



## **Plastic REvolution Foundation**

# Local offtake prospects: Mapping of the diesel value chain and pricing structure in Ghana

Report authored for and supported by the Norwegian Retailers' Environment Fund



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## Background

The Plastic REvolution Foundation is a Norwegian non-profit foundation established in 2019 to reduce plastic pollution around the world through commercially viable solutions. The Foundation aims to build projects with self-sustained project economics and represent long-term sustainability and replicability prospects beyond one-off charitable grants.

PRF's first project is set in Ghana and aims to establish a chemical recycling facility capable of diverting large quantities of plastic waste from inadequate handling and entering the environment. The Foundation has identified a great opportunity to reduce plastic pollution and develop viable collection models, which can represent the first of its kind and form a model for future replication elsewhere. PRF wishes to contribute to achieving the vision of seeing Accra free of plastic waste, and the Foundation has consulted the national and local authorities towards the realization of this first project, which enjoys broad support. There is momentum to do something about the immense problem that is plastic pollution in Accra, and PRF believes that a Plastic-to-Liquid plant can be an important part of the solution. The ultimate objective is to develop a model for self-financing collection through the transformation of used plastics into a product of value. If this concept is proven, not only can the plant in Accra be realized, but the concept would demonstrate a solution that can subsequently be brought to other parts of the world. Further background to the project and the work of PRF is provided in the End-of-Phase report that was written in Q2 of 2020.<sup>1</sup>

Concrete challenges however persist when it comes to reaching economic viability - particularly due to the cost of acquiring feedstock, including collection, transportation and pre-treatment. This must be solved either by lowering costs or by increasing revenues. In the fall of 2020, the Foundation focused specifically on various aspects of this challenge, aiming to confirm economic viability through a combination of factors. Two other reports have been written with the support of the Norwegian Retailer's Environment Fund (HMF) – one concerning plastics quality and pre-treatment options<sup>2</sup>, and one concerning Extended Producer Responsibility as a policy tool for alternative financing mechanisms for waste management<sup>3</sup>.

Offtake is a crucial element in ensuring economic viability as the revenue-generating component of this project. There are different ways to approach offtake, and as described in-depth in the End-of-Phase report, this depends on the type and quality of the end product and the geographical location of the market. The main priority at the current stage is to identify an end market for the product produced by the pyrolysis plant and where the price allows for viable project economics (i.e., covering the costs of collection, pre-treatment, and operations). Thus far, the focus of PRF has been exploring the potential for exporting the end-product to Europe. Early indications

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<sup>1</sup> Available at <https://www.revocean.org/the-plastic-revolution-foundation-summarizes-learning-in-comprehensive-end-of-phase-report/>

<sup>2</sup> Available at <https://www.revocean.org/report-mapping-of-available-methods-for-plastic-feedstock-quality-improvement-for-pyrolysis-treatment-in-accra/>

<sup>3</sup> Available at <https://www.revocean.org/report-developing-extended-producer-responsibility-for-packaging-in-ghana-a-brief-introduction-and-status-report/>



showed that it may be possible to obtain a premium price for the product in Europe. Also, local offtake has been briefly investigated, but an in-depth mapping of pockets of opportunities that may improve revenue prospects has not been undertaken. These pockets of opportunity to increase revenues, enabled by, for instance, appealing to local authorities to waive applicable taxes or circumstances that will allow lower logistics costs (e.g., competitors ship from Europe).

This report is the outcome of Workstream 3 - local offtake opportunities, financed by the HMF. Data collection and analysis were done by Gilbert Kofi Adarkwah, Lecturer/Assistant professor in Strategic Management at the BI Business School Department of Strategy and Entrepreneurship, and support by a team of two researchers in Ghana. This report provides a summary of several deliverables on this topic developed throughout the workstream duration.

The key focus has been mapping the value chain and the pricing structure – including taxes and levies – for diesel (GASOIL)<sup>4</sup> products in Ghana.

The report is structured into three chapters; Chapter one focuses on the value chain of traditional and non-traditional (including biodiesel) products in Ghana. Chapter two provides an overview of petroleum products supply and consumption in Ghana. Chapter three focuses on the pricing structure of diesel products with their different components.

