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**Development of a waste stream-specific roadmap for the circular economy of Malawi**

**Sub report Output 4  
Circularity analysis of the prioritized waste stream**

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## Executive summary

In this activity technical, policy and market options and potential for circular handling of the prioritized waste stream, plastic waste, are analysed.

### *Technological pathways*

The circular economy aims to design out and eliminate waste and pollution, circulate resources at their highest possible value and to regenerate nature. Especially low income households often reuse their plastic products till the point it is not usable anymore and thus becomes waste. Therefore, a crucial area for development is recycling. Different techniques ranging from manually to completely mechanical are available for this. An important first step is the separation of the plastics, on polymer type and colour, which can take place at different locations, e.g. household level, landfills or waste transfer stations. It is an option to export these separated plastics (e.g. to South Africa), however, to generate more value for the Malawi itself it is preferred to further treat the plastics in the country. The next steps for this are cleaning and sizing, through shredding/flaking. After this the plastics can be converted in four different ways: (1) open loop recycling (into other product, downcycling), (2) closed loop recycling (plastics are recycled into the same product), (3) feedstock and (4) plastic to energy.

All these pathways come with some pros and con. The exact costs of plastic waste recycling depend on the activities that are executed. Yet it is important to note that for any waste management system, collection and transportation costs are a key component to the total operational costs. Besides financial aspects, environmental and social impacts are important to consider. Currently, only open loop recycling takes place in Malawi. However, the key technological gaps do not come from a lack of existing technology, but from the fact that there is little domestic development of recycling technologies, nor little domestic availability of spare parts. This means that recyclers are dependent on expensive imports of (parts of) equipment.

### *Policy landscape*

Several policies and regulations are in place that directly or indirectly address waste management. Most of them are developed from the background of environmental pollution and health and aim at ensuring that waste is safely disposed of at designated disposal sites in Malawi. Most of these policies are, thus, designed in line with a linear economy. Additionally, the policies mainly address waste in general and do not have a specific focus on plastics. Although, there are some exceptions, such as the ban for plastic single use products of 60 mm, it should be noted that the consideration of circular economy pillars, such as redesign, refuse, repair and recycling are not thoroughly incorporated in the policies. Therefore, there is also no EPR regulation currently in place. Additionally, an identified gap is the lack of enforcement of the policies.

### *Market and value chain analysis*

Plastic household valorisation is just emerging in Malawi and therefore, although there are some players, this group is still relatively limited.

The value chain currently consists roughly of five roles: (1) sources from where households by their plastic or plastic packaged products, (2) households themselves, who use, reuse, and discarded the product, (3) collection mechanisms, done by public or provide organizations and either separated or mixed, (4) the disposal mechanisms; littering, illegal dumping, controlled dumpsites and (5) waste valorisation; (in)formal waste pickers, aggregators, waste transfer stations, buy back centres, recyclers, processors or export industry. Currently, there is hardly any separation at source, which makes it very difficult to get sufficient volumes for waste valorisation, since separation at a later stage is difficult due

to contamination. Thus, better separation, collection and transport logistics are essential to scale the market for plastic processing within Malawi. Various pathways for separating and collecting waste are implemented in Malawi or emerging in Africa.

The main challenges identified based on this assessment are: (1) getting sufficient volumes in an economic manner, (2) low margins on recycled plastic products and (3) uncertainty about changing regulation that might threaten business. This leads to the gap which is a vicious circle where collection infrastructure (e.g. separation, waste pickers, collection) does not scale due to low prices and difficulty in economy of scale, and recycling industry not getting sufficient volumes in an economic manner meaning they cannot pay collection infrastructure more for delivering plastics.

# Contents

	<b>Executive summary .....</b>	<b>2</b>
<b>1</b>	<b>Introduction.....</b>	<b>5</b>
<b>2</b>	<b>Technology pathways (activity 4.1) .....</b>	<b>6</b>
2.1	Introduction .....	6
2.2	Plastics and end-of-life plastic management basics.....	8
2.3	The basics of plastic .....	10
2.4	Recycling pathways .....	12
2.5	Current application of end-of-life plastic management in Malawi .....	15
2.6	Economics of end-of-life plastic management.....	17
2.7	Impacts of end-of-life plastic management.....	17
<b>3</b>	<b>Policy landscape (activity 4.1).....</b>	<b>20</b>
3.1	An analysis of Malawi's plastic waste management policies .....	20
3.2	Synthesis of the policy assessment.....	1
<b>4</b>	<b>Market and value chain analysis (activity 4.2).....</b>	<b>2</b>
4.1	Organization of the current value chain.....	2
4.2	Current market status .....	5
<b>5</b>	<b>Synthesis of the findings .....</b>	<b>11</b>
5.1	Summary of key gaps in the technology landscape .....	11
5.2	Summary of the key gaps in the current policy landscape .....	11
5.3	Summary of the key gaps in current markets and value chains.....	11
5.4	Conclusion on the relevance of the different pathways for Malawi .....	11

# 1 Introduction

This document is the deliverable of Activity 4 of the CTCN Technical Assistance study on circular economy in waste management in Malawi. During this study, a baseline assessment for the current waste system was conducted, looking at plastics, paper, metal, glass, household organic waste and (small scale) agricultural waste. This was followed by a comparative analysis per waste stream on the potential to move towards higher levels of circularity. After a physical stakeholder consultation in Lilongwe, October 2021 the choice was made to focus on plastic waste for the remainder of the project. Following this specification, a more detailed analysis was conducted on the current status of the plastic waste management system in Malawi, looking at technology use, the policy and regulatory landscape and current markets and value chains on plastic (waste) management. The results of this assessment are presented in the following chapters.

## 2 Technology pathways (activity 4.1)

### 2.1 Introduction

The main purpose of this project is the development of a specific roadmap for circularity within household plastic waste management. An important aspect is to generate knowledge on what the potential technological pathways are for the valorisation of plastic waste. This will be elaborated on in section 2.2 and 2.4. Before we discuss the pathways, it is important to briefly discuss the options for circularity of plastics *before* it has become waste, as the project explicitly defines circularity as a focus point – and circularity involves much more than waste management only.

The circular economy is based on a set of key principles<sup>1</sup>:

- To design out and eliminate waste and pollution
- To keep resources, products and materials at their highest value possible by circulating them
- To regenerate nature

The key principles of the circular economy confirm that it is much broader than waste management only, and that it provides a systemic view to economic redesign. Hence, also in this publication, it is important to not only look at how to manage plastic waste, but also to pay attention to how to avoid waste in the first place, as well as how to retain the value of products and materials that have been put on the market, extending the lifespan to its maximum duration before it becomes waste.

To achieve circularity, various activities are defined as key strategies to give shape to the circular economy. These strategies range from often 3 to 10 so-called R-activities<sup>2</sup>. The following figure gives a synthesis of 7 of the most important R-activities, based on the EllenMacArthur Foundation, among others<sup>3</sup>:

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<sup>1</sup> [What is a circular economy? | Ellen MacArthur Foundation](#)

<sup>2</sup> Vermeulen, W. J., Reike, D., & Witjes, S. (2019). Circular Economy 3.0; Solving confusion around new conceptions of circularity by synthesising and re-organising the 3R's concept into a 10R hierarchy. *Renewable Matter*, 27, 12-15.

<sup>3</sup> EMF is one of the leading institutes in the field of the circular economy. [The 7R Model for a Circular Economy | LinkedIn](#) (For a more thorough explanation to the R strategies see Vermeulen, W. J., Reike, D., & Witjes, S. (2019). Circular Economy 3.0; Solving confusion around new conceptions of circularity by synthesising and re-organising the 3R's concept into a 10R hierarchy. *Renewable Matter*, 27, 12-15 or the original framework by Ellen Mac Arthur Foundation [The butterfly diagram \(ellenmacarthurfoundation.org\)](https://ellenmacarthurfoundation.org))

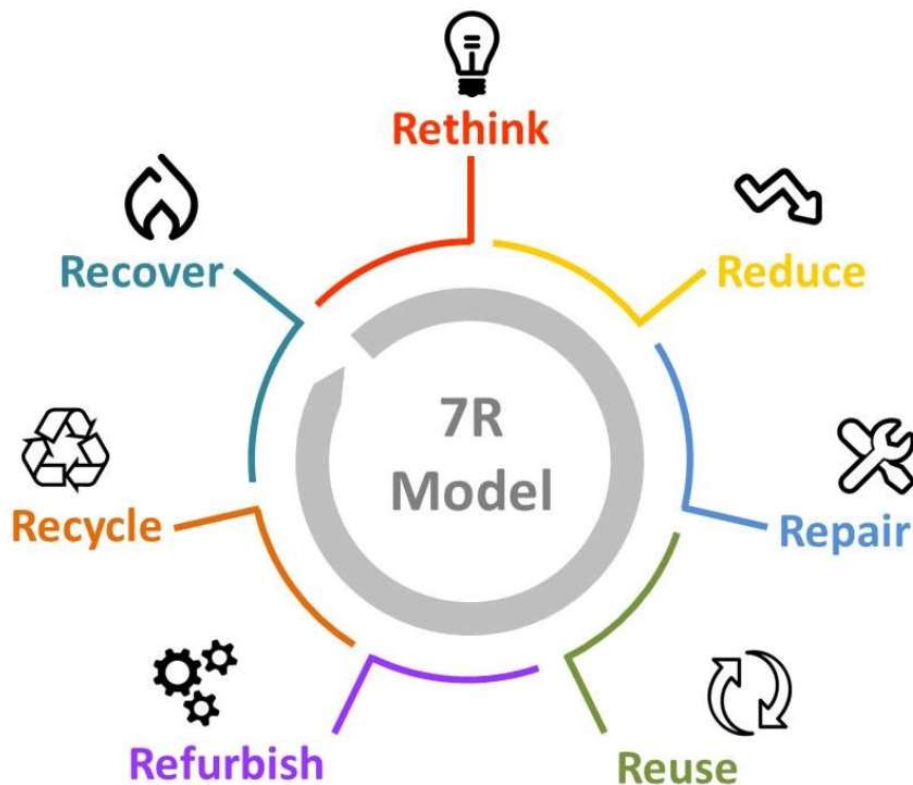


Figure 1. The 7 R's of circularity

When linking this figure to plastics, several strategies from the circularity model come to the fore. It starts with regarding the upstream phases of plastics, rethinking and reducing the total amount of plastics that come into the value chain in the first place - reducing the total amount of waste that is being generated. Examples are the rethinking how products are designed – allowing for improved recycling, or reducing the amount of plastics that come into the market place by limiting the amount of single use plastics. The strategies of repair (fixing a fault) as well as refurbishment (repairing and upgrading a product until (close to) new) are a bit less applicable to household plastics, as these are generally not very well repairable (this applies more to electronics for example, or textiles). Yet one could imagine that in the case of industrial application of plastics (e.g. in aircrafts) timely repair becomes critical to expand the lifespan of products. Reusing plastics is something that can already be seen in Malawi, particularly in the lower income households. Buckets, bottles, and other usable products are reused frequently, both in their same function or with a different function. Reuse of plastic household products however is seen to decrease with rising income levels (see the baseline study to this project).

The least preferable strategy for plastic waste management is recovery, which involves the recovery of the energy content for plastics by converting it into e.g. new hydrocarbons, monomers or fuel, or, scoring lower in terms of circularity, recovery of energy by incineration. This latter is least preferred as this means the plastics is burned with treatment, so there is no circularity achieved (which is aimed at maintaining products or resources in use at the highest value possible).

Thus, instead of recovery the key strategy for plastic once it has become waste is recycling. This strategy will be elaborated on the remainder of Chapter 2.

## 2.2 Plastics and end-of-life plastic management basics

There are multiple pathways towards the valorisation of plastic waste. These variations are summarized in

Figure 2 below. The figure discusses the flows from input, to processing activities and the variations to outputs<sup>4</sup>.

