

Country Assessment Report

Country/Region name: The Republic of Ghana

Ghana is situated along the Gulf of Guinea in West Africa; bordered by Ivory Coast, Burkina Faso and Togo. It has a population over 31 million and a GDP worth \$65 billion (World Bank 2019). Its rapidly developing economy and democratic political structure has made Ghana a regional power in West Africa, with an annual growth rate of 6.3%.

Economic structure and drivers

Ghana is primarily a resource based-economy, with its three main export commodities- oil, gold (largest exporter in the world) and cocoa constituting a significant part of their overall GDP. Oil and gas discoveries brought newfound wealth to the nation, creating a snowball effect of economic growth in other sectors. In recent years, non-oil growth has risen to 6.0%, with new policies stimulating manufacturing and service industries. The diversification of Ghana's economy has prevented specialisation and over-reliance in resource-commodity markets and the agricultural sector.

The industrial sector is dominated by mining, manufacturing, smelting, food processing and small ship construction. Their industrial makeup also consists of textiles, chemicals, pharmaceuticals and food/beverages production. Growing FDI has enabled a strong presence of MNC subsidiaries; including Coca Cola, Toyota and Unilever. Increasing privatisation has led to further opportunities in banking and telecommunication sectors.

Democratisation, formalisation of the economy and an improved taxation structure have transitioned Ghana into a successful market-based economy, performing high in the ECOWAS region. A stable economy and favourable financial conditions have made Ghana an attractive destination for prospective FDI.

(World Bank 2019; PwC 2020)

Private companies with RE commitments

Newmont Golden Ridge Limited (Gold mining) – sustainability constitutes one of the company's core values. Their Global Energy and Climate Team (GECT) implements strategy for reducing carbon footprint, maximising energy efficiency, carbon offsetting and sourcing renewable energy. In 2018, Newmont installed a 120 KW solar plant at the Akyem mine to power the camp during daylight hours (Newmont 2020).

Gold Fields Ghana Limited (Gold mining) – sustainable development, environmental and climate change policies have all been established. They invest in RE, low-carbon energy solutions, energy efficiency and engage in carbon offsetting. The global company is targeting 20% RE generation in all new mine developments. Signed the *Paris Pledge for Action* in 2016 (Stevens and KortenHorst 2016).

MTN Group (Telecommunications) – invest in RE projects, alternative energy solutions and energy efficiency initiatives. Guided by GMSA-led industry wide plan to achieve net zero GHG emissions by 2050, a Carbon Disclosure Agreement and The Ten Principles of the United Nations Global Compact. Implemented Huawei's solar-powered network solution for remote rural areas in Ghana (MTN 2018). (<https://yen.com.gh/108586-top-private-companies-ghana-2019-2020.html>)

Generation and Demand (type, MW, TWh)

The installed capacity as at 2019 comprises the following generation mix for 2019: 39.60% hydro, 58.14% thermal and 2.26% imports.

Table 4.3: Total Installed Generation Capacity as at end of December 2019

Plant	Installed Capacity (MW)	Dependable Capacity (MW)
Hydro		
Akosombo	1,020	900
Kpong	160	105
Bui	400	360
Total	1,580	1,365
Thermal		
Takoradi Power Company (TAPCO)	330	300
Takoradi International Company (TICO)	340	320
Tema Thermal 1 Power Plant (TT1PP)	110	100
Cenit Energy Ltd	110	100
Sunon Asogli Power (Ghana) Limited	560	520
Tema Thermal 2 Power Plant (TT2PP)	87	71.5
Kpone Thermal Power Plant	220	200
Karpowership	470	450
Ameri Plant	250	230
Trojan*	44	39.6
Genser*	95	85
Amandi	203	190
AKSA	370	350
Cenpower	360	340
Total	3,549	3,296.1
Renewables		
Safisana Biogas*	0.1	0.1
VRA Solar*	2.5	2
BXC Solar*	20	16
Meinergy*	20	16
Total	42.6	34.1
Grand Total	5,171.6	4,695.2

*Connected at the sub-transmission level

Figure 1 Installed Generation Capacity as at the end of December 2019 (Ghana Energy Commission, 2020)

Power generation over the period in 2019, power generation was as follows; hydro - 7252GWh, thermal – 10,885GWh and solar - 52GWh.

