



Demand Recycled: Policy Options for Increasing the Demand for Post-Consumer Recycled Materials

Report for Resource Association & WWF UK

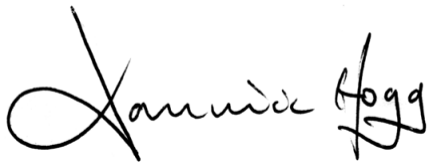
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Executive Summary

E.1.0 Background

It is widely recognised that the use of secondary, or recycled, materials, in place of primary ones generally implies a lower use of energy in manufacturing processes. The UK Government's 25 Year Environment Plan states an ambition to use recycled or reused material wherever possible as part of a broader objective to eliminate avoidable plastic waste by 2042.¹ The demand for post-consumer recyclate (PCR) for some material streams remains weak. This is despite the role that greater use of such materials can play in decarbonisation and aligning with the Clean Growth Strategy, as well as greater ambitions for its use. Those engaged in supplying PCR to the marketplace compete with primary materials. This occurs in a market which fails to reflect the environmental costs, caused by their respective supply chains, in the price paid for materials.

Given the ambitions of government to tackle plastic pollution and to see greater use of PCR and the compelling need to decarbonise production and consumption, the question is, what can be done to bolster the demand for PCR? This report aims to help tackle this question. The report presents the results of a review of policy options for increasing the demand for PCR in the UK and provides further detail on how the most promising options could function. The work builds on and complements another recent report by Eunomia which identified policy options to address wider issues related to managing packaging waste in the UK². This highlighted a way forward for reform of UK packaging policy and pointed towards the desirability of a mechanism to strengthen demand for PCR.

E.2.0 Market Failures in Demand for PCR

Eunomia considered the rationale for policy intervention to bolster demand for the outputs of recycling operations. We identified a number of market failures which affect the demand for PCR:

- **Lack of full internalisation of externalities:** failure to fully internalise externalities associated with the extraction, processing and manufacture of all materials, both primary and secondary. Full internalisation should lead to a price differential

¹ Department for Environment Food and Rural Affairs (2018) *A Green Future: Our 25 Year Plan to Improve the Environment*, January 2018, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/673203/25-year-environment-plan.pdf

² Eunomia (2018) *Policy Options to Address Issues Related to Plastic Packaging Use*, Report prepared for WWF UK.

between secondary and primary materials, with PCR having a reduced price compared to primary;

- **Relatively high search or transaction costs:** a lack of cross supply chain cooperation and transparency leads to high transaction costs. This is due to costs of engaging PCR suppliers and the need for quality checks to ensure the supply meets demand. This is a particular issue in the early stages of market development;
- **Imperfect information:** a lack of accurate and clear information regarding the quality of PCR, including secondary materials, and the potential for their use; and
- **Inappropriate standards:** the lack of accurate information highlighted above, particularly regarding quality, can result in limits being placed on the use of PCR which may be unnecessarily strict.

The existence of the above market failures supports a need for correction through policy interventions.

E.3.0 Policy Options

In previous work for WWF, we indicated that a measure to increase demand for PCR was desirable.³ In this report, the range of policy measures for increasing demand for PCR includes those which have been used elsewhere in the world, as well as other more novel measures. These were considered in relation to all the market failures outlined above.

Many of these measures are aimed at overcoming information failures or reducing high search / transaction costs. These measures can help improve the efficiency with which markets function and thus could be considered as appropriate accompanying measures to all policy options.

The work focuses on those measures designed to address the existence of externalities by generating incentives for increasing demand for PCR. The intention was to encourage a shift towards the use of PCR and away from the use of primary resources, the purpose being to create incentives to increase resource efficiency at the production stage. Consideration was given as to the practicalities of designing a measure which would:

- Be fair (across all materials);
- Not place UK businesses at a competitive disadvantage relative to overseas companies; and
- Not give UK reprocessors favourable treatment relative to overseas competitors.

As is made clear below, a key concern for all policy measures is how to identify, in a credible and verifiable manner, the proportion of a given material / package / product that is PCR. Interviews with those in the recycling industry confirmed that as the PCR of a given material cannot usually be verified at the end product stage, PCR must be identified earlier in the supply chain. Additionally, it must also be identified at a point where it can be verified with a relatively high degree of accuracy. Certified 'credits' would be tracked alongside the

³ Eunomia (2018) *Policy Options to Address Issues Related to Plastic Packaging Use*, Report prepared for WWF UK.

material as it becomes integrated into products and packaging, allowing for verification of the PCR of products and packaging in their finished forms.

We shortlisted four policy measures as options which could effectively overcome the market failures and increase demand for PCR, with one forerunner option:

1. Material taxation;
2. Tradable credits for using PCR;
3. Fee-rebate scheme; and
4. Establishing a single producer responsibility organisation (packaging).

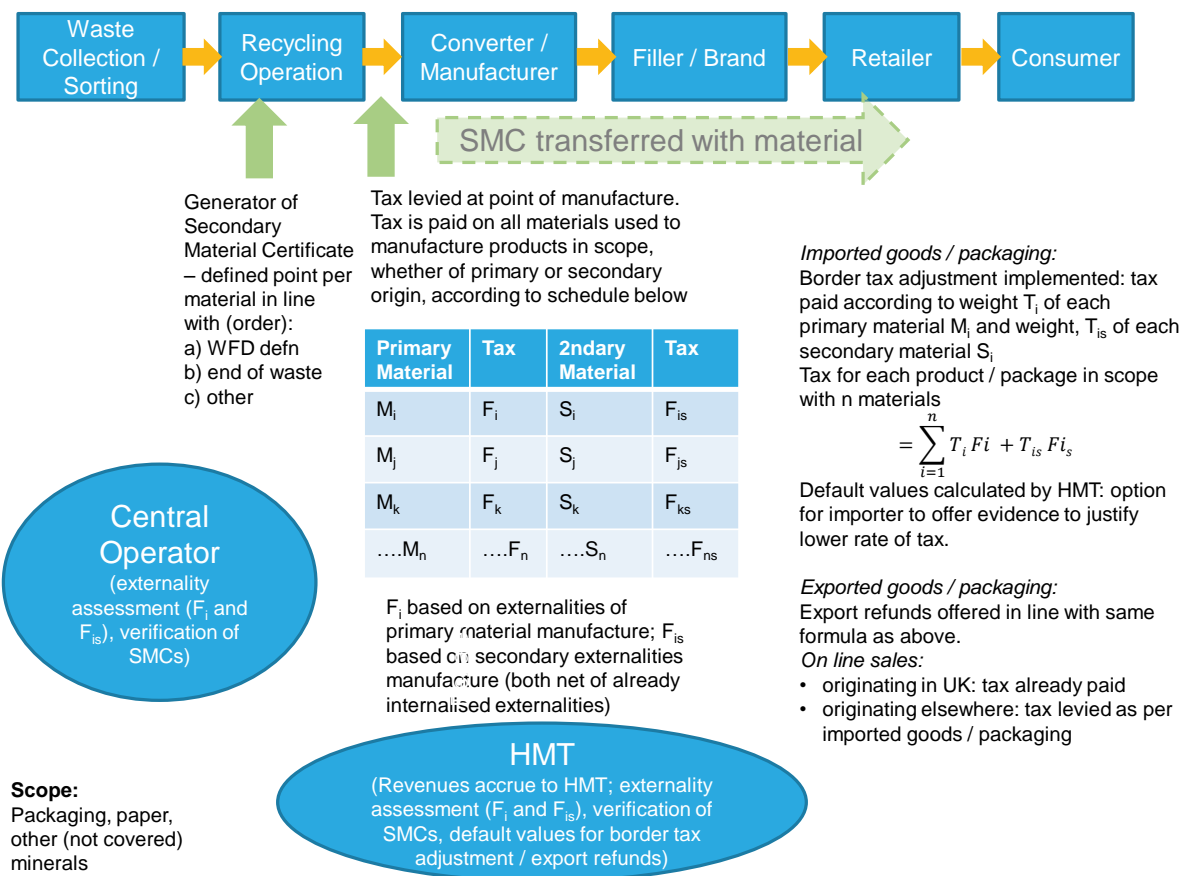
Each of these measures have been outlined on subsequent pages with further detail as to how the design might work. The last of these is somewhat exceptional in that it can complement other measures. As we argue below, there are good reasons to adopt this approach irrespective of what other methods are implemented.