The Ministry of Energy, National Petroleum Authority (NPA), and The Chamber of Bulk Oil Distributors (CBOD) Ghana were the primary sources of official data for this report. Official reports were triangulated by information conversations gathered by local team researchers in Ghana through their contacts in the downstream petroleum industry in Ghana.

Local industry experts, including the management team of one of the major international oil companies operating in Ghana, were used to quality check the output of Workstream 3.

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<sup>4</sup> In Ghana, diesel is called gasoil - a broad term that can refer to a range of intermediates and finished petroleum products – in this report, the words diesel and gasoil are used interchangeably.



## Executive Summary

There is a potent and growing market for diesel products in Ghana. About 70% of diesel is used in the transport sector. The Ghanaian petroleum products market is heavily regulated with strict adherence to quality requirements.

Different government agencies regulate every aspect of the value chain – from purchasing crude oil, shipping, refining, storage, distribution, and marketing to end-users. The main regulatory agencies are the Ministry of Petroleum (MoP), The Energy Commission, and The National Petroleum Authority (NPA). Ghana produces and exports crude oil; it has three very small local refineries: Tema Oil Refinery (TOR), Akwaaba Refinery, and Platon Gas Oil Ghana Ltd. The majority of petroleum products consumed in the country are, however, imported. Local refineries produce about 9% of Ghana's total petroleum products supply (as of 2018). Diesel is the most consumed petroleum product in Ghana. About 1.83 million metric tons were consumed in 2018. There are three categories of Diesel products in Ghana - Gasoil regular, Gasoil mines, and Gasoil rigs. Regular cars account for about 70% of total Diesel sales, while the remaining go to mines.<sup>5</sup>

Most Diesels in Ghana are sourced from crude oil; however, a small percentage is sourced from Bio-sources - derived mainly from the *Jatropha curcas* plant. Biodiesel competes directly with petroleum-based diesel. According to Biofuel producers in Ghana, Biofuel production costs are par with crude oil-based Diesel products in Ghana. Diesel produced from plastics is likely to follow a similar value chain as biofuel from the *jatropha curcas* plant.

The ex-pump price (the final price that consumers pay) of petroleum products in Ghana is governed by the Energy Sector Levies Act, 2015 (ESLA Act 899) enacted in 2015, and as amended in 2017 Act 946.<sup>6</sup> Since 2017, the ex-Pump price has been deregulated - each marketing company is free to price at any level at the pump. The ex-Pump price has three components: (1) the FOB (Price/cost of World crude oil), Insurance, and Freight, and other related charges such as off-loading cost, in-transit losses, inspections, Financing cost, in plant losses, rack loading cost, and so on, (2) Oil Marketing and dealers' margins, and (3) Government Taxes and regulatory margins.

There are five categories of taxes and levies charged on petroleum products in Ghana: Price Stabilization & Recovery levy, Energy Debt Recovery Levy, Energy Fund Levy, Road fund Levy, and Special Petroleum Tax. Taxes and regulatory margins account for between 32 and 43% of ex— pump price final price that consumer pays) for Diesel in Ghana. Taxes and levies are regulated by the ESLA Act 899. The agencies responsible for collecting petroleum taxes are the Ghana Revenue Authority (GRA), the National Petroleum Authority (NPA). With today's diesel prices in Ghana, the project economy appears positive if government levies and taxes are removed for waste plastic generated diesel.

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<sup>5</sup> To supply the mines, the company must be 100% Ghanaian-owned.

<sup>6</sup> The purpose of the ELSA Act is to effectively manage the liabilities of Energy Sector of State-Owned Enterprises (SOEs)



## List of abbreviations

CBOD	The Chamber of Bulk Oil Distributors
ESLA	The Energy Sector Levies Act
GNGC	Ghana National Gas Company
GRA	Ghana Revenue Authority
MoE	Ministry of Energy
MoF	Ministry of Finance
MoP	Ministry of Petroleum
NPA	National Petroleum Authority
TOR	Tema Oil Refinery



## 1. The diesel value Chain in Ghana

There is a potent and growing market for diesel products in Ghana, with an annual consumption of about 1.83 million metric tons<sup>7</sup>. There are three categories of diesel products in Ghana:

