



National Roadmap on Sustainable GHG Reduction from Chemicals Industry for Ghana

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esc.agighana.org



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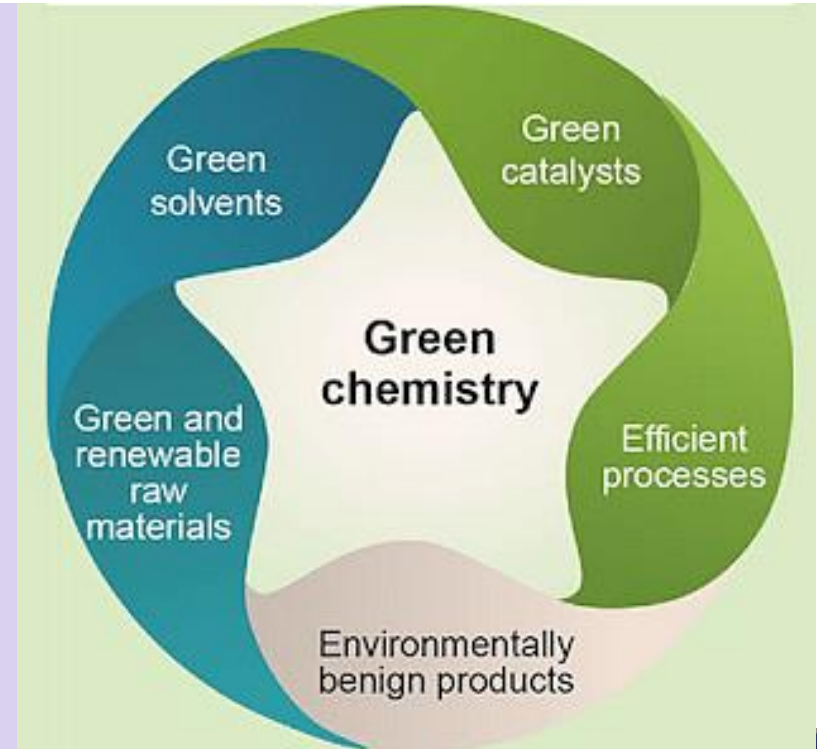
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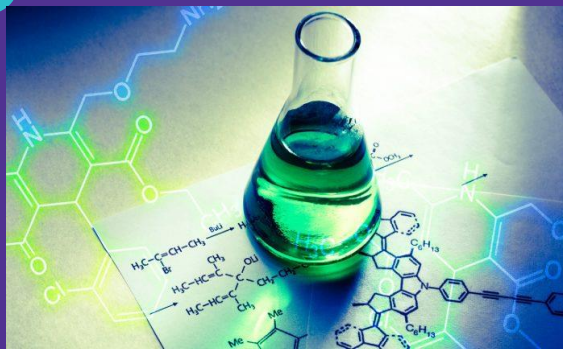
Greenhouse gas emissions related with the production & use of chemicals

Baseline Situation: Ghana

- Production of chemicals is limited to defined segments, that do not include the most carbon-intensive processes. For example Cement-Clinker is imported and finished locally and Steel Mills employ scraps as raw material: For now, **Process Based Emissions are not expected to be a major issue**
- **Most Chemicals are imported**
- Ghana Gas receives 70-120 MMSCFpd of gas from the Jubilee Partners. One MMSCFD equals 1180 m³/h. This gas is processed and piped to several Mines, Steel Mills, Thermal Plants, Refineries, Factories, etc. **Potential Leakages constitute a genuine concern**
- Most Emissions at the Chemical Sector, as at now, are therefore **Energy Related**



The Survey



Survey of the Chemical industry

Period	December 2023
Organisations Interviewed	<ul style="list-style-type: none">• Thirty-Two (32) Factories• Officials of the Association of Ghana Industries (AGI)• Officials of Ministry of Trade and Industry (MoTI),• Officials of Ministry of Environment, Science, Technology and Innovation (MESTI),• Officials of Ministry of Energy (MoEn),• Officials of Ministry of Transport (MoT),• Officials of National Development Planning Commission (NDPC) and• Officials of the Environmental Protection Agency (EPA)
Structure of the Survey	<p>The Structure of the Survey covered:</p> <ul style="list-style-type: none">• Commitments towards Net Zero,• Opportunities and• Challenges envisaged along the pathway

Net Zero Transition Commitments from Gov't Officials

Enabling Environment

Sustainable Finance

Infrastructure

Hydrogen targets

Promoting Sustainability Concepts

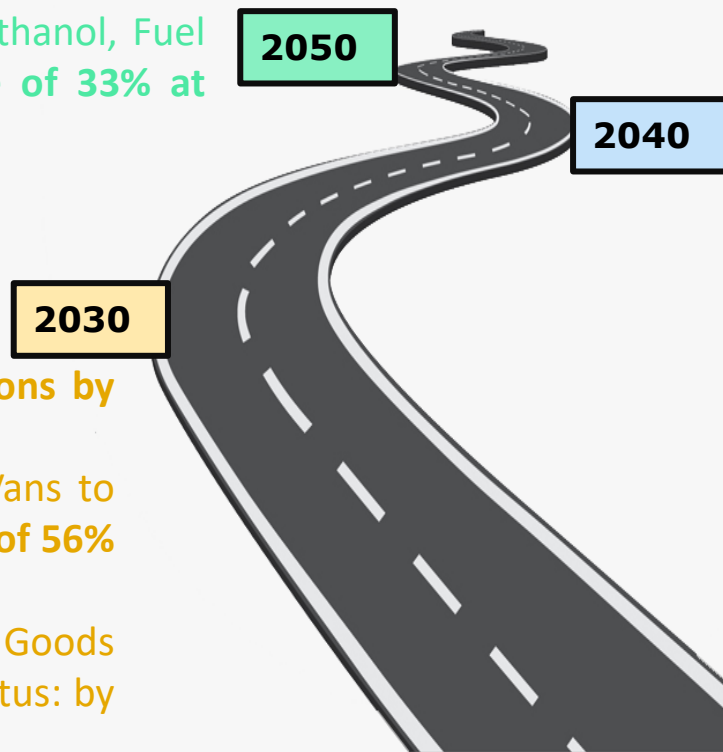
Net Zero Transition Commitments from the Companies