E.3.1 Material Taxation

Option 1 is the introduction of a new materials tax, levied at the point of manufacture. Material taxation is based on a simple principle: a cost per unit is applied to the purchase of the raw materials and PCR in scope, reflecting the externalities of primary and secondary manufacture as appropriate. The revenue generated as a result would accrue to HM Treasury.

- This option includes the environmental cost of primary and PCR production;
- This should create conditions whereby the use of PCR is made more economically favourable relative to primary materials;
- In order to verify that the material origin is PCR, a Secondary Material Certificate (SMC) is proposed. This is generated at a defined point in the material supply chain and is subsequently transferred along with the material. This SMC approach is used in all the measures proposed;
- To ensure domestic producers are not placed at a competitive disadvantage, border tax adjustments (BTA) would be required with this measure. This would allow domestic exports to be exempted from the tax, but would require all imports to be taxed in line with the schedule for the tax;
- The information requirements for such a BTA are somewhat demanding, especially since imported products and packaging can arrive in various stages of the production process. Default levels for the adjustment could be set, with options for importers to offer up evidence in support of their case for a lower level of tax;
- The proposed design of this measure is illustrated in Figure E-1-1-1.

Figure E-1-1: Design Option for a Materials Tax

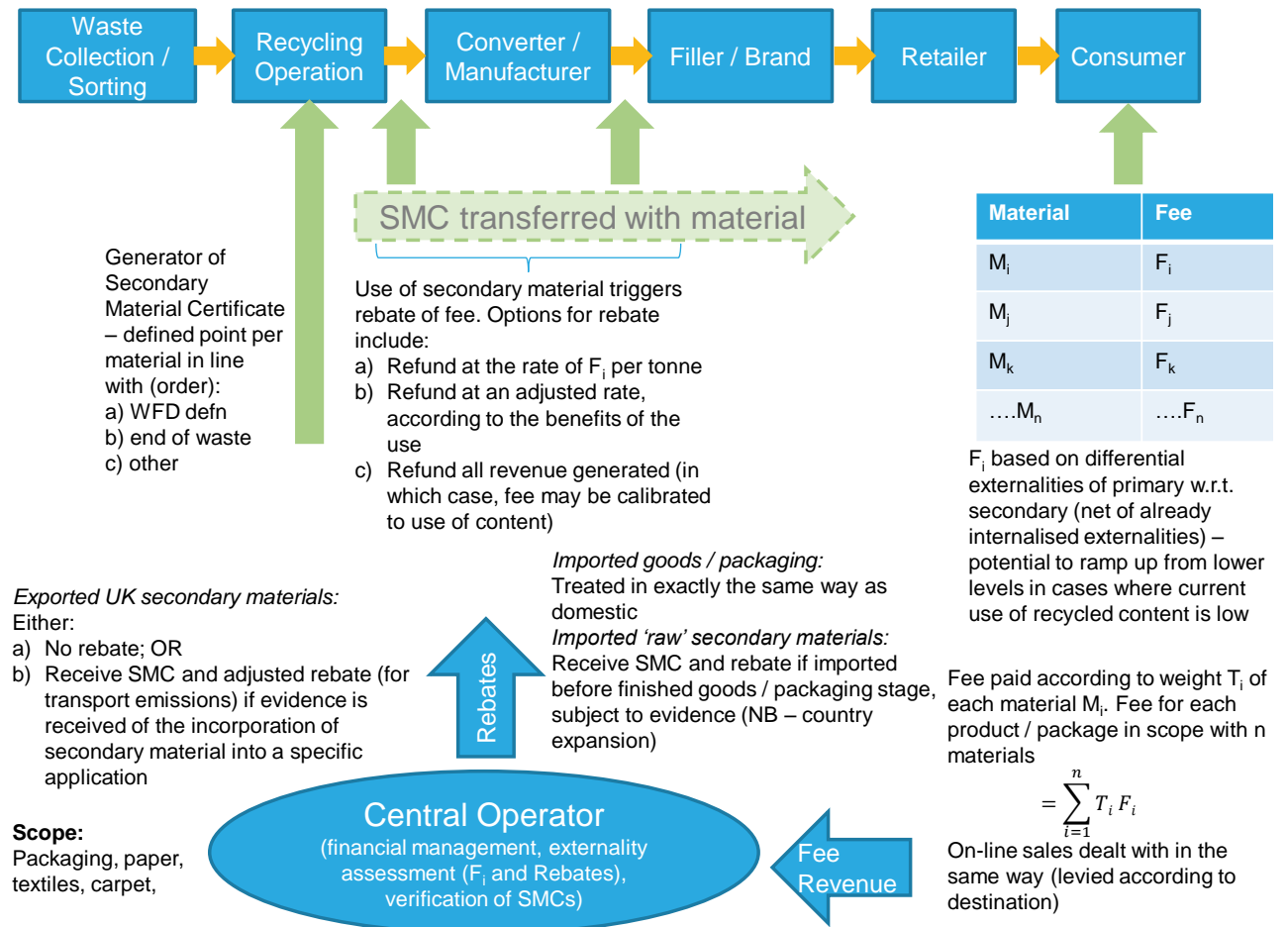


E.3.2 Fee-Rebate System

Option 2 is for a fee-rebate (or ‘feebate’) system. This involves the introduction of a levy on the use of in scope materials. It also offers a full or partial refund of the levy on the basis of the amount of PCR being used.

