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**UNCTAD Sustainable Smart Port (SSP)
Assessment for Port Tema in Ghana
Progressive Tema Port Assessment Presentation**

By

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UNCTAD Sustainable Smart Port (SSP) Assessment for Port Tema in Ghana



PROGRESSIVE TEMA PORT ASSESSMENT PRESENTATION

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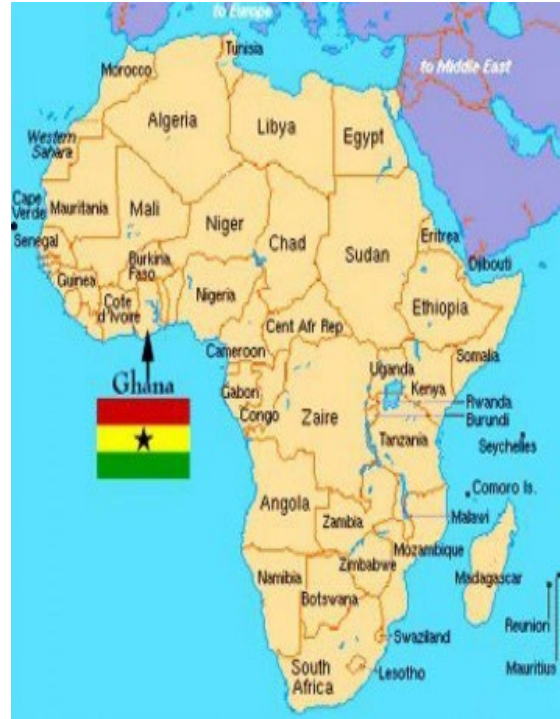
AT THE

**11TH SESSION OF MYEM ON TRANSPORT, TRADE LOGISTICS AND
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1. BRIEF ABOUT GHANA

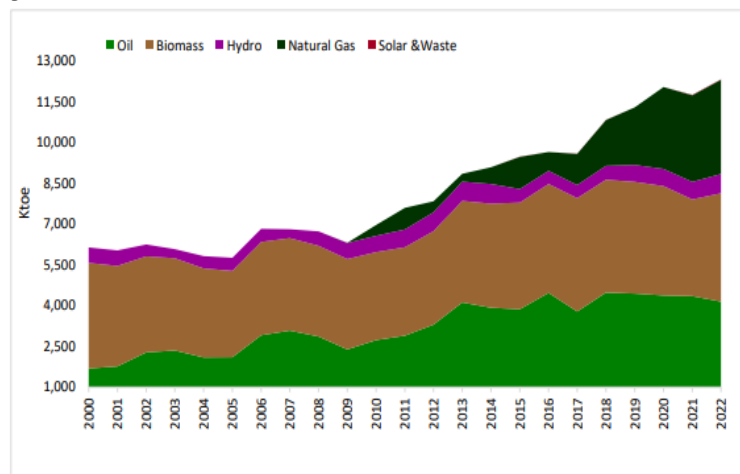
- Ghana is situated in West Africa on the Atlantic Ocean and borders Togo, the Ivory Coast and Burkina Faso.
- It has a population of about 35 million people (2024)
- GDP per capita for 2023 was \$2,380 (0.89% increase from 2022).
- Major industries include cocoa processing, oil and gas production, gold mining, beverage production, textile manufacturing, construction materials, light manufacturing, food processing, wood processing and petroleum, among others.
- Ghana has two major ports located in Takoradi (west) and Tema (east) both managed and operated by the Ghana Ports and Harbour Authority (GPHA).
- Ghana's membership in the Economic Community of West African States (ECOWAS) has facilitated trade relationships with countries in the region and globally. Countries such as Burkina Faso, Mali and Niger depend on Ghana for their imports and exports through the Tema port.



