Special Energy Seminar Series

The Role of Renewables in Meeting Ghana's Energy Targets – How Far with RE Law 832?

Kwabena A. Otu-Danquah
Head, Renewable Energy Division
Energy Commission

25 February, 2015

PRESENTATION OUTLINE

- Overview of Ghana's Energy Situation
- Renewable Energy Resources
- Renewable Energy Target
- Regulatory Framework
- Provisions of the Law
- Progress Made
- Way forward
- Conclusion

OVERVIEW OF GHANA'S ENERGY SITUATION

- Electricity Access (Sept 2013): 74%
- Electricity Installed capacity (2013): 2,847MW
- Electricity generation (2013): 12,870GWh
- Crude oil production (2013): 5.267 million metric tonnes
- Final energy consumed (2013)
  - Biomass 38.9%
  - Petroleum product 47.9%
  - Electricity 13.2%
- Electricity growth rate is 10% per annum

LOCATION OF GHANA

Ghana is located at latitudes 4º 44'N and 11º11'N and longitude 3º 15W and 1º 12'E.

RENEWABLE ENERGY RESOURCES

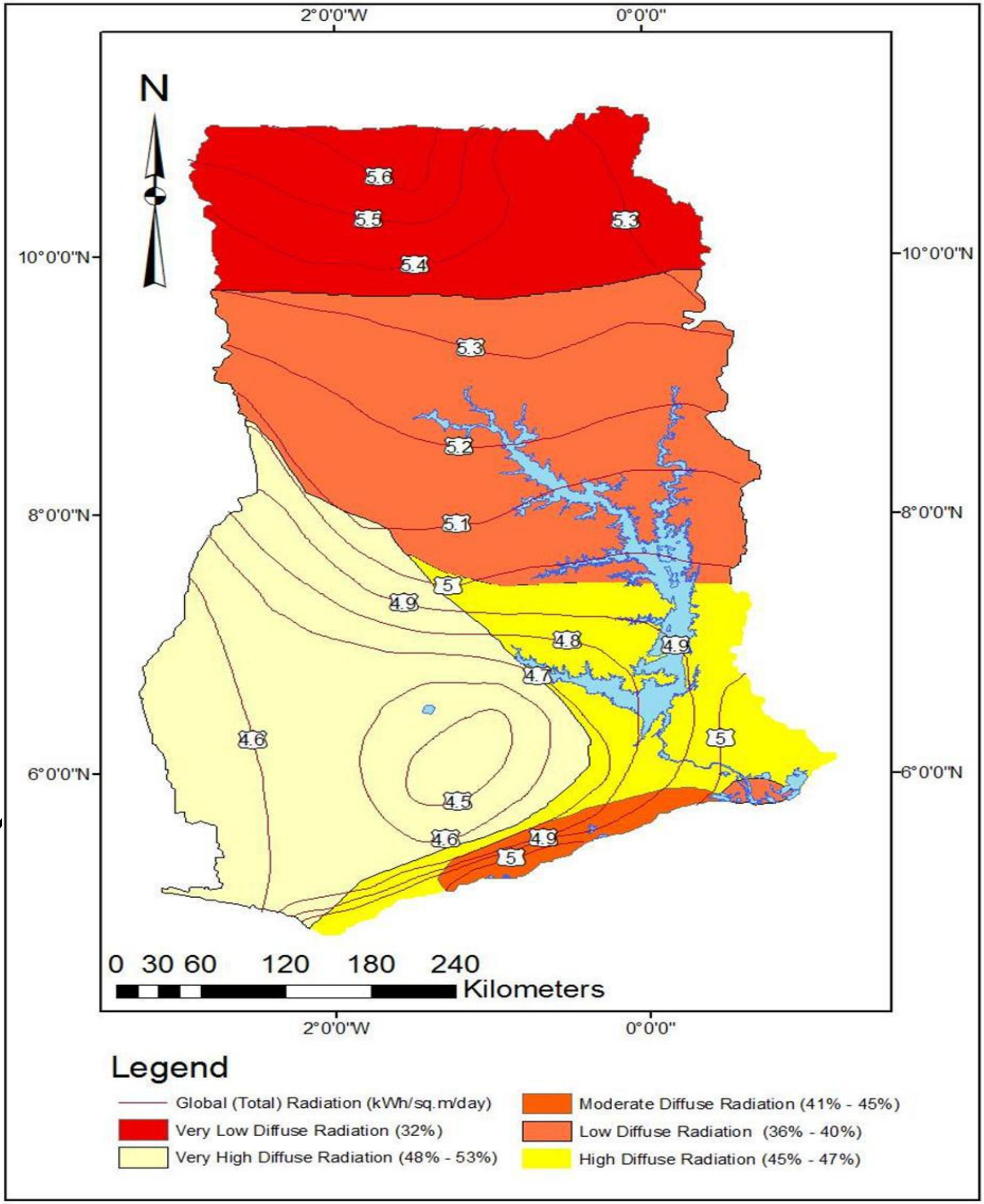
By its geographic position, Ghana is endowed with solar energy resource.