1. Gasoil regular
2. Gasoil mines
3. Gasoil rigs

Gasoil regular, also known as gasoil, or regular fuel, is a volatile mixture of liquid hydrocarbons, generally containing small amounts of additives, suitable for use in spark-ignition internal combustion of engines. It can be used in the construction industry for small scale projects. In Ghana, it is sold as a blend of 20% ethanol and pure regular fuel.<sup>8</sup>

Gasoil mines and Gasoil rigs are primarily sold to mining and exploration and production companies. Gasoil regular accounts for about 60-70% of total diesel sales, while the remaining go to mines. To supply the mines, a company must be 100% Ghanaian-owned.

As of 2020, there were two primary sources of diesel products in Ghana - petroleum-based diesel and biodiesel. Most types of diesel in Ghana are sourced from crude oil; however, a small percentage is from bio-sources, derived mainly from the *Jatropha curcas* plant. Biodiesel competes directly with petroleum-based diesel.<sup>9</sup> According to biofuel producers in Ghana, biofuel production costs are at par with crude oil-based diesel products. Figure 1 presents a simplified diesel value chain in Ghana for both petroleum-based diesel and biodiesel. The preliminary analysis shows that diesel produced from plastics is likely to follow a similar value chain as biofuel from the *Jatropha curcas* plant.

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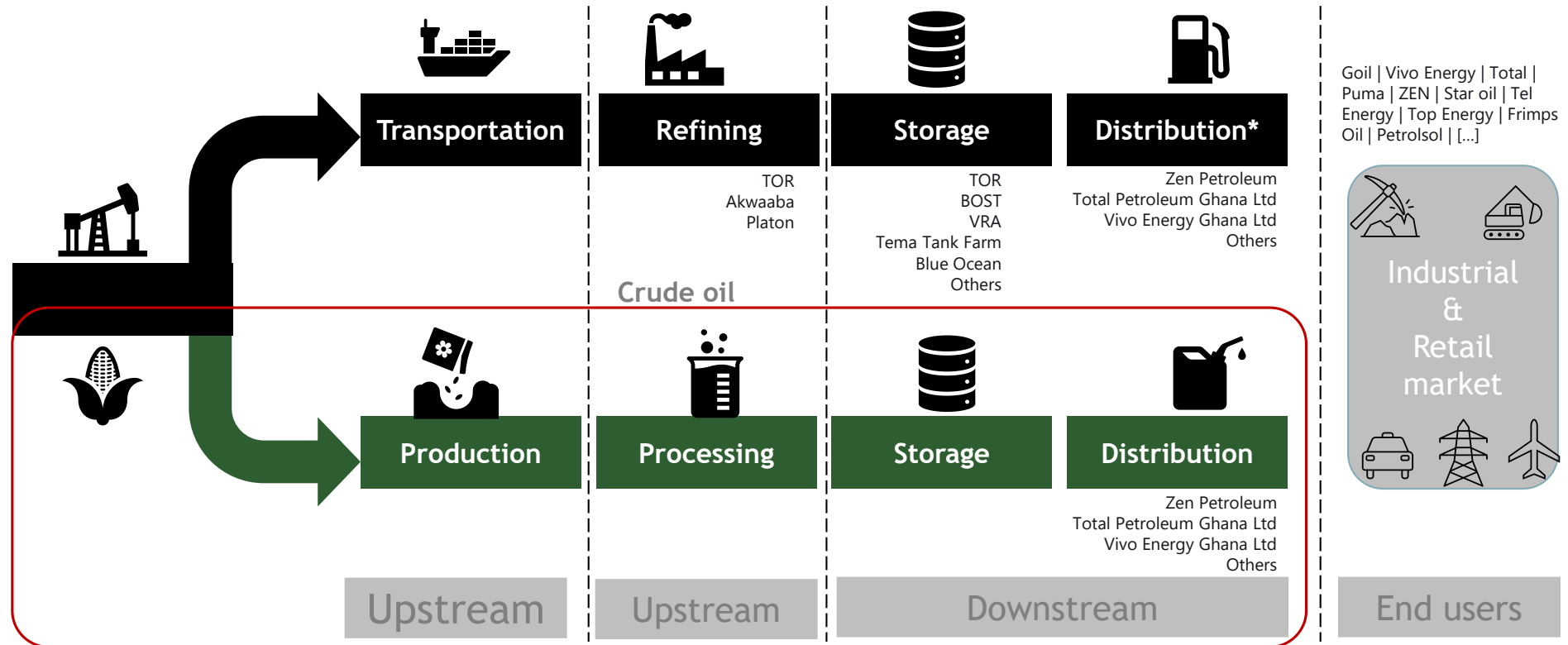
<sup>7</sup> 2018 consumption figure