2. GHANA'S ENERGY SITUATION

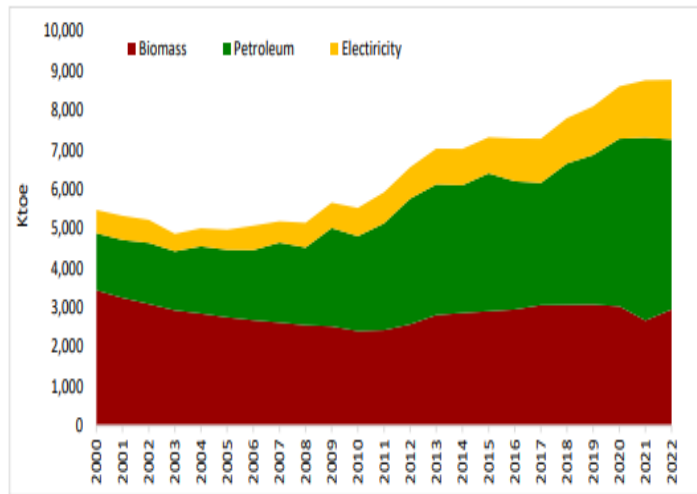
2.1. Trend of Total Energy Supply

- In 2022, the major sources of energy were oil (33.6%), natural gas (28.2%), biomass (32.4%), and hydro (5.7%). Solar energy accounted for less than 1% of the total energy supply.
- Natural gas has experienced a significant increase in its share of the total energy supply, rising from 5.6% in 2010 to 28.2% in 2022.



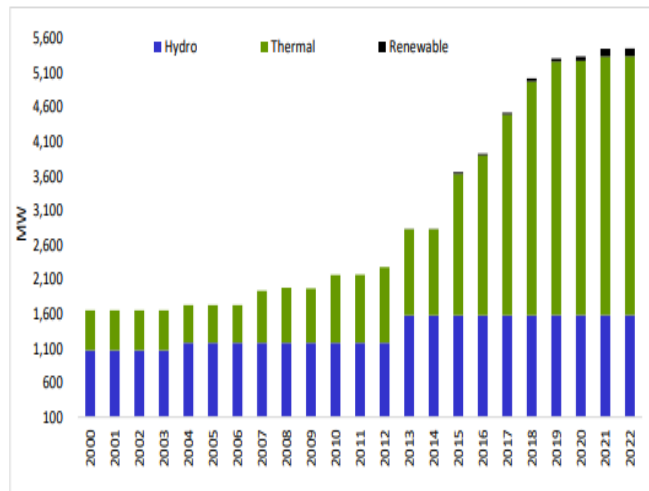
2.2. Trend in Final Energy Consumption by Fuel

- The total final energy consumption grew by 56% from 5,470 ktoe in 2000 to 8,537 ktoe in 2022
- total final energy consumption grew steadily from 5,470 ktoe in 2000 to 8,537 ktoe in 2022.
- Electricity consumption, increased by 155% from 592 ktoe in 2000 to 1,509 ktoe in 2022. Electricity in 2022 accounted for only 17% of total energy consumption.
- Petroleum consumption tripled from 1,445 ktoe in 2000 to 4,318 ktoe in 2022.
- Biomass however declined by 14% from 3,432 ktoe in 2000 to 2,940 ktoe in 2022.



2.3. Installed Electricity Generating Capacity (2000-2022)

- The total grid-installed capacity, excluding distributed generation, increased from 1,652 MW in 2000 to 5,454 MW in 2022, representing an annual average growth of 8%.
- Thermal generation capacity which was 990 MW, quadrupled from 990MW in 2000 to 3758 MW in 2022 at an annual average growth rate of 12.9%. Contribution of non-hydro renewables, though negligible, had an amazing growth rate increasing from 2.5MW in 2016 to 112MW in 2022.
- The electricity generated in 2022 was made of 8,192 GWh (35.4%) from hydro sources, 14,810 GWh (63.9%) from thermal sources, and 162 GWh (0.7%) from non-hydro renewable sources.