- **Solar**
- **Wind**
- **Hydro**
- **Biomass**

SOLAR ENERGY RESOURCE

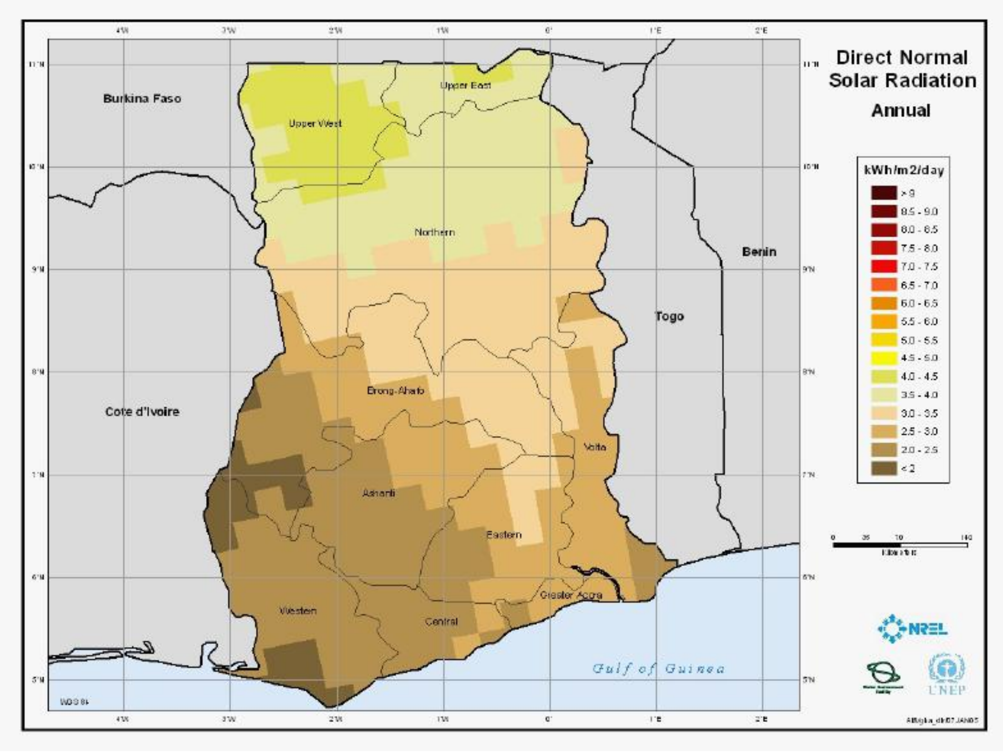
- **Average global solar radiation:**
  4 – 6 kWh/m²/day

- **Sunshine duration:**
  1,800 – 3,000 hours per annum.