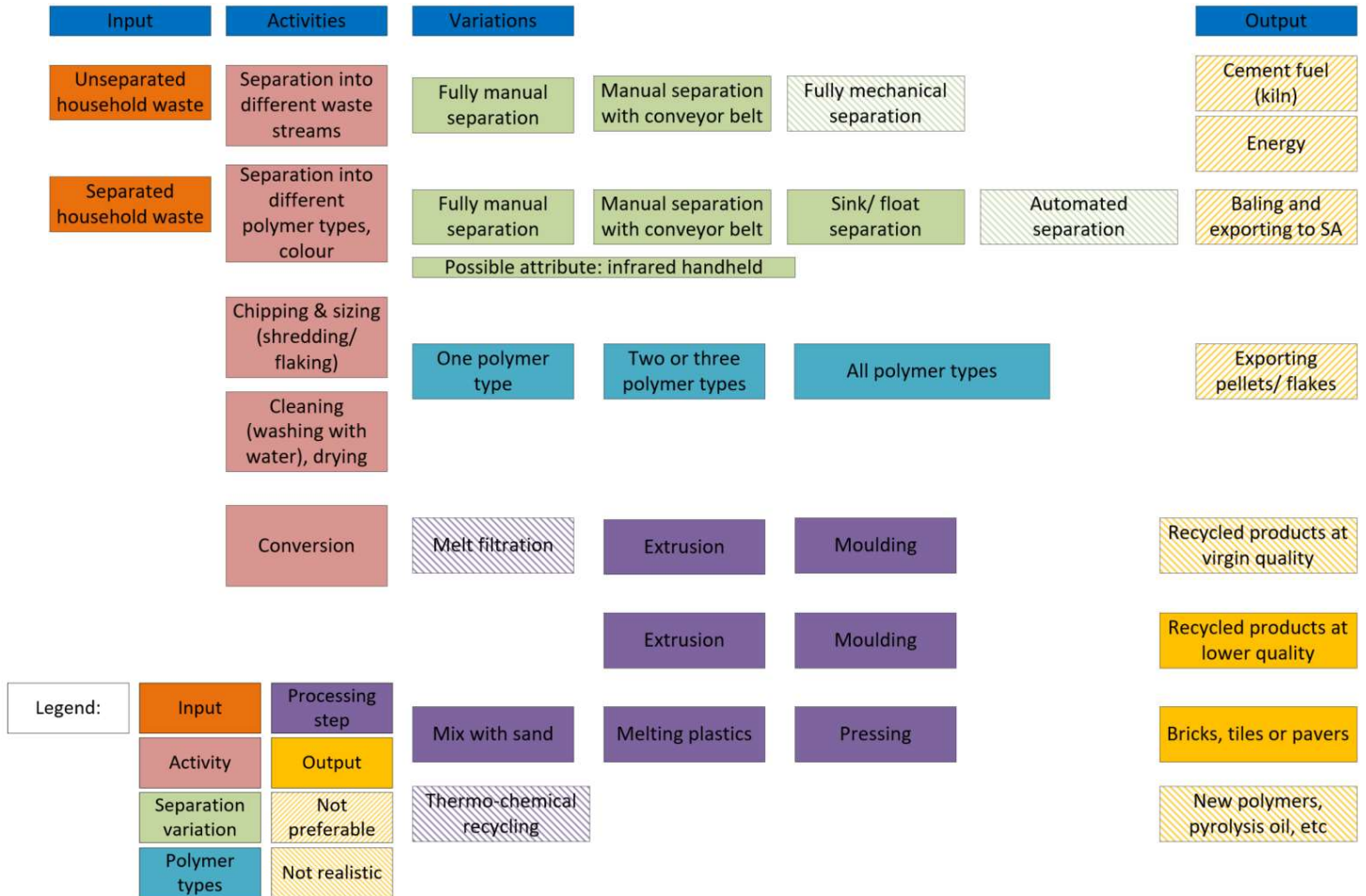


Figure 2 Schematic overview of the pathways and variations to plastic waste valorisation (own scheme)

Waste can be provided in two ways: either the plastics are mixed in the residual waste, or it has already been separated at source by households themselves. If it is unseparated, the first activity is to separate the plastics from the mixed waste.

This can be done in various ways as well: fully manually, as is happening at some waste transfer stations for example, or as currently informal waste pickers are doing at the dumps. Another option is to include one mechanical step, by using a conveyor belt. This allows for easier picking and improved

<sup>4</sup> Summary based on technical expertise of TNO; Grigore, M. E. (2017). Methods of recycling, properties and applications of recycled thermoplastic polymers. *Recycling*, 2(4), 24; Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., ... & Palardy, J. E. (2020). Evaluating scenarios toward zero plastic pollution. *Science*, 369(6510), 1455-1461; Parameswaranpillai, J., Rangappa, S. M., Rajkumar, A. G., & Siengchin, S. (Eds.). (2021). *Recent Developments in Plastic Recycling*. Springer Singapore; Schwarz, A. E., Ligthart, T. N., Bizarro, D. G., De Wild, P., Vreugdenhil, B., & Van Harmelen, T. (2021). Plastic recycling in a circular economy; determining environmental performance through an LCA matrix model approach. *Waste Management*, 121, 331-342 (TNO Study); World Economic Forum, the Ellen MacArthur Foundation, & McKinsey Company (2016) - The new plastics economy, rethinking the future of plastics | [Shared by New Plastics Economy \(thirdlight.com\)](https://www.thirdlight.com)

labour conditions. Of course, fully mechanical separation is technically an option as well, however as these kinds of installations would require major investments, this is not included within the scope of this study as this is not deemed realistic for Malawi in the foreseeable future.

Of course, the plastics could also be provided to a processor already separated at source, or separated by a Waste Transfer Station. In that case, the next step in the treatment process is to separate the plastics into various polymer types, and into different colours. This is because it is generally not possible to recycle plastics in a sufficient quality when different polymers are mixed together. Although some types can be combined, it is safe to assume it is required to include this separation step. This can be done fully manually, or by using a conveyor belt. For manual separation, infrared handhelds can be used to support with the selection of plastics that are difficult to determine, but generally, working with trained staff is faster than supplying everybody with a handheld. Another mechanical separation option that is used frequently in e.g. Europe are sink/float installations, which separates plastics based on the differences in density. PET will sink, while the PE/ PP plastics types float. Full scale and professional sink float systems these are generally quite large installations (4-6 meters at least) which require substantial investment costs, so this is not very realistic in the near future in Malawi. However, it is possible to use more rudimentary sink float separation using salt water basins. Yet, just making use of manual separation is very effective as well, and allows for job creation too.

After this step, it is possible to market the first output, which entails the recovery of energy through the incineration of plastics. This can be done by conventional incineration, after which the energy is converted to electricity, or by using the plastic waste as a feedstock for cement kilns. This reduces the amount of fossil fuels that the cement kilns would need to use, thus positively impacting emission reductions in Malawi (although cement production is limited). However, using the plastics as energy source or kiln fuel would once again mean the product is burned and no life is extended – so in essence this is not circular and should not be pursued as a primary strategy. It could however be an option for those plastics for which no market exists yet.

In addition, after separation into different types of plastics it is also possible to compress and bale the separated polymer types and export this to e.g. South Africa, where a broader range of recycling industries exist. However, this would mean that no value adding activities are done within the country of Malawi itself and (economic and material) value are exported *out* of the country, so this is not a preferred direction for this project.

After separation into different polymer types, the usual next activity entails the sizing of the polymers by shredding/ flaking the plastics and cleaning them. These steps could also be reversed. After cleaning and sizing the plastics are dried and ready for conversion, in other words the actual recycling. Roughly, plastics can be converted in four different ways: through **closed loop recycling** (plastic products are recycled into the same product or applications with requiring materials with similar qualities), **open loop recycling** (plastic are downcycled into a different product, often thick walled products of lower quality), **feedstock or thermo-chemical recycling** (which breaks down the plastics into monomers or other hydrocarbon products). There are multiple routes clustered under the umbrella of chemical recycling, for example depolymerisation, hydrolysis and pyrolysis. The last conversion strategy is **plastic to energy**, often through incineration (described above). The mechanical recycling steps (open and closed loop) usually use an extruder (melting and converting the plastics into pellets or granules) and a mould (blow or injection moulds), to make the desired end product. Another open loop method of plastic recycling is the mixing with sand into bricks or pavers.

This can be done with mixed plastics, or those plastics that are not suitable for mechanical recycling. Closed loop recycling usually asks for high quality cleansing and melt filtration (this depends a bit on the product), thereby increasing the process complexity and costs and reducing the applicability for Malawi. Thermo-chemical recycling asks for industrial-sized, high energy consuming facilities and are

therefore beyond relevance for Malawi in the foreseeable future (these are still in pilot scales in Europe as well).

The above provided insights provide a brief summary of the key pathways for plastic waste valorisation. The different elements as have been discussed here will be elaborated on in the following sections.

### 2.3 The basics of plastic

#### Types of polymers

Plastics are defined by their polymer type. There are seven main types of polymers, as can be seen in Figure 3<sup>5</sup>.



Figure 3. The seven main plastic types (Plastics for Change)

Besides clustering the plastics based on their polymer types it is possible to cluster the types of plastics by their physical characteristics, providing a clustering of three categories: rigid mono-materials, flexible mono-materials and multi-material multi-layers. Rigid mono-materials involve items like buckets, flexibles are thin bags for example, and a common example of multi-layers are crisp bags. The occurrence globally is 33%, 45% and 22% of plastics consumed, respectively<sup>6</sup> (see Figure 4).

<sup>5</sup> [The 7 Different Types of Plastic<br/> | Plastics For Change](#)

<sup>6</sup> Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., ... & Palardy, J. E. (2020). Evaluating scenarios toward zero plastic pollution. *Science*, 369(6510), 1455-1461; World Economic Forum, the Ellen MacArthur Foundation, & McKinsey Company (2016) - The new plastics economy, rethinking the future of plastics | [Shared by New Plastics Economy \(thirdlight.com\)](#)

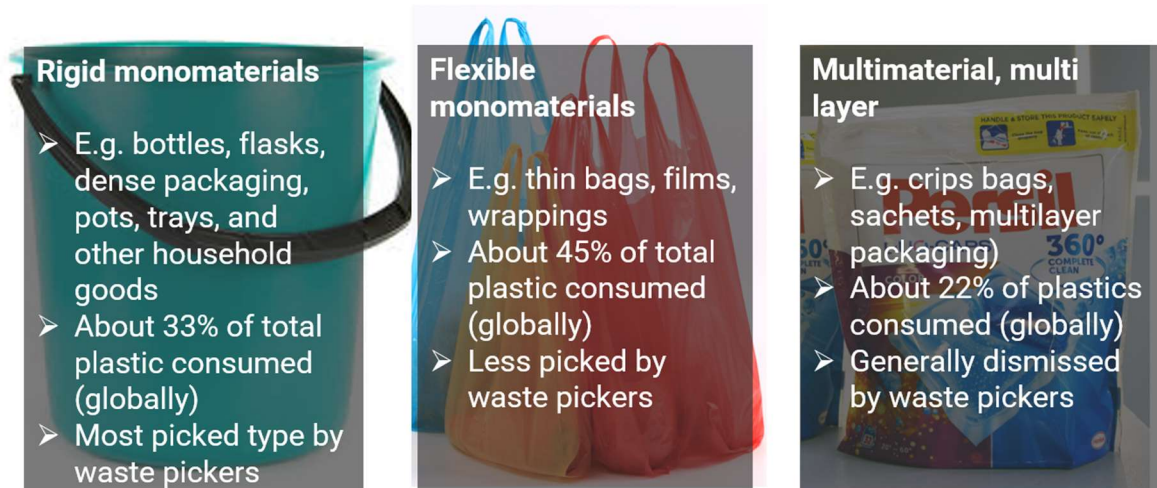


Figure 4. Plastic categories and their occurrence<sup>7</sup>

The attractiveness of the three categories of plastics for waste pickers says something about their recyclability – the easier the recycling, the more recyclers there generally are and the more this category is picked by waste pickers (as it is easier for them to find a taker for the plastics). Rigids (which are very often but not limited to PET, PP, HDPE) are generally easiest to recycle and thus most popular amongst waste pickers, while flexibles (very often but not limited to LDPE) are more difficult to recycle, and multilayers (often combinations of different polymers types, or combinations of polymers with other materials such as paper or aluminium) are currently barely recyclable and thus neglected by waste pickers (this division was also confirmed by waste pickers themselves during the field work). Figure 5<sup>8</sup> shows the recyclability of plastics per polymer type.

<sup>7</sup> Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., ... & Palardy, J. E. (2020). Evaluating scenarios toward zero plastic pollution. *Science*, 369(6510), 1455-1461.