Hydro Power Generation: 1584MW (7252GWh)

Thermal Power Generation: 3,456 MW (10,885GWh)

Solar Power Generation: 42.5MW (52GWh)

Further details of generation are in the table below:

Table 4.4: Grid Electricity Generation

Year	Generation (GWh)				Share (%)			
	Hydro	Thermal	Renewables	Total	Hydro	Thermal	Renewables	Total
2000	6,610	614	-	7,224	91.5	8.5	-	100
2001	6,609	1,250	-	7,859	84.1	15.9	-	100
2002	5,036	2,237	-	7,273	69.2	30.8	-	100
2003	3,885	1,996	-	5,881	66.1	33.9	-	100
2004	5,280	758	-	6,038	87.4	12.6	-	100
2005	5,629	1,159	-	6,788	82.9	17.1	-	100
2006	5,619	2,811	-	8,430	66.7	33.3	-	100
2007	3,727	3,251	-	6,978	53.4	46.6	-	100
2008	6,196	2,129	-	8,325	74.4	25.6	-	100
2009	6,877	2,081	-	8,958	76.8	23.2	-	100
2010	6,995	3,171	-	10,166	68.8	31.2	-	100
2011	7,561	3,639	-	11,200	67.5	32.5	-	100
2012	8,071	3,953	-	12,024	67.1	32.9	-	100
2013	8,233	4,635	3	12,870	64.0	36.0	0.0	100
2014	8,387	4,572	4	12,963	64.7	35.3	0.0	100
2015	5,844	5,644	3	11,491	50.9	49.1	0.0	100
2016	5,561	7,435	27	13,023	42.7	57.1	0.2	100
2017	5,616	8,424	28	14,067	39.9	59.9	0.2	100
2018	6,017	10,195	33	16,246	37.0	62.8	0.2	100
2019	7,252	10,885	52	18,189	39.9	59.8	0.3	100

Source: GRIDCo and ECG PDS

Figure 2 Grid Electricity Generation (Ghana Energy Commission, 2020)19

Electricity Supply Plan

Electricity demand over the period saw a system peak of 2,665.68MW and an estimated system high demand of 2,796.92MW. Electricity consumption over the period was 17,237.79GWh.

RE Market Potential

Ghana is wanting to diversify its energy portfolio because of an over reliance on thermal and hydroelectricity, susceptible to external shocks and droughts respectively. The development of more RE projects would significantly enhance the nation's energy security, with huge potential for biomass, mini hydro, wind and solar. GoG's Renewable Energy Master Plan formally recognised this potential in 2019 and presents a framework for promoting the RE sector to support economic growth, quality of life and mitigation of climate change effects in Ghana. Its main aim is to "increase the penetration of renewable energy in the national energy generation mix from the 2015 baseline of 42.5 MW to 1363.63 MW" (UNDP 2019).

Ghana's average solar irradiation ranges between 4.4-5.6 kWh/m² per day and sunlight duration comprises of 1,800 to 3,000 hours annually.

Estimated wind power is more than 5,000 MW, with average wind speeds at 6.4-7.5 metres per second (m/s). The mountainous terrain in south-east Ghana and coastal areas in the east have been cited as the most promising areas for wind turbine deployment. Ghana's largest hydropower sites have already been exploited, but potential remains for mini and small-medium sized hydropower plants, as depicted in

tables 3 and 4. In recent years, non-perennial rivers and inadequate rainfall due to climate variability have reduced inflows to existing hydro energy generators, raising questions over the dependable capacity of hydropower plants.

Region	Number of sites	Potential minimum power (kW)	Potential maximum power (kW)
Upper East and Upper West	8	499	2,100
Northern	16	913	4,420
Brong Ahafo		364	1,900
Western and Central	9	332	2,150
Ashanti	4	140	720
Eastern	9	569	1,150
Volta	17	4,919	12,065

Figure 3. Identified mini hydropower sites (IRENA 2015).

Figure 4. Potential small-medium sized hydropower plants (IRENA 2015).