SOLAR ENERGY RESOURCE

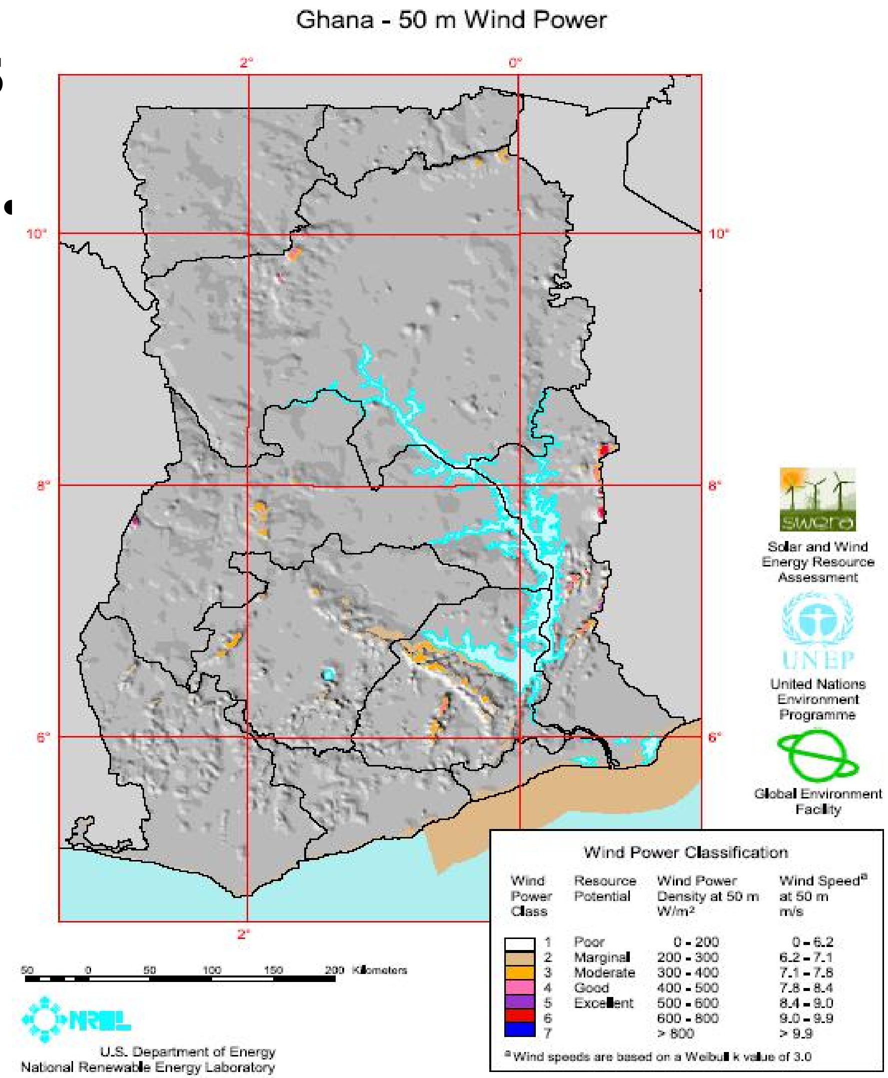
- **The direct solar radiation over the entire country is generally low because of the high diffuse radiation.**
  - **Only 48,701km^2 of the total land area of Ghana receive direct solar radiation level of over 4.5kWh/m^2/day**



MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OC T	NOV	DEC	AV.
KUMASI	4.8	5.3	5.3	5.4	4.7	4.0	4.0	3.8	4.0	4.7	5.0	4.6	4.6
ACCRA	4.7	5.2	5.3	5.7	5.4	4.6	4.2	4.5	5.1	5.6	5.5	4.9	5.1
AXIM	4.9	5.4	5.6	5.6	5.1	3.9	4.2	4.2	4.4	5.2	5.5	5.0	4.9
NAVRON GO	5.4	5.4	5.8	6.0	5.9	5.7	5.3	5.1	5.3	5.7	5.6	4.8	5.5
SALTPON D	4.9	5.6	5.5	5.7	5.4	4.4	4.7	4.5	5.0	5.7	5.7	5.2	5.2
ADA	5.0	5.4	5.6	5.9	5.6	5.0	5.1	5.1	5.5	5.9	5.5	5.4	5.4
KOFORID UA	4.7	5.1`	5.3	5.4	5.3	4.6	4.1	3.8	4.4	5.2	5.2	4.9	4.8
WENCHI	5.2	5.5	5.5	5.7	5.5	5.0	4.4	4.1	4.4	4.9	5.1	4.9	5.0
TAMALE	5.1	5.5	5.6	5.9	5.9	5.5	5.0	4.8	5.0	5.5	5.7	5.2	5.4
BEKWAI	4.7	5.1	5.3	5.5	5.3	4.6	4.1	3.8	4.1	5.0	5.0	4.4	4.7
HO	4.9	5.2	5.5	5.7	5.6	4.9	4.6	4.2	4.7	5.5	5.6	5.1	5.1
WA	5.5	5.8	5.8	5.9	5.9	5.6	5.1	4.9	5.1	5.6	5.6	5.4	5.5
AKIM ODA	4.5	4.8	4.9	5.2	4.9	4.3	4.0	3.8	4.2	4.8	4.9	4.5	4.6