Factories' Commitments: 2030-Low Complexity, 2040-Medium Complexity and 2050 High Complexity

- Commit to reduce carbon Emissions by an average of 31.4% at 2050
- Committed to moving Cars and Vans to Zero Carbon status by an average of 8% at 2050
- Committed to moving Heavy Goods Vehicles (HGV) to Zero Carbon Status: Methanol, Fuel Cells, Electric Etc. by an average of 33% at 2050%



- Commit to reduce carbon Emissions by an average of 34.4%
- Committed to moving Cars and Vans to Zero Carbon status by an average of 56% at 2030
- Committed to moving Heavy Goods Vehicles (HGV) to Zero Carbon Status: by an average of 20% at 2030,



- Commit to reduce carbon Emissions by an average of 34.2% at 2040
- Committed to moving Cars and Vans to Zero Carbon status by an average of 36% at 2040
- Committed to moving Heavy Goods Vehicles (HGV) to Zero Carbon Status: Methanol, Fuel Cells, Electric Etc. by an average 48% at 2040



Decarbonising the Chemical Industry

Decarbonising the Chemical industry

Decarbonising Fossil Fuel Intensive Processes

The members of the chemical industry in Ghana mostly use fossil fuels in the production of steam, power and for drying purposes. Residual Fuel Oil, LPG and PNG are the most common

Fuel Switching

RFO & Diesel

PNG, RDFs, Wood Pellets from Waste Wood

- Getting **Piped Natural Gas** to the Clusters of Chemical Industries or Manufacturers.
- Industries could **use PNG to produce heat and power in situ**.
- Some of the **members of the clusters could supply others nearby with steam and power as well**.
- The development of a **Piped Natural Gas Network needs to be hastened across the country**.
- Encouraging the setting up of plants to produce biomass such as wood chippings, palm kernel shells, coconut husks, etc.
- Processing fermentable wastes from their facilities into biogas for heat production and power generation.

Electrification

The cost of power is a challenge for the electrification of fossil fuel intensive processes. The in-situ production of power with the switched fuels mentioned above could enhance the chances of electrification.

Decarbonising the Chemical industry

Electrification

There are factories in Ghana that have already shifted a great deal of their power requirements to solar energy. With the prices of solar panels dropping, this appears to be a good option as well for industry. Finally, the new sets of Hydrogen Fuel Cell would revolutionize the Portable Power Sector in the coming years. **Price of Panels: US\$0.16/W: Price of Solar Power US\$0.024/KWh**

Hydrogen Based Systems

Hydrogen is key to Net Zero ambitions. The actions or measures under Hydrogen Based Systems include:

- Encouraging the setting up of Hydrogen Plants within the Chemical Clusters, using PNG to supply Grey Hydrogen as fuel
- Encouraging the setting up of Hydrogen Plants within the Chemical Clusters, using PNG to supply Blue Hydrogen as fuel, with CCS
- Encouraging the setting up of Hydrogen Plants within the Chemical Clusters, to supply green Hydrogen as fuel
- Setting the target for Hydrogen Production of different types i.e. Grey, Blue and Green in Ghana for 2030, 2040, and 2050

Other solutions include:

- **Carbon capture, utilization, and storage (CCUS)**
- **Bioenergy with carbon capture and storage (BECCS).** In Ghana, wastes from palm oil processing are examples of raw materials that could be employed in the production of Biodiesel. The idea is to provide such a solution coupled with CCS

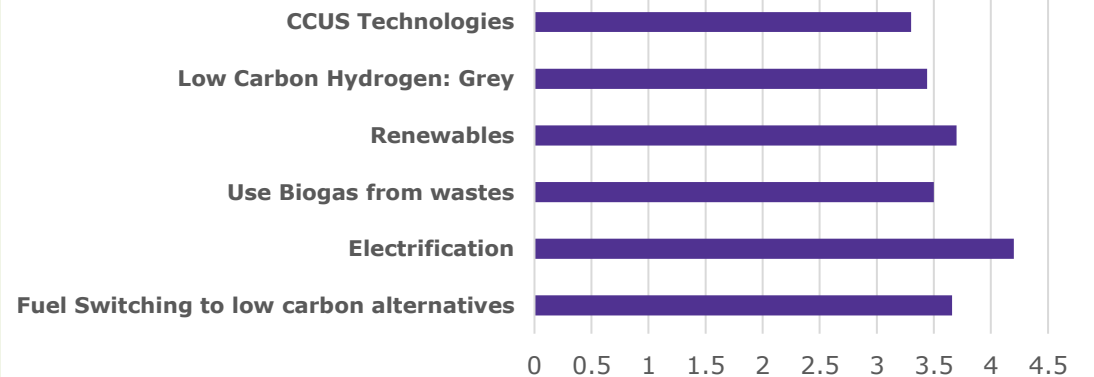
Decarbonising the Chemical industry

The interviewees graded their commitments to the solutions to decarbonising the fossil fuel intensive processes (from 1-Low to 5-High), during the survey. These have been analysed in the adjacent graph

Green hydrogen is made using water and electricity ideally generated from renewable energy. This process is called 'electrolysis.'

Blue hydrogen comes from natural gas with carbon capture and storage (CCS) to capture emissions produced during the process.