<sup>8</sup> Digital dividends in plastics recycling, GSMA 2021

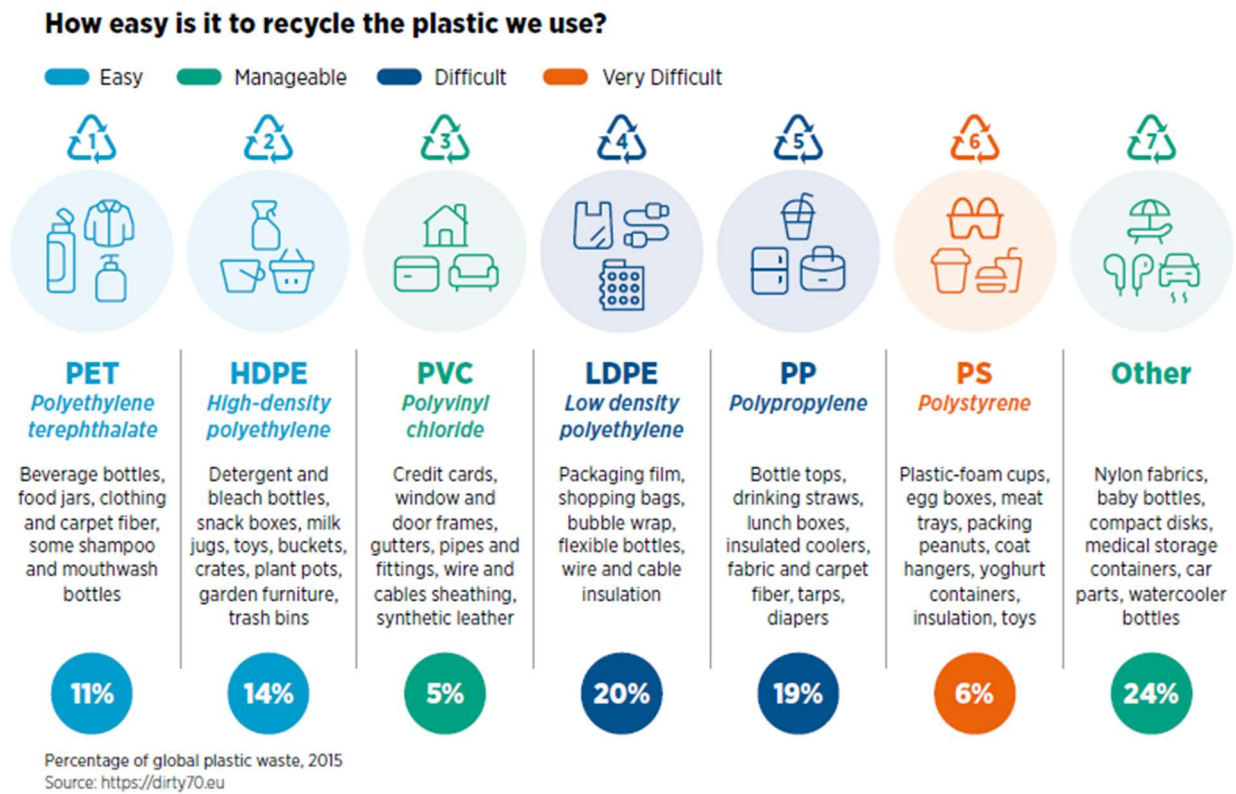


Figure 5. Overview of plastic recycling difficulty, from the 2021 Digital Dividends report (GSMA)

## 2.4 Recycling pathways

As discussed in above, there are four main pathways for the end-of-life treatment of plastics:

- (1) closed loop mechanical recycling (primary recycling)
- (2) open loop mechanical recycling (secondary recycling)
- (3) feedstock or thermo-chemical recycling (tertiary recycling)
- (4) plastics to energy or fuel conversion (quaternary recycling)

Figure 6<sup>9</sup> provides a visual overview of the four pathways and its hierarchy in terms of value retention:

<sup>9</sup> Davidson, M. G., Furlong, R. A., & McManus, M. C. (2021). Developments in the life cycle assessment of chemical recycling of plastic waste—A review. *Journal of Cleaner Production*, 293, 126163.

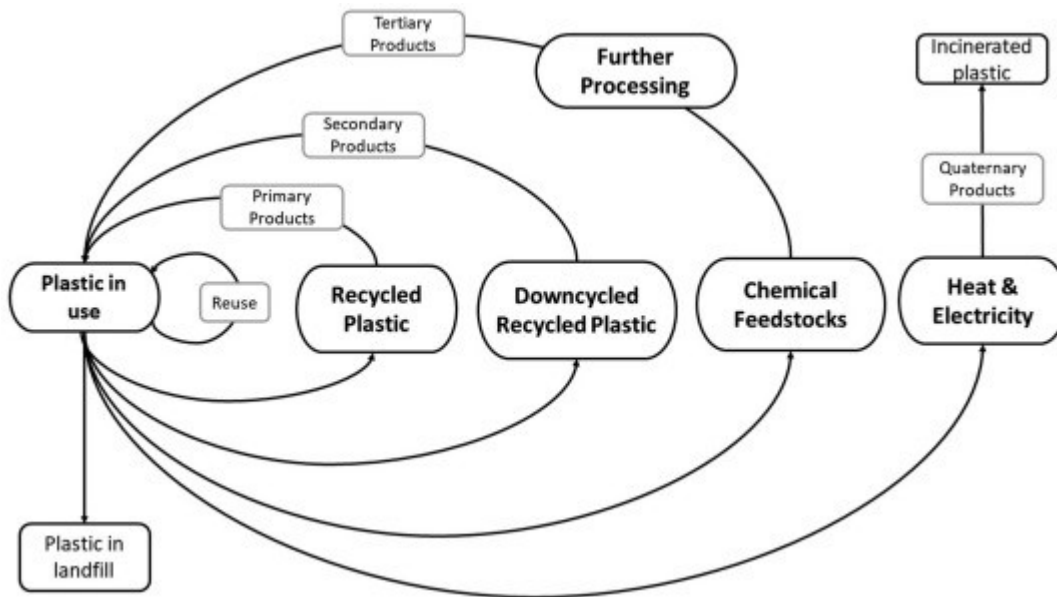


Figure 6. Overview of the four end-of-life plastic pathways (Davidson et. al 2021)

A brief overview of the pros and cons of each pathway is presented in Table 1<sup>10</sup>.

Table 1. Pros and cons per end-of-life pathway

Pathway	Pros	Cons
Closed loop	Highest level of circularity as it keeps polymers intact and the quality at the same level as the original product; Moderate overall costs; Larger range or possible applications; Well-known technologies; Applicable to a large range of the most used plastic types (LDPE, HDPE, PP, PET, etc)	Requires (compared to open loop recycling) more extensive pre-treatment (= more costly and energy intensive); Waste must be pure and from a single source; Recyclate can typically not be used for food grade packaging or performance textiles; Cannot remove dyes or flame retardants or other contaminants
Open loop	Moderate circularity as it keeps polymers intact but reduces the quality; Relatively low overall costs; Useful pathway when higher levels of circularity cannot be achieved; Could mix certain types of plastics (PE and PP), or plastics and sand to e.g. pavers; Well-known technologies; Applicable to a large range of the most used plastic types (LDPE, HDPE, PP, PET, etc)	Reduces the quality of the recyclate (degrades the polymer); Over-degradation can negatively influence the number of recycling cycles; Decreases the range of possible applications and potential markets; Recyclate can typically not be used for food grade packaging or performance textiles; Cannot remove dyes or flame retardants or other contaminants;

<sup>10</sup> Grigore, M. E. (2017). Methods of recycling, properties and applications of recycled thermoplastic polymers. *Recycling*, 2(4), 24; Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., ... & Palardy, J. E. (2020). Evaluating scenarios toward zero plastic pollution. *Science*, 369(6510), 1455-1461; Parameswaranpillai, J., Rangappa, S. M., Rajkumar, A. G., & Siengchin, S. (Eds.). (2021). *Recent Developments in Plastic Recycling*. Springer Singapore;. Schwarz, A. E., Ligthart, T. N., Bizarro, D. G., De Wild, P., Vreugdenhil, B., & Van Harmelen, T. (2021). Plastic recycling in a circular economy; determining environmental performance through an LCA matrix model approach. *Waste Management*, 121, 331-342 (TNO Study); World Economic Forum, the Ellen MacArthur Foundation, & McKinsey Company (2016) - The new plastics economy, rethinking the future of plastics | Shared by New Plastics Economy (thirdlight.com)

Feedstock	Can be used for recycling of those polymers that are very difficult to recycle mechanically (e.g. PS); Although the polymers are not kept intact the valuable components can be recovered; Could provide a solution to multi-layered plastics; Contaminants can be removed	Only operational (yet not widespread) for PET, rest still in pilot phases; Economically not viable yet, processes are energy intensive and expensive, with high investment costs; Requires large and continuous influx of feedstock
Plastic to energy	Suitable for those types of plastics that are not recyclable mechanically or chemically (e.g. containing harmful substances); Can substitute fossil fuel use by generation of considerable amounts of energy from the plastics; No costly separation and pre-treatment steps	Environmentally less acceptable due to emission of gases and CO <sub>2</sub> through incineration; Not circular at all as there is no opportunity for further use of the polymer or monomers; Removes all future potential for reuse or recycling – should not be pursued as primary strategy

**Global application of pathways**

Figure 7<sup>11</sup> provides an overview of the status of global plastic waste management in 2013 (open loop recycling is defined as ‘cascading recycling’). It shows that worldwide, the majority of plastics is still not being recycled, but ends up at dumpsites, as litter or is incinerated. Of the percentage that is collected for recycling, the large majority is recycled open loop. Only a minor part is recycled closed loop (mainly applicable to PET, some HDPE). The level of thermo-chemical recycling is neglectable on a global level. Even though almost a decade has passed, not much has improved in terms of the total amount of recycling achieved: in 2022 the OECD indicated that currently still only about 9% of all plastics are recycled properly<sup>12</sup>. The figure is different per region – in Europe for example current recycling levels are at 32,5% of the total collected plastics, with 42,6% going to incineration and almost 25% being landfilled. The recycling percentage mainly indicates mechanical recycling, as only two countries currently employ operational chemical recycling plants (Germany and Italy), and only at minimum levels (<0,3%)<sup>13</sup>.

<sup>11</sup> World Economic Forum, the Ellen MacArthur Foundation, & McKinsey Company (2016) - The new plastics economy, rethinking the future of plastics | [Shared by New Plastics Economy \(thirdlight.com\)](#)

<sup>12</sup> OECD 2022, Global Plastics Outlook, [OECD iLibrary \(oecd-ilibrary.org\)](#)

<sup>13</sup> Plastics Europe 2020, [Plastics - the Facts 2020 • Plastics Europe](#)

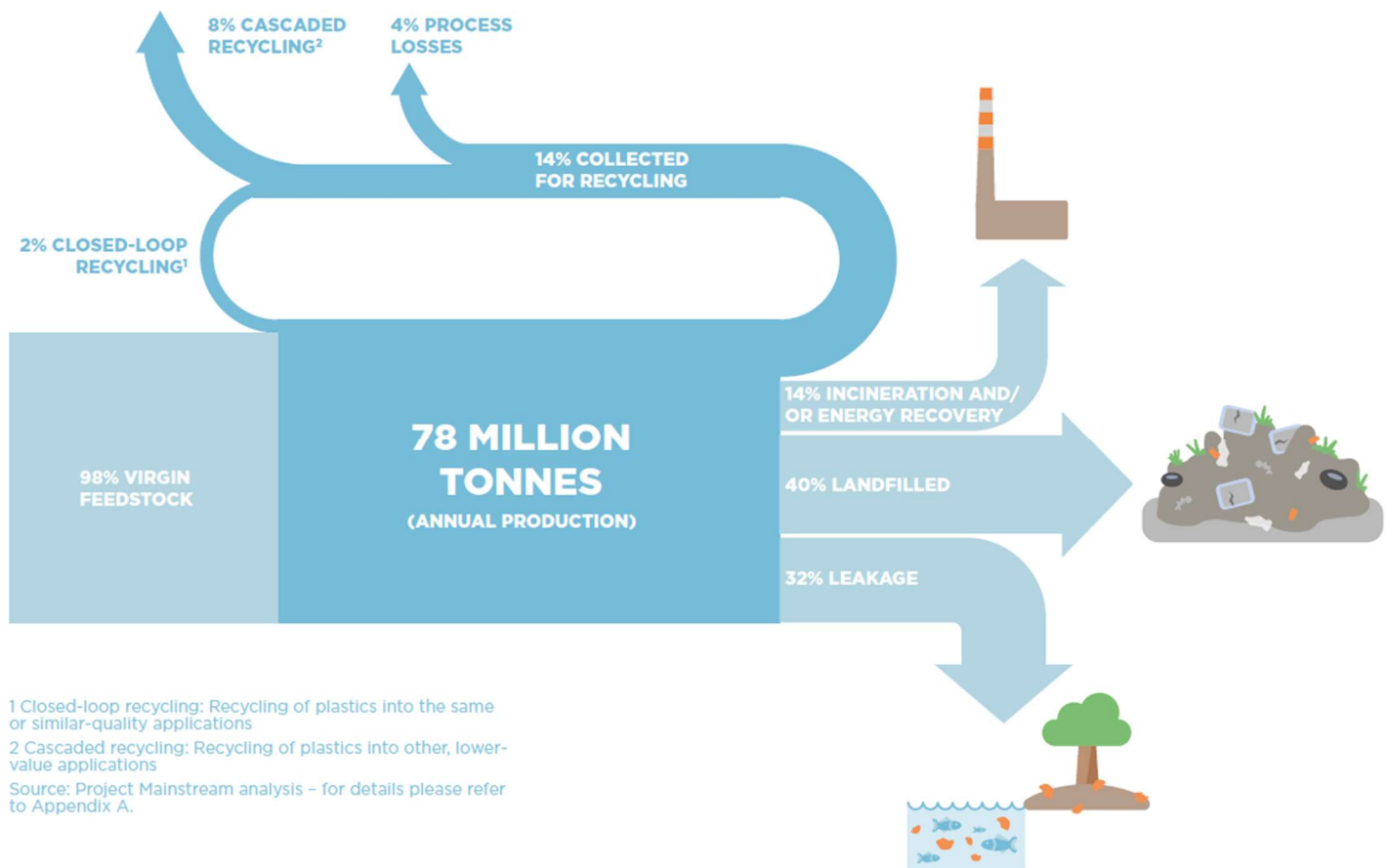


Figure 7. Global flows of plastic packaging materials in 2013 (Ellen MacArthur Foundation, 2016)