River basin	Potential (MW)	Average annual energy (GWh)
Black Volta		
Koulbi	68	392
Ntereso	64	257
Lanka	95	319
Jambito	55	180
Total:	282	1,148
White Volta		
Pwalugu	48	184
Kulpawn	36	166
Daboya	43	194
Total:	127	544

(https://www.afdb.org/sites/default/files/documents/projects-and-operations/ghana_country_strategy_2023_en.pdf)

Electrical interconnection and import/export:

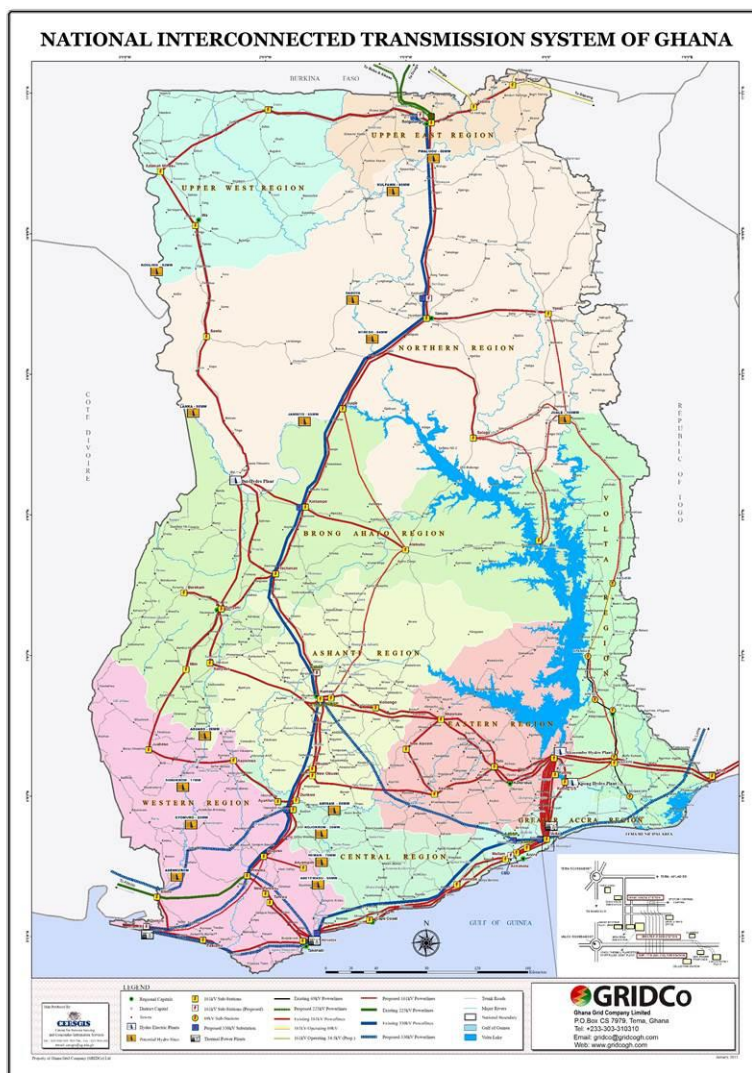
Ghana has a devolved electricity system comprising generators, grid network and distribution following power sector reforms from the late nineties through to the first decade of the 21st century. There are two state-owned generators – Volta River Authority, operators of Akosombo and Kpong hydro-electric dams constructed in 1965 and 1977 and 1982 when Kpong's capacity was increased. In addition to hydro, the Volta River Authority has thermal as well as solar electricity generation plants. The Bui Power Authority is state-owned operator of the Bui hydroelectric dam constructed in 2013 to meet the increasing demands of the growing economy. Independent Power Producers (IPPs) complement state efforts by operating mainly thermal generators. There are currently three utility scale solar PV generators who connect to the grid through the Medium Voltage Distribution System.

Electricity transmission is undertaken by GRIDCo which was established in accordance with the Energy Commission Act, 1997 (Act 541) and the Volta River Development (Amendment) Act, 2005 Act 692, which provided for the establishment and exclusive operation of the National Interconnected Transmission System (NITS) economic dispatch and transmission of electricity from wholesale suppliers (generating companies) to bulk customers by an independent utility and the separation of the transmission functions of the Volta River Authority (VRA) from its other activities within the framework of the Power Sector Reforms.

