study conducted by The World Bank found infrastructure disparities in Ghana, with greater ICT infrastructure in the South and Southwest than in the North.[47] Much of the infrastructure challenges could be a result of urban-rural energy disparities in different regions in Ghana.

Unlike Kenya and Namibia, Ghana integrated some of the core principles of sustainable development and green economy before the 1992 Rio Declaration. In 1989, Ghana established a national initiative to power the entire country by 2020 and included renewable energy schemes.[48] To help meet this goal, off-grid renewable energy sources could bridge the gap between centralized grid capabilities and population demands, especially since the cost of energy in Ghana is expected to reach $5.2 billion by 2020.[49]

Namibia

Namibia is located in Southern Africa and borders the South Atlantic Ocean, between Angola and South Africa.[50] Namibia has the lowest population density of the three countries in this article, which stands at roughly 2.1 million, with a median age of 21.7 years.[51] Roughly 60 percent of households are rural

households.[52] There are approximately 127,500 Internet users in Namibia and 1.5 million mobile phones within Namibia.[53]

Few innovative programs exist in Namibia similar to those in Kenya and Ghana geared towards civil activism and development through ICT solutions.[54] None of these programs have the high visibility of Ushahidi or the ICT for education initiatives in Ghana. Still, Namibia only gained its independence two years before the 1992 Rio Declaration.[55] The government in Namibia understands that it lacks the capacity necessary for sustainable development and has incorporated themes of cooperation and partnership embodied in the 1992 Rio Declaration.[56] For instance, Namibia is looking to India to assist with long-term challenges. This partnership with India could enable the ICT sector to provide e-services through distance learning and health resources by connecting Namibia with Indian counterparts thereby allowing direct assistance.[57] Utilizing this assistance, Namibia should pursue learning best practices and green initiatives toward the goal of implementing sustainable development in rural areas.

Access Crisis and the Use of Renewable Energy Planning Solutions

The 1992 Rio Declaration failed to provide a guide for states to deal with the accelerating demands for energy. Estimates show that by 2015, more Africans will have mobile phone access than electricity.[58] Increased demands coupled with lack of national infrastructure to accommodate growth and the high price of fossil fuels have created an energy crisis in Sub-Saharan Africa. For example, in Namibia energy deficits exist whereby demand stands at 550 mega-watts and current capacity is just above 380 mega-watts.[59] Lack of reliable energy stifles rural Sub-Saharan Africa and prevents citizens from enjoying the thriving ICT industries. Currently, approximately eight percent of the rural population in Sub-Saharan Africa has access to electricity, which is substantially lower than in urban areas where fifty-three percent of the population has access.[60]

Most of Sub-Saharan Africa relies on biomass, diesel, and kerosene, all of which are expensive and costly in the long run. In rural areas, high costs of electric grids incentivize the use of diesel and oil, whereas in urban areas, the costs are distributed over larger populations. In Namibia, wood remains the dominant source of energy in the rural areas.[61] Namibia currently relies on purchase agreements with power utilities in neighboring countries, thereby importing over fifty percent of its electricity.[62] In Ghana, high growth rates in demand for power are rapidly outstripping what the Akosombo Reservoir can supply in terms of hydropower; and as a result many must return to oil.[63] Most Kenyan households are still reliant on kerosene lamps, disposable batteries, and diesel generators.[64] These energy sources are very expensive and harmful to human health and the environment.

All states should fully incorporate Principle Four of the Rio Declaration into national energy policies, which requires that "environmental protection constitute an integral part of the development process [that] cannot be considered in isolation from it."[65] This should include acknowledging and implementing renewable energy initiatives as one step in the process of integration. Sub-Saharan Africa is abundant with renewable energy resources and use of these resources would avoid the environmental damages created by deforestation and greenhouse gas emissions. The GSMA predicts that East Africa alone has a potential to create 11,000 community power projects to help supply electricity and communication to rural populations.[66] Countries can replace their reliance on diesel, kerosene, or biomass with solar and/or wind energy.[67] Africa has twenty percent of the world's landmass, and land in Sub-Saharan Africa is plentiful and cheap, making the installation of wind or solar farms in rural Sub-Saharan Africa is more feasible than in other areas of the world.[68] Sunshine is also plentiful and the cost of both wind and solar photovoltaic energy sources is becoming progressively cheaper.[69] Moreover, additional financial resources could be recovered with power sector cost recovery.[70]

Solar Photovoltaics

Photovoltaic cells transform sunlight into electricity while also storing this energy for later use.[71] Meeting household demand depends on the given system size, which is the number of panels necessary to "produce enough power to meet demand."[72] Solar photovoltaics (solar PV) are easily adaptable, use both direct and diffused beams, and the cost is dropping at a faster rate than other technologies.[73] Solar PV is well suited for rural Sub-Saharan Africa. It requires minimal maintenance and the sun in rural Sub-Saharan Africa is especially plentiful year-round. [74] Yet, critics remain hesitant about the viability of solar PV as a long-term solution because solar panels are often shipped internationally, require costly maintenance, and can be difficult to replace locally.[75]

Kenya

Kenya's location allows for fierce, yearlong exposure to sun. The Ministry of Energy estimates exposure at about 4 to 6 kWh per square meter per day, which is comparable to 300 million tons of oil equivalent.[76] Most areas in Kenya also receive around six hours or more of sunlight a day.[77] All thirteen public micro grids in Kenya use diesel fuel to generate electricity and fuel costs are passed through to the consumer.[78] For instance, in November 2009, the fuel cost adjustment accounted for forty percent of the total consumer electricity bill.[79] Diesel generation can be effectively replaced by solar generation in the micro grids to alleviate this burden on the consumer.

Ghana

Similar to Kenya, the Ministry of Energy in Ghana estimates solar exposure at about 4 to 6 kWh per square meter per day.[80] The Ministry also recorded high levels of solar energy in about sixty percent of the total national land mass.[81] Solar PV installations in Ghana can help electrify homes and communities, power rural telephony, power battery-charging stations, support distance education tools, and power other telecommunications tools. Solar battery service stations for community members can be a profitable business venture for rural entrepreneurs in

Ghana.[82] The government can also encourage national energy companies to adopt renewable energy plans to fill disparity gaps.