<sup>8</sup> Total Ghana. 2020. *Our Fuels*. [online] Available at: <https://www.total-ghana.com/our-business/our-fuels> [Accessed 11 December 2020].

<sup>9</sup>According to Eric Fanchini, MD of Total Ghana, 24.09.2020



Figure 1 A simplified Diesel value Chain in Ghana



Source: Gilbert & Partners (2020)

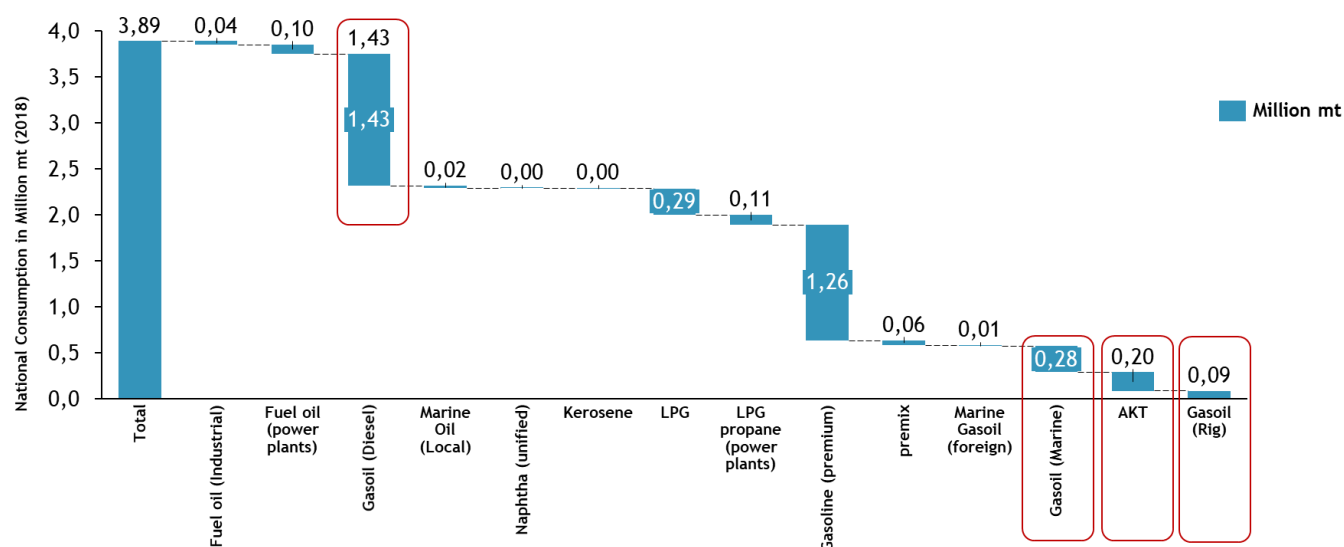




## 2. Petroleum products consumption in Ghana

Ghanaians consumes about 4.68 million metric tons of petroleum products (including petrol and diesel) per day. About 83% of these goes to the non-power sector – not for power generation - 3.89 million metric tons). While the power sector – for power generation – consumes the remaining 17%<sup>10</sup>. Of the 83% consumed by the non-power sector, Diesel (Gasoil) is the highest consumed. Figure 2 below represents the petroleum products consumption in Ghana for 2018/2019.