- As illustrated in Figure E-1-2, the proposed design is a levy implemented at the point of consumption;
- The levy rate could be based on the difference in the environmental costs of using primary materials in preference to secondary ones, or on the scale of the costs associated with primary production;
- In order to verify the origin of material as PCR source, a Secondary Material Certificate (SMC) is proposed. This is generated at a defined point in the material supply chain and is subsequently transferred with the material;
- Depending on the level at which the levy was raised, it would be fully or partially rebated where PCR was used in the manufacture of the product or packaging. The SMCs would be used as evidence against which the rebate would be made;
- There are then several options for how the rebate would be paid:
 - where the levy was raised at the level of the primary material externality, the rebate would be made in line with the differential externality (externality associated with primary production minus externality associated with PCR production);

Figure E-1-2: Design Option for a Fee-Rebate System



- where the levy was raised at the level of the differential externality (as in the Figure), the rebate could be made in full. However, one possibility would be to differentiate the rebate according to the nature of the use of the PCR and the associated environmental benefit of that use.
- This would require the holder of the SMCs to also demonstrate the nature of the application to which the material was put. This would incentivise the use of the material in the applications generating the highest benefits.
- For imported goods / packaging the measures could be applied in the same way as for domestic goods / packaging. Whereas for imported 'raw' materials, a SMC could be issued and rebated subject to provision of adequate evidence. For exporters, either no rebate would be paid or an adjusted rebate accounting for the relevant transport emissions could be paid.

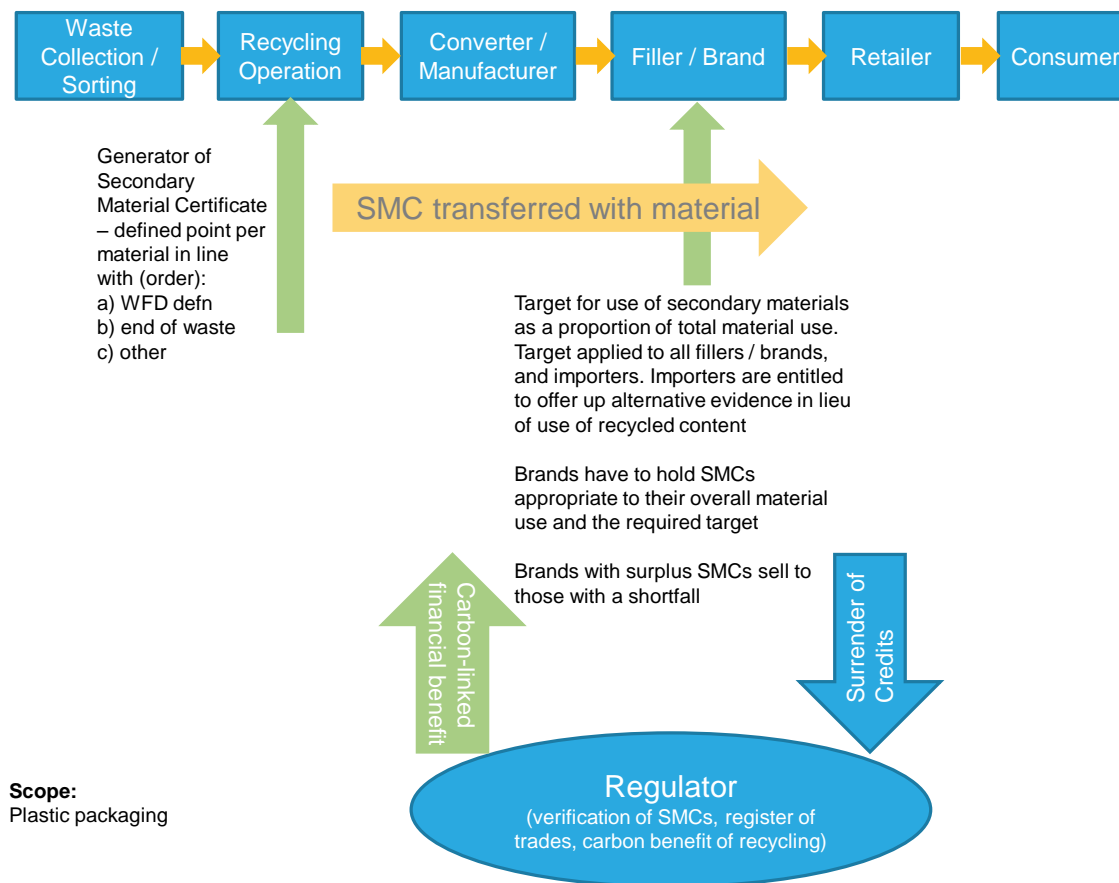
The level at which the levy is set would have impacts for the way in which revenue is captured and hence, how it is collected. On the basis of per unit of packaging, where for instance, an item of packaging might be subject to a levy of 0.1p, collecting the levy revenue through sales would not necessarily be appropriate. Given this point, the alternatives would be either a) to set the levy at a level high enough so that the levy on items was not fractions of a penny, which, assuming a high level of rebate, would lead to a very strong incentive not only to use PCR, but to design the product / packaging so that it was readily recyclable, or b) to set the levy at a lower rate and collect the fees indirectly. Where producer responsibility schemes are in place, reporting of quantities sold or placed on the market would offer a route to collection of the revenue.

E.3.3 Tradable credits for using PCR materials

Figure E-1-3: Design Option for a Tradable Credit System

Option 3 is the introduction of tradable credits for using PCR. A highly focussed PCR target, risks simply shifting the location of use of PCR rather than enhancing overall demand. If the material coverage is broadened, a tradable credit scheme offers the opportunity to introduce incentives to increase the use of recycled materials. This also allows the target to be met in the most efficient way, including by those for whom use of PCR was most straightforward.

- This approach would set a material-based PCR target for a specified range of applications. It would cover production by UK manufacturers and importers, for example 30% of plastics used in packaging;
- The manufacture of PCR would trigger the generation of a Secondary Material Certificate (SMC);
- Use of PCR would entitle the user to receive the SMCs relevant to the amount of material used;
- At least three options are available for the credits to highlight value:
 - Each individual producer would be required to hold a number of certificates equal to the overall percentage target. Those with insufficient credits would have to purchase them from others;



- As shown in the above Figure, a variant of this is linking the value of credit to the carbon savings from utilising PCR, either through the EU-Emissions Trading Scheme, or through other market mechanisms⁴; and
- A further variant would be where a fund is established for making rebates via a levy on the materials sold. However, this essentially becomes a passive form of trading which would be more or less identical to the fee rebate scheme described above.
- The treatment of imports and exports would be as for the fee/rebate scheme above.

⁴ This has been considered in work for the metals recycling industry, and for the plastics recycling industry.

E.3.4 Establishing a Single Producer Responsibility Organisation

Option 4 is to establish a single producer responsibility organisation. This aims to overcome some of the failures in coordinating linked markets in the current system for packaging and to encourage investment in quality systems for collection, sorting and reprocessing. This recommendation was made in our previous report on the UK packaging system:

If producer fees are now required to fund all costs of collection and sorting / treatment, net of material revenues (as is the case under the new Directives), it follows that there is no need for revenue from PRNs / PERNs, and no need for a market for trading them.⁵

The current producer responsibility system in which compliance schemes compete for evidence of agreement with recycling targets, delivers far from optimal outcomes for the overall system. A key issue is the absence of coordination in the scheme which makes it harder to ensure that there is a business case for investment in reprocessing.