Ghana is bordered by Côte d'Ivoire to the west, Burkina Faso to the north and Togo to the east. Both Côte d'Ivoire and Burkina Faso have larger economies and more developed electricity generation capacity than Togo. There has been consistent electricity import and export amongst the trio underscored by the creation of the West African Power Pool – a cooperation of the power producing companies in West Africa who aim to build a power distribution network. Ghana imported 139.70 GWh from Côte d'Ivoire and exported 100MW to SONABEL, Burkina Faso and 60MW to CEB, Côte d'Ivoire in 2018.

As shown in Table 3.5, with regards to export, 392 GWh (representing 5.9% of the total generation) of electricity was exported in 2000 increasing to 1,430 GWh in 2019 (7.8% of the electricity generated).*

**127 GWh of electricity was imported representing 0.7% of total electricity generated.*



Historical support or development of renewables in the country/region:

With the construction of the Akosombo Hydroelectric dam in 1961, Ghana has had a long history of relying on renewable energy to address its electric power needs. Having previously relied on large diesel generators as was the trend in that era.

A combination of environmental factors highlighted the vulnerability of the hydro-sources in electricity generation and consequently socio-economic activity in the near and long term. This heralded the development of research into alternative technologies including renewables. Considering the cost and efficiency of these modern technologies, Ghana developed thermal sources. Notwithstanding these initial challenges, Ghana continued along with development partners to explore and test the deployment of renewables such as solar PV and small wind turbines. The passing of the Renewable Act 2011, heralded a new phase of state support for independent power producers to explore these opportunities. The state conditioned to develop its renewable resources with the construction of the Bui hydroelectric dam in 2007 and solar PV farms. Ghana continues to be committed towards developing renewable energy as it seeks to strengthen and align its renewable energy laws to be in step and responsive to market and environmental conditions and projections.

Electricity market structure:

Regulatory

The Energy Commission was set up as a statutory body by an Act of Parliament, the Energy Commission Act, 1997 (Act 541) with functions relating to the regulation, management, development and utilisation of energy resources in Ghana. It is the technical regulator of the industry and is the body responsible for assessing applications for licenses, either as generators, transmitters or distributors of electrical power.

Generators

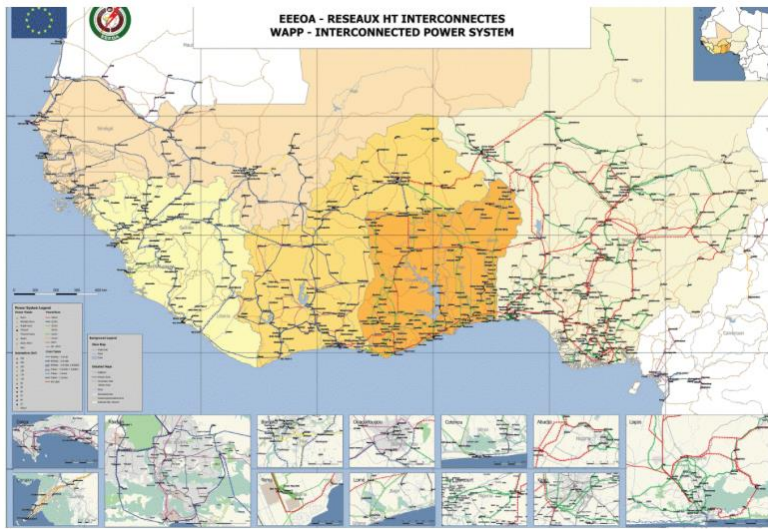
The Volta River Authority (VRA), Bui Power Authority and Independent Power Producers.

Distribution

The electricity market is characterised by state and independent producers, a transmission service that maintains the grid and distributes power to wholesale and bulk consumers including the Electricity Company of Ghana (ECG) which serves retails electricity to southern Ghana with 62% market share, Northern Electricity Distribution Company (NEDCo) serves the northern part of Ghana, Enclave Power Company serves bulk sales to mines and other industries.