Figure 2 Petroleum products consumption in Ghana



Source: CBOD Industry report (2020)

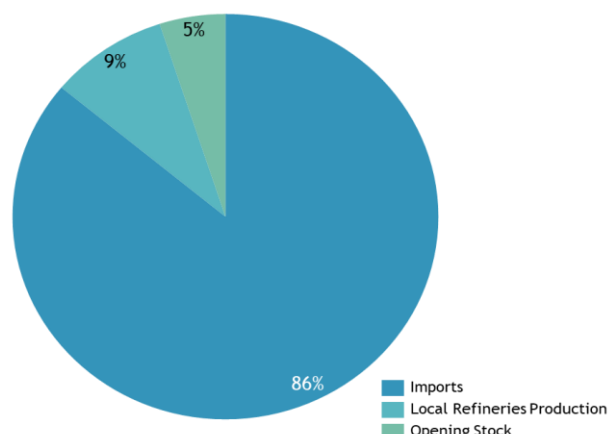
### 2.1 Total petroleum products supply

Most petroleum products consumed in Ghana are imported – not locally produced. Over the years, the Government in several fora expressed their desire to reduce petroleum products' importation. In 2018/2019, imports accounted for 86% of all petroleum products consumed in Ghana. Local refining was accounted for only 9%. Figure 3 presents the distribution of total petroleum products supply in Ghana for 2018/2019.

<sup>10</sup> Fuel sold to the power generation sector are called various names such as fuel oil, crude oil, and propane for power



Figure 3 Total Petroleum products supply (2018/2019)



Source: CBOD Industry report (2020)

The fact that the great majority of petroleum products are imported means that they bear additional freight and import costs, which will be reflected in the end price. The Ghana Chamber of Bulk Oil Distributors (CBOD) references a benchmark premium on imports in September 2020, amounting to \$112 per metric ton of AGO/Gasoil and PMS/gasoline.<sup>11</sup>

## 2.2 Local refineries

Ghana has three main refineries.<sup>12</sup> These could serve as domestic off-takers for potential final products from Plastic REvolution Foundation if a non-refined end product is produced. The refineries are Tema Oil Refinery (TOR with a nameplate capacity of 50,000 bbl/y), Akwaaba Refinery, and Platon Gas Oil Ghana Ltd – producing six main petroleum products for the local market.

1. LPG where the majority producer is the gas treatment plant at Atuabo, owned and operated by GNPC
2. Gasoline
3. Gasoil (Diesel)
4. Aviation Turbine Kerosene (ATK)
5. Residual Fuel Oil (RFO)
6. Naphtha

Local refineries account for about 9% of the total petroleum products supply. Table 1 presents an overview of the key products produced by each refinery in Ghana.

<sup>11</sup> CBOD Petroleum Price Outlook [online] Available at: <https://cbodghana.com/download/cbod-petroleum-price-outlook-1st-15th-december-2020/> [Accessed 17 December 2020].

<sup>12</sup> Ghana National Gas Company (GNGC) was removed as they only refine gas.



Table 1 Local refineries and the key products

Products	TOR	Platon	Akwaaba	GNGC
LPG	✓	✗	✗	✓
Gasoline	✓	✗	✗	✗
Gasoil (Diesel)	✓	✓	✓	✗
Aviation Turbine Kerosene (ATK)	✓	✗	✗	✗
Residual Fuel Oil (RFO)	✓	✓	✓	✗
Naphtha	✗	✓	✗	✗
Condensates	✗	✗	✗	✓

Source: Gilbert & Partners (2020)

In other words, all three might be able to process an unrefined pyrolysis oil product into diesel. However, there remains uncertainty about their capacity and ability to refine the product further. Talking with them on this matter is the next step to establish the viability of this scenario. Local upgrade of the pyrolysis oil to diesel to be sold in the domestic market as addressed here is one potential offtake solution that may form a sustainable framework for the PRF project.

Another offtake solution that will have to be addressed is to produce pyrolysis oil to be lifted by a petrochemical cracker operator that will use this oil as feedstock to produce olefins (ethylene and propylene), i.e., the building blocks for new plastics. A premium price for such recycled feedstock would, in this case, be necessary to make the project financially and economically sustainable.