Decarbonising the Fossil Fuel Intensive Processes



The Enablers

These are actions that are proposed to be implemented by the Government. They include:

- Establishing a fund, with a reasonable interest rate, that could be accessed by manufacturers to make the necessary changes towards Net Zero. The idea is for manufacturers to effect repayment from the savings made by switching to low-carbon options and avoid burdening them with additional costs
- Setting hydrogen capacity targets for 2030, 2040 and 2050 and incentivizing the private sector to establish hydrogen plants in the Industrial Clusters, making hydrogen available as an alternative fuel
- Working to develop the hydrogen infrastructure to facilitate access to hydrogen by the industrial clusters
- Setting targets to decarbonise electricity production whilst maintaining and increasing capacity with renewables including hydro power, small modular nuclear power plants, etc. by 2030, 2040 and 2050
- Working to access and implement innovative ^[1]_[SEP] CCUS technology and infrastructure to enable wide scale deployment across industrial sites for hard-to- decarbonize-processes

Decarbonising the Chemical industry

The Enablers

Working to access and implement innovative ^{SEP} Hydrogen Cell Portable Power Systems and develop the necessary infrastructure to enable wide scale deployment across industrial sites for processes electrification purposes



**Beyond
Combustion: The
1kW Hydrogen
Fuel Cell
Revolutionising
Portable Power. It
delivers 5x the**

CLEAN FUTURE

**Sustainable Carbon
for a Net Zero
Chemical Industry**



Decarbonising the Chemical industry

SAMPLE of a current solution: A microgrid can also be thought of as a stool supported by three legs.



Leg #1 is the power grid.

This is where you are connected to a utility receiving power from a power plant. Sometimes using grid power will be cheaper and more available, and you will strategically use grid power in this way.



Leg #2 is alternative power.

This usually comes in the form of wind or solar, but can also be something like a [water-wheel](#). These devices are able to use renewable energy sources to power the microgrid when it aligns with the environmental conditions. (e.g. when the wind is blowing or the sun is shining)



Leg #3 is hydrogen fuel cells. This bridges the gap and creates 100% uptime for your microgrid. If the traditional grid goes down at night (and therefore, the sun isn't powering your solar), you can run your property on hydrogen fuel. The hydrogen fuel can be generated using excess power from alternative power sources in Leg #2. This is done using an electrolyzer to convert solar energy to hydrogen fuel cells.

All three legs join to create a true microgrid capable of energy

Decarbonising the Chemical industry

SAMPLE of a current solution:



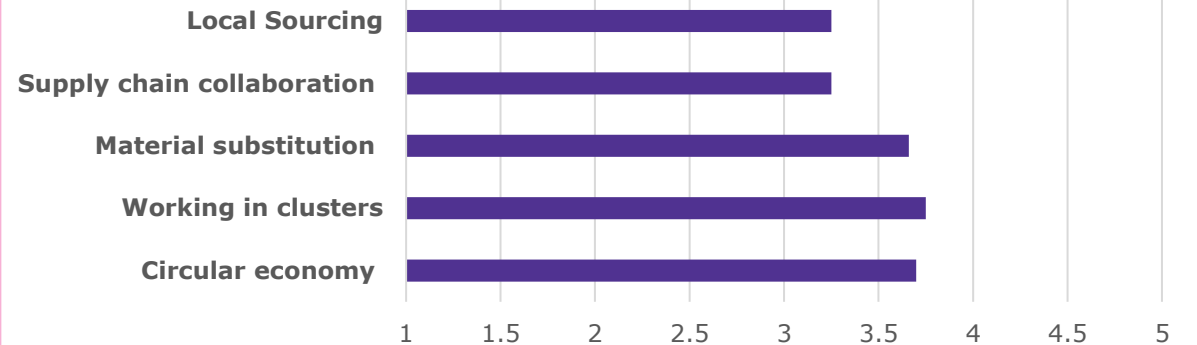
Decarbonising the Chemical industry

Raw Material Supply

Solutions include:

- **Circular Economy:** Circular economy involves the use of recycled raw, or even waste materials, rather than new, primary resources
- **Material Substitution**
- **Supply Chain Collaboration**
- **Local Sourcing**

Decarbonising Raw Material Supply



The Enablers

Setting up a policy and fund to support large scale and SME manufacturing companies to decarbonise products in a cost and time efficient way, targeting a given number of manufacturers by 2030, 2040 and 2050. This will require a broad census of manufacturers in the country

Encouraging the introduction of low-carbon clauses in tenders to incite suppliers to decarbonise their activities, with specific targets set for 2030, 2040 and 2050

Introducing low-carbon product standards. This could be started with a Pilot phase i.e. 2025 and then set targets for 2030 and 2040.

Setting up a policy and fund i.e. **Low- carbon and Circular Economy Fund**, to support large scale and SME manufacturing companies to implement circular economy approaches

Setting up a policy and fund to support upstream technological innovation that will allow large scale suppliers to decarbonise operations

Decarbonising the Chemical industry

Raw Material Supply

The Enablers

Creating the environment to facilitate:

- Establishing **chemical industries reduce Scope 3 of local manufacturers**
- Establishing **glass factories** for local manufacturers and enhance solar panel production
- Establishing **fibre-to-fibre recycling plants**
- Establishing **waste paper recycling plants**
- **Establishing waste plastic to energy recycling plants**
- Establishing of battery recycling facilities
- Establishing facilities to recycle aluminium
- Establishing industries to process **Non-ferrous metals to reduce Scope 3 of the local manufacturers and encourage the development of battery production for renewable energy systems and the assembly of electric vehicles**
- Establishing **industries to process ferrous metals to reduce Scope 3 of the local manufacturers**
- Establishing **industries to process Ceramics to reduce Scope 3 of the local manufacturers and produce refractory insulation used in renewable applications (wind turbines and solar) and nuclear applications**
- Establishing industries to produce **Die casting components to reduce Scope 3 of the local manufacturers. These components provide precision products needed for a wide range of renewable energy technologies**
- Etc.