WIND ENERGY RESOURCE

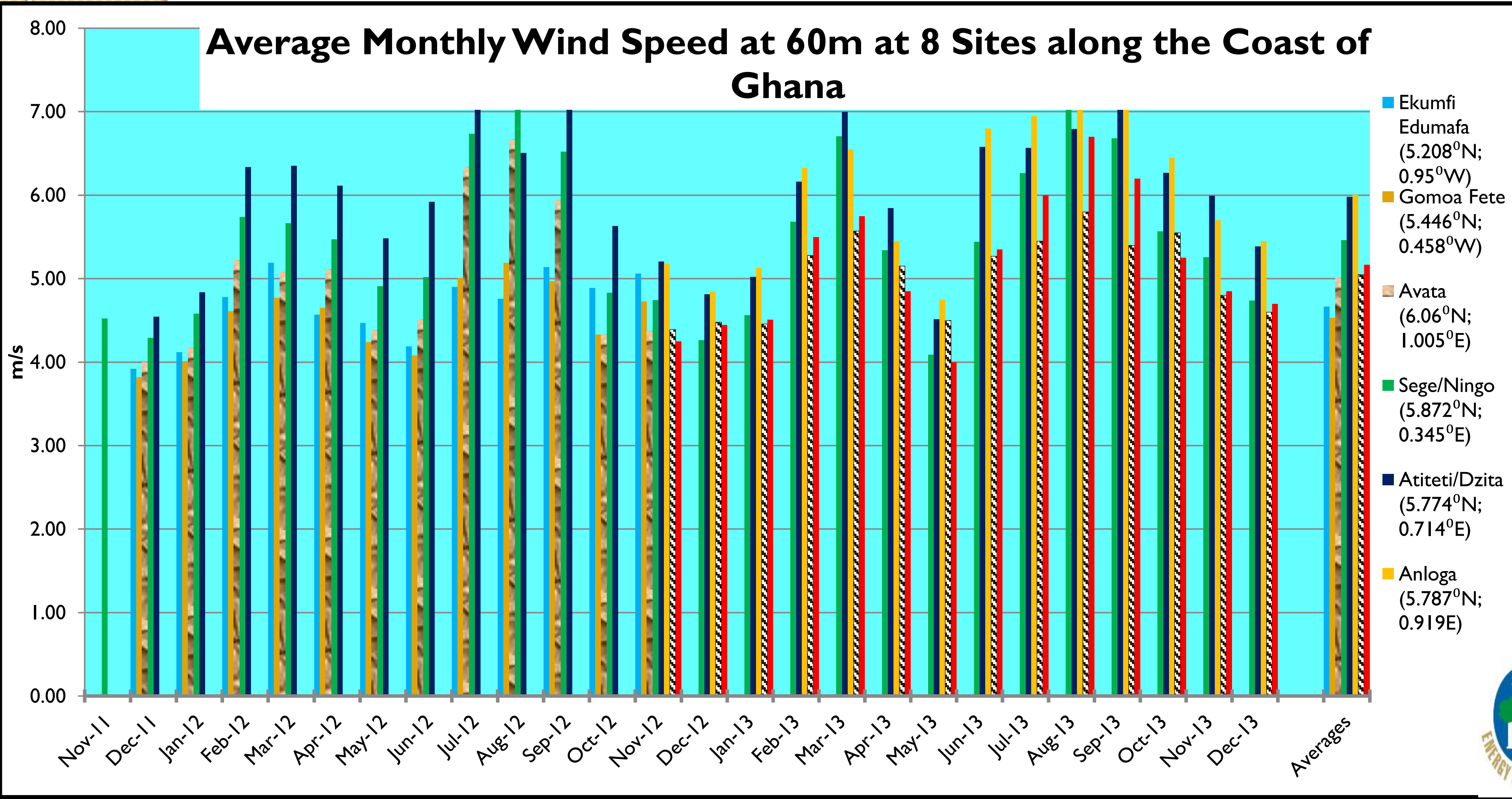
- Ghana's wind energy is marginal to moderate.
- Found mainly along the coast.
- Monthly average wind speed 5m/s – 6.0m/s at 60m height.