## 2.5 Current application of end-of-life plastic management in Malawi

Given the global status of plastic recycling it is not surprising that in terms of recycling, only mechanical recycling is being implemented in Malawi, and no chemical recycling takes place. Based on inquiries with local stakeholders it shows that all recycling activities currently are based on open loop recycling, either into consumer products or by mixing end-of-life plastics with sand into bricks and tiles. The most common plastic category for recycling is rigid plastics, often HDPE's (see Figure 8), LDPE, PP or PET. There is some recycling of flexible plastics as well, only in Lilongwe and Blantyre. This is less widespread than recycling of rigids. Visits to both formal and illegal dumps show that rigid plastics are scavenged by informal waste pickers, and only thin films and especially multi-layers remain – as there is a much smaller recycling market (see Figure 9). There is currently no incineration of plastics, as there are no incinerators for waste at all. As there are also no engineered landfills, the non-recycled plastics are either brought to the formal dumpsites or littered and dumped illegally. In terms of technology development, there are examples of local entrepreneurs making their own moulds for plastic recycling for example, or for brick making. However, in total it can be concluded that there is little production of recycling equipment in Malawi, nor is there little availability of spare parts. This means that for recyclers, when machines break down, this leads to high costs for replacements, as everything has to be imported. Chapter 4 provides a more detailed overview of the current market for plastic recycling in Malawi.



Figure 8. Rigid plastics (mainly HDPE) in 30kg bags at a local plastic manufacturer and recycler in Lilongwe (own picture)

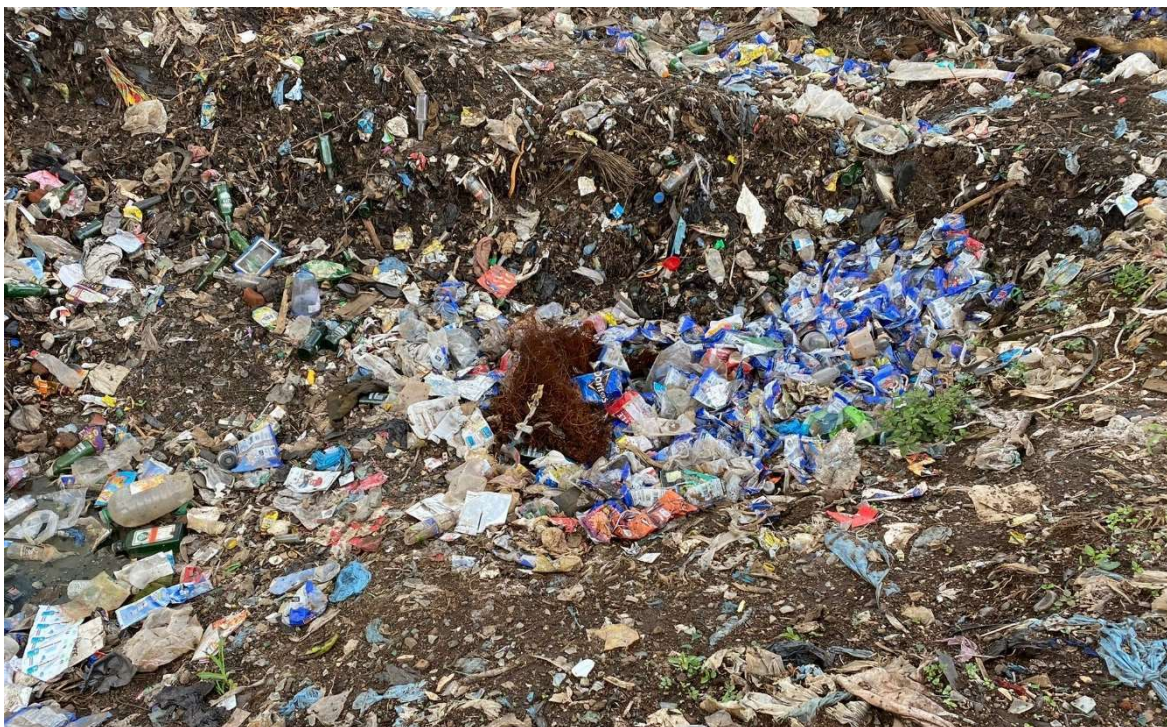


Figure 9. Multi-layered plastics remaining on the formal dumpsite of Lilongwe (own picture)

## 2.6 Economics of end-of-life plastic management

The exact costs of plastic waste recycling depend on the activities that are executed. Yet it is important to note that for any waste management system, collection and transportation costs are a key component to the total operational costs. According to the What a Waste 2.0 World Bank study of 2018, this typically accounts for 60-70% of total costs for municipal waste management<sup>14</sup>.

Figure 10 gives rough estimates of the typical waste management costs per disposal type. The costs for collection and transportation provide an argument to only opt for separation of dry and wet fractions instead of the separation of multiple fractions – the reduces the overall transport movements needed but increases the recycling potential of household waste (due to less cross contamination of organic waste by dry fractions and vice versa).

US\$/tonne				
	Low-income countries	Lower-middle-income countries	Upper-middle-income countries	High-income countries
Collection and transfer	20–50	30–75	50–100	90–200
Controlled landfill to sanitary landfill	10–20	15–40	20–65	40–100
Open dumping	2–8	3–10	—	—
Recycling	0–25	5–30	5–50	30–80
Composting	5–30	10–40	20–75	35–90

*Source: World Bank Solid Waste Community of Practice and Climate and Clean Air Coalition.*  
*Note: — = not available.*

Figure 10. Typical waste management costs by disposal type(US\$/tonne) (World Bank, 2018)

When comparing recycling technologies itself, it is safe to assume that closed loop recycling is more expensive in both Capex and Opex than open loop recycling. Overall, in low income countries, closed loop recycling is expected to be about 35% more capital intensive compared to open loop recycling. In terms of revenues however, closed loop recycling is expected to provide best recyclate sales prices (about a factor 0,35 higher) compared to open loop<sup>15</sup>. Chemical recycling is not taken into account, as this is highly capital intensive and not even operational in developed countries either, so not applicable to Malawi.

## 2.7 Impacts of end-of-life plastic management

The economics of recycling are one side of the coin. It is also important to consider the impacts of the potential pathways when comparing alternative end-of-life options. Every activity always has a certain pressure on resources and energy and thus creates impact. Yet, there are differences between the various pathways in terms of their impact scores.

<sup>14</sup> Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: a global snapshot of solid waste management to 2050*. World Bank Publications.

<sup>15</sup> Lau, W. W., Shiran, Y., Bailey, R. M., Cook, E., Stuchtey, M. R., Koskella, J., ... & Palardy, J. E. (2020). Evaluating scenarios toward zero plastic pollution. *Science*, 369(6510), 1455-1461 (Supplementing material)

**Environmental impact**

Overall, mechanical recycling scores much better in environmental impact compared to landfilling and waste to energy. Major contributions to the better environmental impact scores of mechanical recycling comes from the avoidance of virgin materials. Compared to incineration, the impact score improves due to reduction of GHG emissions as well<sup>16</sup>. Also chemical recycling has much better environmental impact scores compared to landfilling, regardless of the energy requirements<sup>17</sup>.

However, the potential impact reduction for mechanical recycling depends on the polymer type and the state-of-the-art in recycling. Figure 11<sup>18</sup> provides a comparative overview of mechanical recycling versus landfilling and incineration on kg CO<sub>2</sub>-eq. It shows that although mechanical recycling as a process leads to environmental impact, this is easily compensated by the reduction in impacts by avoided virgin production.

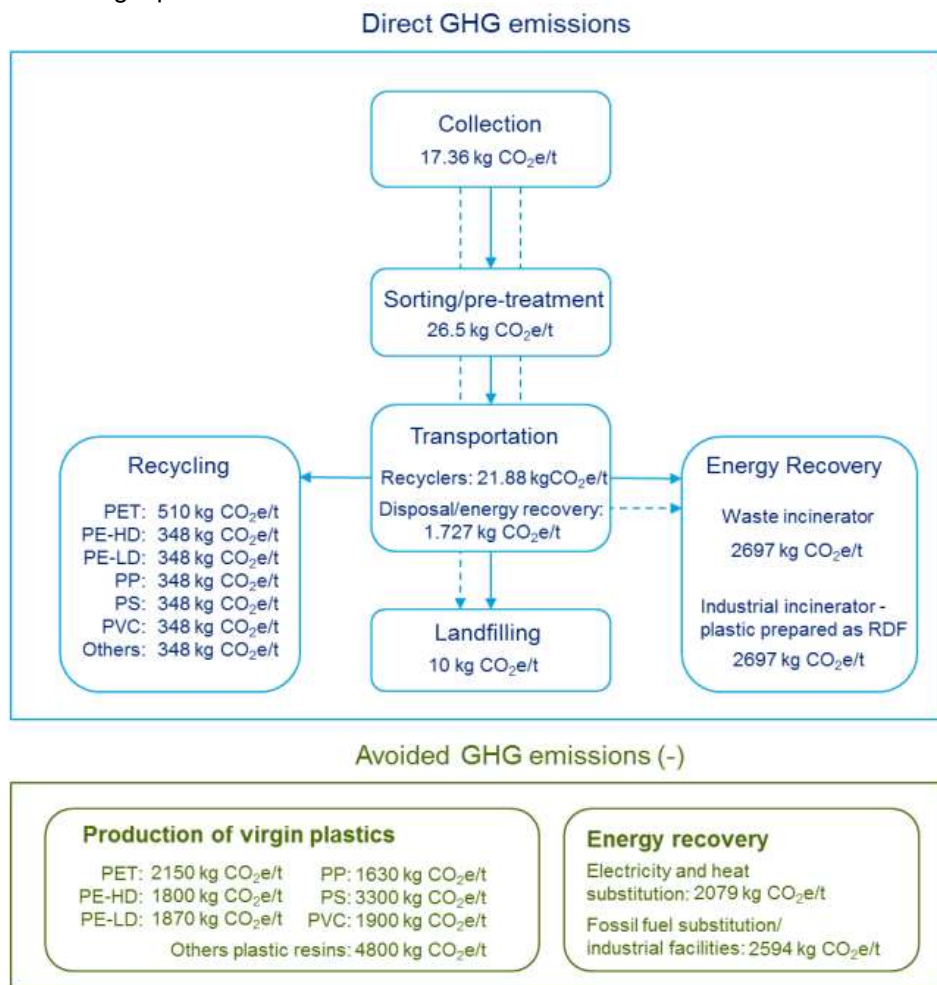


Figure 5 : GHG emissions factors used along the plastics recycling value chain

Figure 11. GHG emissions factors along the plastic recycling value chain (Deloitte, 2021)

<sup>16</sup> Arena, U., Mastellone, M. L., & Perugini, F. (2003). Life cycle assessment of a plastic packaging recycling system. *The international journal of life cycle assessment*, 8(2), 92-98.

<sup>17</sup> Antelava, A., Damilos, S., Hafeez, S., Manos, G., Al-Salem, S. M., Sharma, B. K., ... & Constantinou, A. (2019). Plastic solid waste (PSW) in the context of life cycle assessment (LCA) and sustainable management. *Environmental Management*, 64(2), 230-244.

<sup>18</sup> Hestin, M., Faninger, T., & Milios, L. (2015). Increased EU plastics recycling targets: environmental, economic and social impact assessment. Retrieved, 17, 2018, Deloitte.