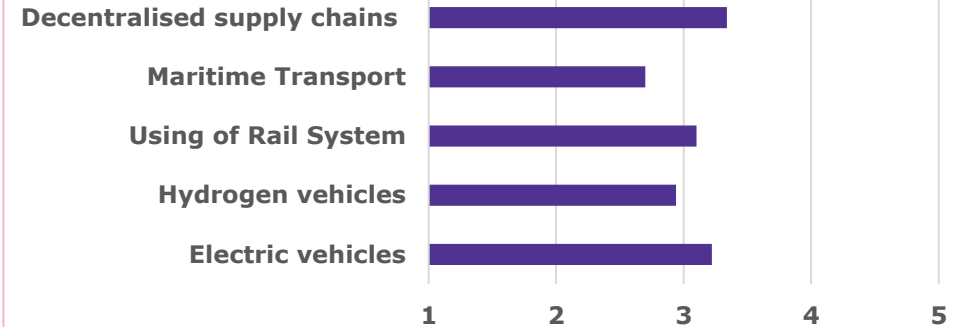
Decarbonising the Chemical industry

Transport & Logistics

Solutions include:

- **Decentralised Supply Chains**
- **Maritime Transport**
- **Using the Rail System**
- **Hydrogen Vehicles**
- **Electric Vehicles**

Decarbonising Transport & Logistics



The Enablers

Setting targets for the elimination of fossil fuel powered vehicles i.e. personal vehicles and HGVs for 2030, 2040, and 2050

Setting hydrogen capacity targets for 2030, 2040 and 2050 and incentivizing the private sector to establish hydrogen plants in the Industrial Clusters, making hydrogen available as an alternative fuel

Setting hydrogen filling station targets for 2030, 2040 and 2050

Setting Electric Vehicle Charging Stations targets for 2030, 2040 and 2050

Undertaking trial roll out of EVs and Hydrogen Vehicles on a Pilot Basis as a sample for people to see and adopt

Formulating a Government policy to support the development of low-carbon hydrogen production and infrastructure

Decarbonising the Chemical industry

Transport & Logistics



The Perfect Trio

**PERFORMANCE
SAFETY
COMFORT**

Revolutionize Mining productivity by reducing 70 tons of CO2 emissions per truck annually. Leap to the future of EV and save our planet.



**GAME
CHANGER**
LEAN GREEN PROFIT MACHINE



**PERFORMANCE
THAT SETS US APART**

- Heavy duty truck with the highest payload rating in the 6x4 and 8x4 segment
- 470hp motor with max torque
- Shorter turning radius, shorter wheel base for easy maneuverability
- Higher ground clearance for trouble free off-road operations
- 1 hour Fast charging supported battery
- 30% gradeability

Decarbonising the Chemical industry

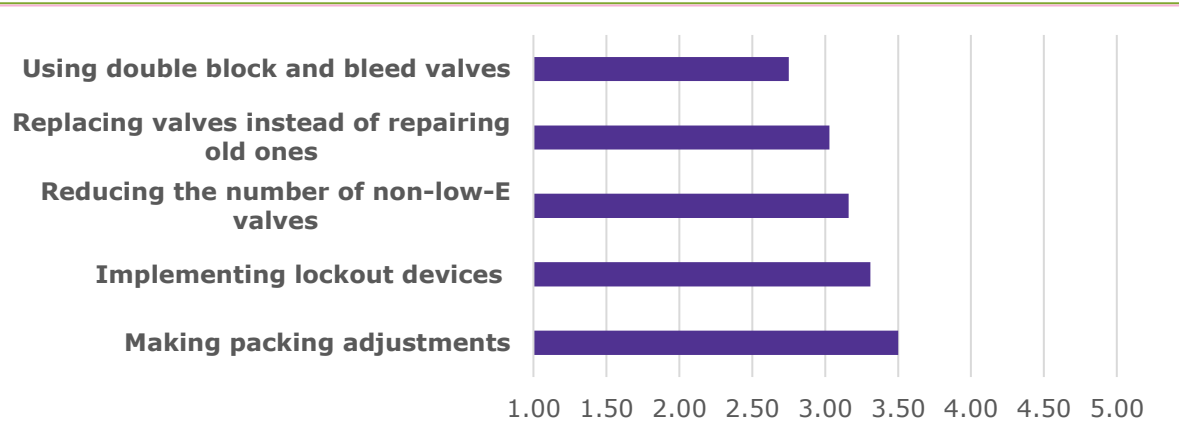
Transport & Logistics

The Enablers	Developing the rail sector in order to lower emissions from goods transport within the country
	Providing incentives to facilitate investment in the marine transportation of goods via sea and the Volta Lake
	Forming Industrial Clusters to facilitate the linking of manufacturers with potential suppliers or producers of raw and packaging materials
	Ensuring that future industries and suppliers/producers of raw and packaging materials are located in SIAs in order to cut down on emissions from transport and logistics