Currently, multiple compliance schemes are seeking to attain least cost compliance on behalf of their customers. The system offers a weak basis for stable relationships between the multiple compliance schemes and the off-takers of material. The outcome is a market that is genuinely competitive. There is little or no impact of the scheme on the costs or quality of collection and sorting services, and no reward for schemes which seek to enhance quality. This is mainly because achievement is a) not straightforward, and b) may increase costs. In principle, this could be sustained in a situation where, as anticipated, producers are required to cover net material revenue costs in full. However, the rationale weakens where the basis for 'cost reduction' lies mainly with the cost of operating services, rather than obtaining compliance credits.

If a single scheme takes responsibility for materials after the point of collection, there is an incentive, in the form of reducing fees paid by producers, in realising value for the materials collected for recycling. Arguably, this arrangement makes it possible to procure sorting and reprocessing infrastructure for a time period consistent with the nature of the required investments. Furthermore, it enables support for investments in the former, to improve the quality of materials or the yield of materials of the same quality. Control over materials enables the scheme to call on the market to deliver services which are consistent with the interests of the producers and with the objectives of the scheme.

This arrangement is not inconsistent with any of the above options. Indeed it can complement them. By going out to the market for procurement of services, it embraces the use of markets where these deliver value to the system. Not least since this value would accrue to the producers who fund the costs, not of revenues of the scheme's operation. Moreover, it allows for the nature of competition to be made consistent with the delivery of high quality material for reprocessing, rather than, as now, competition happening in a market for compliance where the drivers are not aligned with maintaining quality, nor

⁵ Eunomia (2018) *Policy Options to Address Issues Related to Plastic Packaging Use*, Report prepared for WWF UK.

stability in the supply of feedstock that is required on the part of would-be investors in reprocessing infrastructure.

The scheme harnesses competition so as to procure activities which can be designed to deliver quality of, and higher value for, the materials being collected, sorted, and reprocessed. The producers and the scheme representing them, have a financial interest in the value derived from the recycling of materials.

This option can complement the other options and ought to be considered irrespective of action taken to implement other measures. It creates conditions that can support investment in recycling operations which further enable the use of PCR. It does not, however, provide the financial incentives to increase demand which the other options generate.

E.4.0 Key Conclusions

Of the above options, the attractions of Option 1, in the form of a materials input tax, are tempered somewhat by the complexity of the required BTA and the need to understand the primary and PCR content of all materials imported and exported. We believe these information requirements will be progressively overcome. In the future, this will allow for the application of this type of approach, based on the use of technologies such as blockchain, allowing information regarding products to be passed along the supply chain, irrespective of the complexity of the manufacturing process.

Option 3, the tradable credit scheme, offers a more flexible approach than one or more standards for product-specific PCR. The value of the credit could be linked to CO₂, but this is complicated by the extent to which the externalities related to CO₂ emissions are already internalised through the EU-ETS; or, on leaving the EU, an alternative measure which might be tax-related. There might be concerns, therefore, that the interaction complicates an already complicated policy landscape with respect to climate change, albeit that the occasion of leaving the EU offers an opportunity to simplify, and hopefully, re-invigorate, the policies designed to combat climate change.

Another way to approach this option would be to require each producer of the targeted products / packaging to acquire the credits and to allow these to be traded on the open market. This might be politically attractive in that it would retain an element of 'compliance-related trading' in the UK scheme especially when the arguments for multiple schemes in their current form seems rather weak. However, this leads to an uncertain magnitude of the incentive and would require some careful tuning of the target to retain a given level of incentive.

An alternative approach to Option 3 is to link the value of credits to a defined value. The fund for this is generated from a levy on all packaging. This becomes equivalent to the fee-rebate scheme, or Option 2, which is effectively a form of passive trading.

On balance, Option 2 appears to be the scheme with most to recommend it. Here, the credits have a value which can be fixed and can vary according to the use to which the PCR is put, giving some stability in terms of the incentive and allowing it to vary with the nature of the use of PCR. For example, those delivering the greatest environmental benefit receive

the highest rebate. **On balance, this is the option we prefer on the basis of its versatility in design, its reduced administrative complexity relative to the tax-based measure and the stability of the incentive it gives.**

We believe that the move to a single compliance scheme for producer responsibility for packaging (Option 4) would help to secure the benefits of the measures we have discussed. We believe it is part of the system which ought to be considered as complementary to the other three front-running options.

E.4.1 The Merits of Joint Action

Although we have considered a scheme for the UK, there is clearly wider interest in supporting the development of markets for recycled materials. Indeed, a range of brands have committed to increasing the PCR of their products. Wherever products or packaging are crossing borders, market-based instruments would ideally function alongside credible information regarding the PCR content of what is crossing borders. The use of Secondary Material Certificates that we have proposed, or any similar accreditation scheme, would usefully be broadened beyond the UK as other countries consider similar measures. This would facilitate equal treatment at the border and improve the administration of the scheme.

This would be an advantage of joint action. Through accreditation of PCR suppliers it would offer a means to make different schemes designed to reward the use of PCR ‘interoperable’.

E.4.2 The Nature of the Targets

We have not discussed here the nature of the targets that should be set. Clearly this will be of great interest, not least for materials such as plastic packaging, where there is some uncertainty about the quantity of material which is actually collected and suitable for recycling. The expressed desire on the part of businesses, as well as the targets in the EU circular economy package, to increase recycling of plastics and the change in the measurement method for recycling, will have an impact here. In principle, targets for plastic packaging should increase swiftly over time from their currently low levels, probably of the order of 10% or less (see Appendix), so as to pull through material of the desired quality for recycling.

E.5.0 Accompanying Measures

We highlighted a range of instruments to address market failures in Table 3-1. It is clear that the quality of information and the state of knowledge in one part of the supply chain regarding the capabilities of other aspects of the PCR supply chain, is not what it could be. Mechanisms, networks and platforms that enrich the supply of quality information have a role to play in helping strengthen demand for PCR on the part of would-be users. Inappropriate standards may also still be a barrier in some markets and applications.

Furthermore, if the UK aligns with the EU Waste Framework Directive, we noted that eco-modulation of fees will be a requirement of producer responsibility schemes. In principle, these could also support increased use of PCR. However, one possible alternative, as

indicated above, would be for the feebate scheme to be based on revenues collected as a 'top-sliced' element of producer responsibility. Those who made use of PCR might then be beneficiaries of the rebates, assuming the benefits of these were fully or partially passed on by manufacturers. The net effect would be a form of modulation.

Finally, in respect of the measures examined in the report, it seems strange that one still needs to point out that offering subsidies, either implicit or explicit, to primary resource extraction is completely antithetical to the efficient operation of the economy, let alone one that aspires to becoming more resource efficient.

It should be noted that as far as packaging is concerned we have already made a number of recommendations for change in respect of UK policy affecting packaging. These have been elaborated elsewhere. The policy mechanisms proposed here would help complement these changes and ensure that the UK has in place a policy framework for the 21st century, contributing positively to the 'Clean Growth' to which Government aspires.