### 3. Taxes and levies for diesel in Ghana and the agencies responsible

Taxes and regulatory margins account for between 32 and 43% of the ex-pump price (the final price that consumer pays) for diesel in Ghana. Taxes and levies are regulated by the Energy Sector Levy Act (ESLA) 899.<sup>13</sup> As illustrated in Figure 4, the ex-pump price has three components: (1) the FOB (Price/cost of World crude oil), insurance, and freight, and other related charges such as off-loading cost, in-transit losses, inspections, financing cost, in plant losses, rack loading cost, and so on, (2) Oil Marketing and dealers' margins, and (3) Government taxes and regulatory margins. There are five categories of taxes and levies charged on petroleum products:

1. Energy Debt Recovery Levy
2. Energy Fund Levy
3. Road fund Levy, and
4. Price Stabilization & Recovery levy
5. Special Petroleum Tax, and
6. Bost Margin<sup>14</sup>

The Special Petroleum Tax is the equivalent of VAT for petrol products in Ghana. They are charged on all petroleum products. There are no additional VATs on petrol products in Ghana. Table 2 summarizes the applicable taxes and levies on the sale of diesel in Ghana in 2019.

*Table 2 Governmental taxes and regulatory margins account for between 32 and 43% of ex-pump price*

#	Levy	Collecting Agency	Beneficiary a/c / Institution	Diesel (ppl in GH¢)
1	Energy Debt Recovery Levy	Ghana Revenue Authority (GRA)	Ghana debt service Account, Power, and infrastructure support sub-account	0.41
	- o/w foreign exchange under-recoveries	GRA	Energy Debt Service Account	0.05
	-o/w TOR debt recovery levy	GRA	Energy Debt Service Account	0.08
	- o/w Power gen. and infra. Support	GRA	Power Generation and Infrastructure Support Sub-Account (PGISsA)	0.28

<sup>13</sup> The purpose of the ESLA Act is to effectively manage the liabilities of Energy Sector State-Owned Enterprises (SOEs), promote investments in the sector, support road maintenance and the activities of the Energy Commission, without constraining the National Budget. As such, the ESLA Act imposed various levies on the price per litre (ppl) level for petroleum products as well as on the price per kilogram (ppkg) and price per kilowatt hour (ppkwh) for LPG and electricity, respectively.

<sup>14</sup> Bost Margin will likely not be applicable to Plastic REVolution Foundation