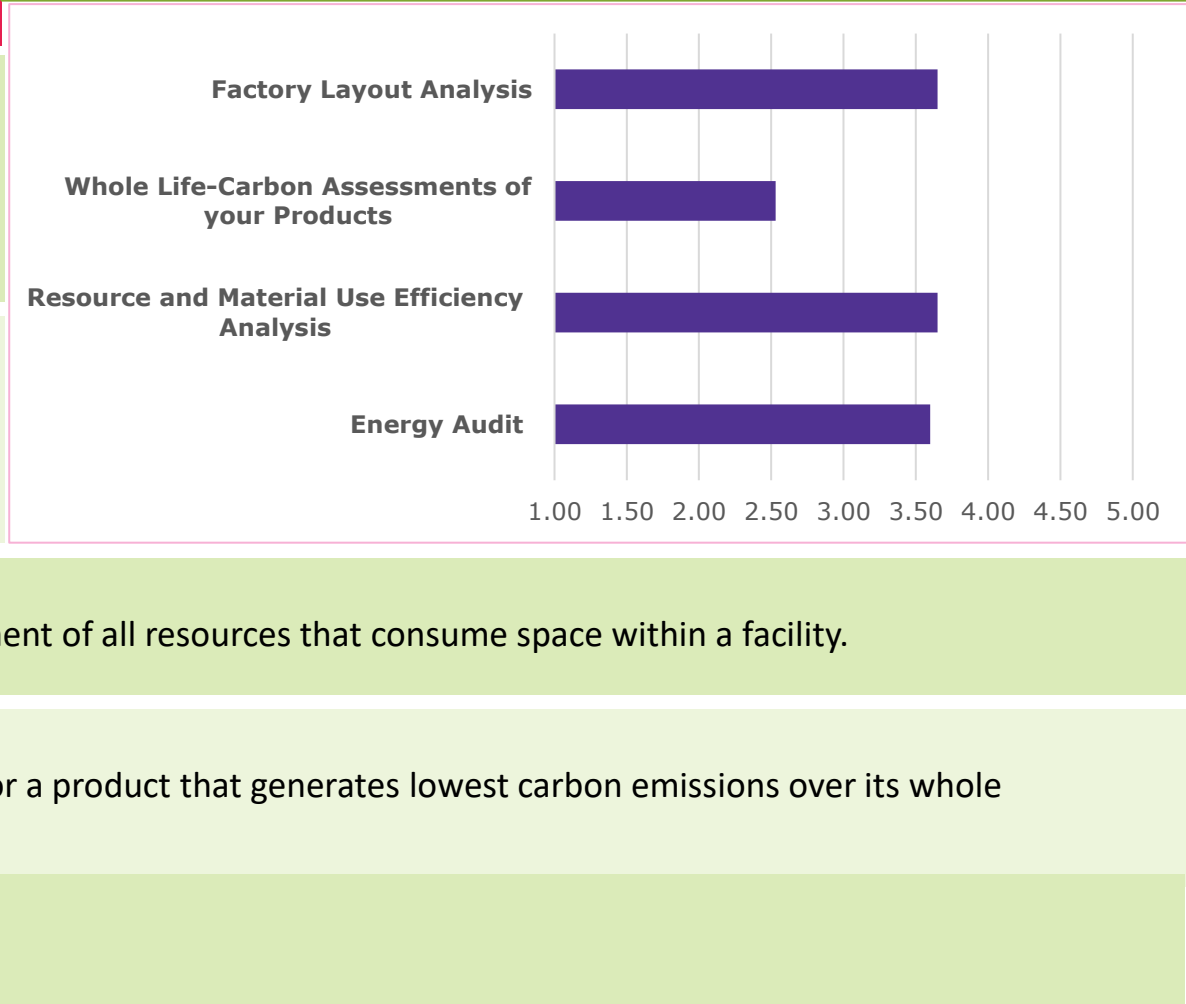
Fugitive Emissions

The Enablers	Setting up a policy and fund to support large scale and SME manufacturing companies to effect changes regarding valves
	Setting up a policy and fund to support capacity of members of the chemical industry and manufacturers in general

Reducing Fugitive Emissions



Decarbonising the Chemical industry

Efficient Resource Use	Commitment to undertake Efficiency Analysis										
Solution	<p>Energy Auditing The Energy Audits as per ISO 50002: 2014 COMPLIANT TYPES 1 and 2 Analysis carried out for manufacturers tend to address the flaws and gaps in the energy usage by the factories and propose solutions</p>										
	<p>Resource/Material Use Efficiency Analysis The objective of this analysis is to limit wastage and improve efficiency as much possible. This gradually leads to lowering emissions, cost of production, which enhances the potential to make a profit.</p>										
	<p>Factory Layout Planning and Analysis Layout planning is deciding on the best physical arrangement of all resources that consume space within a facility.</p>										
	<p>Whole Life-Carbon Assessment of a Product The purpose of using WLC is to move towards a building or a product that generates lowest carbon emissions over its whole life (sometimes referred as 'cradle-to-grave').</p>										
	<p>Setting Up a fund to support Audits and Analysis</p>										
The Enabler	 <table border="1"> <caption>Commitment to undertake Efficiency Analysis</caption> <thead> <tr> <th>Analysis Type</th> <th>Commitment Score (approx.)</th> </tr> </thead> <tbody> <tr> <td>Factory Layout Analysis</td> <td>3.6</td> </tr> <tr> <td>Whole Life-Carbon Assessments of your Products</td> <td>2.5</td> </tr> <tr> <td>Resource and Material Use Efficiency Analysis</td> <td>3.6</td> </tr> <tr> <td>Energy Audit</td> <td>3.6</td> </tr> </tbody> </table>	Analysis Type	Commitment Score (approx.)	Factory Layout Analysis	3.6	Whole Life-Carbon Assessments of your Products	2.5	Resource and Material Use Efficiency Analysis	3.6	Energy Audit	3.6
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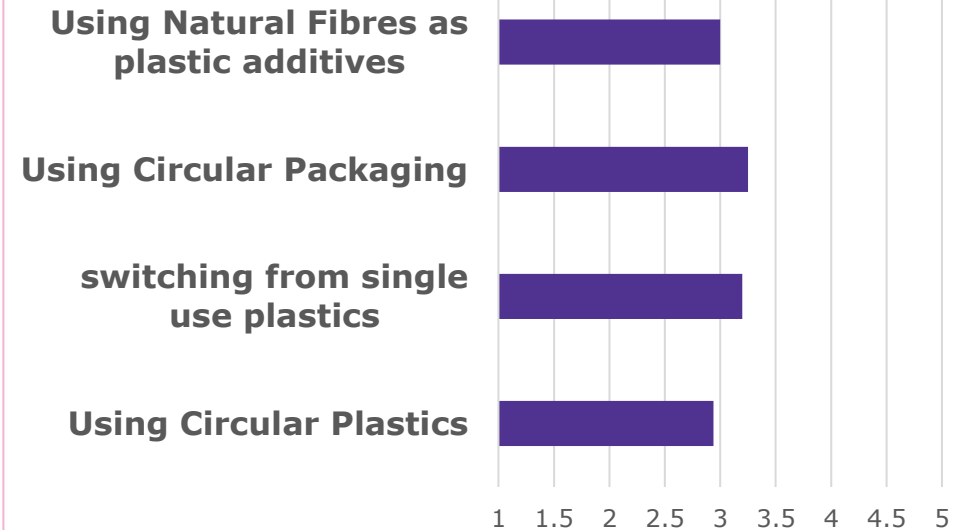
Decarbonising the Chemical industry