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1.0 Introduction

The UK's policy landscape in respect of waste management has changed in highly significant ways since the start of the millennium. A great deal of progress has been made by various actors in the supply chain to ensure that materials that are taken from the waste stream can be used in manufacturing processes.

Policy, whether it be in respect of landfill tax, or producer responsibility, or recycling targets, has tended to increase the extent to which materials are drawn out of the waste stream for recycling. It has worked principally to enhance the supply of PCR into the market place. There has been much less emphasis on the demand side of the equation. It can reasonably be argued that this has led to a lopsided pattern of development of recycling markets. The emphasis has been on 'not landfilling', or on demonstrating that a given recycling target or obligation has been met, with less consideration given to how the material was recycled, or what the recycled material was used for and sometimes even whether or not the material really was recycled.

The UK is an exporter of materials for recycling. Until recently, the main outlet for the UK's PCR was China. China's decision to restrict access to its recycling markets has reignited interest in the development of markets for recycled materials closer to or at home. This has been given further impetus by a number of high-profile announcements by major brands that. In the face of an increasingly critical situation in respect of marine plastic pollution, these brands would variously ensure that in future not only would all packaging be 'recyclable', but that it would, on average, incorporate a specified minimum level of PCR.

The reference to 'reigniting' this interest calls to mind the considerations which were being given, in the late nineties and early noughties, to how markets could be developed for recycled materials. For what was then DETR (Department of Environment, Transport and the Regions), a study was undertaken on policy measures to address market failures in the demand for PCR. WRAP's early years were focused specifically on how to develop markets for PCR. It recognised that if the UK was to increase its (at the time) low recycling rate, then the efforts made should have a positive purpose.

The intervening years, however, have seen relatively little by way of development of domestic markets. Yet there has been a growing concern that what is exported for recycling is not always utilised in the hoped-for manner. Some notable exceptions relate to work on quality protocols, such as for aggregates and for compost. But concerns remain as to the fate of some key materials, including some paper and cardboard, and perhaps most significantly, for plastics. In the main, however, it is widely recognised within the PCR supply chain that current strategies are too heavily focused at directing materials into recycling collection systems to meet targets (supply side measures), rather than creating a buoyant demand for PCR. Demand remains fickle. Those engaged in recycling are exposed to competition from primary materials in markets which fail to internalise the externalities of the respective supply chains.

1.1 Objectives of the Study

Against this backdrop, Eunomia is extremely pleased to have been commissioned by the Resource Association and WWF UK to conduct this work. Its objective is to review the policy options for increasing the demand for secondary (i.e., recycled) materials which are collected in the UK for recycling, and provide further detail of how the most promising options could work. The work follows on from previous research for WWF-UK, specifically focused on packaging, in which we suggested that in the absence of other measures:

a specific mechanism to increase recycled content would be desirable. This could be a tradable credit system, or a set of mandates for recycled content applied to specific product types: the former has the benefit of allowing flexibility across the applications / uses;

The work does not aim to provide a full cost-benefit analysis. It concentrates on how policy mechanisms can be designed and implemented. It recognises that the major barrier to demand side measures thus far, may well have been a reluctance to step into territory where few nations, regions, states or provinces, have actually dared to tread.

The urgency of this work acquires additional relevance when considered in the context of the challenges posed by climate change. Most credible studies regarding how to keep the warming of the planet below a 2 degree increase from pre-industrial levels, let alone a 1.5 degree increase, indicate that 'simply' decarbonising energy supplies will not be sufficient. The use of energy has to be reduced. It is well understood that using PCR in place of primary ones implies a lower use of energy. Other things being equal, ensuring that production processes make greater use of materials with a lower embodied energy content will support efforts to reduce emissions of greenhouse gases. Hence, this work also has relevance to strategies to address climate change.

There is a clear public and government level interest to address the current policy shortcomings. Under the recent Plastics Call for Evidence⁶ the majority of respondents highlighted '*the lack of end markets for recycled plastic material, or a lack of requirement to use recycled content, as one of the main barriers to increased investment in recycling infrastructure*'. UK, mainly Englis, recycling rates have stagnated at around 45% over the last few years and are likely to fall short of the EU target of 50% by 2020 and the Circular Economy Package (CEP) recycling targets of 55% by 2025, 60% by 2030 and 65% by 2035. It is axiomatic that at some stage, if material is being collected for which there is no demand, then augmenting supply is of limited use.

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/734837/Plastics_call_for_evidence_summary_of_responses_web.pdf

2.0 Review of Approaches in Use

This Section presents a range of measures which can be used to increase use of post-consumer recycle (PCR) and in some instances, offers examples of their implementation.

2.1 Measures Targeting the Quantity of PCR Inputs

2.1.1 Recycled Content Mandates

Recycled content mandates set a requirement for the proportion of PCR embedded in product manufacture. The organisation ReLoop has recently called for legislation to establish recycled content mandates at the EU level⁷. This reflects the absence of such mandates at present, alongside the European Commission's call for pledges to boost the use of recycled materials.⁸ Examples are given below of mandates used in California to stimulate demand for recycled newsprint and recycled plastics used in some rigid plastic containers.

⁷ ReLoop (2018) A Call for EU Action on Recycled Content Mandates, https://reloopplatform.eu/wp-content/uploads/2018/06/RELOOP_POSITION-ON-RECYCLED-CONTENT_June-2018.pdf

⁸ Annex III of the EU 'Plastics Strategy' introduced an EU-wide pledging campaign for the uptake of recycled plastics, under which the European Commission called on stakeholders to come forward with voluntary pledges to boost the uptake of recycled plastics. The objective is to ensure that by 2025, ten million tonnes of recycled plastics find their way into new products on the EU market. The deadline passed on 30 September 2018.

Recycled Content Mandate - California – Recycled Content Newsprint (RCN) Program^{9,10}

California law mandates the use of a specified amount of recycled-content newsprint (RCN) by printers and publishers located in California. CalRecycle implements the program to encourage and track the use of RCN. Its aim is to promote and sustain markets for the collection and use of postconsumer newsprint in California.

RCN is defined as newsprint comprised of at least 40% postconsumer waste paper fibre. The RCN programme sets out that at least 50% of the newsprint used for printing and publishing by printers and publishers in California must be RCN. Printers and publishers annually report the total amount of RCN and the total amount of other newsprint used. The programme is enforced with fines for non-compliance.

Since its introduction in 1991, newsprint has declined both in volume and as a percentage of waste in California landfills from approximately 1.5 million tonnes and 4.3% in 1999 to 500,000 tonnes and 1.3% in 2008. The reductions cannot be solely attributed to the RCN program, as newsprint production and usage has undergone decline over the same period. However, it is estimated that significant resource savings have been made as a result of the recycled-content newsprint production. In 2010, CalRecycle reported that the resource savings of RCN use were equivalent to 2 million trees, and 102 million kilowatt hours of electricity. Since the inception of the program in 1991, approximately 16.7 million tonnes of recycled-content newsprint has been used by California's printers and publishers.