Grid and transmission

GRIDCo is governed in accordance with the Companies Act, 1963 (Act 179), Public Financial Management Act, 2016 (Act 921), Energy Commission Act, 1997 (Act 541), Government of Ghana is the only shareholder of GRIDCo and is represented by the Ministry of Finance and the Ministry of Energy. GRIDCo has installed 5,965.83 circuit kilometres of high voltage transmission lines across the country, which are mainly operated at 161 kV. The other transmission voltages are 69 kV, 225 kV and 330 kV. The transmission lines carry power from various generating stations to sixty-four (64) substations. In 2018, a total of 15.96TWh of energy was transmitted on the transmission network.



Exports

Ghana exports to SONABEL (Burkina Faso), CEB (Togo/Benin) and CIE (La Cote d'Ivoire) was 0.74TWh.

Prior to 2008, generation and transmission of electricity was controlled largely by the VRA. The situation however changed with the reform of the power sector by the amendment to the Volta River Development Act. The Volta River Development Act, 2005 (Act 692) essentially hived off the transmission function of the VRA

and put its functions and core staff in a private limited liability owned company called GRIDCo. Under the current law, only one entity can hold the transmission license at any one time and GRIDCo is the current holder.

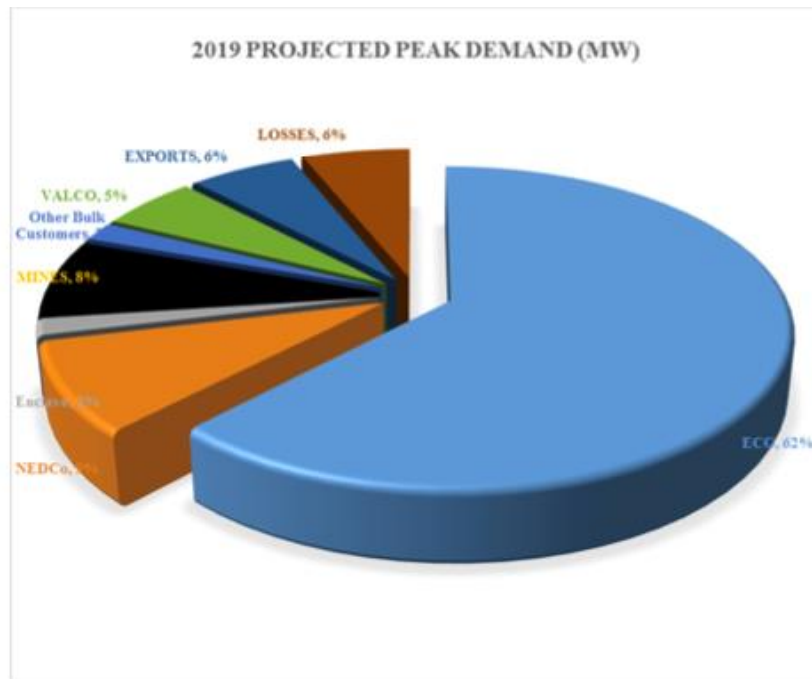
The generation and distribution side is open to competition and there are numerous opportunities for participation by Independent Power Producers ("IPPs"). The VRA, which is by far the dominant player in the power sector, boasts the following assets: the Akosombo Dam, the Kpong Dam, the Aboadze Thermal Plant, the Tema Thermal Plant and a 10% stake in the Takoradi International Company ("TICO"). The remaining 90% stake in TICO is owned by a subsidiary of UAE investment firm, TAQA.

The resultant effect of the break-up of the transmission function of the VRA was in keeping with the Government's objective to reform the power sector and allow for IPPs to get into the power sector. This initiative has led to the injection of investment into the Ghanaian power sector by a number of IPPs. These have largely been on the generation side.

As at January 2013, the following IPPs had commenced or were in the process of commencing operations in Ghana: Sunon Asogli Thermal Plant (200MW) and the CENIT Thermal Plant (100MW). There are however a long list of entities that have obtained provisional licenses from the Commission to undertake electricity generation and the provision of ancillary services.