Namibia

There are few statistics on the exact potential of solar energy in Namibia, but Namibia's solar resource is abundant with some estimates showing 3,300 hours of sunshine per year in Namibia.[83] Furthermore, in 2010, the World Bank estimated that Namibia held the "highest multiple, annual production potential from solar, wind, hydro, geothermal, and biofuels."[84] This potential is about one-hundred times the current energy consumption.[85] In 2005, the government of Namibia asserted its commitment to sustainability through the promotion of natural resources for energy production.[86] This included the establishment of the Solar Electrification Revolving Fund.[87]

Wind Turbines

Wind Turbines extract energy from moving air and enable an electric generator to produce electricity.[88] The amount of energy and the reliability of wind energy vary due to wind velocities and turbine characteristics. However, wind turbines are ideal for rural Sub-Saharan Africa because most feasible wind velocities are concentrated in fairly remote rural areas.[89] Nonetheless, meeting rural demand will depend on many technical factors including determining the ideal hub height and blade size necessary for efficient operation, that in turn affect the total cost of building and operating the turbines .[90]

Kenya

Kenya has one of the highest wind velocities in the world with averages ranging between three and ten m/s (meter per second) and northern Kenya with wind velocities at 11 m/s.[91] The UN Environment Programme estimates that Kenya's wind potential is more than double the national demand, or approximately 3,000 MW.[92] Wind energy can also alleviate the state's reliance on hydropower, which is currently strained by lack of rainfall and environmental degradation of watersheds.[93] Electricity generation from wind can play an important role in rural electrification in Kenya because it is cheaper than oil-fired generation and easily accessible to rural households that are not connected to a national grid.

Ghana

Wind energy potential in Ghana is estimated at 5,600 mega watts.[94] Tapping into this resource will be crucial for Ghana to reach its goal to achieve "10 percent contribution of new renewable sources in electricity generation" by 2020.[95] As it stands, existing power plants are unable to meet the growing demands in Ghana, especially with increased oil prices.[96] Ghana has also invested capital and resources into solar PV solutions, but overlooked ways to incorporate wind energy projects into the national goals of sustainable development. Local wind turbines in Ghana can even use scrap metals, automobile wheel bearings, and axles to produce cheaper alternatives than solar PV.[97]

Namibia

There are few statistics on the exact potential of wind energy in Namibia, but the geography suggests that wind power could provide a great deal of energy. Sources found wind energy potential in Namibia to be significantly high.[98] The coast of Namibia provides favorable wind velocities for turbine operation.[99] Namibia is water stretched, so hydropower is less viable and wind energy requires little to no water.[100] Although wind energy will not provide a majority of Namibia's energy, it can nonetheless help reduce its energy deficit.[101]

Integration and Implementation

The advances currently made in Kenya, Ghana, and Namibia are largely based on 1992 Rio Declaration principles. States take varied approaches at incorporating these principles. Often the initial step involves incorporating principles of renewable energy sources into commissioned reports and then into national energy law. Solar and wind energy policies are relatively young in much of Africa, but governments along with private partnerships are integrating and implementing large-scale projects. Many of these projects are still concentrated in urban areas or connected to the national grid and therefore create disparities between the urban and rural areas. Cooperation among states with regards to scientific expertise and technology transfers can also assist local development processes to achieve sustainable development in areas outside of the energy sector.

Kenya

In 2004, the government released Sessional Paper No. 4, which outlined the government's energy policy through 2023.[102] The government acknowledged the "power system weaknesses" and recognized the "great potential" for solar and wind energy, but also found challenges with "attracting substantial private sector investments."[103] The paper sought to develop local expertise, initiate local adaption of technologies, and adequately fund rural electrification penetration from 2004-2012.[104] In the long run, 2004-2012, the plan proposed greater financial incentives for investors in power generation and the development of "local manufacturing capabilities for advanced renewable energy technologies."[105] Later in 2006, the government passed the Energy Act of 2006, which serves as Kenya's premiere legislation on the consolidated national energy policy.[106] This law emphasizes efficiency and conversion of Kenya's energy sources, and affirms Kenya's commitment to sustainable development.[107] The Minister is also required to promote the "development of renewable energy technologies" and is permitted to inspect factories to analyze whether their energy utilization complies with concepts of efficiency and conservation.[108] The Act created two new bodies — the Energy Regulatory Commission and the Rural Electrification Authority — both of which demonstrate Kenya's commitment to sustainable development.[109] Moreover, the Act integrates 1992 Rio Declaration chapters nine through twenty-two on conservation management of resources in order to hold the Ministry of Energy accountable for ensuring compliance is met.[110]

As a result of the Ministry's rigorous efforts, the government installed more than 300,000 solar systems in Kenyan households.[111] Future projects by the Ministry will mainly focus on schools and health facilities.[112] The government uses solar systems to electrify 220 schools and has plans to electrify an additional 497 institutions.[113] Investment in future solar system projects is estimated at $24.8 million U.S. dollars.[114] Additionally, an initial line of 50 MW will be online in 2014.[115] Moreover, since 2009 Kenya has supported widespread access to ICT services through a universal service fund, which promotes capacity building and innovations in ICT services.[116]

Kenya is in the process of building Africa's largest wind farm in Lake Turkana.[117] The project will construct 365 wind turbines in a 24,000-acre area, which will cost $772 million.[118] The Dutch-led project will generate clean energy to meet more than 20 percent of the country's electricity needs.[119] The wind farm is estimated to add an additional 300 MW to the national grid.[120] Still, many rural communities may not enjoy the benefits of the wind turbines, because they will lack connection to the national grid. Unfortunately, Kenya is also planning to open the country's first nuclear power plant to produce twenty-five percent of electricity needs, despite global fears of nuclear waste and impacts on the environment.[121] Additionally, there are no details as to whether Kenya adhered to the 1992 Rio Declaration, which requires Kenya to assess the "environmental impact" of this new plan on the surrounding area and population.[122]