Packaging

Solutions include (These are related to RM Supply solutions):

- **Using Circular Plastics**
- **Switching from single use plastics to making greater use of recycled and lower carbon materials**
- **Using Circular Packaging:** Circular packaging is product packaging intended to have a low environmental impact
- **Using Natural Fibres:** Hemp and plantain fibres are a suitable alternative to mineral and synthetic additives to decarbonize plastic. About 20-40% by weight in a plastic part, manufacturers are able to reduce their carbon footprint by upwards of 50% without changing the plastic itself. (According to Imperium)

Decarbonising Packaging



The Enablers

Setting up a policy and fund to support investment in Packaging change to a low-carbon and more circular options

Setting up a policy and fund to support capacity of SMEs and Manufacturers on low-carbon packaging options available

Setting up a policy, fund with the necessary environment to support the setting up of Packaging Factories in the Clusters and SIAs to service the local manufacturing sector

Decarbonising the Chemical industry

Packaging



Pineapple Leaves



Pineapple Fibers



Blended Fibers



Flexible PF Aerogel



Towards Net Zero

Opportunities

For the Manufacturers & Businesses

- The transition is a chance to make changes to be efficient, to improve product quality, to improve the capacity of manpower, to cut costs and increase profitability
- The potential to manufacture a host of products regarding mobility i.e. EV batteries and fuel cells, and producing the materials needed to make these essential components
- The potential to assemble for e-bikes, scooters, tricycles, BEVs, FCEVs, Solar Panels, Wind Mills, Fuel Cell Systems, etc.
- The potential to build, make, and operate infrastructure for charging BEVs and refueling FCEVs; and creating digital solutions to integrate the new vehicle energy infrastructure with the power grid
- The potential to produce raw materials and inputs locally for industry to reduce Scope 3 Emissions

For the Government

- The opportunity to put in the right policy and make the necessary sacrifices, with the necessary incentives, standards and regulations to industrialise and make manufacturing more efficient.
Ghana has to position itself well to take advantage of this transition. Meet NDC Targets

For Young People

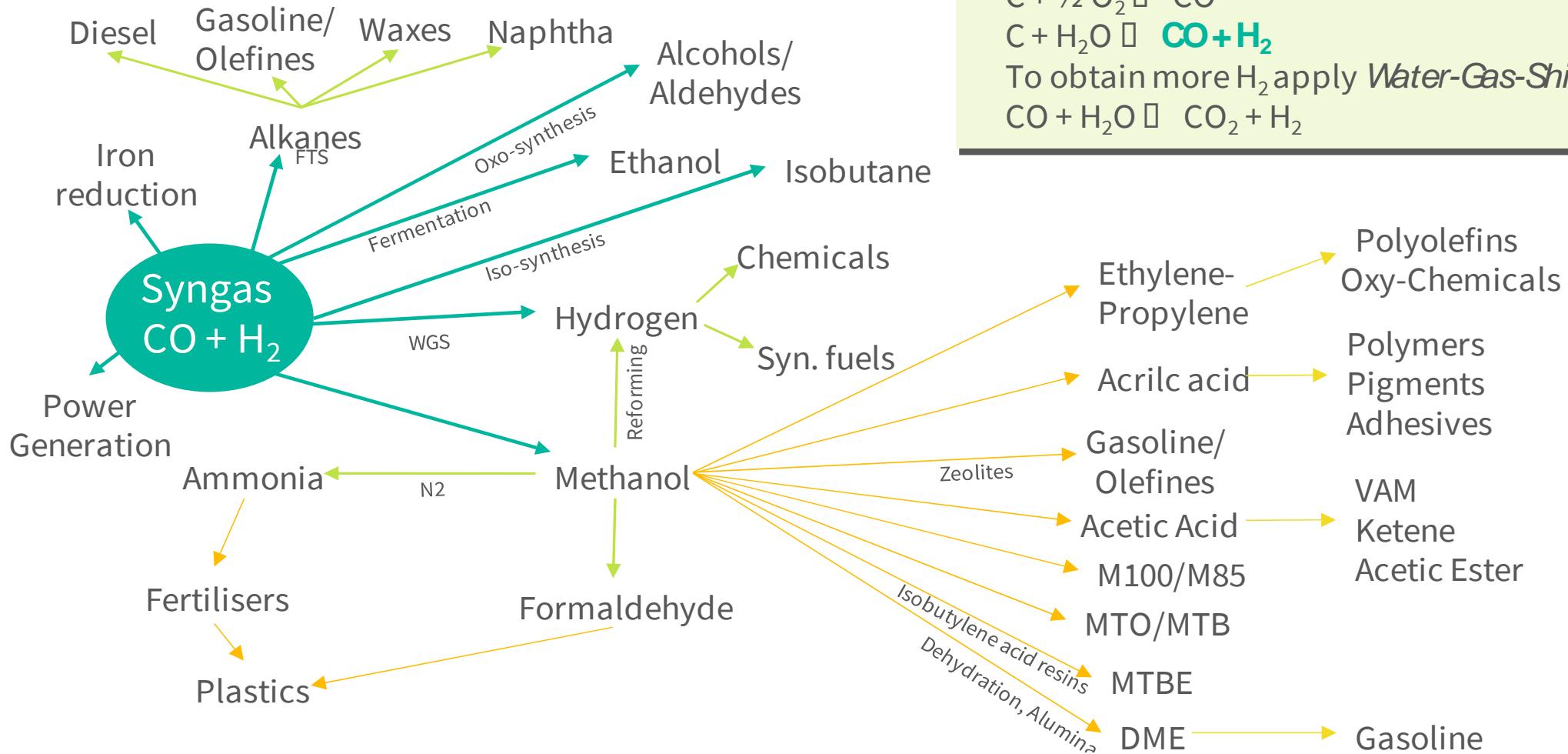
- The transition is an opportunity to learn new green skills/trades, new ideas, get green jobs and position themselves to play a role in the transition, while they grow as well.