GROSS WIND RESOURCE POTENTIAL

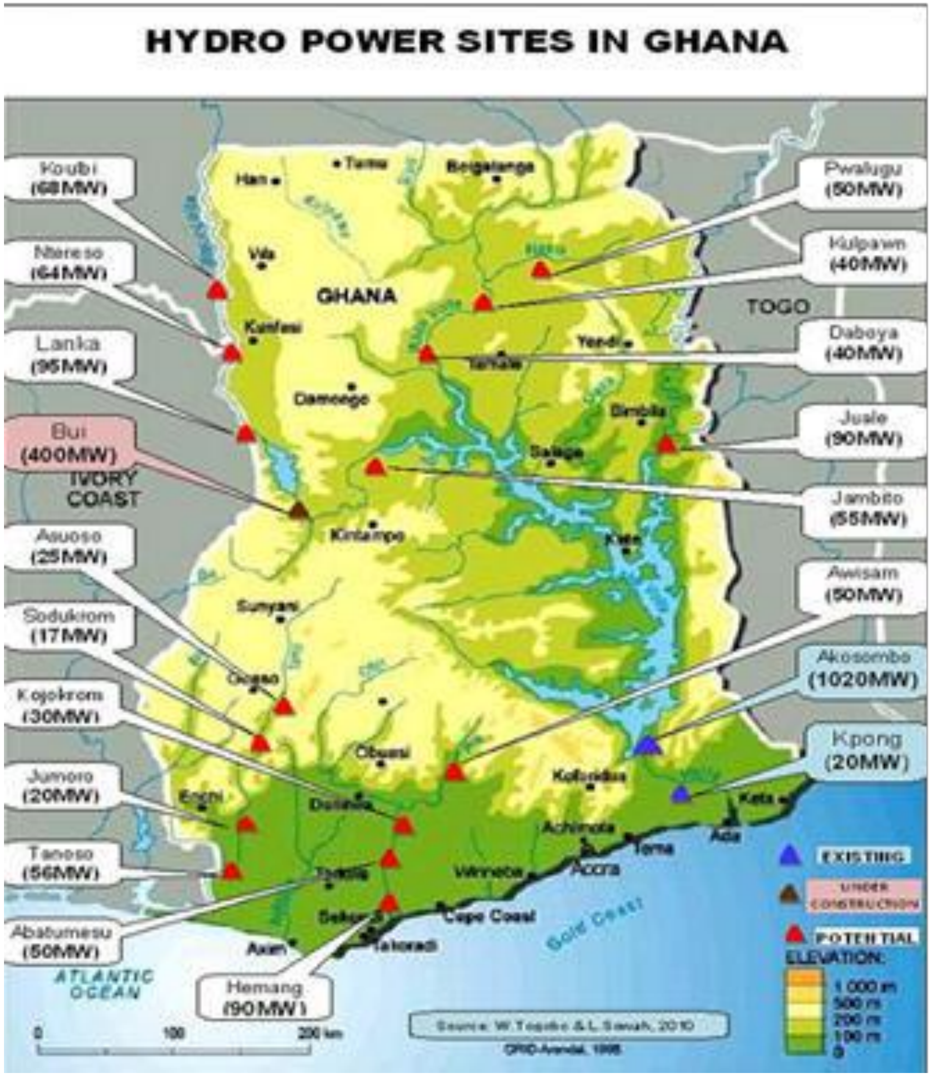
Wind Resource Utility Scale	Wind Class	Wind Power at 50 m (W/m^2)	Wind Speed at 50 m (m/s)	Total Area (km^2)	% Windy Land (%)	Total Technical Capacity (MW)
Moderate	3	300 -- 400	6.4 – 7.0	715	0.3	3,575
Good	4	400 – 500	7.0 – 7.5	268	0.1	1340
Very Good	5	500 – 600	7.5 – 8.0	82	<0.1	410
Excellent	6	600 – 800	8.0 – 8.8	63	<0.1	315
Total				1,128	0.5	5,640