3. POLICIES AND INSTITUTIONAL FRAMEWORK

From the 1980s to date, the promotion of RETs in Ghana have been supported by government and development partners. Records are found in various policy and strategy documents. Below is a list of the major policies, plans and strategy documents that have been developed since 1986:

3.1. Policy Initiatives

- a) Issues and Options in the Energy Sector (1986)
- b) National Electrification Scheme (1989)
- c) Vision 2020 (1995)
- d) Energy Commission Act 1997
- e) Public Utility and Regulatory Commission Act 1997
- f) Ghana Poverty Reduction Strategy (2003)
- g) Growth and Poverty Reduction Strategy (2006)
- h) National Renewable Energy Strategy (2003)
- i) ECOWAS White Paper on Access to Energy Services (2006)
- j) ECOWAS Regional Bioenergy Strategy
- k) Strategic National Energy Plan (2006/2020)
- l) Ghana Shared Growth and Development Agenda I & II (2009/2014)
- m) National Energy Policy (2010)
- n) Energy Sector Strategy and Development Plan (2010)
- o) Renewable Energy Act, 2011 (Act 832)
- p) Sustainable Energy for All Action Plan / Agenda of Ghana (2012/2016)
- q) Mini-grid Electrification Policy (2016)
- r) Bioenergy Policy
- s) Feed-in-Tariff (FITs): guaranteed price for renewable energy fed into the national grid.

3.2. Policy Incentives

The following additional policies and Legislative Instruments have also been put in place since 2017 to scale up the deployment of renewable energy and to promote energy efficiency.

- a) Ghana's Intended National Determined Contribution 2018
- b) Energy Sector Levies Act
- c) Import Duty Exemption. Renewable Energy equipment exempted from import Duties
- d) Value Added Tax (VAT) exemption
- e) Corporate Tax Reduction for Renewable Energy Companies
- f) National Renewable Energy Development Fund
- g) National Energy Transition Framework
- h) Renewable Energy Amendment Act 2020 (Act 1045)
- i) Bui Power Authority Amendment Act 2020 (Act 1046)
- j) National Energy Policy 2021 (updated)
- k) Net Metering scheme that allows households to generate and sell excess energy to the grid

All the above policy initiatives and incentives demonstrate Ghana's commitment to promoting renewable energy and reducing carbon footprints. However, the extent of their implementation remains a big challenge.

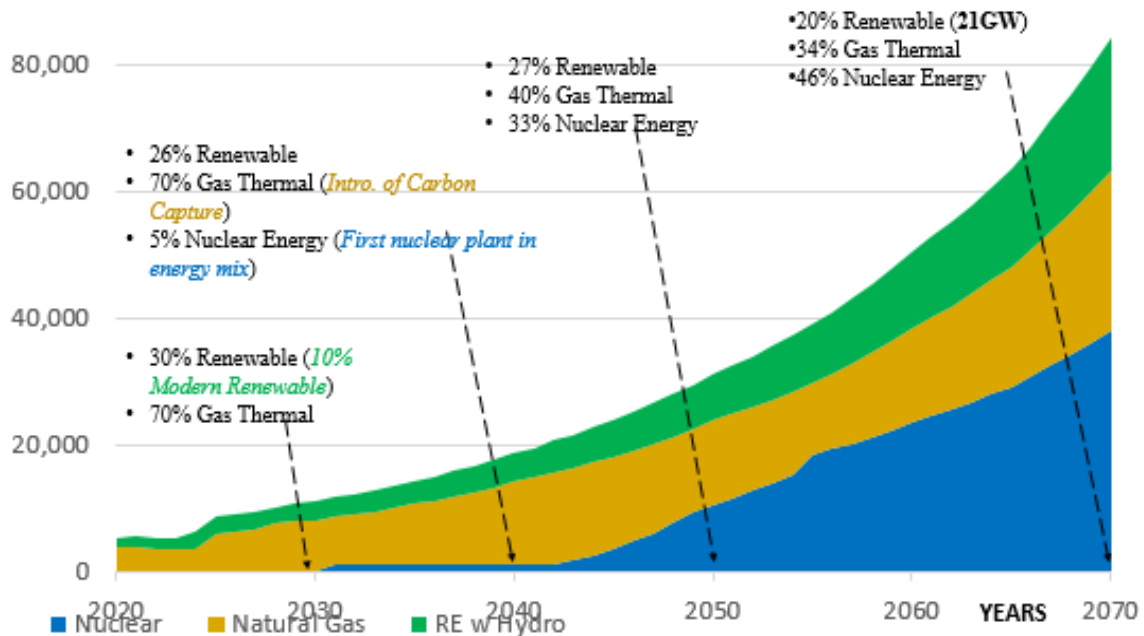
4. NATIONAL ENERGY TRANSITION FRAMEWORK AND INVESTMENT PLAN

4.1. Energy Transition Framework

Ghana is committed to fulfilling her pledge to implement measures that will address climate change and its negative impacts on our socio-economic gains. Therefore, responding to climate change issues is top of the national development agenda. Ghana, as a signatory to the Paris Agreement, is thus, implementing her Nationally Determined Contributions (NDCs) and the agreements of the Conference of Parties (CoP) to contribute her quota to achieving the objectives of the Paris Agreement.