Ghana

Decentralized and off-grid renewable energy sources in Ghana can serve as an alternative to grid electricity to power much of the industrial and service sectors.[123] Ghana's solar PV programs are moving at a fast pace. As of 2008, over 5,000 solar PV systems were installed in Ghana.[124] Even the Ministry of Energy is connected to a 50kWp Solar PV Grid.[125] One successful project is Ghana's Energy Development and Access Project ("GEDAP") to build local and regional solar capacity, which is funded by the World Bank, the International Development Agency, Global Energy Facility, and the African Development Bank.[126] GEDAP installed solar systems for solar street electrification, vaccination refrigeration, and to power home systems.[127]

Several local wind power projects are successful in Ghana. For instance, the Washington D.C. based EnterpriseWorks Worldwide along with Rural Energy and Environment Systems ("REES") of Ghana, and the UK's Scoraig Wind Electric created a program to train local technicians in manufacturing small-scale wind turbines.[128] The materials for the turbines are found locally and maintained by local technicians. The First of the turbines was erected in Accra.[129] By 2004, the project constructed another eight turbines in six off-grid communities.[130] These projects create jobs for local technicians and are cost-effective because all materials are recycled and locally sourced.

In 2011, Ghana's cabinet approved a vital Renewable Energy Bill to promote the development of renewable energy sources and to make the Energy Commission responsible for implementing all government directives.[131] The Bill is also intended to build greater awareness within the population about the advantages of renewable energy.[132] However, the cabinet should incorporate 1992 Rio principles into the final bill, receive public input on the legislation, and include principles in the upcoming Rio+20 outcome document in order to strengthen this vital piece of legislation.

Namibia

Namibia still requires greater institutional reform and a national policy on renewable energy distribution that integrates the 1992 Rio Declaration. The vast land area and low population density in Namibia create difficult challenges for access distribution. Only four to seven percent of the population has access to ICTs.[133] In 2004, the government initiated the Vision 2030 development plan, which aims to make Namibia a "prosperous, harmonious industrialized state by 2030" by allocating billions of dollars towards the development of different industries.[134] The budget expansion suggests that Namibia is making serious efforts to assess long-term solutions.[135] Unfortunately, the plan also allocates large amounts of money to defense instead of energy efficiency, telecommunications, or specific green economy initiatives.[136] The plan does, however, state that the "creation of an enabling environment is essential for the attainment of sustainable development," but this language remains vague and "an enabling environment" does not necessarily equate to a full integration of the 1992 Rio principles.[137] The plan does address ICT deployment and even designates a series of strategies for the government to promote that will make ICT "the most important sector in Namibia" by 2030.[138] Namibia will still require specific investment in renewable energy solutions to foster the sustainable growth strategies outlined in the Vision 2030 agenda.

The Ministry of Mines and Energy ("MME") originally launched the "Promotion of the Use of Renewable Energy Sources" in 1993 as a bold step after the 1992 Rio Declaration to handle the energy crisis and sustainable development.[139] Currently, Namibia has three turbines at the Ruacana hydropower station and is months away from completing construction on a fourth turbine.[140] Additionally, in late 2011, the government of Namibia held talks with regulators, utility developers, financiers, and NGOs to discuss the future of wind power in Namibia.[141]

Role of Non-State Actors

In many ways the 1992 Rio Declaration was ahead of its time in recognizing the role that non-state actors can play in promoting sustainable development and modernizing societies. The 1992 Rio Declaration, however, could not have predicted the major role mobile penetration and ICT solutions would play in assisting non-state actors to achieve the very principles of the Declaration.

Mobile operators can serve as examples of efficient and conservationist practices. Recently, Safaricom, Kenya's largest mobile operator reported the company would use a combination of wind and solar solutions to power eighty-six base stations.[142] At the same time, non-state actors can work with

rural populations to help with principles of technology transfer. For instance, the United Nations Industrial Development Organization ("UNIDO") along with the government of Kenya launched rural energy centers to spread the use of off-grid renewable energy sources in rural Kenya.[143] The centers will promote small business entrepreneurship and provide ICT training to communities. UNIDO also partnered with Microsoft to provide training in ICT solutions for micro-businesses in rural Kenya.[144] Phase one of the joint efforts deployed resources and energy centers in Bungoma, Siaya, and Karachuonyo while phase two will take place in Meru, Ngong, and Dadaab refugee camp.[145]

Non-state actors can also share scientific advancements that incorporate local input. Currently, organizations like *access:energy* create renewable wind turbines for rural Kenyans.[146] *Access: energy* helps citizens participate in their own development by building wind turbines.[147] The Kenyans along with the Yale University and the EngineerAid network make turbines out of scrap metal and car parts.[148] The turbines generate power at a cost that is two to three times lower than equivalent solar PV panels; they can generate enough power for fifty rural homes (about 2.5 kWh per day); and they can be built using locally sourced materials.[149]

Educating the future generation through the use of ICT solutions can help states achieve competitive advantages. Intel has a program designed to create Africa's first WiMAX connected school in Ghana.[150] HP is creating community-learning centers in Ghana.[151] Additionally, the African Youth Initiative and One Village Foundation has founded CatchIT, which is designed to foster the growth of ICT clubs in Ghana.[152] Also, the World Bank along with the University of Ghana is creating research and education networks to connect researchers and institutions from around the world.[153]

Good state practices with regards to energy projects may become transferable. In August 2011, Juwi Solar and Alternative Energy Systems launched the Tsumkwe Energy Project, one of Africa's "largest off-grid solar systems." [154] This project supplies public buildings and one hundred private households with electricity in a rural village in Northern Namibia.[155] Although the system includes some integrated diesel generators, the plant is innovative, only took six-weeks to create, and similar projects may be transferred to the rest of rural Sub-Saharan Africa.[156]

Civil society organizations and companies may function as driving mechanisms. For example, in Namibia, the Information Communication Technology Association ("NICTA") can work closely with the Ministry of Information and Communication Technology in determining mutual objectives in the ICT sector as well as access to renewable energy. Likewise, the ICT Alliance in Namibia serves as a cabinet advisor to the government and therefore can play an active role incentivizing projects that create green economy initiatives in the rural areas.