**Social impact**

Although not many studies are available on plastic recycling and social impact, it is possible to estimate the difference per pathway on three social parameters: labour potential, gender equality and working conditions. Labour potential is based on the amount of manual activity involved in the pathway. For chemical recycling, this is assumed to be zero, as this pathway is not realistic in the near future for Malawi. For mechanical recycling, the potential for job creation is mainly based on the level of manual versus automated activities. If all sorting and cleaning steps are done in more rudimentary, manual fashion, the labour potential increases compared to fully automate operations. The gender equality potential is based on the likeliness in the current context of woman participating in the activities. As was found during the study, there are some female entrepreneurs active in the low-tech recycling of plastics in Malawi at this point in time, but the large majority of the recyclers are men. Waste pickers and aggregators are more often women than men. However, the limitations of women to the recycling domain are concluded to be more due to lower education levels and gender bias than any existing physical limitation: thus, there is ample potential to shift this balance. The working conditions are based on human toxicity involved with the activities. For mechanical recycling, this is mainly based on the amount and type of additives and chemicals that are included in the plastics that are processed<sup>19</sup>. This can differ per type. Risk occurs when it is unknown that certain chemicals are included in the plastics that are processed, leading to ignorance on required safety measures as well as the reintroduction of these chemicals into the value chain by mechanical recycling. Currently, recyclers have very limited ways of knowing what chemicals are contained in the plastics, because there is no transparency nor regulations on communication on this figures. As a result, recycling plants have limited ability to filter out plastics containing harmful compounds<sup>20</sup>. This increases toxicity risks compared to incineration and chemical recycling, which burn or break down the plastics entirely. Nevertheless, for incineration there are additional health risks due to the potential release of toxic substances<sup>21</sup>.

Table 2. Overview of the social impact assessment per pathway (from low (X) to high/ positive (XXXX))

Pathway	Labor potential	Potential for gender equality	Working conditions
Closed loop recycling	XXX	XXX	XX-XXX
Open loop recycling	XXX	XXX	XX-XXX
Feedstock recycling	-	-	XXX
Plastic to energy	X	XX	X-XX

<sup>19</sup> Parsai, T., & Kumar, A. (2016, November). Human risk assessment: Toxicity issues and challenges associated with mixture of chemicals released during plastic reuse and recycling. In *The 1st International Electronic Conference on Water Sciences*; Brosché, S., Strakova, J., Bell, L., & Karlsson, T. (2021). WIDESPREAD CHEMICAL CONTAMINATION OF RECYCLED PLASTIC PELLETS GLOBALLY, IPEN.

<sup>20</sup> Brosché, S., Strakova, J., Bell, L., & Karlsson, T. (2021). WIDESPREAD CHEMICAL CONTAMINATION OF RECYCLED PLASTIC PELLETS GLOBALLY, IPEN

Ágnes, N., & Rajmund, K. U. T. I. (2016). The environmental impact of plastic waste incineration. *AARMS—Academic and Applied Research in Military and Public Management Science*, 15(3), 231-237.

## 3 Policy landscape (activity 4.1)

### 3.1 An analysis of Malawi's plastic waste management policies

#### Introduction

This chapter focuses on policies, laws, and regulations that enable circularity for the plastic waste stream in Malawi. It presents the status quo in the policy space. Data in this chapter is gathered from interviews and document review and examines the extent to which policies aim to keep plastic products, components, and materials in the economy for as long as possible, reducing or eliminating waste and, in particular, preserving the value of plastic materials through various feedback loops and recovery schemes.

#### Policy landscape in Malawi

Malawi is a democratic country where policies and legislation formulation follow the democratic process and principles. Like most countries across the world, Malawi is governed by the rule of law. When the necessity for new legislation or adjustment to an existing one is discovered and accepted by the cabinet, the relevant ministry develops a proposal in consultation with the Attorney General's office. This becomes a bill debated and adopted in the National Assembly. After support by the National Assembly, it is delivered to the President, after approval by the President, it becomes an Act of Parliament.

At the national level, the Acts of Parliament and Statutory Instruments (SI) are the guiding laws of the land. At the local authority or municipal level, there are by-laws. Policy formulation starts with problem identification, for example, perceived problems in society or political parties that need government intervention. The policy agenda is set and analysed for feasibility, cost, and benefits and implemented. Policies and legislation that addresses waste management in Malawi are;

<b>POLICIES</b>	
	<ul style="list-style-type: none"> <li>• National Environmental Policy (NEP) 2004</li> <li>• National Climate Change Management Policy 2016</li> <li>• Gender Policy (2015)</li> </ul>
<b>LEGISLATIONS</b>	
a)	Constitution - The National Constitution of Malawi (1994 as amended)
b)	Acts of parliament <ul style="list-style-type: none"> <li>• Environmental Management Act, 2017</li> <li>• Local Government Act of 1998</li> <li>• Public Health Act CHAPTER 34:01 (1992)</li> </ul>
c)	Statutory Instruments <ul style="list-style-type: none"> <li>• Environment Management (Waste Management and Sanitation) Regulations. s. 37 of 2008</li> </ul>
d)	By-Laws, among others <ul style="list-style-type: none"> <li>• Lilongwe By-Laws</li> <li>• Blantyre City Council) (General Cleanliness) (Refuse and Rubble Disposal) By-Laws under s.103. G.N.16/2003</li> </ul>

### Overview of policies that support the circularity of plastics in Malawi

Most policies and legislation address solid waste in general. Only the Environment Management (Waste Management and Sanitation) Regulations, s. 37 of 2008 deals with some circular economy principles in the waste sector. The Environmental Management (Plastics) Regulations (2015) specifically deal with plastic waste. In addition to policies, Malawi developed a national strategy for solid waste management with a budget.

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
The National Constitution of Malawi (1994 as amended)	<p>The Constitution of Malawi (1994, as amended) recognizes that responsible environmental management can contribute to achieving sustainable development, improved standards of living, and conservation of natural resources. The Constitution states that the environment of Malawi should be managed to:</p> <ul style="list-style-type: none"> <li>• Prevent the degradation of the environment.</li> <li>• Provide a healthy living and working environment for the people.</li> <li>• Accord full recognition of the rights of future generations using environmental protection.</li> </ul>	<p>The Constitution is the basis for other laws and sets the pace in establishing laws, regulations, and policies. The acknowledgment of environmental protection as a right indicates that waste management is key to ensuring this right.</p> <p>Despite the obligations and rights in the Constitution, there is environmental degradation and threats to health in Malawi as a result of poor urban planning; 70% of municipal solid waste is not officially disposed of but dumped in unlined dumpsites, rivers, roadsides, and backyards<sup>7</sup>. Official dumps have no fencing, have large-scale rodent infestations, and are an active source of human poisoning, pollution, and water contamination<sup>22</sup>. In unplanned settlements, plastic and other waste are disposed of everywhere, including on streets and rivers, posing a threat to public health. This shows the need for action to actualize the right.</p>
National Environmental Policy (NEP) 2004 <sup>23</sup>	The National Environmental Policy was produced in 1996 and revised in 2004. According to NEP, every person in Malawi has a	It is observed that the policy advocates for the separation of waste at the source, recycling, and

<sup>22</sup> Nyirenda. 2016. *Status of Waste Management in Malawi*

<sup>23</sup> National Environmental Policy of Malawi. 2004. <http://www.ead.gov.mw/storage/app/media/Resources/Policies/Malawi%20National%20Environmental%20Policy.pdf>

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
	<p>right to a clean and healthy environment and a duty to maintain and enhance the environment. Women should effectively participate in policy, program, and project design and implementation to enhance their role in natural resource use and management activities.</p> <p>The policy stipulates that to promote urban and rural housing planning services that provide all inhabitants with a healthy environment and sustainable human settlements, among other strategies Malawi should;</p> <p>4.10.2. Improve waterborne sanitation systems and solid waste disposal using appropriate technology as well as proper design, selection, and licensing of disposal sites and routes.</p> <p>4.10.4. Facilitate adoption of systems that sort industrial, clinical, domestic, and other waste at source to facilitate recycling of materials wherever possible.</p> <p>4.10.5. Facilitate privatization of waste management.</p>	<p>the adoption of appropriate technology to dispose of waste. It is commendable that the policy states that privatization of waste management should be facilitated. The policy direction sees waste as a business area. Several private sectors and civil society initiatives are rising. However, like any other policy, NEP expresses commitment by the government of Malawi to private sector development, yet there is limited engagement with the private sector and limited private sector participation in waste management<sup>24</sup>. In addition, the policy is not promoting other ways of waste management such as reduction, reuse, and recovery. According to the study's findings, much of Malawi's waste is not yet being sorted at the source, recycled, or planned to be reused, with the remainder being disposed of in lined landfills. Nonetheless, there are several areas in the policy that are applicable to integrate circularity in plastic waste management in the country.</p>
<p>Environmental Management Act, 2017<sup>25</sup></p>	<p>According to the EMA Act, every person shall take all necessary and appropriate measures to protect and manage the environment, conserve natural resources, and promote sustainable utilization of natural resources. PART III of the Act also establishes the Malawi Environment Protection Authority (EPA), the principal agency for</p>	<p>Regardless of the existence of this act of Parliament, many Malawians still have large rubbish pits outside their homes and routinely burn built-up waste. This includes plastics, and other toxic materials, consequently releasing greenhouse gases and causing higher levels of respiratory</p>

<sup>24</sup> World Bank.2019. Malawi Country Environmental Analysis

<sup>25</sup> <http://www.ead.gov.mw/resources/document-library>

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
	<p>protecting and managing the environment and sustainable utilization of natural resources.</p> <p>PART VII On Environmental Standards, the Act stipulates that the authority shall, in liaison with relevant lead agencies among others, establish;</p> <p>41(d) guidelines for the disposal of any waste in the soil, the optimal utilization of any soil, identification of the various soils and practices necessary to conserve soil and prohibition of activities that may degrade the soil, and monitoring and control of soil degradation.</p> <p>PART VIII — Management of The Environment and Natural Resources</p> <p>The authority shall, in liaison with lead agencies and operators;</p> <p>(a) formulate such measures as are necessary to regulate the collection, storage, transportation, reduction, and safe disposal of waste;</p> <p>(b) promulgate such rules or formulate criteria and standards for the classification and analysis of waste and shall determine the method or methods for safe disposal of waste;</p> <p>(c) control the handling, storage, transportation, classification, importation, exportation, and destruction of waste;</p> <p>(d) control the reduction of waste; and</p> <p>(e) monitor any waste disposal site and direct the control of any such site if its continued use as a waste disposal site</p> <p>A person shall not handle, store, transport, classify or destroy waste other than domestic waste, operate a waste disposal site or plant, or generate waste except by a license issued under this section.</p>	<p>illness. Waste that is not burnt is dumped – in local areas, in rivers/water systems, on farming land, or thrown out windows of moving cars<sup>26</sup>. One major sited challenge is the implementation of the Act. This implementation constraints are likely due to inadequate resources, resistance from interest groups, and low organizational capability.<sup>27</sup> Another cited constraint is limited coordination of institutions and intra-ministerial arrangements to address multi-sectoral environmental challenges<sup>13</sup>. The Act of parliament is keen to address the country's issues in managing its waste. Nonetheless, low levels of awareness are a contributing factor in creating a gap between policy and law drafting and compliance.</p>

<sup>26</sup> <https://wasteaid.org/wasteaid-and-iccm-tackling-waste-in-malawi/>

<sup>27</sup> Bridges and Woolcock. 2017. *How (Not) to Fix Problems that Matter: Assessing and Responding to Malawi's History of Institutional Reform. Policy Research Working Paper.*

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
	<p>The Act provides for those who want to carry on the business of handling, storing, transporting, classifying, destroying, or disposing of waste to apply for a license.</p>	
<p>Environmental Management (Plastics) Regulations (2015)</p>	<p>The Environmental Management (Plastics) Regulations bans the importation, manufacture, trade, and commercial distribution of plastic bags/sheets that are less than 60 micrometres in thickness. However, commonly used plastics are exempt from this ban, such as plastics meant for food packaging, medicine or veterinary products, laundry dry cleaning bags, and plastics used for waste storage (Environmental Management (Plastics) Regulations, 2015). Each bag will need to have printed on it the name of the manufacturer and the thickness of the bag (Environmental Management (Plastics) Regulations, 2015).</p>	<p>The Malawian government has been attempting to implement a stronger plastic bag ban, given the success of Single-Use Plastic (SUP) bans in neighbouring countries like Rwanda and Kenya. This first attempt of Malawi's to ban plastic bags was met with opposition from the Plastics Manufacturers Association of Malawi (PMAM) and led to tension between some private companies and the Malawi Environmental Protection Agency (MEPA). Some of the companies argued that Malawi's choice of 60-micron thickness was over-ambitious and destructive to the plastic business. Moreover, many companies indicated not that have been involved timely in the design of this policy, leading to huge resistance. Effects of the regulation saw some companies such as OG Plastic and City Plastics close. Some reported huge revenue and employment loss. It was also argued that a plastic ban would dramatically influence the Malawian economy, this argument was supported by the fact that between 1990-2015, Malawi imported one billion USD worth of plastic.</p>