⁹ Calrecycle (2018) *Recycled-Content Newsprint Program*
<https://www.calrecycle.ca.gov/buyrecycled/newsprint> Date accessed: 30/08/2018

¹⁰ Calrecycle (2010) *2009 Compliance Report for the Recycled-Content Newsprint Program*
<https://www2.calrecycle.ca.gov/Publications/Details/1357> Date accessed: 30/08/2018

Packaging Requirements: California – Rigid Plastic Packaging Container (RPPC) Law^{11,12,13,14}

California demonstrates how recycled content legislation can be used to stimulate demand for secondary materials. They have done this in their RPPC law enacted in 1991. The RPPC law aimed to reduce the amount of plastic waste disposed in California's landfills and to increase the use of postconsumer plastic. Product manufacturers selling products in RPPCs must meet one of a number of compliance options. Selling includes direct sales as well as products offered for sale in California by other means such as wholesalers or via the internet. CalRecycle is responsible for overseeing the law and annually they review a percentage of the registered product manufacturers to ensure compliance with the regulations. Food containers are exempt from the regulations, as are those for cosmetics or baby products.

The options for compliance are as follows – containers must be:

- Made from at least 25% postconsumer material;
- Source reduced (light weighted) by 10%;
- Reused or refilled at least five times;
- Have a recycling rate of 45% if it is a brand-specific or particular type of RPPC
- Recycling rate: The RPPC must be recycled at a 45 percent recycling rate.

Some flexibility is allowed in meeting of the RPPC's requirements, with companies able to meet compliance by "averaging" the postconsumer content, the source reduction, or the refill and reuse of its containers. However, for the containers "averaged", the same compliance option must be claimed.

Whilst California's RPPC law was introduced in 1991, it underwent significant revisions in 2013 resulting in an expansion in scope.

In 2003 it was reported that most of the companies in compliance in the first round of assessment were using post consumer resin (PCR) in their products, at an average rate of 28.2%, above the target required. This covered 253 containers. A further 40 were source-reduced by an average of 14.5% - again, above target.

¹¹ CalRecycle (2018) *Container Compliance Options: Rigid Plastic Packaging Container (RPPC) Program* <https://www.calrecycle.ca.gov/Plastics/RPPC/Enforcement/Compliance/> Date accessed: 30/08/2018

¹² *RPPC LAW: Understanding this Landmark Legislation | Churchwell White LLP*

¹³ Integrated Waste Management Board, S. of C., Paparian, M., and Medina, J. (2003) *Plastics White Paper: Optimising plastics use, recycling and disposal in California*, p.66

¹⁴ Lingle, R. (2018) *Understanding California's rigid plastic container law*, accessed 11 September 2018, <https://www.plasticstoday.com/packaging/understanding-californias-rigid-plastic-container-law/25110291658121>

2.1.2 Voluntary Agreements

Voluntary agreements (VAs) involve negotiation of a target and may establish a level for the use of recycled material in manufacture of certain products, or in whole sectors or sub-sectors. They are a means by which any standard *could* be introduced. However, because of their voluntary nature, commitments to targets made under such agreements tend either to be relatively straightforward to meet, or where they are not, measures that ensure that the targets are met are often lacking. There is rarely any incentive or sanction to achieve targets and individual companies are generally unaccountable beyond the scope of their own organisation.¹⁵

For this reason, a key factor which may contribute to the success of a VA is a commitment on the part of government to formulate, or even have at hand, a worked-up proposal for a legislative requirement in the event that the VA does not deliver the desired outcome. Below, are a number of UK based examples.

¹⁵ Extended Producer Responsibility Alliance (2014) *The Effects of the Proposed EU Packaging Waste Policy on Waste Management Practice - A Feasibility Study*, October 2014, www.expra.eu/downloads/expra_20141004_f_UGGge.pdf

Voluntary Agreement – The Milk Roadmap (*later renamed The Dairy Roadmap*)

16,17,18,19

The Milk Roadmap was a voluntary agreement in the UK's dairy sector which set a number of producer and processor targets aiming to increase resource efficiency across the dairy supply chain. Of the processor targets set, one related to the inclusion of secondary materials in milk bottles. It required that a minimum of 10% of recycled UK HDPE was included in the production of milk bottles by 2010 or sooner. Since establishment of the Milk Roadmap, additional targets of 30% by 2015 or sooner were set, and 50% by 2020 or sooner. The Milk Roadmap estimated that around 80% of the milk sold by retailers in the UK (around 3 billion bottles each year) utilises plastic HDPE milk bottles. The targets of the roadmap equate to usage of 12,000 tonnes of recycled-HDPE (rHDPE) in 2010, 36,000 tonnes in 2015 and 60,000 tonnes in 2020.

The 2010 target for inclusion of 10% recycled HDPE was met, after which the 30% target for 2015 was set. In 2014, 31% recycled content in HDPE milk containers was achieved. However, a reduction in the capacity of recycled HDPE producers in the past few years has reduced the rHDPE content of milk bottles, standing at approximately 25% in 2017.

The Milk Roadmap has been successful in increasing the proportion of recycled UK HDPE in milk bottles. As a result of the Roadmap, several major dairy companies approved the use of recycled UK HDPE bottles and capacity for processing recycled HDPE initially increased.

However, whilst recycling companies had invested in UK factories to meet the demand for recycled HDPE, the use of secondary material was sensitive to price fluctuations in primary HDPE and crude oil. The rapid fall in the price of oil in late 2014 and Defra's earlier decision to step away from recycling policy, led milk companies to renege on the voluntary agreement. This contributed to the collapse of Closed Loop Recycling formerly the largest recycler of plastic milk bottles in the UK.

¹⁶ NFU (2018) *The UK Dairy Roadmap – showcasing 10 years of environmental commitment*

<https://www.nfuonline.com/assets/107806>. Accessed 30th August 2018

¹⁷ Dairy UK (2017) *Environmental Benchmarking Report*

¹⁸ Green Alliance (2018) *Completing the Circle*

¹⁹ The Guardian (2015) *'UK's biggest plastic milk bottle recycler on brink of collapse'*

Voluntary Agreement – The Newspaper Agreement²⁰

The newspaper agreement is another UK based voluntary agreement. It targeted the use of primary resources in the production of newsprint and set increasing targets for the embedded quantity of secondary material. The targets as detailed in **Error! Reference source not found.** were met on time and the level of recycled content in newsprint was estimated to be around 80% in 2011. However, the level of recycled content in newsprint has since dropped, estimated to be ~71% in 2015. The decrease has reportedly been influenced by the closure of Aylesford Newsprint, who supplied recycled newsprint and closed early in 2015.

It is thought that the effect of the Newspaper agreement was strongest in its earlier years, with the commercial realities favouring the inclusion of recycled content in later years.

Voluntary Agreement - The UK Plastics Pact (2018)^{21,22}

The UK Plastics Pact commits companies to using 30% recycled content by 2025, alongside a number of other targets addressing consumption of plastics and their reusability and recyclability. The Pact is a voluntary agreement led by WRAP, with 68 brands, retailers, makers of packaging and waste and recycling companies.