In view of the fact that the energy sector is one of the high-emitting sectors, Ghana developed a National Energy Transition Framework with a target to achieve net zero emission by 2070. This framework document was launched by President Nana Akufo-Addo at the 26th UN Climate Conference in November 2021 in Glasgow, Scotland.

The graph below summarizes the targets set out to achieve net zero energy transition by 2070 as outlined:

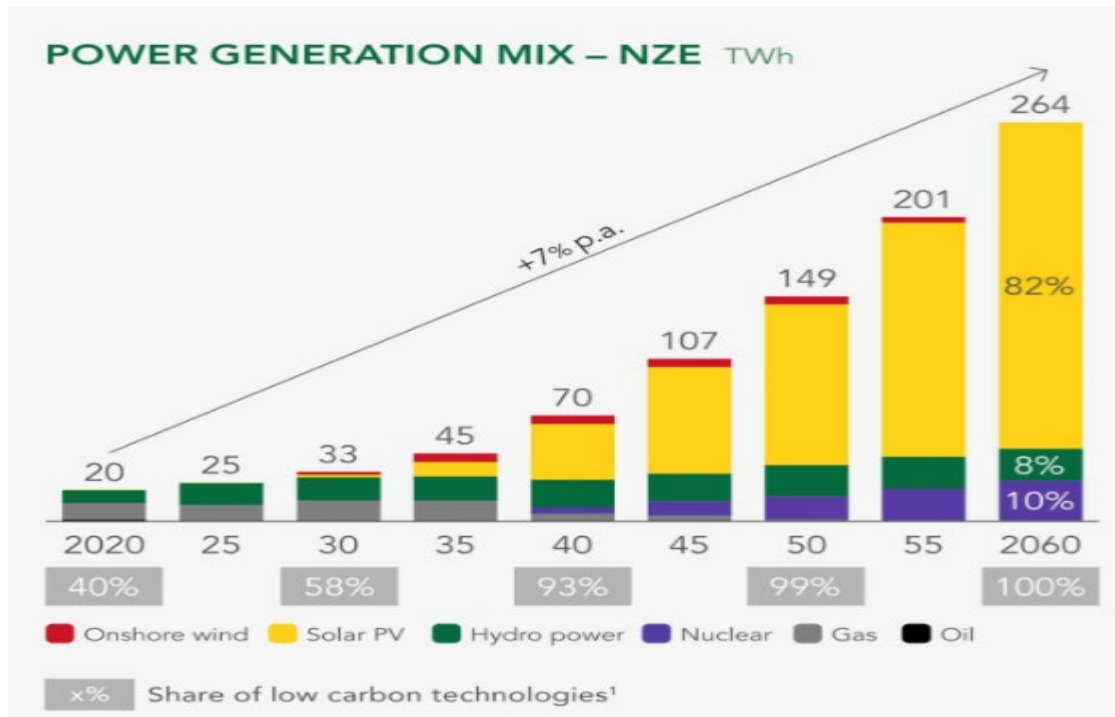


Projected Energy Mix in The Power Sector Under the Energy Transition Framework

4.2. National Energy Transition Investment Plan and Targets

In September 2023, the President Nana Akufo Addo unveiled the Ghana Energy Transition and Investment Plan during the UN General Assembly. The plan which was said to be built on Ghana's Energy Transition framework, however had a target of achieving net zero carbon emission by 2060 with solar PV accounting for 82% of total power generation mix.

The graph below summarises the targets set to achieve net zero under the investment plan.