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
		<p>Although, the plastic ban was consistently challenged. As of 2021, the ban became active<sup>28</sup>. Some of the companies continued to produce, and as a result, two big companies were banned, and some are still operating illegally<sup>29</sup>. On the other hand, environmentalists, including civil society, are often celebrating the ban.</p>
<p>Environment Management (Waste Management and Sanitation) Regulations. s. 37 of 2008<sup>30</sup></p>	<p>The regulations stipulate measures that encourage the circularity of waste. If implemented, this is going to save Malawi from waste management challenges and environmental degradation that the country is experiencing.</p> <p>Part III and Part IV regulates General or Municipal Solid Waste, Solid Waste Recycling, and Recycling Facilities. According to the regulation, Any person who generates or collects solid waste shall sort out the waste by separating hazardous waste from the general or municipal solid waste. The general or municipal solid waste shall be further sorted out into categories of wastes that can be recycled or reclaimed and waste that is earmarked for disposal</p> <p>The law specifies plastic among the waste types to be recycled. The law instructs recyclables to be delivered only at any recycling facility licensed for that purpose under these Regulations and not to a waste disposal site or plant.</p>	<p>The regulations encourage and address the waste recycling business and stipulate that any recycling business requires a license to operate and develop solid waste reduction, recycling plans and annual reports. Formal recycling companies made use of the regulation. However, many informal recycling companies and waste pickers are operating without licenses. The capacity to enforce the regulations has been a major challenge.</p>
<p>Local Government Act of 1998</p>	<p>Local Government Act of 1998 assigns the municipalities to be responsible for SWM (this law is presently under review). It is reported that the law is not implemented well due to a lack of</p>	<p>The mandate to manage waste is delegated to the municipalities through the Local Government Act.</p>

<sup>28</sup> Bezerra, J. C., Walker, T. R., Clayton, C. A., & Adam, I. (2021). Single-use plastic bag policies in the Southern African development community. *Environmental Challenges*, 3, 100029.

<sup>29</sup> Bezerra, J. C., Walker, T. R., Clayton, C. A., & Adam, I. (2021). Single-use plastic bag policies in the Southern African development community. *Environmental Challenges*, 3, 100029.

<sup>30</sup> Environment Management (Waste Management and Sanitation) Regulations.S37. 2008

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
	understanding among stakeholders, lack of specialized facilities, inadequate expertise, and lack of appropriate budget allocation <sup>31</sup> .	Decentralization of these activities should support the adoption of local context solutions.
National Waste Management Strategy of 2019-2023	<p>The strategy guide the overall management of waste concerning the current, projected waste situation and local and global trends. Among the key priority areas of the national strategy is; The key priority areas of the NWMS are:</p> <ul style="list-style-type: none"> <li>(iii) Teach responsible public behaviour on waste management;</li> <li>(iv) Promote waste segregation at source;</li> <li>(v) Promote public-private participation in waste management;</li> <li>(vi) Reduce, reuse, recycle, and recover energy from the waste (4Rs);</li> <li>(vii) Promote waste treatment; and</li> <li>(viii) Establish environmentally sound infrastructure and systems for waste Management.</li> </ul>	The strategic document provides for waste segregation at source and transport. It outlines strategies and budget allocation for reducing, reusing, recycling, and recovering energy from waste. Results are yet to be recorded.
Malawi National Environmental Action Plan (NEAP) in 2004	<p>The first Environmental Action Plan was developed in 1994, which provided the framework for integrating environmental protection and management in all national development programs to achieve sustainable socio-economic development. The Action Plan was used as a reference document to guide planners, developers, and donors and sought to document and analyse environmental issues. It also was aimed at identifying measures to alleviate them, promote the sustainable use of natural resources, and develop an environmental protection and management plan;</p> <p>5.4.2.1 To minimize waste from source;</p>	These action plans are designed based on a linear economy and thus a linear model of waste management. Therefore, the focus is on waste disposal. There are no actions on waste avoidance, minimization, recycling, or recovery developed. Although, the importance of waste separation at the source is identified, it is not clear whether the waste is going to be transported and disposed of separately. There is no action plan to keep up with collection for the increasing amount of

<sup>31</sup> [https://africancleancities.org/assets/data/Organization/Malawi\\_EN.pdf](https://africancleancities.org/assets/data/Organization/Malawi_EN.pdf)

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
	<p>(b) ensure that households in areas not covered by a refuse collection service have rubbish pits;</p> <p>(c) introduce the separation of different types of waste before disposal.</p> <p>5.4.2.2 Improve waste collection and transportation of municipal wastes.</p> <p>(a) improve the solid waste collection services, by e.g. introducing rubbish banks in traditional housing areas including squatter areas;</p> <p>(d) ensure that master plans for their sanitation programs are developed;</p> <p>(e) intensify public education on rubbish disposal.</p> <p>5.4.2.3 Improve conveyance and disposal of wastes.</p> <p>(a) practice sanitary waste disposal methods at landfills;</p> <p>(b) ensure that siting of landfills and sewage treatment plants should take into consideration hydrological and soil characteristics as well as proximity to human settlement;</p> <p>(f) sensitize the general public on the dangers of scavenging at refuse pits.</p>	<p>waste coming from a growing number of household.</p>
<p>National Climate Change Management Policy 2016</p>	<p>The National Climate Change Management Policy (2016) is a key instrument for managing climate change in Malawi. It is a guide for integrating climate change in development planning and implementation by all stakeholders at local, district, and national levels to foster the country's socio-economic growth and, subsequently, sustainable development. The waste sector is embedded in the mitigation policy statement, (i) promoting the reduction of greenhouse gas emissions.</p>	<p>The policy does not address the sectors that generate GHGs or recommends how GHGs can be reduced. The climate change adaptation policy statements plans the engagement of women, girls, and other vulnerable groups, however the mitigation sector where waste is covered is not yet gender inclusive.</p>

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
Nationally Appropriate Mitigation Actions (NAMAs)	<p>Malawi's NAMA was developed in 2015 to promote country-driven and voluntary mitigation actions. Sectoral NAMAs are planned for development at various levels depending on the country's priorities, capacities, resources, and other support interventions. Waste management is one of the prioritized areas in NAMA. The recommended technological approaches to mitigate GHGs in the waste sector are waste generation, use of landfill biogas, controlled incineration, and composting for organic manure. It is estimated that the total reduction in GHG from municipal waste reduction, composting, and conversion of wastes to energy is 2,792.5 Gg of CO<sub>2</sub> eq. between 2015 and 2030.</p>	<p>Capacity in terms of technology, human, and financial resources should be strengthened for proposed actions to be fully implemented.</p>
Intended Nationally Determined Contributions (INDCs) 2015	<p>Malawi developed its Intended National Contributions (INDC) and submitted it to the UNFCCC at the Paris Conference of Parties Conference in 2015. The INDC is intended to address challenges to climate change to contribute to a reduction of GHG following a low carbon development path and to promote anticipatory adaptation strategies<sup>32</sup>. The main sectors contributing to GHG emissions in Malawi are energy, industrial processes and product use (IPPU), agriculture, forestry and other land use (AFOLU), and waste. To reduce GHG emissions, Malawi commits to mitigation interventions in the waste, among other sectors. INDCs recommended reduction of waste generation, recovery and use of landfill biogas, controlled waste incineration, and composting for organic manure as technological approaches to mitigate GHG emissions in the waste sector. Conservative estimates indicate that the mitigation potential could be as high as 400 Gg CO<sub>2</sub> equivalent by 2025 if additional</p>	<p>Currently, the country is updating its INDCs.</p>

<sup>32</sup> Intended Nationally Determined Contributions (INDCs). 2015

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
	<p>measures (i.e. waste incineration, biogas recovery, processing MSW into fertilizers) will be implemented with external support<sup>13</sup>. To attain the targets, there are policy-based actions that should be taken including;</p> <ul style="list-style-type: none"> <li>• Construct ca controlled landfill for biogas recovery to generate up to 240 GWh of primary energy (95 GWh of electricity) per year.</li> <li>• Promote solid and water waste reduction practices at household, institutional, and industry levels to reduce waste generation.</li> <li>• Process municipal solid wastes into fertilizers.</li> <li>• Install waste-to-energy incinerators to generate up to 250 GWh of electricity per year.</li> </ul>	
<p>Local Authorities By-Laws e.g. Local Government (Blantyre City Council) (General Cleanliness) (Refuse and Rubble Disposal) By-Laws under s.103. G.N.16/2003<sup>33</sup></p>	<p>Every owner or occupier of premises shall provide and maintain for use at his premises at least one receptacle for depositing refuse. Every occupier of premises shall cause all refuse from his premises to be deposited in his refuse receptacle and not elsewhere for collection by the Council's refuse collection service. The city councils/ municipalities are responsible for collecting waste from the waste receptacles to the waste disposal site.</p>	<p>The by-laws encourage waste management, but do not focus on nor encourage principles such as separation, reuse and or recycling. In addition, not all authorities have By-laws yet, and some, such as Zomba City, are still at the draft stage.</p>
<p>Public Health Act CHAPTER 34:01 (1992)<sup>34</sup></p>	<p>According to PART IX, on sanitation and housing, Section 59. No person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge, any</p>	<p>Solid waste is not clearly defined in the public health Act but is embedded in the category of a nuisance. In respect to waste, the emphasis is on avoidance and removing the waste. Plastic waste</p>

<sup>33</sup> Blantyre City Council General Cleanliness (Refuse and Rubble Disposal) By-Laws under s. 103 G.N. 16/2003

<sup>34</sup> Public health Act. 1992

Title of Policy, Legislation/ Statutory Instrument (SI) and National Strategies	Overview of the policies and legislation relevant to plastic waste	Analysis of the policy/ law as an enabler for circularity in managing plastics as a waste stream
	<p>nuisance or other condition liable to be injurious or dangerous to health.</p> <p>According to the Act nuisance is any of the following, among others; any collection of water, sewage, <b>rubbish, refuse</b>, ordure, or other fluid or solid substances which are offensive or which are dangerous or injurious to health or which permit or facilitate the breeding or multiplication of animal or vegetable parasites of men or domestic animals, or of insects or of other agents which are known to carry such parasites or which may otherwise cause or facilitate the infection of men or domestic animals by such parasite.</p> <p>Section 60 says it shall be the duty of every local authority to take all lawful, necessary, and reasonably practicable measures for maintaining its area at all times in clean and sanitary condition and for preventing the occurrence therein of, or for remedying or causing to be remedied, any nuisance or condition liable to be injurious or dangerous to health and to take proceedings at law against any person causing or responsible for the continuance of any such nuisance or condition.</p>	<p>is embedded in all other waste. The focus is on preventing environmental pollution from waste.</p>

### 3.2 Synthesis of the policy assessment

Malawi has a lot of legislation (EMA Act, 2017, Waste Regulation, 2018) dedicated to fighting waste generation and poor infrastructure. Nevertheless, despite several attempts, there are only two legislations, and a few national policies that particularly target plastic pollution. These policies call for improved waste management and recycling initiatives. These policies are affirmative, such as planning to commit to developing a stronger waste management sector or recycling techniques. However, the analysis of the policy landscape confirmed that actual operationalization and enforcing regulations is a major challenge in Malawi and that with the existing policies not all challenges are covered.

Moreover, although the government and Malawian stakeholders have demonstrated a commitment to create policies that address plastic pollution more directly, there is still a gap in addressing circularity in the policies and regulations. As described in the above section, several policies and regulations serve a more linear model of production and consumption. Most of them were developed from the background of environmental pollution and health and aim at ensuring that waste is safely disposed of at designated disposal sites in Malawi. Therefore, the policies do not fully recognize circularity to address environmental challenges and resource scarcity. Besides regulations such as Environment Management (Waste Management and Sanitation) Regulations, s. 37 of 2008, which provides for recycling, none of the available policies and regulations fully advocates for designing plastic products such that they can keep circulating for a long period. Furthermore, there are limited policies on other pillars of the circular economy such as reuse, re-distributing, remanufacturing, and refurbishing. This gap is supported by feedback that came from stakeholder consultations, especially in the private sector. They reported challenges in plastic waste valorisation, such as high taxes and levies, no incentives or subsidies to promote investment in the plastic valorisation business. In other countries like Zimbabwe, the government removed duty on equipment and technology used for collection and valorisation. Hence, there is a gap in the economic support of the plastic waste value chain. The same goes for the availability of funding and finance mechanisms for basic waste management infrastructure. There is very little available in terms of national budgets, that have been operationalized through any of the policies. Nor is there an EPR mechanism in place, even though such a policy could greatly support in the acquisition of funds for both waste management and recycling from the private sector.