Challenges and Criticisms

The major challenges associated with renewable energy sources are costs, human capacity, and lack of knowledge. Capacity for investment is limited in all of Sub-Saharan Africa and governments have faced difficulties raising the capital necessary to accelerate renewable energy sectors. Large wind energy systems and solar PV systems require high initial capital costs. For example, solar PV systems generally only maintain three years of self-sufficient management.[157] In Kenya, the Feed-in-Tariffs introduced by the Ministry of Energy in 2008 are helping to ease this problem.[158] The tariffs essentially, allow "power producers to sell renewable energy sources generated electricity ("RES-E") to a distributor at a pre-determined fixed tariff for a given period of time."[159] This will likely accelerate the investment process because power companies can be more innovative and less constrained by other pressing issues juggled by the government. Unfortunately, the tariffs are currently limited to wind, biomass, and small hydro generators.[160] Replacement costs present another major challenge. The average lifespan of a solar PV panel is thirty years and few states actually compute the replacement costs associated with ensuring reliable systems.[161] Implementing fees may be difficult and requires more innovative techniques. One solution might be to create financial incentives that waive the cost of import duties.[162]

Most of Sub-Saharan Africa's states also suffer from lack of ICT-engineers, technicians, and scientists. In Ghana, the government created the Renewable Energy Education Project ("REEP") to facilitate education to strengthen human resource capacity.[163] The REEP project uses ICT solutions like distance learning to help workers receive courses on renewable energy.[164] Partnerships with Indian or Chinese engineers, technicians, and scientists may also serve as a viable solution to this challenge in Africa. That said, the partnerships should stress the need to develop local capacity and avoid over-reliance on importing technicians.

States will also need to educate rural inhabitants on the benefits of renewable energy sources. For instance, in Ghana many rural citizens will continue to perceive renewable energy sources as a "transition source," until the government can expand a national grid.[165] However, the reality of resources makes grid expansion unrealistic. Solar and wind energy are often more cost-effective than extending grid power, so governments should reach out to rural citizens in the form of workshops to educate citizens and challenge any misconceptions.

Rio+20 Conference

In many ways the original 1992 Rio Declaration was ahead of its time. Yet, a great deal has changed in the global environment since 1992. Sub-Saharan Africa has made great progress in the area of sustainable development. Many states have adopted policies to promote sustainable development.[166] Regional players are now more active than international institutions. New sources of investment are prevalent. Nonetheless, emerging challenges face Sub-Saharan Africa and not all states have adopted the goal to eliminate policies that degrade the environment.[167] Paramount among these challenges is the energy crisis, which includes access to energy by rural Africans. Today, the Rio+20 conference presents an opportunity for forward thinking. Several submissions serve as a good point of reference on the energy crisis

for the Rio+20 conference. For example, the Africa Consensus Statement to Rio+20 stated that "access to sustainable energy facilitates development and contributes to the achievements of internationally agreed sustainable development goals including the Millennium Development Goals."[168] The states in this article have national energy or development policies that incorporate principles of conservation, efficiency, and awareness. Moreover, in 2010 governments in Africa increased investment in renewable energy by 280 percent or $3.6 billion.[169] This is the largest increase among all developing regions. Still, more international implementation principles should be discussed and analyzed at the upcoming Rio+20 conference. The governments in Sub-Saharan Africa should also seek a greater role in the discussion of the green economy in Rio+20 to ensure their needs are met and that an outcome document takes African circumstances into consideration.

The Rio+20 conference is an opportunity for international players to discuss ways of incorporating access to ICT solutions within a more concrete and expansive "means of implementing" section.[170] ICTs can play an increasing role in connecting the three pillars of sustainable development — economic, social, and environmental — while also providing mechanisms to facilitate green economies. ICTs can facilitate the fusion of local knowledge and technological knowledge. A future inclusive outcome document already has a point of reference with regard to incorporating ICTs into the process of promoting green economies. The International Telecommunication Union ("ITU") submission is a comprehensive document detailing that the "sustainability of future growth will rely critically on taking advantage of ICTs as drivers and central elements of a greener, fairer, and more sustainable economy."[171] Moreover, since 1992, numerous international documents have recognized the vital role ICTs play in development, including the World Summit on the Information Society, the Broadband Commission for Digital Development, and the Istanbul Programme of Action.[172] Thus, the outcome document to Rio+20 can consolidate the role of ICTs in sustainable development and green economies.

Although the global governance structure attempts to safeguard the integration of 1992 Rio Declaration principles, Rio+20 should consider other mechanisms that can facilitate green economies. A consensus to transition Sub-Saharan African economies for the purpose of promoting sustainable development for all will require great focus. The Rio+20 Outcome Document should, among other things, consolidate these concerns with access to renewable energy and innovative ICTs. Within the context of Sub-Saharan Africa, the Rio Outcome Document may include concrete measures or provisions dedicated to:

- The challenge of access to renewable energy in rural areas and possible innovative solutions.
- The reality that Sub-Saharan Africa is witnessing initial stages of industrialization and therefore requires a different path to sustainable development.
- The acknowledgement that challenges of sustainable development overlap with the challenges facing the implementation of renewable energy sources in Sub-Saharan Africa — lack of finance or investment, the need for capacity building, and educational awareness or "technology transfer."[173]
- The recognition of the role of ICTs in strengthening civil society and leveraging ICT solutions to build sustainable development and eradicate poverty.
- The implementation of national ICT infrastructure development, human resource development, universal access, ICT literacy, and technological research development in addition to the current goals for developing states.[174]
- A goal addressing access to ICT through renewable energy strategies.