The plastics pact has been criticised for not containing strong enough language and for being written in such a way that brands may be able to avoid committing to any concrete action. As an example, on the pledge to remove single use plastics by 2025, the wording used states they will remove “unnecessary” or “problematic” single use packaging through redesign and innovation but does not define these terms. Indeed, the participants are likely to define the terms themselves, thus enabling them to ensure that commitments are not overly challenging.

Further, there is no clear sanction that could apply if targets are not met. Voluntary agreements are thought to work best when there is a credible threat of alternative policy coming in if the agreement fails to achieve its objectives.

Defra is expected to consult on legislation in this area later this year. As the agreement is still relatively new it is not possible to comment on its level of success.

²⁰ The ENDS Report (2011) *Voluntary agreements made by the UK*
<https://www.endsreport.com/downloads/27057.xls> Accessed 29th August 2018

²¹ Shukman, D. (2018) Companies sign up to pledge to cut plastic pollution, *BBC News*

²² *Analysis: UK retailers' plastics pact 'must be backed up by real change'* | *Ethical Corporation*, accessed 3 September 2018, <http://www.ethicalcorp.com/analysis-uk-retailers-plastics-pact-must-be-backed-real-change>

2.1.3 Hybrid Voluntary Agreements

A special case of the above, is a hybrid voluntary agreement. Hybrid agreements include incentives for participation in, and performance improvement of, the VA. An example of such an incentive would be a tax reduction or exemption for producers using specified levels of PCR. We are not aware of any existing VAs for PCR which apply such an incentive. However, the concept has previously been worked up in some detail in the context of work previously conducted for what was then DETR.²³

2.1.4 Green Public Procurement

Green Public Procurement (GPP) can contribute to consumption of PCR by reducing primary resource consumption through commitment to procurement of products which have embedded recycled content.

In addition, it is suggested that governments may encourage businesses and households to follow similar purchasing policies. Such initiatives can be applied at national and local levels of government and could, for example, set purchasing guidelines requiring particular products to contain a minimum amount of recycled content or achieve a specified level of energy efficiency.

Green public procurement is appealing as it couples increased concern about environmental quality with governments leading the way by improving their own purchasing habits. However, the influence that a GPP policy will have, depends on the sector. When applied to an area where the government sector is a large co-ordinated purchaser of relevant products, the influence can be significant. In other sectors, the influence of GPP may be more limited if the government accounts for only a small proportion of overall demand, or where purchasing is spread across many units who do not generally coordinate their purchasing.²⁴

It should be noted that some research suggests that GPP is not a cost-effective way of reducing the environmental impact of production.²⁵ Marron writes, regarding the effects of green public procurement on development of green technologies:²⁶

‘... when available, other policies that encourage both the government and the private sector to increase purchases of green products should be more effective in promoting innovation’.

²³ ECOTEC (1999) *Policy Instruments to Correct Market Failure in the Demand for Secondary Materials*, Report to Department for the Environment, Transport and the Regions.

²⁴ Marron, D. (2003) Greener Public Purchasing as an Environmental Policy Instrument, *OECD Journal on Budgeting*, Vol.3, No.4, pp.71–105

²⁵ Lundberg, S., and Marklund, P.-O. (2013) Green public procurement as an environmental policy instrument: cost effectiveness, *Environmental Economics*, Vol.4, No.4, p.10

²⁶ Marron, D.B. (1997) Buying Green: Government Procurement as an Instrument of Environmental Policy, *Public Finance Review*, 25(3), 285-305.

These concerns generally relate to the ‘command and control’ nature of the GPP approach. Although, it should be possible for GPP to resemble market-based incentives where evaluations account for environmental benefits in a costs benefit framework.

2.2 Measures Affecting the Price of Material Inputs

2.2.1 Resource Taxes

The intention of a resource tax would be to encourage a shift towards the use of PCR and away from primary resources. It could take a number of different forms. The purpose of a resource tax is to create incentives to increase resource efficiency at the production stage of goods.²⁷ In principle, such a tax is simple; a cost per unit is applied to the purchase of a certain raw material, with revenue generated as a result and without PCR being subject to this tax. This aims to identify and internalise in the product price, the environmental cost of primary material production, and should create conditions whereby the use of PCR is economically favourable.

Resource taxes are considered to be most effective and applicable where one of the following conditions are met:²⁸

- there is high dependency on the material, which is or could become problematic for the economy. This includes materials with high economic importance, increasing demand, import dependency or geopolitical risk of supply;
- the sustainability principle that leaves future generations sufficient resources is not currently considered; or,
- there is an environmental impact of extraction, use or recycling that is not reflected in current prices.

To avoid ineffectiveness and trade discrimination, resource taxes would need to take account of and tax target material that is embodied in imported intermediate and final products. This would require a Border Tax Adjustment (BTA). Taxes on national resource extraction and use can make domestic industry less competitive. With global trade, this could be an issue and a political barrier to introduction, or indeed result in industries looking to move production overseas. Such an outcome should be avoided as the environmental impact of primary and secondary production relocating overseas where there is no internalisation of external costs could be significant.

BTAs look to resolve these issues and are made up of two elements. First, a tax on the import of resources, or products embodying the resource. Second, a refund on exported products containing the resource. Therefore, potentially negative impacts on domestic producers can be addressed. However, application of such a BTA is challenging, as

²⁷ European Environment Agency (2015) *Material Resource Taxation: An analysis for selected material resources*

²⁸ European Environment Agency (2015) *Material Resource Taxation: An analysis for selected material resources*

obtaining data on the materials embodied in imported goods is very difficult. Estimating the quantity of raw material is required and can be problematic if the domestic extraction tax is set in terms of resource units. Inaccurate estimation could result in domestic advantage or disadvantage relative to imports.

The cases below highlight the use of taxes for goods that are not widely exported (aggregates) and for addressing packaging.

Resource Tax - The UK Aggregates Levy ²⁹

The UK Aggregates Levy was announced in 2000 and first introduced in 2002. It aimed to reduce the negative environmental impacts of quarrying as well as increase the recycling rate of construction materials by reducing the rate of primary material extraction. The levy applies to all sand, gravel and rock which has been extracted within the UK, via quarrying or dredging, as well as to imported raw materials.

When first introduced, the levy applied at a rate of £1.60 per tonne of aggregates. In 2008, this was increased to £1.95 per tonne to account for inflation since its introduction. In 2009, the levy increased to £2.00 per tonne and has stayed at this level since. A revenue of £250 million was raised in 2002/2003 which increased to £350 million in 2014/15. From 2002 to 2011, £35 million per year was ring-fenced into a specific fund aiming to mitigate the environmental impacts of quarrying.

The environmental impacts of the aggregates levy are difficult to determine. The intensity of use of primary aggregates in the construction sector has declined over the period, however this trend was in existence prior to the levy's introduction and has been linked to the 1997 landfill tax increasing the cost of disposal and contributing to creation of a market for secondary materials. The use of primary aggregates per unit of construction output has been reduced by around 40%, in the years 2010-2014 compared to the baseline at the levy's announcement in 2000.

The aggregates levy is not thought to have had significant additional impacts. The cost of primary aggregates tends to be a small proportion of the overall cost of construction projects and the levy is expected to have been passed onto consumer.