Though it seems that Malawi is starting to make a stronger effort to target plastic pollution specifically and eventually ban all plastic bags, no new policies or draft policies were found as of August 2021, while the existing policy has mainly led to major tension between the private and public domain on plastics. With the establishment of MEPA that is less than two years old, substantial problems still exist to make environmental regulations smooth, especially in this transition phase. As highlighted above, programmatic monitoring and evaluation challenges are myriad; mainly due to insufficient staffing and challenges in implementing plastic waste regulations. Also, the organogram detailing how the agency will be structured still needs to be finalized to ensure its coherence with current policies. This makes current enforcement of policies a challenge. As an example, policies that are designed for waste management model are not efficiently implemented, as more than 70% of waste is still not collected. It should be acknowledged that several initiatives, projects, and policies have been developed in Malawi over the past 20 years. Yet, there are challenges in coordinating thematic or sectoral policies that support each other.

Another challenge is the limited engagement with the private sector and limited private sector participation in waste management, even though in some policies such as the NEP this is explicitly expressed. Even stronger, the current plastic ban has led to tensions between private sector and government, instead of harmonized efforts.

## 4 Market and value chain analysis (activity 4.2)

The goal of the market and value chain analysis is to derive a detailed overview of the current situation for plastic household waste. In addition to the data gathered during activity 2 and interviews with 40 market parties in Lilongwe, Blantyre, Mzuzu and Zomba were carried out. These included mainly private companies, local authorities and government departments. Additionally, the team visited the Lilongwe dumpsite, an illegal dumpsite in a small village just outside Lilongwe, two companies active in plastic recycling, one waste transfer station, and had two interviews with companies active in recycling plastics. This has led to a thorough analysis of the current situation of the value chain and market for plastic household waste which will be described in this section.

Plastic household waste valorization is just emerging in Malawi. As of this moment there are not many players involved in it yet. In urban areas most plastic household waste is mixed with other waste and ends up at open dumpsites and illegal dumpsites. Plastic household waste also regularly ends up in the environment, contaminating soil, or blocking rivers and hindering power supply. Plastic reuse is rather high among low income communities out of economic necessity. However, since plastic cannot be reused indefinitely, most plastic still ends up as waste eventually. In rural areas most plastic household waste is reused, burned or buried.

There is huge potential in valorization of plastic household waste, since the volumes are expected to increase with urbanization as well as economic and population growth. The value of plastic products is relatively high when compared to other waste streams. There are already some plastic manufacturers within the country that might be willing to increase plastic recycling. However, there are some barriers that should be overcome in order to implement the full potential of plastic household waste valorization in Malawi. This section will provide a detailed overview of the current situation, and its implications for a roadmap and pilot.

### 4.1 Organization of the current value chain

The value chain for plastic household waste valorization consists roughly of five roles, as visualized in Figure 12. The first role represents the sources from where households buy plastic, or plastic packaged, products, such as the market, retail or import (green). The second role represents the household itself which uses the plastic products, reuses them and eventually the plastics end up as waste (grey). The third role represents the collection mechanisms, which can either be public or private (including community based enterprises) and the waste that is collected can either be mixed or separated (yellow). The fourth role represents the disposal mechanisms used for plastic household waste, which are either littering, illegal dumping or local authority controlled dumpsites (blue). The fifth and final role represents actors involved in waste valorization, starting with informal and formal waste pickers, aggregators, waste transfer stations or buy back centers, ending with recyclers, processors or the export industry (orange).

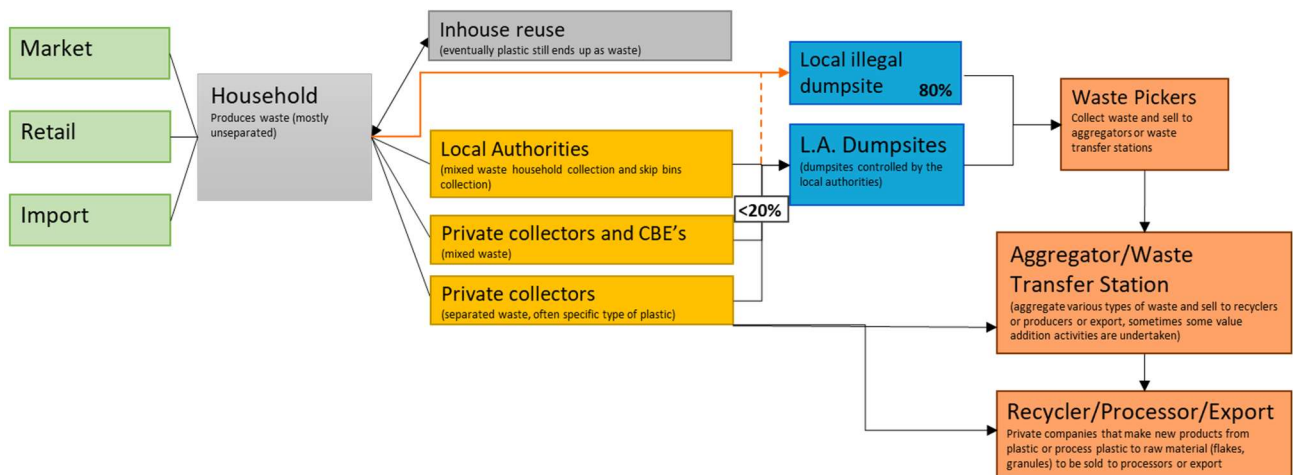


Figure 12: Visualization of the plastic household waste value chain in urban areas in Malawi.

The flow of materials and money within the plastic household waste value chain is as follows: Households buy products that are wrapped or contained in plastics from either markets, super markets, street vendors, retail such as shops or restaurants or from import.

- In the household plastic is often reused out of economic necessity but cannot be reused indefinitely and still ends up as waste. The waste is largely mixed with other types of waste such as paper, organics or glass and stored in bins or bags inside the house.
- These bags/bins are then either collected by public or private collectors (20%) or end up at illegal dumpsites or littered (80%). In the case of formal collection households usually pay a small monthly fee for mixed waste collection.
- There is hardly any separated plastic collection.
- The waste that is collected by public authorities is disposed in controlled dumpsites.
- The waste that is collected by private authorities is either disposed in dumpsites (both legal and illegal) or sold to aggregators or the processing industry if the waste is already separated
- At the local authorities controlled dumpsites or the illegal dumpsites, informal waste pickers collect certain plastic polymer types and sell this to aggregators or waste transfer stations, who then bulk this and sell to recyclers, processors or export it. Sometimes the aggregator does some value addition such as shredding or melting.
- In some cases waste transfer stations operate independent of private and public collectors and collect waste from the community they are involved in, or ask the community to dump their waste at the waste transfer station. Waste is then separated and sold to processing industry.

This system implies that currently the only option for plastic household waste valorization is either via separated collection which hardly happens, or via collection by informal waste pickers. This results in very little of the total amount of plastic waste finding its way to the processing industry, for a variety of reasons: (i) plastic often gets contaminated by organics at the household, during transport or at the dumpsite, reducing the opportunity for valorization and thus waste pickers will not collect. This implies that separating organics from other waste, can not only greatly increase plastic waste valorization but any type of waste valorization, since organics are the main source of contamination of other waste types, (ii) plastic waste has a short collection window before it gets buried by other waste, and (iii) only the plastic polymer types with the highest value are collected. These reasons together lead to an insufficient system where only very little of the total amount of plastics get collected, resulting in difficulties for the processing industry to get plastic materials in an economic matter in order to recycle.

Without sufficient volumes a profitable business case or scaling the current operation, becomes challenging.

**Thus, better separation, collection and transport logistics are essential to scale the market for plastic processing within Malawi.**

Various pathways for separating and collecting waste are implemented in Malawi or emerging in Africa. Table 3 and Table 4 summarize the existing and emerging pathways for separation and collection and the pros and cons of each pathway.

Table 3: Current practice (with asterisk) and emerging pathways for separation of household waste including pros and cons.

Proposed method	Requirements	Pros	Cons
Full household separation and separated collection	Frequent collection of various waste streams	Limited separation infrastructure needed after collection, easy to get sufficient volumes	Requires a big behavior change, various bins and thus space at households as well as a lot more trucks and frequent collection that might not be economically interesting due to low volumes
Only organic waste separation and separated collection	Frequent collection of two different waste streams	No cross contamination of organics to other waste types, easier to separate waste	Requires a behavior change, one more bin at households and more trucks to do frequent collection
Waste picking at disposal sites*	(informal) waste workers	Situation as is now, no changes needed	Only small percentage of waste gets recycled
Manual separation at disposal sites	(informal) waste workers and a lot of space	No behaviour changes at households needed	Labour intensive, waste gets easily contaminated or buried
Manual separation at waste transfer stations*	(informal) waste workers, and a lot space	Transfer facility that links collection to processing industry, only true waste ends up at disposal site	Labour intensive
Combination of manual and mechanical at disposal site or waste transfer station	(informal) waste workers, conveyor belt	More efficient than via solely waste workers	More expensive
Full mechanical separation	Specialized machinery and equipment	Efficient, not dependent on waste pickers	Does not create jobs for vulnerable groups, requires expert knowledge, high investment and O&M

Table 4: Current practice (with asterisk) and emerging pathways for collection of household waste including pros and cons.

Proposed method	Requirements	Pros	Cons
Kerbside system – trucks with open top*	Trucks, and high level of infrastructure, frequent collection to prevent illegal dumping	Limited behavior change needed from households. IT solutions can improve collection routes	Not possible in areas with narrow or bad roads, regular maintenance of trucks necessary,
Bring system – communal/block collection*	Trucks, and high willingness of communities, proper design to prevent smell	Less requirements on infrastructure and frequent collection	Large behavioural change necessary, regular maintenance of trucks necessary,
Informal sector IT-based collection	(informal) waste workers, IT infrastructure to connect households with waste to collection services	No high level of infrastructure needed, opportunities for job creation	Separation at households needed to earn profit, willingness from both waste collectors and households to go use app

## 4.2 Current market status

### 4.2.1 Actor overview

Even though valorization of plastic household waste is in its early stages, there are some organizations pioneering in this field. These organizations are mainly based in Lilongwe. Their reach is still small, but it shows that early commercialization of valorization pathways is possible. Table 5 provides a non-exhaustive overview, to give an idea on the actors currently operating in plastic waste valorization, their role and a description of their activities.

Table 5: Overview of actors working in plastic valorization in Malawi, a non-exhaustive list

Organization	Description	City & Focus Area	Pathways
<b>OG Plastic Ltd</b>	Involved in the production of plastic products since 2008. Use approximately 24% of its raw materials from waste. Recycle 6-7 tonnes of domestic waste. Have machine that can wash 100kg/hour of plastic waste in the wash line.	Blantyre City PVC and HDPE pipe and fittings. PET preforms, bottle, jars & closures. Household & molded furniture products like plates. Plastic and polythene bags and sheets. Woven sacks Plastic water tanks	Plastic Recycler, processor and exporter
<b>Shore Rubber Ltd</b>	Collects and recycle plastic waste. Involved in production of LLDPE, HDPE and LDPE products. Do recycle 15-20mt a month of waste at a cost of MWK200 per kilo. Have Recycle machines that can do 2MT a day but there is lack of proper waste collection. Total costs after	Lilongwe Plain & printed bread bags, snack packages, carrier bags, flour packs, clear oil and water pouches	Plastic Recycler, processor