The Energy Commission is the technical regulator of Ghana's electricity, natural gas and renewable energy industries, and the advisor to Government on energy matters.

The electricity market comprises three different activities; generation, transmission and distribution with devolved actors working in each sphere. The pricing is regulated by The Public Utilities Regulatory Commission following broad consultations with market actors and consumers. The Energy Commission is the government agency responsible for policy, governance and technical advices and coordination of the sector. Finally, the Ministry of Energy is the government agency that responsible for energy and energy related developments in the country.



Description of renewables support mechanism:

The 2011 Renewable Energy Act initially provided 'feed in tariffs' as a financial incentive to encourage the development of renewable energy projects in Ghana. This is now being amended in step with global trends in the financing structure of renewable energy projects which seeks to "establish a competitive procurement scheme and a net-metering scheme in respect of electricity generated from a renewable energy source" (Renewable Energy Amendment Bill 2020).

Ghana has abolished the FiT for RE and replaced with competitive tendering. The FIT at the time was higher than the average generation tariff and therefore the Act gave obligation on bulk consumers to procure RE at the FIT. However with the drop in prize for REs especially solar, FIT had to be abolished and the purchase obligations removed. Accordingly the RE Act is being amended. The Amendment bill is awaiting Cabinet consideration and parliamentary approval. This notwithstanding, relevant provisions in the amendment bill such as competitive bidding instead of FiT are already being implemented.

Under the amendments proposed in the Amended Renewable Energy Bill, distribution utilities will be obliged to procure electricity from consumer-generators to encourage small-scale self-generation through net-metering. Furthermore, the Bill mandates fossil fuel-based wholesale electricity suppliers, fossil fuel producers, and other companies that contribute to greenhouse gas emissions to complement the global effort of climate change mitigation by investing in non-utility scale renewable energy technologies.

Responsible government department: (include key contacts)

Ministry of Energy and Petroleum is the leading government institution in Ghana's electricity sector, led by [REDACTED]. [REDACTED] is the Director of Renewable and Alternative energies. The Ministry is responsible for energy policy, development, monitoring and evaluation. Its

purpose is to ensure a reliable, efficient and responsible delivery of electricity to Ghana's industrial, commercial and residential sectors.

Energy commission (EC) is a parastatal organisation that manages the development of energy and is particularly responsible for electricity licensing, renewable energy, energy efficiency and natural gas.

Environmental Protection Agency (EPA) is a branch of the *Ministry for Environment, Science, Technology and Innovation*. It promotes sustainable development, conservation and efficient resource management.

ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREE) aims to create the necessary conditions for renewable energy and energy efficiency markets in West Africa. It supports policy development, capacity building, raises awareness and design financial mechanisms for environmental markets.

Public Utility Regulatory Commission (PURC) is a multi-sectorial regulator of tariffs. It establishes rates for purchase of electricity from both conventional and RE sources.

[REDACTED] – Minister for Energy
 [REDACTED] – Chief Director, Ministry of Energy
 [REDACTED] – Director of Renewable & Alternative Energy, Ministry of Energy –
<http://www.energymin.gov.gh> – [REDACTED]
 [REDACTED] Executive Secretary Energy Commission
 [REDACTED] – Renewable Energy Expert, Energy Commission –
<http://www.energycom.gov.gh> - [REDACTED]
 [REDACTED] – Executive Secretary, PURC –
<http://purc.com.gh>

Environmental Protection Agency – <http://www.epa.gov.gh/epa/>

Existing/Planned energy legislation: (is there a CPO)

Renewable Energy Amendment Bill 2020 – attached.

Existing/Planned energy certificate systems: (purpose, extent)

Ghana does not currently issue Energy Attributable Certificates (EAC). The I-REC Standard would be adopted and implemented without restrictions. In recognition of Ghana's new entry position, the Green Certificate Company (GCC) will operate as the issuer until a Ghanaian or Africa based company is identified to act as an I-REC local issuer.

State the central public source of periodic (monthly, quarterly or annual) generation volumes – this information can be used to verify registration and generated volumes of devices.