Source Ministry of Energy and Petroleum, 2013



Average Monthly Wind Speed at 60m at 8 Sites along the Coast of Ghana
m/s
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Nov-11
Dec-11
Jan-12
Feb-12
Mar-12
Apr-12
May-12
Jun-12
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Averages
Ekumfi Edumafa (5.208^{0}N; 0.95^{0}W)
Gomoa Fete (5.446^{0}N; 0.458^{0}W)
Avata (6.06^{0}N; 1.005^{0}E)
Sege/Ningo (5.872^{0}N; 0.345^{0}E)
Atiteti/Dzita (5.774^{0}N; 0.714^{0}E)
Anloga (5.787^{0}N; 0.919E)

HYDRO RESOURCE

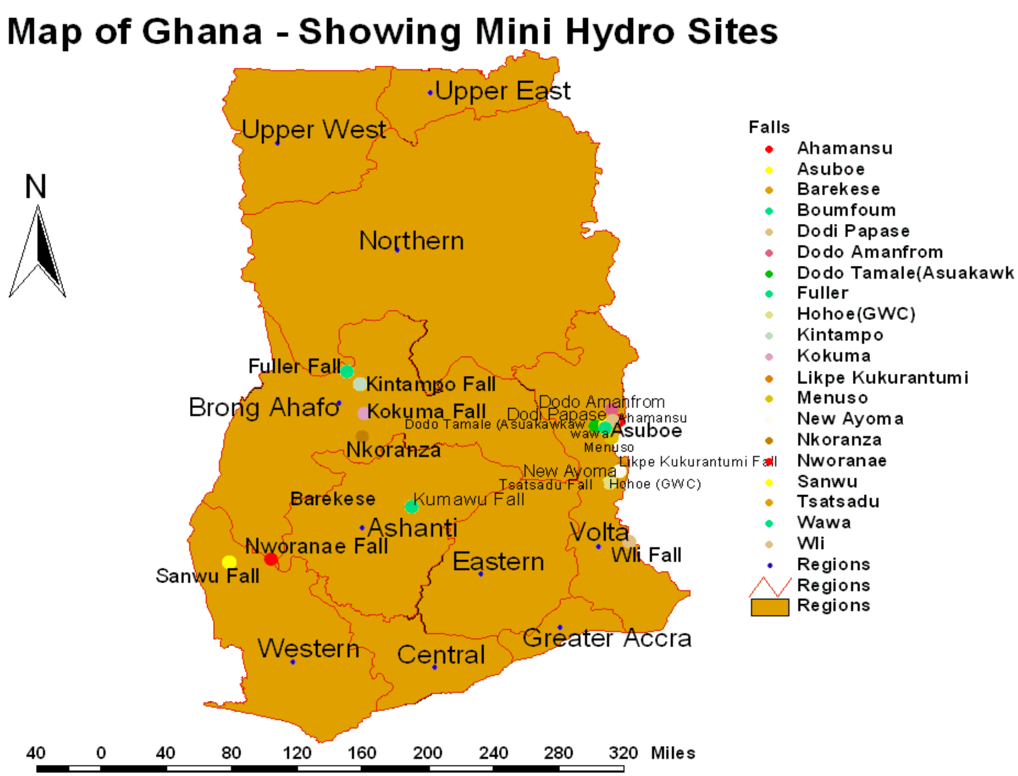


HYDRO POWER POTENTIAL

RIVER BASIN	POTENTIAL (MW)	ANNUAL ENERGY (GWH)
Black Volta		
Koulbi	68	393
Ntereso	64	257
Lanka	95	319
Jambito	55	180
White Volta		
Pwalugu	48	184
Kulpawn	36	166
Daboya	43	194
Oti River		
Juale	90	405
River Tano		
Asuaso	25	129
Sedukrom	17	67
Jomoro	20	85
Tanoso	56	256
Pra River		
Awiasam		
Hemang	50	205
	90	336
Abatumesu	50	233
Kojokrom	30	136
Ankobra		
Nsueam	25	33
Breman	25	41
Mehami	50	63
TOTAL POTENTIAL	937	3,681

Source: Volta River Authority

MINI HYDRO RESOURCE



Source: Energy Foundation, Ghana

Region	Potential (kW)
Volta	3117 - 12,065
Eastern	226 - 1.150
Brong Ahafo	364 - 1,900
Central and Western	472 - 2,150
Ashanti	720
Northern	913 - 4,420
Upper East and West	499 - 2,100
TOTAL	5591 - 24,505

Source: Hydrological Service Department Ministry of Water Resources, Works and Housing

BIOENERGY RESOURCES

Total Wood supply for fuel	**30.7 million tonnes/annum**
Woodfuel supply	**8 million tonnes /annum**
Municipal waste	**2 million tonnes/annum;**
Wood residue	**2 million tonnes/annum**
Animal waste	**11 million tonnes/annum.**

Entire land cover has potential for energy crop / biofuel cultivation.