Projected Energy Mix in The Power Sector Under the Energy Transition Investment Plan

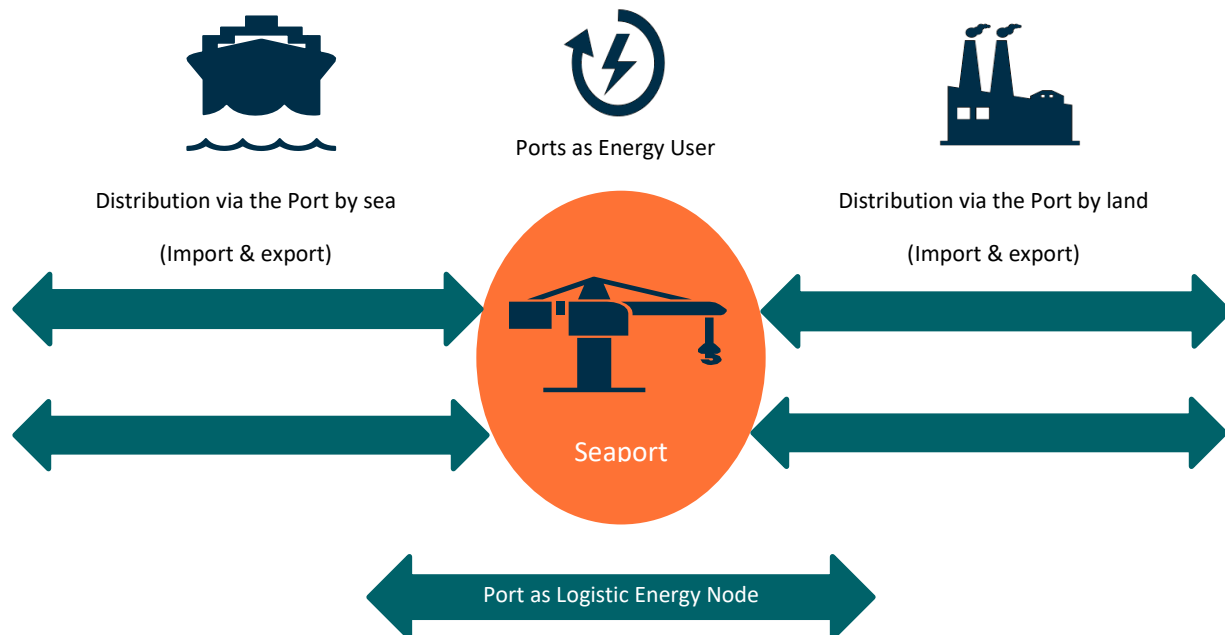
From the above two graphs, the targets set for the power generation mix are entirely different. Achievement of the targets set out in the Investment Plan to achieve 82% of electricity generation mix from solar PV is however doubtful as solar radiation in Ghana has a maximum of 6-7 sunshine hours a day. The sun is not available for 24 hours a day in Ghana.

5. PORT & TRANSPORT CONTEXT IN GHANA

Ghana has two major ports and several minor ports across the country. The major ports, which handle 85% of Ghana's trade, are operated by the Ghana Ports & Harbour Authority (GPHA) in Tema and Takoradi.

The port of Takoradi until recently becoming is Ghana's main oil and gas hub, has been the main port for handling dry bulk export cargo from Ghana. The port of Tema, located close to the capital of Ghana, Accra, on the other hand, is the largest port in Ghana and handles most of Ghana's imports as well as a reasonable market share of transit cargo to/from Mali, Niger and Burkina Faso. The Port of Tema handled about 20 million tonnes of cargo and 1.2 million TEU in 2022¹. The throughput in the port of Tema is about 70% of the international maritime trade in Ghana². Hinterland transportation is mainly done by road. The Volta Lake Transport Company (VLTC), a subsidiary of the Volta River Authority (VRA) manages all inland ports on the Volta Lake.