The first step for any outcome document is a clear and measurable definition of the green economy. This definition should consider the reality that Sub-Saharan Africa is industrializing, and therefore requires a language that acknowledges different paths to sustainable development. Recognizing that the energy crisis in Africa has serious implications to this future green economy also requires greater cooperation among states to allow for the sharing of best practices in green economy initiatives. This may include practical examples of political direction or policies that incentivize renewable energy projects. The document should include access to information and mobile penetration. Furthermore, the outcome document should encourage states to leverage ICT solutions to strengthen civil society and to eradicate poverty.

The global governance model has not failed, but innovative solutions should be sought to bring about systemic change in Sub-Saharan Africa through cooperation with younger regional players. In Africa this might involve working closely with the African Union ("AU") on a concrete document concerning the green economy, sustainable development, and energy issues. For example, allocating regulatory authority to the Energy Commission within the AU might be more effective and influential than entrusting this authority to an international institution. Globally, India's increasing role in Africa should be leveraged. India's level of investment in Africa is great, with 2010-2011 investment at $52.81 billion.[175] The outcome document from Rio+20 should emphasize investment not only in human capacity, but possibly the creation of a universal fund to ensure Africa integrates 1992 Rio Declaration principles as well as establishes long-term green economy initiatives.

Conclusion

Africa is witnessing a *trente glorieuses*.[176] Nonetheless, high oil prices coupled with global warming concerns have necessitated the development of renewable energy throughout Africa. Much of Africa understands these concerns, but incentive structures should be set so that states continue to diversify their energy supply.

Another challenge in Sub-Saharan Africa is that few statistics and little information are available about various smaller players. Consequently, little to no data exists on a large scale on access issues or ICT solutions beyond Kenya, South Africa, and Nigeria. Timely and accurate research should analyze needs in

the rest of Sub-Saharan Africa and objectively assess whether or not they are being met.

While most of this paper focuses on access to energy sources as a means to facilitate ICT-related growth, I would be remiss if I failed to note that there are many issues that compete for attention and funding in Sub-Saharan Africa. The creation of a green economy does not only require investment in the energy sector. Growth entails the transformation of society from traditional mechanisms to innovative modes of knowledge. Access to ICTs through the use of renewable energy sources is but one way states may transform their societies.

Endnotes: Shining Sun and Blissful Wind: Access to ICT Solutions in Rural Sub-Saharan Africa Through Access to Renewable Sources

[1] This article will confine ICT solutions to primarily mobile platforms, distance learning or other e-learning mechanisms, and e-health or other health related technologies. Energy in this article will refer to both power and electricity interchangeably; however some statistics refer only to access to electricity or electricity supplies and not other sources of power generation.

[2] Wendy Atkins, *This is Africa: Green Light*, This is Africa Online (Jan. 5, 2012), http://www.thisisafricaonline.com/news/fullstory.php/aid/369/Green_light.html.

[3] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services 39 (GSMA, A.T. Kearney & Wireless Intelligence 2011).

[4] Inare Akinola, *Africa's Green Energy Revolution*, This is Africa Online (Feb. 26, 2012), http://web.thisisafricaonline.com/print/?pid=1792.

[5] *See generally* Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3.

[6] GSMA, GSM Association, is an association of mobile operators and related companies dedicated to supporting the standardizing, deployment, and promotion of the GSM mobile telephone system. GSM Association, http://www.gsma.com.

[7] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, supra note 3, at 34.

[8] *Id.*

[9] *Id.*

[10] *Kenya,* CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html (last updated Mar. 22, 2012).

[11] *Id.*

[12] Madanmoham Rao, *Mobile Africa Report 2011: Regional Hubs of Excellence and Innovation*, MobileMonday 35 (March 2011).

[13] *See Id.* at 55.

[14] Christine Mungai, *Is Kenyan African Silicon Valley?*, TalkAfrique, *available at* http://www.talkafrique.com/science-and-technology/kenyan-ict-african-silicon-valley (last visited Apr. 24, 2012).

[15] Infrastructure in this context primarily refers to fiber optic cables, satellite dishes, electric wires, or solar and wind power generators, which allow Internet connectivity, computing, and battery charging.

[16] Gabriel Demombynes, *Is Mobile Technology Over-Hyped*, Worldbank Blogs (Mar. 16, 2012, 1:43 PM), http://blogs.worldbank.org/africacan/node/2107.

[17] *About*, Ushahidi, http://ushahidi.com/ (last visited Apr. 24 2012).

[18] Rao, *supra* note 12, at 28.

[19] *Id.*

[20] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3, at 34.

[21] Rao *supra* note 12, at 54.

[22] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3, at 36.

[23] Interview with CEO of Renewable Energy Ventures Joseph Ng'ang'a, ABNDigital (May 4, 2011).

[24] *Id*.

[25] Warigia Bowman, *Governance, Technology and the Search of Modernity in Kenya*, 1 Wm & Mary Pol. Rev. 87, 114 (2010).

[26] Interview with CEO of Renewable Energy Ventures Joseph Ng'ang'a, *supra* note 23.

[27] Bowman, *supra* note 25, at 99.

[28] *See Rio Declaration on Environment and Development*, UN Conference on Environment & Development principle 9 (1992), available at http://www.unesco.org/education/information/nfsunesco/pdf/RIO_E.PDF.

[29] Bowman, *supra* note 25, at 99.

[30] Universal Access Report, (2004) §§ 2.1.4, 4, (Kenya) available at http://www.cck.go.ke/services/universal_acce ss/downloads/FinalUAreport.pdf.

[31] *Ghana,* CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html (last visited Apr. 24, 2012).

[32] *Id.*

[33] Kofi Mangesi, *Survey of ICT and Education in Africa: Ghana Country Report*, InfoDEV.org 1, 5 (2007), http://www.infodev.org/en/Publication.406.html.

[34] *See Id*.; *see also* World Bank Sustainable Development Department, *Ghana's Infrastructure: A Continental Perspective* 21-22, U.N. Doc. WPS5600 (Mar. 2011), *available at* http://www-wds.worldbank.org/servlet/WDS ContentServer/WDSP/IB/2011/03/17/000158349_20110317145909/Rendered/PDF/WPS5600.pdf.; *see also* Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3.