Organization	Description	City & Focus Area	Pathways
	processing MWK800 & Sell for MWK 1200-MWK1400		
<b>Golden Plastic Company</b>	Buys used plastic paper from middle men at K 300/kg and the price depends on the quality of waste. If the waste quality is not good (cleaned/washed before they are brought to the company), price is reduced. The middle men buys waste plastic from residents or waste pickers and charge price based on the quantity and prices vary depending on seller of waste and the middlemen buyer.	Lilongwe Produces sack, plastic bags and plastic sheets from the plastic waste	Plastic Recycler, processor and exporter
<b>Vegan Africa</b>	Collecting waste and plastic recycling	Mzuzu City Eco bricks	Plastic Recycler
<b>Anonymous Company A</b>	Buys plastic waste from local middlemen at K350/kg and prices depends on quality	Lilongwe Produces polyethylene products e.g Basins, cups, spoon, containers etc	Plastic Recycler and processor
<b>Anonymous Company B</b>	Buys plastic waste from middlemen from local middlemen and prices depends on quality	Lilongwe Produces polyethylene products such as Basins, cups, spoon, containers etc	Plastic Recycler and processor
<b>Anonymous Company C</b>	Used to buy white plastic waste e.g bottles and plastic paper and producing plastic bag. Company used to buy waste from both organized and other middlemen at K400/kg depending on quality.	Lilongwe - Produced plastic bag	Plastic Recycler and processor
<b>RK Plastics</b>	Involved in the manufacture and recycling of plastic.	Blantyre - Water Buckets, water dispensers, , dishes, cups, plates	Plastic Recycler and processor
<b>Poly Park Plastic</b>	Involved in manufacturing and recycling of plastic such as PP, PET and HDPE.	Blantyre - Plastic packaging materials. Packaging bags. Print of packaging plastic	Plastic Recycler and processor
<b>Plan International Malawi Pvt Ltd</b>	Involved in waste collection and aggregation	Lilongwe - Aggregated plastic material	Plastic aggregation
<b>Innovative Green</b>	Collect and aggregates solid waste,	Lilongwe - Aggregated plastic material	Plastic aggregation
<b>Our World International</b>	Collect and aggregates solid waste, recycle them into various environmentally friendly products	Lilongwe - Aggregated plastic material	Plastic aggregation
<b>Easy Pack</b>	Processing Thick walled plastic	Based in Limbe	Processor and Recycling
<b>Poly Park Plastic</b>	Involved in manufacturing and recycling of plastic such as PP, PET and HDPE.	Blantyre - Plastic packaging materials. Packaging bags. Print of packaging plastic	Plastic Recycler and processor
<b>Parklink Industries</b>	Involved in the processing of thick walled plastic.	Located in Chirimba Blantyre. Plastic Bottles	Processor and Recycling

Organization	Description	City & Focus Area	Pathways
<b>Auro Plastic</b>	Involved in the processing of thick walled plastic.	Located in Chirimba Blantyre. Plastic Bottles	Processor and Recycling
<b>BNC</b>	Involved in the processing of thick walled plastic.	Ngirande, Blantyre	Processor and Recycling
<b>Flow Tech</b>	Involved in the processing of thick walled plastic.	Chirinda Blantyre	Processor and Recycling
<b>GM Plastic</b>	Involved in the collection and processing of thick walled plastic. Produce plastic chairs	Limbe, Blantyre	Collection and processing
<b>Anchor Industries</b>	Involved in the processing of thick walled plastic.	Limbe Blantyre	Collection and processing
<b>Pipeco Pvt limited</b>	Involved in Plastic processing	Chirimba, Blantyre	Collection and processing
<b>Rehaat Initiative</b>	Plastic sorting, developing building/pavement blocks, melt	Mzuzu	Sorting and Recycling
<b>Filory for All organisation</b>	Art and Craft recycling and plastic for briquettes making	Zomba	Aggregator
<b>Umodzi Green Collection</b>	Recycle plastic bottles to reusable products	Zomba	Plastic collection and Recycling
<b>Fire – Logs Africa</b>	Involved in waste picking, Sorting and grinding for sale	Kasungu	Collection and aggregating
<b>Pakachere</b>	Plastic waste collection from transfer station for Briquet production from waste	Zomba Briquet production from waste	Waste collection for recycling
<b>Ngoms</b>	Waste Collection from households	Liwonde Waste collection services	Private Waste collection services
<b>Kasonga Charcoal Group</b>	Waste collection from households and production of briquettes/ pellets	Zomba Briquettes/pellets	Waste Collection and plastic recycling
<b>Green Care</b>	Waste collection services from the households	Zomba Service provider	Waste collection
<b>Aluminum and steel Engineering</b>	Involved in using plastic waste to produce PVC and air vents. They collect waste from households, waste transfer centers and buying from waste pickers	Lilongwe PVC and airvents	Waste processing and recycling
<b>JHB Plastics</b>	Making plastic kitchen ware using recycling materials and virgin materials	Lilongwe Plastic kitchen ware	Plastic waste processing and recycling

The actor analysis shows that actors are present in each position of the value chain: there are actors present in plastic waste collection, aggregation, material, recycling of products (mainly open loop). The types of products made within Malawi of recycled plastics also greatly differs, e.g. pipes and fittings, packaging material such as various types of plastic bags, agricultural film, dust bins/pans, hard-shell plastic household items and so on.

There are 15-20 plastic manufacturers in Malawi that produce about 75.000 tonnes of plastic each year, of which 80% is single-use plastic. These manufacturers normally recycle their own (industrial) plastic waste and some are interested in also recycling post-consumer plastic waste.

#### 4.2.2 Price overview

##### Prices overview Waste Pickers

Waste pickers are critical players in plastic waste valorization in Malawi and they are found mostly at waste disposal sites. They pick different kinds of waste and they are influenced by the demand and price on choosing what type of waste to pick. Each Waste Picker (WP), picks approximately 30-50kgs of plastic waste per day. Costs and income related to waste picking are;

Item	Cost/Income
Transport	K 350 000/ week
Labor	K 5000
Income per Waste Picker	K 30 000- K 45 000/ week

Some of them reported that the demand for plastic waste is low compared to paper and metal since currently there is not much plastic recycled products on the market in Lilongwe. Biggest challenge for them is that waste is not separated making it difficult to select plastic at dumpsites. They also face stigma and no support from local government for accommodation, no space for sorting waste and storage of collected waste.

##### Price overview Aggregators

The prices for waste material greatly depends on the polymer type, quality and cleanliness, the geographic area and the business, however in general prices collectors receive from aggregators (such as buy back centers or waste transfer stations) are:

- HDPE MWK 250-350/kg
- PP MWK 250-350/kg
- LDPE MWK 150-250/kg
- PET MWK 50-150/kg

Processors buy these per ton from aggregators at MWK50-100/kg above the price the aggregator bought if for.

##### Price overview of Plastic Products

The prices of the products made from recycled plastics depend heavily on the process required to make the products. Some processes require a lot of steps, from washing, to shredding, melting and molding, which all require large amounts of electricity, while other processes are more low tech and do not require expensive and energy intensive equipment. The price for product made out of recycled plastics, differs from the prices of products made out of virgin plastics, and can be seen in Table 6. From table 6 one can conclude that in general prices for recycled products are 20-100MWK lower than for products from virgin material. This might be due to the fact that customers think products from recycled plastics are of lower quality, and are therefore not willing to pay the full price. Also producing products from recycled plastics is lower than from virgin material in a situation where collection and transport is working properly.

Table 6: Prices of products made from recycled plastic vs products made out of virgin plastics

Organization	Pathways	Products	Market Prices Recycled Products	Market Price Virgin Products	Customers
Parklink industries	Processor and Recycling	Plastic Bottles	K80-200	K100-200	Companies and individuals
Aero Plastics	Processor and Recycling	Paper Bags Plastic Bottles	K80-100	K500	Lilongwe dairy, food chain stores and estate owned companies.
BNC	Processor and Recycling	Paper Bags Plastic Bottles	K600	>K680	Farmers, sugar manufacturing companies and individuals.
GM Plastic	Plastic collection processing	Plastic pipes	K180	K200	Shopping malls and households
Anchor Industries	Plastic processing	Plastic Bags	K180	K200	Shopping malls and sugar manufacturing companies and households
OG Plastic Ltd	Plastic Recycler, processor and exporter	PVC pipes and fittings. HDPE pipe and fittings PET preforms, bottle, jars \	K150	K150-200	Shopping malls, Construction/ hardware and domestic homes
Vegan Africa	Plastic Recycler	Eco-bricks	K500-K800	K400-K 800	City council, middle income citizens and organizations.
Kasongo Charcoal Group	Plastic Recycler and processor	Briquettes/ pellets	K400/kg	NA	Local community, small market
RK Plastics	Plastic Recycler and processor	Chairs, cups, plastic bags etc	K 1650	K1650	Companies & individuals
Poly Park Plastic	Plastic Recycler and processor	Plastic bags & black sheets	K80- K200	K80- K200	Shopping malls
JHB Plastic	Plastic aggregation	Eco-bricks, kitchen ware	K500- K800	K500-K6000	Residents

#### 4.2.3 Challenges experienced by the processing sector

The interviews and learning visits to the processing sector highlighted some key challenges they experience that limits them from scaling their business and which they believe limits scaling of the plastic processing industry in general.

The first challenge is **getting sufficient volumes in an economic manner**, the lack of separation at source, collection infrastructure, and post collection separation, results in large difficulties in getting sufficient volumes in an economic manner. The plastic material market is quite competitive and diffuse

with the processing industry competing with each other to get enough materials. The unsatisfied demand has not led to more plastic volumes collected. Smaller issues regarding volumes are that processors cannot rely on a steady stream of plastics. Aggregators come when they have enough plastics and if they can get a higher price somewhere else they will take that opportunity.

The second challenge has to do with **low margins on recycled plastic products**.

The costs of machinery to extrude and melt plastics is quite high, from 250.000\$ for a simple granule producing plant to \$2.000.000 for an integrated manufacturing facility. There are no incentives such as subsidies, tax holidays or reduced import duty on equipment used for recycling and circular activities. Additionally there is no equipment manufacturer in the country so everything needs to be imported. If equipment breaks down replacement parts are difficult to come by and expensive to import. Loans or other forms of financing for plastic waste processing is difficult to come by since the interest rate is very high and there is no data available on plastic quantities and types making business projections difficult. Additionally most professional plastic recycling equipment requires extensive electricity to function, which is quite expensive and unreliable, especially in dry season when availability of hydro energy is low. Recyclers experience regular blackouts and after each blackout it takes about 3 hours before the business is in operation again. Another reason for the low margins is that recycled plastic is now mainly open-loop recycled into low quality products, which leads to relatively low margins on products.

The third challenge is **uncertainty about changing regulation that might threaten business**. The plastic industry has expressed their dissatisfaction with the ban on certain thin film plastic bags. This has put some plastic manufacturers out of business. The industry feels that they were not consulted properly and to them the ban came quite suddenly. Also manufacturers active in other types of plastics have expressed concerns regarding uncertainty of rules and regulations which has led some manufactures to change their business and refrain from plastic manufacturing. It also limits willingness to invest in the industry.

## 5 Synthesis of the findings

This section provides an overview of the key conclusions and gaps in the current landscape for plastics management, as well as the concluding advice on the relevance of the different pathways for Malawi.

### 5.1 Summary of key gaps in the technology landscape

The assessment of the current implementation of plastic waste management technologies shows that the key gaps are not due to lack of existing technology – recycling technology is in place, and there are already several companies implementing these. However, there is little domestic development of recycling technologies, nor little domestic availability of spare parts. This means that recyclers are dependent on expensive imports of (parts of) equipment.

### 5.2 Summary of the key gaps in the current policy landscape

Plastic waste valorisation in Malawi is happening, but public policy's coherence and update is needed to scale current efforts. In summary, the following gaps are identified:

- ✓ Mismatch between policy development and operationalization and enforcement
- ✓ Low engagement of private sector in policy development
- ✓ MEPA is still under development and not fully capacitated
- ✓ Low integration of circularity in the existing policy (most policies focus on a linear waste management system and do not take design of products, reuse, repair and recycling into account)
- ✓ Hindering mechanisms in place obstructing circular activities (high taxes and levies)
- ✓ Little financing mechanisms for (plastic) waste management and infrastructure
- ✓ No adoption of the Extended Producer responsibility scheme

### 5.3 Summary of the key gaps in current markets and value chains

The market and value chain assessment of plastic household waste valorization shows that the key gaps are getting sufficient volumes in an economic manner. Together with high costs for energy, frequent blackouts, problems with equipment and spare parts, this leads to low margins made from recycled plastic products. This leads to a vicious circle where collection infrastructure (e.g. separation, waste pickers, collection) does not scale due to low prices and difficulty in economy of scale, and recycling industry not getting sufficient volumes in an economic manner meaning they cannot pay collection infrastructure more for delivering plastics.

### 5.4 Conclusion on the relevance of the different pathways for Malawi

Based on the assessment of the pathways, the study of the current policy framework and the development of current markets and value chains it can be concluded that within the next ten years, the most important pathway for Malawi will be open loop recycling. This pathway is most accessible and can provide a solution for many of the currently abundant plastics within the country (rigid and some thin film plastics). Moreover, rudimentary efforts of open loop recycling to bricks for example could potentially even provide a (temporary) solution for the more difficult to recycle multi-layered or multi-material plastics.

In addition, there is already some open loop activity within the country that can be build on. Closed loop recycling could play a role in the Malawi system for plastic recycling, but this will expectedly be in the more distant future, as there are no current initiatives to be built on, and closed loop recycling generally asks for higher investment costs, while the current budgets nor policy support is not in place to facilitate that. In terms of thermo-chemical recycling, this is not deemed realistic within the near future, as this is still in pilot scale for most plastics, not commercially viable yet and requires huge amounts of energy. Plastics-to-energy is not advised as a primary pathway due to the environmental impacts and it not being a circular pathway (no value retention possible).