For Entrepreneurs

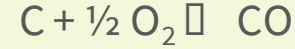
- There are immense SME opportunities (green entrepreneurship) to manufacture products and provide services for the industrial sector going into the transition

Opportunities

Syngas for production of hydrocarbons, alcohols, and dimethyl ether (DME)



Syngas is mother of all molecular Lego



To obtain more H₂ apply *Water-Gas-Shift-Reaction*:

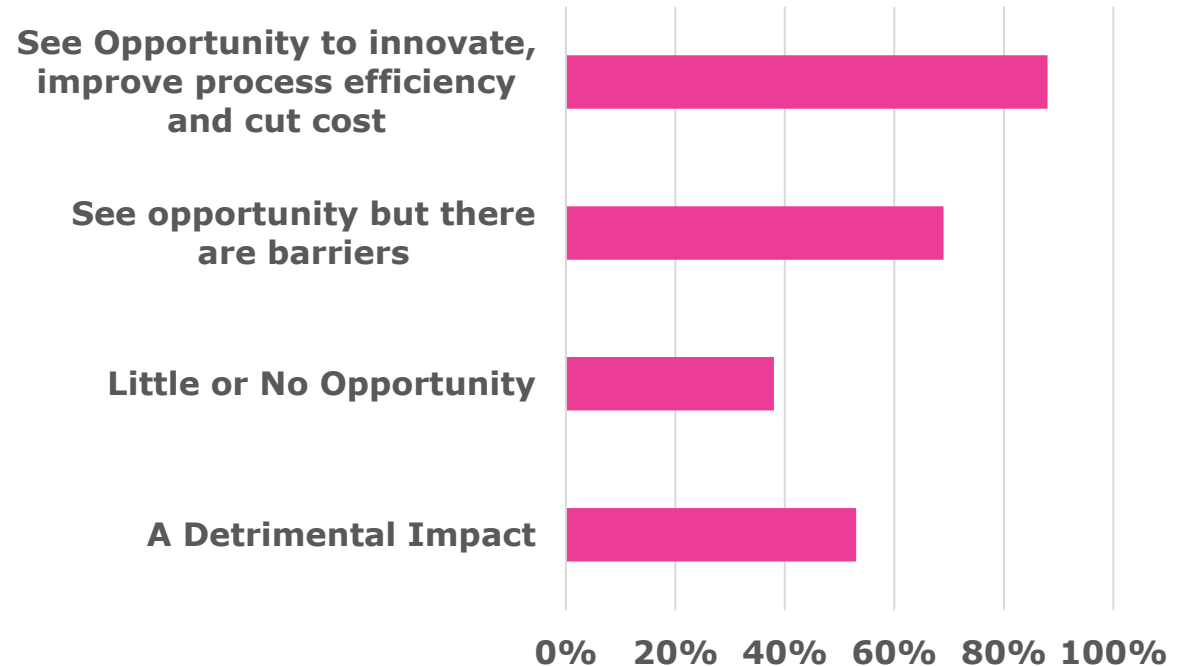


on the basis of a decision
by the German Bundestag

Opportunities

During the survey:

- 9% of the interviewed manufacturers indicated that they are yet to consider Net Zero.
- 88% of the interviewed manufacturers indicated that they see Net Zero as an Opportunity
- 88% of the interviewed manufacturers indicated that they are committed to net zero Road Map
- 91% of the interviewed manufacturers indicated that they are committed to setting or submitting science-based targets



In a survey of members of the Chemical Industry in Ghana in August of 2023, **81.8% of the interviewees announced that they would like to have a Climate Protector Logo on their products**

Net Zero: Way forward

All factories are advised to **complete Energy Audit, measure GHG Emission Baseline** covering **Scopes 1 and 2**; and carry out **Efficiency Analyses covering Resource/Material Use, etc.** in order to have a clear **Blue Print (Net Zero Roadmaps/Strategies)** going forward

All businesses are advised to have their **blue Print (Net Zero Roadmaps/Strategies)** in place by early 2025 and ready^[L1]_[SEP] to take the first meaningful steps thereafter (conditional to government laying out the necessary policies, and providing the right level of support)

All businesses should carry out the measurement of their carbon emission baseline by the end of 2024. By then, they should have installed half-hour (or less) electricity metering (or equivalent energy monitoring systems) on the lines of production and/or most energy-consuming points

All manufacturers to start screening and identifying their Scope 3 emissions in 2025

All manufacturers to engage with their value chain to gauge the willingness and potential of their suppliers and customers to reduce their own Scope 1 and 2 emissions

Net Zero: Way forward

The **Government, AGI** and other stakeholders should work out a Monitoring and Reporting System that is easy and straightforward for manufacturers

All **Manufacturers** over the threshold due to Scope 3 Emissions:

- must have measured their Scope 3 Inventory by 2025
- could require that their own direct suppliers should report their Scope 1 and 2 carbon footprints by the end of 2026

Suppliers to manufacturing companies would be required by the end of 2026 to have a baseline of their own full carbon footprints, make this data available, and produce products compatible with a net zero future. This approach is to prepare "Made in Ghana" products for the export markets as well.