[35] World Bank Sustainable Development Department, *Ghana's Infrastructure: A Continental Perspective* 21-22, U.N. Doc. WPS5600 (Mar. 2011), *available at* http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP /IB/2011/03/17/000158349_20110317145909/Rendered/PDF/WPS5600.pdf.

[36] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3, at 36.

[37] *Mobile Technology for Community Health in Ghana: What it is and What Garmeen Foundation Has Learned So Far*, Mobile Technology for Health (Mar. 2011), *available at* http://www.cs.washington.edu/education/courses / cse490d/12sp/docs/MOTECH.pdf.

[38] Garth Moore, *Interview: Peering into Ghana's Mobile Future with Mac-Jordan Degador*, One.org (Jan. 31, 2012), http://one.org/blog/2012/01/31/interview-peering-into-ghanas-mobile-future-with-mac-jordan-degadjor/.

[39] *Background to the Evolution of GARNET*, GARNET, http://www.garnet.edu.gh/ (last visited Apr. 24, 2012).

[40] *Rio Declaration on Environment and Development, supra* note 28, at ch. 21.

[41] *See Id.* at ch. 29.

[42] Evan Welsh, *Nut Farmers in Ghana Crack Into Mobile Technology*, Forbes, (Sept. 26, 2011), *available at* http://www.forbes.com/sites/sap/2011/09/26/nut-farmers-in-ghana-crack-into-mobile-technology/.

[43] *Id*.

[44] *Id.*

[45] Moore, *supra* note 38.

[46] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3, at 33.

[47] *Ghana's Infrastructure: A Continental Perspective*, *supra* note 35, at 21-22.

[48] *Challenges of Solar PV for Remote Electrification in Ghana*, Ministry of Energy (2004), http://www.zef.de/fileadmin/webfiles/renewables/praesentations/Ahiataku-Togobo_solar%20PV%20Ghana.pdf.

[49] *Id*.

[50] *Namibia,* CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html (last updated Mar. 27, 2012).

[51] *Id*.

[52] European Commission, Country Strategy Paper and National Indicative Programme for the Period 2008-2013 1, 11 (2008), *available at* http://ec.europa.eu/development/icenter/repository/scanned_na_csp10_en.pdf.

[53] *Namibia, supra* note 50.

continued on page 60

[149] *Id.* (giving examples of new accountability represented by "constitutions and laws [which] now guarantee freedom of information in nearly 100 countries and many more have enacted administrative processes, such as permitting systems or environmental impact assessments that mandate public participation. . . [and] [s]pecialized environmental courts and tribunals [which] have been established in over 44 countries providing additional environmental dispute resolution forums.").

[150] *Id.* (quoting the U.N. Secretary General to have called for governments to do more to "build on progress made to promote transparency and accountability through access to information and stakeholder involvement in decision-making").

[151] U.N. High-Level Panel on Global Sustainability, *Resilient People, Resilient Planet: A Future Worth Choosing*, at 10 (2012) [hereinafter Panel Report] (stating that the need to integrate different aspects of society to achieve development has been accepted knowledge for a quarter century).

[152] Rio Declaration, *supra* note 3, princ. 1 ("Human beings are at the centre of concerns for sustainable development.")

[153] Panel Report, *supra* note 150, at 10 ("Citizens will no longer accept governments and corporations breaching their compact with them as custodians of a sustainable future for all. More generally, international, national and local governance across the world must fully embrace the requirements of a sustainable development future, as must civil society and the private sector.").

[154] De Silva, *supra* note 1 (finding that only open policies will be able fight rent capture and corruption and that successful policies will "depend upon broad-based constituencies that have been engaged in and benefit from sustainable development").

[155] Maya Forstater et al., The Institute of West-Asian and African Studies of the Chinese Academy of Sciences, Corporate Responsibility in African Development: Insights from an Emerging Dialogue 19 (Oct. 2010), http://www.hks.harvard.edu/m-rcbg/CSRI/publications/workingpaper_60.pdf (noting that, unlike in the West where pressure for CSR has been driven by civil society, in China it has been driven by the government as a stakeholder).

[156] *Id.* at 13.

[157] *Id.* at 19 (reporting the results of a study conducted by members of the Institute of West-Asian and African Studies of the Chinese Academy of Social Sciences and the John F. Kennedy School of Government at Harvard University).

[158] *Id*. at 19-20.

[159] *Id.* at 36.

[160] Pew Research Center, Global Unease with Major World Powers (2007), http://www.pewglobal.org/files/pdf/256.pdf (finding in a 2007 survey of Africans in ten countries that in nine out of the ten countries, by a margin of between 61% and 91%, African respondents said Chinese influence was good, substantially exceeding the positive response for American influence).

[161] Forstater, *supra* note 154, at 8 exhibit 1.

[162] *See, e.g.* El Tayeb Siddig, *China vows to support Sudan after southern secession*, Reuters, Aug. 8, 2011, http://www.reuters.com/article/2011/08/09/us-sudan-china-idUSTRE77800Z20110809.

Endnotes: Shining Sun and Blissful Wind: Access to ICT Solutions in Rural Sub-Saharan Africa Through Access to Renewable Sources

continued from page 60

[54] A local NGO and Telecom Namibia collaboratively created, Xnet Development Trust, which provides affordable Internet access to various social sectors like, education, health, and agriculture; The Namibian Ministry of Education developed TECH/NA!, which provides "educational institutions with hardware, software," Internet and technical support, as well as, education for "administrators, staff, teachers, and learned in ICT literacy" Shafika Isaacs, *Survey of ICT and Education in Africa: Namibia Country Report*, InfoDEV.org (2007), http://www.infodev.org/en/Publication.420.html; however programs have not proven effective as seen with SchoolNet Namibia. A not-for-profit civil society organization intended to provide "sustainable, affordable open source technology solutions and Internet access . . . to schools" and other education-based organizations throughout Namibia, but has "failed because of mismanagement by the Ministry of Education and a lack of vision inside the ministry" Augetto Graig, *Namibian ICT State Shocking*, Namibian Sun (Oct. 21, 2011), available at http://www.namibiansun.com/content/click/namibian-ict-state-shocking.