RENEWABLE ENERGY TARGET

Government's policy target of attainment of 10% renewable energy in the national energy mix by 2020.

REGULATORY FRAMEWORK

Renewable Energy Act, 2011 (Act 832) was passed by Parliament:

- **To create enabling environment for private investment in the Renewable Energy sector**
- **To remove bottlenecks in the development of renewable energy in Ghana**
- **To ensure transparency in the development of the sector**

PROVISIONS OF THE LAW

- **The RE Law mandates the Energy Commission (EC) to license persons or corporate bodies who engage in commercial activities in the renewable energy industry.**

- **Commercial activities include:**
  - **Production**
  - **Transportation**
  - **Storage**
  - **Distribution, sale and marketing**
  - **Importation**
  - **Exportation and re-exportation and**
  - **Installation and maintenance**

- **Feed in Tariff (FiT) scheme to guarantee the sale of electricity generated from RE sources**
  - **FiT rate**
  - **Renewable energy purchase obligation**
  - **Connection to the distribution and transmission systems**

FEED IN TARIFF RATE

- The RE Law enjoins PURC to approve FiT rates and published them in the Gazette and in at least one national daily newspaper on annual basis.

- The rate shall be guaranteed for 10 years and subsequently be subjected to review every two years.

RENEWABLE ENERGY PURCHASE OBLIGATION

- All power distribution utilities and bulk customers are required to procure a specified percentage of its total purchase of electricity from RE sources
  - 3 Power Distribution Utilities
    - ECG and NEDCo – state owned companies
    - Enclave Power – private company
  - Bulk Electricity Customers

- **In specifying the percentage level of electricity the PURC shall take into account the:**
  - **technology being used to generate electricity from the RE source.**
  - **Assurance of the financial integrity of the public utilities.**
  - **net effect of the cost of renewable energy on the end user tariff.**

RENEWABLE ENERGY PURCHASE OBLIGATION - PENALTY

- **An electricity distribution utility or a bulk customer that fails to purchase electricity for RE source shall pay a premium.**

- **Where an obligated entity fails to pay the premium:**

  - **the permit obtained by the bulk customer to purchase electricity from a wholesale supplier shall be suspended.**

  - **A fine of 5,000 penalty units shall be imposed on the bulk customer.**

Renewable Energy Fund

- **Establishment of RE Fund to provide financial resources for the promotion, development and utilisation of RE resources**

Control and management of biofuel and woodfuel

- The Minister shall designate biofuel blend as a petroleum product in accordance with the National Petroleum Authority Act, 2005 (Act 691).

- The National Petroleum Authority shall price biofuel blend in accordance with the prescribed petroleum pricing formula provided for under Act 691.

- The proportion of biofuel in biofuel blend offered for sale to consumers at the point of sale shall be determined from time to time by the National Petroleum Authority.

SUSTAINABILITY OF WOODFUEL PRODUCTION

- The Energy Commission shall collaborate with relevant institutions to ensure the development and implementation of programmes to sustain woodfuel production and consumption

PROGRESS MADE

FIT RATES FOR VARIOUS RE TECHNOLOGIES HAVE BEEN SET AND GAZETTED BY PURC

RE Technology	FiT Effective 1st October 2014 (GHp/kWh)
Wind with grid stability systems	55.7369
Wind without grid stability systems	51.4334
Solar with grid stability/storage system	64.4109
Solar without grid stability/ storage system	58.3629
Hydro ≤ 10MW	53.6223
Hydro (10MW>≤100MW)	53.8884
Biomass	56.0075
Biomass (Enhanced technology)	59.0350
Biomass (Plantation feedstock)	63.2891

The approved rates are based on Ghana Cedis/US Dollar Exchange Rate of GH₵3.1985 to US$1.0000 being the Average Selling Rate as at 1st October 2014 obtained from the Association of Bankers