All **manufacturers** could set up a Net Zero Advisory Committee (NZAC). The committee should have an objective, functions or Terms of Reference clearly spelt out. The NZAC should have a clearly stated Management Responsibility (Who the ultimate responsibility rests with), Allocation of Management Responsibilities, a Committee Coordinator, Employees Training Plan, Employee and Management Information/Manuals, External Information and Public Participation Procedure, Monitoring & Verification Plan and Data Collection, Documentation and Archiving Procedure

Net Zero: Way forward

Net Zero Advisory Committee Structure



There are currently no known low-carbon funding schemes available to manufacturers, including SMEs. The idea is to provide long-term investment security to help action decarbonisation risks and challenges.

It is important to indicate that in some countries in Europe, the inflows from the Carbon Tax are put in a bowl that feeds and supports the manufacturing sector with investment funds and grants, as it is the main driver of development and the backbone of the socio-economic life of a country.

It is worthy to point out that taxing manufacturers directly due to emission could be counterproductive, as Ghana, as a manufacturing centre, is competing with other centres and blocks in the world and should be wary of over-burdening the country's manufacturing sector.

Access to Funds

During surveys carried out on the chemical industry in Ghana, manufacturers identified funding as key for overcoming decarbonisation challenges and highlighted the need for specific support around capital spend incentives, and grant funding

Conclusions

Conclusions

The Chemical Industry in Ghana appears to be committed to playing its role in the country's march towards net zero

On the pathway to net zero, the chemical industry has indicated its commitment to achieve an average of 34.4% reduction in emissions by 2030, and 34.2% by 2040 and 31.4% by 2050.

The industry members are also committed to **engaging with Government and other stakeholders to create the right business and regulatory environment for the manufacturing industry to become net zero, supporting suppliers and customers to go net zero and developing net zero products**

They also commit to supporting the establishment of low-carbon clusters by 2040 with several mini, dispersed low-carbon clusters and zero carbon clusters by 2050

The transition to Net Zero is an opportunity for manufacturers to make changes to be efficient, to improve product quality, to improve the capacity of manpower, to cut costs and increase profitability and it is an opportunity for the to embark on the long-awaited industrialization drive

Conclusions

The key challenges for manufacturers in reaching net zero are:

- Decarbonising **fossil fuel intensive processes**
- Decarbonising **raw materials supply**
- Decarbonising **transport and logistics**
- Decarbonising **Packaging**
- Ensuring **Efficient Resource/Material Use**
- Doing Away with **Fugitive Emissions**
- **Staying cost competitive**

The good news is that **there are solutions for all of the above challenges**. They cost money and **that means that support is required from the Government of Ghana in order for the Chemical Industry to reach its Net Zero targets**.

To create the right business and regulatory environment for the chemical industry to become net zero, the Government of Ghana needs to;

- support the manufacturing industry to transition to net zero without major negative impacts on their competitiveness;
- provide the right access to finance that will support the development of low-carbon technologies and green skills

Next Steps

Private Sector

Establishing a **core group of companies i.e. 15 companies**, from the sector, and building a network, which is guided over a two-year running term and would benefit among others from the following:

1. Energy Analysis (Comprehensive Energy Audit)

- Energy and CO₂-Saving Potential
- Economic Benefit Analysis of the Measures
- Individual Energy Saving Target

2. Resource Use & Material Flow Audit

3. Carbon Emission Accounting

4. Monitoring of implemented measures:

- Monitoring tool for each participant
- Monitoring and report per participant (confidential)
- Monitoring and report for the group

5. Meetings per year (in-person or virtual) of the participants to exchange experiences and knowledge, access to cutting-edge technologies and experts. In between the meetings, there will be:

- Individual energy audits and analysis per participant
- Individual support to implement the measures /recommendations.

6. Publish articles on the drive and transition to net zero, **emphasizing on Decarbonisation Solutions** and **Industry Success Stories**

Next Steps

Private Sector

- **Monitoring the progress the "CAPCI" factories are making** in general for the next 2 Years
- Building the capacity of **factories, refrigerant users, consumers of PNG, etc.**

Academia

- Collaborate with stakeholders and showcase studies and research works carried out during Net Zero Fora
 - 1. Fora by Person or Webinar**
 - Organised twice a Year for Two Years

Government

- Building the capacity of **policy makers i.e. Parliamentarians, Cabinet, Ministers, Government Agencies, Regional Coordination Council and District Assemblies**
 - a. Focus attention of the **validated Road Map on its Implementation**
 - b. Training**
 - c. Insights on GHG Emissions**
 - d. Information on **Decarbonisation Technologies and Solutions**
 - e. The Potential **Impact on Trade with the rest of the World**
 - f. Seeing Net Zero as an opportunity for Ghana to industrialise, while lowering Scope 3 Emissions for the private sector in the country
 - g. Examples from other countries in Africa
 - h. The Potential Impact of Carbon Taxes
 - i. The Need for Investment in Incentives for Businesses and Citizens to make changes towards Net Zero
 - j. Etc.

Thank You

If you are interested to continue the discussion on Decarbonising the Chemical Sector, and / or want to cooperate with us, let us know!

Please send ideas, questions, suggestions to:

juneboateng@gmail.com