The Energy Commission of Ghana has a central registry from which periodic generation volumes can be used to independently verify registration and generated volumes of devices.

Extent of engagement with government:

The opportunities presented by the introduction of an EAC system in Ghana adherent to the I-REC Standard have been discussed with senior leaders of the Ministry of Energy, Energy Commission and renewable energy generators – all of whom have expressed support for its implementation. I-RECs would operate on a voluntarily basis. This would allow end-users in Ghana to claim zero or low-carbon emission and further support the local desire of the country to become a manufacturing base in West

Africa. This would also allow for greater potential and myriad of opportunities under the West Africa Power Pool and the Africa Continental Free Trade Area.

Furthermore, the developments in the renewable energy sector could be accelerated through increasing awareness for renewables in Ghana as a result of an EAC implementation. Upon implementing an EAC, end-users can create a demand-driven market which means that a large variety of stakeholders can now participant and contribute in RE development.

Response from Government in relation to attribute tracking systems:

There is a positive view from government on the prospects and opportunities presented by potential of attribute tracking on the development of renewable energy in the energy generation mix. To this effect there is opportunity to deepen transparency through the sharing of timely generation data to provide comfort to I-REC Standard and the market.

Demand-side market potential or strategic nature of market development:

There is growing interest in the market for Energy Attribute Certificates from emerging economies, such as Ghana.

This interest is expressed in contacts from demand-side market participants for EACs from Ghana and wider market recognition of the potential from emerging market products.

Analysis of political disruptions or market risks:

Ghana has a stable democracy that has been variously hailed globally for its capacity, resilience and stability in tolerating divergent political traditions in changing power between one political party to the other.

The laws of Ghana have not been suspended at the expense of arbitrary power. Contracts are honoured and breaches fairly adjudicated under the laws of Ghana.

Analysis of regulatory risks including linkages with carbon markets and support systems:

Ghana has reported on its Nationally Determined Contributions (NDCs) to the United Nations Framework on Climate Change being a signatory to the Paris Agreement.

It is not expected that joining and implementing I-REC Standard will undermine NDCs nor the nascent carbon mitigation project market.

Current environmental reporting in energy:

Power generators led by the Volta River Authority reports on its corporate greenhouse gas emission using the ISO-14064-1:2006 standard

Ghana's INDC in Paris agreement took hydro into consideration. The 10% increase in renewable energy penetration is calculated based on the renewable energy capacity (hydro) at the time. In that we increase the share of renewable energy by 10%. It is also important to note that as per the INDC, the 10% increase is on condition that external support is made available to achieve the targets clearly indicated in the Paris agreement INDC.

The committed actions to increase penetration of renewable energy by 10% by 2030 includes the following:

1. Increase small to medium scale hydropower installed capacity up to 150-300MW

2. Attained utility-scale wind power capacity up to 50-150MW
 3. Attain utility solar electricity installed capacity up to 150-250MW
 4. Establish 55 mini-grids with average installed capacity of 100KW which translates to 10MW
 5. Scale up 200,000 solar home systems including distributed generation in urban and selected non electrified households.
 6. Increase solar lantern replacement in rural non electrified households to 2 million.
- It is important to note that even though RE penetration has increased in recent years, the percentage contribution in the total generation mix of total generation mix have been decreasing since Paris agreement due to increasing thermal generation contribution.

INDCs and NDC reporting in compliance with Paris Agreement

Ghana regularly reports on its nationally determined contributions in compliance with the Paris Agreement. Notably, the Volta River Authority became the first corporate entity in Sub-Saharan Africa outside of South-Africa to report annually on its corporate carbon consumption and takes action internally to mitigate its carbon footprint in conjunction with community adaptation efforts in communities within the Volta basin and finally, increasing its renewable energy footprint.

Mechanisms in place to support the reliable verification and issuance of I-RECs:

The country will fully implement the I-REC Standard as well as provide a link to regulatory source data on generation and consumption from the Energy Commission. In addition, recommendations from the I-REC Standard secretariat will be implemented to increase transparency.

Local organizations of importance and their opinion on local I-REC market development:

Ministry of Energy
Energy Commission
Volta River Authority

Any other relevant information:

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