FRAMEWORK FOR LICENSING PERSONS OR CORPORATE BODIES WHO ENGAGE IN COMMERCIAL ACTIVITIES IN THE RE INDUSTRY HAS BEEN DEVELOPED AND OPERATIONAL

- **Category of licences:**
  - **Wholesale Electricity Generation and Supply License**
  - **Installation and maintenance licence**
  - **Importation licence**
  - **Charcoal export licence**

- **3 Stages are involved in securing Wholesale Electricity Generation and Supply License**

  1. **Acquisition of Provisional licence**
  2. **Acquisition of Siting and Construction Permits**
  3. **Acquisition of Operational licence**

- **Procedure for Acquisition of Provisional Wholesale Supply Licence**
  - **An applicant shall submit a signed application letter addressed to the Executive Secretary of EC**
  - **Applicants shall fill and submit one original application form signed by a Principal Officer**
  - **Applicants shall attach receipt confirming the payment of prescribed licence application fee**
  - **Applicants shall provide ten (10) hard copies of the application**

CURRENT STATUS OF LICENCES

Type of Licence	No. of Provisional licences (PLs) issued	No. of PLs renewed	No. of PLs expired	No. of Siting Permits issued	Construction Permit issued
Wholesale Electricity Generation and Supply	52 (Solar 34, Wind 6, Waste to energy 6, Biomass 2, Hydro 3 & Wave 1)	21	13	16 (Solar 14, Wind 1 & wte 1)	2 (Wave 1 & Solar 1)
Installation and maintenance	5				
Importation	2				
Charcoal export	6				
Briquette	1				

PROJECT PIPELINE

Type of technology	Proposed capacity (MW)
Solar	2,155
Wind	776
Waste to energy	430
Biomass	68
Hydro	101
Wave	1,000
Total	4,530

5 companies have signed PPAs with ECG to install over 700MW of solar PV plants in the country.

PROJECTS UNDER CONSTRUCTION OR COMPLETED

Project	Capacity (MW)	Location of project
BXC Solar plant	20	Gomoa Onyadze, Central Reg
TC Ocean Wave plant	20	Ada Foah, Greater Accra
VRA plant*	2.5	Navrongo, Upper East
Noguchi Solar plant*	0.715	Accra, Greater Accra
Total	43.215	

* Completed

CODES AND GUIDELINES HAVE BEEN DEVELOPED AND OPERATIONAL

- **RE Grid Code**
- **RE Distribution code**
- **Net metering code**
- **Standardised Power Purchase Agreement has been prepared**
- **Framework for the operationalisation of the RE Fund**

A PROPOSAL HAS BEEN SUBMITTED TO MINISTRY OF POWER FOR THE ESTABLISHMENT OF THE RE FUND

- **The opening of a bank account for the RE Fund.**
- **The upward adjustment of the Petroleum Levy and part used to support the Fund.**

CHALLENGES TO THE IMPLEMENTATION OF THE RE LAW

- **Poor financial creditability of ECG and NEDCo**
- **All prospective IPPs are asking for sovereign government guarantee**
- **Difficulty in securing Government Concern and Support Agreement to back signed PPAs**
- **ECG has signed PPA for capacities far in excess of what the grid can handle**
- **Weakness of the transmission and distribution systems**
- **Inadequate spinning reserve to back intermittent generation plants (solar and wind plants)**
- **Reluctance of prospective IPPs to sell power to bulk customers**

WAY FORWARD

- **Revision of RE licence framework to address challenges that have been encountered in implementing the framework**
- **Establishment of the RE Fund with contributions from government, donors and other sources to support such activities as**
  - **Off-grid electrification**
  - **Research and development**
  - **Others**
- **Capacity building for the utilities, regulators and relevant stakeholders on RE intermittent generation**
- **Commencement of the implementation of the Net metering scheme by ECG**

- **Facilitation of massive deployment of Rooftop Solar Home Systems in the country**

CONCLUSION

- **The Renewable Energy Law has raised the interest of private sector investors in the RE sector of the country.**
- **The National Interconnection Transmission System needs to be strengthened to take more intermittent generation (solar and wind power generations)**
- **Massive deployment of rooftop solar systems under the net metering scheme will give a big boost to the implementation of the RE Law**