[55] *See Namibia, supra* note 50 (acknowledging Namibia's formal independence as 1990).

[56] *See generally* Namibia Vision 2030, (2004) (Namibia) *available at* http://www.npc.gov.na/vision/pdfs/Summary.pdf; *see also* Interview with Minister of Information and Communication Technology Joel Kaapanda, ITU Telecom World, (Oct. 24, 2011).

[57] Interview with Minister of Information and Communication Technology Joel Kaapanda.

[58] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3, at 34.

[59] Interview with Vestas Vice President of Communications Andrew Hilton, Vestas Central Europe, (Nov. 8, 2011).

[60] *Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services*, *supra* note 3, at 38.

[61] *Country Strategy Paper and National Indicative Programme for the Period 2008-2013*, *supra* note 50, at 14.

[62] *Id.* at 38.

[63] *Ghana's Infrastructure: A Continental Perspective*, *supra* note 35, at 21-22.

[64] Ariel Schwartz, *Truly Local Power: African Wind Turbines Built From Scrap*, Co.exist, http://www.fastcoexist. com/1679335/truly-local-power-african-wind-turbines-built-from-scrap (last visited Apr. 24, 2012).

[65] *See generally Rio Declaration on Environment and Development, supra* note 28, at principle 4.

[66] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3, at 37.

[67] Akinola, *supra* note 4.

[68] *Id.*

[69] *Id.*

[70] *Ghana's Infrastructure: A Continental Perspective*, *supra* note 35, at 37.

[71] R.B. Hiremath et al., *Decentralised Renewable Energy: Scope, Relevance, and Applications in the Indian Context*, 13 Energy for Sustainable Development 4 (2009).

[72] *Id*.

[73] Atkins, *supra* note 2.

[74] R.B. Hiremath et al., *supra* note 71, at 4-10.

[75] *Id.*

[76] Peter Kahare, *Innovation and Diversification Are Key for Kenya's Renewable Energy Industry*, (February 20, 2012), *available at* http://www.renewableenergyworld.com/rea/news/article/2012/02/innovation-and-diversification-are-key-for-kenyas-renewable-energy-industry.

[77] *Id*.

[78] *Id.*

[79] Henry Gichungi, *Solar Potential in Kenya* (2010), *available at* http://www.sv.uio.no/iss/english/research/projects /solar-transitions/announcements/Kenya-Henry_Gichungi.pdf.

[80] *Renewable Energy Sector*, Ministry of Energy (Ghana), http://www.energymin.gov.gh/index105.php?pgtid=1&cntid= 11&pgt=Renewable%20Energy%20Sector (last updated Dec. 2010).

[81] *Id.*

[82] *Challenges of Solar PV for Remote Electrification in Ghana*, *supra* note 48.

[83] *Solar Energy in Namibia Comes of Age,* TotalSolarEnergy.co.uk, http://www.totalsolarenergy.co.uk/solar-power-in-namibia.html (last visited March 18, 2012).

[84] Uwe Deichmann, Craig Meisner, Siobhan Murray & David Wheeler, The World Bank, *The Economics of Renewable Energy Expansion in Rural Sub-Saharan Africa* 2 (Jan. 2010).

[85] *Id.* at 2.

[86] *Energy: Mission Statement*, Ministry of Mines & Energy (2006, Namib.), *available at* http://www.mme.gov.na/directe.htm.

[87] *Id*.

[88] R.B. Hiremath et al., *supra* note 71, at 4-10.

[89] *Id.*

[90] *Id.*

[91] Kahare, *supra* note 72.

[92] *Kenyan Wind Farm, Africa's Largest, to Produce Lowest Cost Electricity*, Cleantechnica.com (Mar. 25, 2012), http://cleantechnica.com/2012/03/25/kenyan-wind-farm-africas-largest-to-produce-lowest-cost-electricity/.