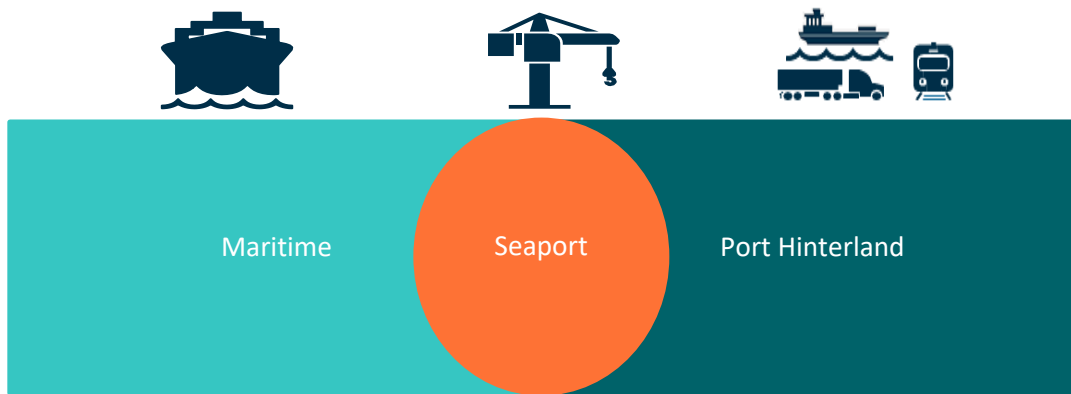
5.1. Role of The Port in The Energy Sector



¹ See [link](#), Tema & Takoradi Port Statistics 2013-2022

² Ghana Ports Handbook 2018-2019

5.2. Current Energy use at the Tema Port



Maritime

Fuel Oil & Diesel

- Heavy Fuel Oil (HFO)
- Marine Gas Oil (MGO)
- Marine Diesel Oil (MDO)
- Liquefied natural gas (LNG)

Seaport

Electricity

- Hydropower
- Petroleum
- Natural Gas
- Renewable Sources

Port Hinterland

Road Transport

- Gasoline
- Diesel

Electricity and Diesel Consumption at Tema Seaport

	2022	2023
Total Electricity Consumption at Tema Port (KWh)	45,637,434	73,448,880
Total diesel Consumption at Tema Port (Liters)	5,402,170	4,898,883

5.3 Ideal Energy Requirement for Sustainable Smart Port in Tema



Maritime

- Biodiesel
- Methanol
- Liquefied natural gas (LNG)
- Biomethane/bio-LNG
- E-Methane/e-LNG
- Hydrogen
- Green/blue hydrogen
- E-ammonia
- Blue ammonia
- Nuclear



Seaport

Electricity

- Renewable Sources
- Hydropower
- Natural Gas
- Hydrogen
- Nuclear



Port Hinterland

Road Transport

- Electricity
- EVs
- Electric power trains
- Methanol
- Methane (LNG)
- Hydrogen

6. ONGOING INITIATIVES AT THE TEMA PORT LINKED TO SDG GOALS

The Ghana Ports and Harbours Authority (GPHA) is committed to the attainment of the sustainable goals and has been implementing various initiatives to combat climate change at the Tema Port. GPHA is indeed collaborating with International Maritime Organization (IMO) to explore alternative fuel and technology options aimed to reduce greenhouse gas emissions and promote sustainable maritime practices.

In February 2024, the IMO and Ghana Maritime Authority co-hosted a Green Shipping conference in Accra, Ghana, focusing on "Unlocking Opportunities for Green Shipping in Africa". The event chaired by the CEO of the Tema Port brought together experts to discuss energy efficiency, technology development, and regulatory frameworks for decarbonizing international shipping. Indeed, all the activities at the Tema port can be linked to the 17 SDG goals. Below are some of the notable climate change related projects being undertaken at the Tema Port.

6.1. Tema Port Expansion Project

The port is currently undergoing an expansion project under which climate-resilient design and infrastructure, including the installation of 15 state-of-the-art electric gantry cranes to boost cargo handling capacity has been incorporated³. The climate-resilient design and infrastructure ensure maximum and efficient energy consumption leading to reduction in the use of fossil fuel and greenhouse gas emission. This project is anticipated to generate substantial employment opportunities for the Ghanaian construction workforce.

6.2. LNG Powered Vessel

The port of Tema now receives LNG-powered vessel, the CMA CGM Scandola Valletta, on regular basis, which showcases its commitment to sustainable practices by reducing greenhouse gas emissions and promoting eco-friendly shipping.