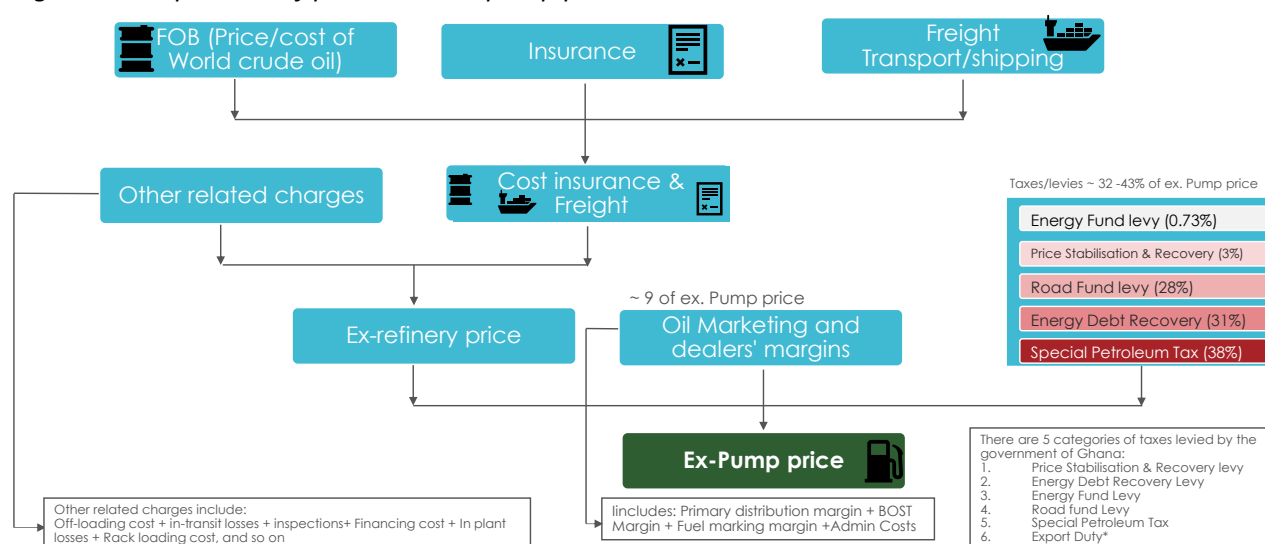


2	Road Fund Levy	GRA	Road Fund	0.4
3	Energy Fund Levy	GRA	Energy Commission	0.01
4	Price Stabilisation & Recovery Levy	NPA	Price stabilization and recovery Account	0.1
5	Special Petroleum Tax	GRA – through Oil marketing companies	Ghana's central government revenue accounts	15%* [ca. 0.46 for 2020]
6	BOST Margin	Bulk Oil Storage & Transportation Company Limited (BOST)	Bulk Oil Storage & Transportation Company Limited (BOST)	0.03

Source: Energy Sector Levies Act (ESLA) Act 899

The agencies with responsibility for the collection of petroleum taxes are the Ghana Revenue Authority (GRA), in the case of the Price Stabilization & Recovery Levy, the National Petroleum Authority (NPA), and the Bulk Oil Storage & Transportation Company Limited (BOST). The Ministry of Finance (MoF) is taxed with the responsibility of managing the ELSA. Every year, the MoF report to parliament per Section 6 ELSA Act 2017 (act 946) on various levies imposed under the Act, the energy levies pricing matrix, and the performance of the levies, including the total volume of products lifted and exemptions granted. In 2018, exemptions were granted for 189.19 million liters of diesel valued at GH¢174.05 million. Figure 4 present an overview of various components of the petrol products tax in Ghana.

Figure 4 Components of petroleum ex-pump price in Ghana



Source: Gilbert & Partners (2020)



## 4. Conclusion and significance for PRF

This report has been written to summarize the main findings during the work on a dedicated workstream on local offtake by the Plastic REVolution Foundation, financed by the Norwegian Retailers' Environment Fund (HMF). The report has summed up the diesel value chain (including biodiesel) in Ghana. It has also provided an overview of petroleum products supply and consumption in Ghana and the pricing structure, taxes, and the various government agencies that manage these taxes in Ghana.

Several findings from this workstream are of great significance to PRF's work in establishing the economic viability of a pyrolysis plant in Accra. As highlighted in the End-of-Phase report, there are clear challenges to prospects of economic viability of the plant, primarily due to the cost of collection and pre-treatment, which cannot be covered by revenues in the absence of a premium.

However, a local offtake scenario may appear more promising than initially thought due to a combination of factors. Firstly, if a premium cannot be achieved by exporting to Europe, selling the product locally will mitigate the costs of outbound freight. Furthermore, as most diesel is imported to Ghana, producing locally constitutes a cost advantage, which may be transformed into a revenue boost if the end product can be sold at the same rates as imported diesel. Finally, taxes and levies constitute a significant proportion of the ex-pump price (the final price that consumer pays) for diesel in Ghana. In the End-of-Phase report, it was highlighted that the Government has the opportunity to strengthen the economic case significantly by considering the introduction of tax exemptions for local sale of diesel/pyrolysis oil produced from recycled plastics. This has now been confirmed by the investigations of this workstream to have a potentially significant and immediate effect on improving the project's economic prospects. Exceptions from taxes and levies have been granted in the past, and this would be a concrete and tangible approach for the Government of Ghana to support the large-scale collection and chemical recycling of plastic waste.

Another workstream financed by HMF focuses on Extended Producer Responsibility (EPR) in Ghana – and the status and prospects for introducing this policy tool as a way to shift the financial burden of collection and management of plastic waste to producers. This would be another way to enable the economics of the project, but may be a longer-term solution. The work and assessment of the status of EPR is described in a separate report.<sup>15</sup>

As a summary report, some details have been left out from the work delivered by Gilbert & Partners. Please feel free to contact Selma Skov Høye, Strategy Lead at Plastic REVolution Foundation should further detail regarding the intermediate deliverables be required.

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<sup>15</sup> Available at <https://www.revocean.org/report-developing-extended-producer-responsibility-for-packaging-in-ghana-a-brief-introduction-and-status-report/>