[93] *Id.*
[94] Pascal Kelvin Kudibor, *Ghana has 5,600 MW of Wind Potential — Prof. Akabzaa*, Ghana Business News (Aug. 2, 2011), *available at* http://www.ghanabusinessnews.com/2011/08/22/ghana-has-5600-mw-of-wind-energy-potential-prof-akabzaa/.
[95] *See Id.* (quoting the Chief Director at the Ministry of Energy on potential renewable energy sources).
[96] *Ghana's Infrastructure: A Continental Perspective*, *supra* note 35, at 21-22.
[97] Leigh Darroll, *Turning Wind Turbines in Ghana*, J. African Energy (2004).
[98] Jerome Kisting, Baobab Equity Management (Pty) Ltd., Opportunities in the Renewable Energy Sector in Namibia 19 (March 2008), *available at* http://www.highcommissionofindia.web.na/documents/Renewable%20energy-opportunities%20in%20Namibia.pdf.
[99] *Id*.
[100] Interview with Vestas Vice President of Communications Andrew Hilton, *supra* note 59.
[101] *Id.*
[102] *See generally* Ministry of Energy, Sessional Paper No. 4 on Energy (Kenya, 2004), *available at* http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=3&ved=0CFMQFjAC&url=http%3A%2F%2Fwww.erc.go.ke%2Ferc%2FRegulations%2FSESSIONAL%2520PAPER%25204%2520ON%2520ENERGY%25202004.pdf&ei=KH21T83PL8fJ6gGwqIDmDw&usg=AFQjCNFPFibnTHEs0qT5FgB2dk_YbN3afw.
[103] *Id.* at § 2.4.
[104] *Id.* at § 7.2.
[105] *Id.* at § 7.3.
[106] *See generally*, The Energy Act, No. 12 (2006) (Kenya), *available at* http://www.erc.go.ke/energy.pdf.
[107] *See Id.* at pt. V.
[108] *Id.*
[109] Bowman, *supra* note 25, at 87, 99.
[110] *See Rio Declaration on Environment and Development, supra* note 28, at § 2.
[111] Atkins, *supra* note 2. This number includes efforts since the 1980s.
[112] *Id.*
[113] Gichungi, *supra* note 79.
[114] *Id.*
[115] *Kenyan Wind Farm, Africa's Largest, to Produce Lowest Cost Electricity*, *supra* note 92.
[116] Conference Report, Is the Universal Fund in Africa Creating an Enabling Environment for ICT Infrastructure Investment in Rural and Perceived Uneconomic Areas?, CPRsouth Conference (May 2011, *Xi'an, China*,), http://uct.academia.edu/EnricoCalandro/Papers/506916/Is_the_Universal_Access_Fund_in_Africa_Creating_an_Enabling_Environment_for_ICT_Infrastructure_Investment_in_Rural_and_Perceived_Uneconomic_Areas.
[117] James Mbugya, *Kenya: The Making of the Huge Lake Turkana Wind Power Project*, The Star (Mar. 14, 2012), *available at* http://allafrica.com/stories/201203150073.html.
[118] *Id*.
[119] *Kenyan Wind Farm, Africa's Largest, to Produce Lowest Cost Electricity*, *supra* note 92.
[120] *Id.*
[121] *Kenya's Nuclear Energy Drive to Boost Electricity Supply*, Grassroots.co.ke (Mar. 29, 2012), http://www.grassroots.co.ke/business/kenyas-nuclear-energy-drive-to-boost-electricity-supply.html.
[122] *See Rio Declaration on Environment and Development*, *supra* note 28, at principle 17.
[123] Kudibor, *supra* note 94.
[124] Gabriel Takyl, INEES, Solar PV Development in Ghana (Oct. 8, 2010).
[125] *Id.*
[126] *Id.*
[127] *Id.*
[128] Darroll, *supra* note 97.
[129] *Id.*
[130] *Id.*
[131] *Cabinet Approves Renewable Energy Bill*, Ghana.gov (May 13, 2011), http://ghana.gov.gh/index.php?option =com_content&view=article&id=5880:cabinet-approves-renewable-energy-bill&catid=96:top-headlines.
[132] *Id*.
[133] Augetto Graig, *Namibian ICT State Shocking*, Namibian Sun (Oct. 21, 2011), *available at* http://www.namibiansun.com/content/click/namibian-ict-state-shocking.
[134] Dominic Farrell, *Is Namibia's Vision 2030 Just a Pipe Dream?,* Think Africa Press (Aug. 3, 2011), *available at* http://thinkafricapress.com/namibia/vision-2030-pipe-dream-or-burgeoning-reality-0.
[135] *Country Strategy Paper and National Indicative Programme for the Period 2008-2013*, *supra* note 52 at 22.
[136] *See generally Id.*
[137] *See* Namibia Vision 2030, *supra* note 56, at § 3.9.
[138] *See Id.* at § 4.5.
[139] Kisting, *supra* note 98.
[140] Nico Smit, *Namibia: Ruacana Upgrade on Course*, Namibian, Feb. 16, 2012, *available at* http://allafrica.com/stories/201202160233.html.
[141] Interview with Vestas Vice President of Communications Andrew Hilton, *supra* note 59.
[142] Africa Mobile Observatory: Driving Economic and Social Development through Mobile Services, *supra* note 3, at 39.
[143] *Kenya: UNIDO Partners with Microsoft on Renewable Energy for Productive Use*, UNIDObeta (Feb. 14, 2011), *available at* http://www.youtube.com/watch?v=THukq6Pj0UM&feature=related.
[144] *Id*.
[145] *Id*.
[146] *About*, access:energy, http://access-collective.com/about/what-we-do/ (last visited Apr. 26, 2012).
[147] *Id.*
[148] *See* Schwartz, *supra* note 64.
[149] *See Id.*
[150] Mangesi, *supra* note 33.
[151] *Id.*
[152] *Id.*
[153] *Id.*
[154] Syanne Olson, *Hybrid Solar System Comes On-line in Namibia Thanks to Juwi Solar*, PV Tech (Sept. 5, 2011), *available at* http://www.pv-tech.org/news/hybrid_solar_system_comes_on_line_in_namibia_thanks_to_juwi_solar.
[155] *Id*.
[156] *Id.* (showing the head of juwi's off-grid power supply department intent to transfer the idea behind the Tsumkwe Energy Project to other African projects).
[157] *Challenges of Solar PV for Remote Electrification in Ghana, supra* note 48.
[158] *See* Kenya Ministry of Energy, Feed-In-Tariffs Policy on Wind, Bio-Mass, and Small Hydro Resource Generated Electricity (Mar. 2008).
[159] *Id*.
[160] *Id.*
[161] *Challenges of Solar PV for Remote Electrification in Ghana, supra* note 48.
[162] *Id.*
[163] Takyl, *supra* note 124.
[164] *Id.*
[165] *Challenges of Solar PV for Remote Electrification in Ghana, supra* note 48.
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[167] *Id.*
[168] *Id.*
[169] Atkins, *supra* note 2.
[170] *See generally Rio Declaration on Environment and Development*, *supra* note 28, at §4.
[171] UN Conference on Sustainable Development, ITU Input to the Compilation Document (Nov. 11, 2011), *available at* http://www.itu.int/osg/blog/2011/11/15/ITUsSubmissionToTheRio20CompilationDocumentICTsAreMajorCrosscuttingDriversOfSustainableDevelopment.aspx.
[172] *Id.*
[173] *See generally* UN Economic & Social Council, Rio de Janeiro Declaration on ICT for Development (June 2001), *available at* http://hukum.unsrat.ac.id/hi/rio_ict.pdf.
[174] *See generally Id*.
[175] Invest India Initiative, India-Africa Partnership: Gaining Currency (last visited March 2, 2012), *available at* http://www.indiaafricainvest.in/index.php?option=com_content&view=article&id=297&Itemid=457.
[176] *See* Garton Ash, *We Friends of Liberal International Order Face a New Global Disorder*, The Guardian (Sept. 11, 2008), *available at* http://www.guardian.co.uk/commentisfree/2008/sep/11/1 (stating that the French first used trente glorieuses to refer to their 30 years of economic growth after World War II).