6.3. Clean Coast/Beach Project

One notable project is the Clean Coast/Beach Project, which aims to reduce plastic waste volumes entering the port and the ocean. This initiative has been successful in ensuring clean shorelines along the Accra/Tema coastal zone, improving coastal tourism, and creating better conditions for fisheries and aquaculture development.

6.4. Investment in Renewable Energy Project.

Management of the Ghana Port and Harbour Authority is committed to incorporate and use clean energy generation options in the electricity generation mix at the Tema Port. Management is therefore in discussion with the Ministry of Finance for Public Private Partnership with prospective wind power developers for the installation of wind turbines at the Tema Port.

The Tema Port has also signed a Memorandum of Understanding with the Bui Power Authority for the development of a 3-9MW Wind and Solar Power Plant to augment the electricity consumed within the Tema Port. Discussions are currently underway for the lease of land for the project.

6.5. GPHA Green Club Association

The Ghana Ports and Harbours Authority (GPHA) has embarked on an initiative to create a sustainable environment and effective waste management in Tema. GPHA inaugurated a Green Club Association in partnership with the Coastal Conservancy Organization and with support of the Ghana Education Service. The objective of the club is to assist students with the opportunity to learn more about the environment and its associated issues while empowering them to make positive change. 1,234 trees have so far been planted within the Port Enclave.

7. STRENGTHS, WEAKNESS, OPPORTUNITIES and THREATS

7.1. Strengths:

1. **Environmental Benefits:** Transitioning to low-carbon energy systems (such as solar, wind, and waste-to-energy) can significantly reduce greenhouse gas emissions, lowering Tema Port's environmental footprint.
2. **Cost Savings Over Time:** While initial investments may be high, renewable energy sources such as solar and wind can offer long-term cost savings by reducing reliance on fossil fuels.
3. **Energy Security:** Low-carbon energy systems can reduce the port's dependency on the national grid, improving energy security and reducing the impact of power outages.
4. **International Appeal:** Companies operating in Tema Port that focus on sustainability may attract more international businesses concerned about their carbon footprint.
5. **Policy Alignment:** Adoption would align with Ghana's national climate change goals and its commitment to international agreements like the Paris Agreement.

7.2. Weaknesses:

1. **High Initial Capital Costs:** Installation of renewable energy systems can be expensive upfront such storage systems, wind turbines
2. **Technology Readiness:** Low-carbon technologies may not be readily available or mature enough in Ghana, leading to potential operational challenges.
3. **Maintenance and Skill Gaps:** Ghana may lack the necessary technical skills or expertise for maintaining advanced low-carbon systems.
4. **Space Constraints:** Finding suitable locations within Tema Port for renewable energy installations may be a challenge due to space limitations.

7.3. Opportunities:

1. **Government Support and Incentives:** The Ghanaian government offers subsidies, tax incentives, or other support for organizations that adopt low-carbon technologies, which can reduce upfront costs.
2. **Export and Trade Opportunities:** Tema Port could become a regional hub for green logistics
3. **Technological Advancements:** Advancements in renewable energy technology and storage solutions (such as batteries).
4. **Government Incentives & Global Funding:** Tema Port may benefit from global climate finance, green bonds, or international aid. to fund renewable energy projects.
5. **Expanding Trade Relations:** Partnering with international companies and stakeholders in green energy can open up new business opportunities and enhance trade partnerships.
6. **Job Creation:** The installation and maintenance of low-carbon systems can create jobs and contribute to local economic development in the Tema region.
7. **Regulatory Compliance:** Early adoption can help Tema Port get ahead of future regulations regarding emissions and sustainability.

7.4. Threats:

1. **Economic Fluctuations:** Unstable economic conditions, such as inflation or currency devaluation, can affect the availability of funding.
2. **Energy Policy Changes:** Changes in government priorities or policies could reduce support for renewable energy projects, creating uncertainty around the financial feasibility of low-carbon systems.
3. **Technological Failures:** New technologies, especially those adapted for a large industrial port, might face implementation challenges or underperform, risking financial loss or operational inefficiencies.
4. **Competition with Fossil Fuels:** Price of fossil fuels are currently high in Ghana but if it becomes low, it may make it harder to justify
5. **Resistance to Change:** Stakeholders may resist the transition due to the perceived complexity and high investment cost