In terms of implementation, the aggregates levy is administered and enforced by HM Revenue and Customs (HMRC). Any business that exploits aggregates is liable to register and file quarterly returns. Revenue was previously divided between national budget and contribution to the Aggregate Levy Sustainability Fund. The fund was abolished in England in 2011.

²⁹ Ettliger, S. (2017) *Aggregates Levy in the United Kingdom*, 2017, <https://ieep.eu/uploads/articles/attachments/5337d500-9960-473f-8a90-3c59c5c81917/UK%20Aggregates%20Levy%20final.pdf?v=63680923242>

Denmark – Tax on Raw Materials and Packaging Tax^{30,31}

Since 1990 Denmark has applied a tax on raw materials extracted in Denmark of 5 Dkr/m³. However, this applies only to a limited number of materials that are actually extracted in Denmark, namely, gravel, stone, clay and chalk. The change enacted by tax led to an increase in recycled construction & demolition waste from 12% in 1985 to 94% in 2004.

The tax on packaging and raw materials was initially introduced in 1978, with a number of subsequent revisions. For paper & board and plastics, higher rates of tax are applied for virgin materials than for recycled materials.

	DKR/kg	EUR/kg
Paper & board: virgin materials, incl. textiles	0.95	0.13
Paper & board: recycled materials	0.55	0.07
Plastics (excl. EPS & PVC): virgin materials	12.95	1.71
Plastics (excl. EPS & PVC): recycled materials	7.75	1.02

Source: Danish Ministry of Taxation, February 2003.

2.2.2 Mechanisms Linking with Emissions Trading

Mechanisms which link to emissions trading can also be used. Such measures look to quantify and recognise the difference in carbon intensity of production from raw materials, versus that from secondary or recycled materials. A reduction in carbon intensity of production from increased use of recycled materials in lieu of primary materials, could, in principle, be linked to the traded price of carbon as in the EU-ETS. A form of price reduction can then be attributed, related to the amount of carbon offset and the prevailing price of carbon. The outcome would be that producers should be able to reduce the cost of production through using a higher proportion of recycled material.

The current EU ETS covers CO₂ emissions from EU-based production of a number of materials, including steel, aluminium, glass, pulp, paper and cardboard.³² Plastic production is not included under the EU ETS at present.

³⁰ http://ec.europa.eu/environment/integration/research/newsalert/pdf/262na1_en.pdf

³¹ Environmental indices for the Dutch packaging tax, Delft, November 2007

³² https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf

Such a mechanism would be unstable given its link to the traded value of carbon, which fluctuates from day to day. A Carbon Price Floor (CPF) could protect against this to some extent. Thus, whilst linking to emissions trading would provide a form of support to those using PCR, it would not necessarily be stable.

Another issue which needs to be considered is how to ensure all relevant emissions are covered in such a way that primary production is not simply moved overseas as a result of the costs imposed by the system. If both primary and secondary producers in the EU had to bear the full costs of emissions, this would put them at a relative disadvantage compared with overseas competitors. This might have the net effect of increasing global emissions if both primary and secondary production were to relocate overseas to jurisdictions where there was no internalisation of external costs.

As per the approach discussed in relation to resource taxes, one way to compensate for this might be to tax imports and subsidise exports to the level of cost implied by the EU ETS. However, it is more difficult to implement a system of BTAs where the instrument being used is not 'a tax', but a trading scheme where the value of allowances can vary. This system would be more justifiable if supported by a floor (i.e. minimum) price for allowances, which could then set the level for the necessary BTA. As a minimum price for carbon allowances, the CPF has been in place in the UK since 2013 and supported implementation of the EU ETS, the aim being to drive low carbon investment by setting a minimum price for traded carbon.³³

This could then establish the level of import tariffs/taxes and export subsidies on certain products imported from, or exported to, regions where companies are not subject to similar climate change policies. In theory, if such adjustments were designed so that importers/exporters face the same carbon costs as domestic producers/foreign producers they would help to tackle carbon leakage and competitive distortions.

However, there are a number of practical difficulties in establishing BTAs. Key among these is the requirement for detailed information on the carbon emissions associated with the production of both items produced in the EU and items imported. As this would be very costly to establish, the use of 'benchmarks' could perform this role, albeit imperfectly.³⁴

2.2.3 Other Measures

2.2.3.1 Eco-modulation

A small number of producer responsibility schemes in Europe have sought to influence the design specification of products or packaging through varying the fees which

³³ Hirst, D., and Keep, M. (2018) Carbon Price Floor (CPF) and the price support mechanism

³⁴ Umweltbundesamt (2008) *Impacts of the EU Emissions Trading Scheme on the Industrial Competitiveness in Germany*, Research Report 3707 41 501, available at <http://www.umweltdaten.de/publikationen/fpdf-l/3625.pdf>

producers pay to discharge their obligations according to specific features of the product or packaging. This is set to become more common now that Article 8a of the revised Waste Framework Directive has made fee modulation a required feature of producer responsibility schemes. The best-known example of such modulation is the approach used by CITEO for packaging in France. In a specific case, the modulation of fees reflects recycled content, as indicated below.

France – Reduction in Producer Fee for Recycled Content in Paper and Cardboard Packaging³⁵

Citeo, which organises the recycling of household packaging in France, offers an incentive for recycled content in paper and cardboard packaging. Paper and cardboard packaging which contains at least 50% recycled material by weight are eligible for a 10% reduction in their EPR contribution (€0.163 /kg in 2018). This must be demonstrated with a packaging suppliers' certificate.

³⁵https://www.citeo.com/sites/default/files/inside_wysiwyg_files/Rate%20table%202018%20packaging%20english%20february%202018.PDF

3.0 Market Failure in the Demand for Post-consumer Recyclate (PCR)

A fundamental of economic theory is that under a set of restrictive assumptions a competitive market economy will exhaust all possibilities for mutually beneficial exchanges in equilibrium. In other words, when demand equals supply in all markets, then no economic agent can be made better off without making at least one other agent worse off. In economic jargon, it is said that a competitive economy is Pareto efficient. Where one of the restrictive assumptions is not met, a “market failure” is said to exist. The task of the policy maker is then to identify the policy instruments that would correct for ‘market failures’.³⁶

The HM Treasury Green Book identifies the following market failures:³⁷

- **Public Goods:**
Many aspects of the environment, for example the benefits of clean air, can be described as public goods. We can all enjoy clean air. It is difficult to actively exclude anyone from enjoying it (non-excludable in supply) and once provided, it largely doesn't matter how many people enjoy it (non-rival in demand). These features mean it is difficult for businesses to provide public goods and they are often provided (or in the case of the environment, protected) by government policies. A public good will be both non-rival and non-excludable.
- **Imperfect Information:**
Information is needed for markets to operate efficiently. Buyers need to know the quality of a good or service to judge the value it can provide. Sellers, lenders and investors need to know the reliability of a buyer, borrower or entrepreneur. This information must be available to all or there is ‘asymmetry of information’ which

³⁶ It is worth highlighting that this presentation is not accepted by all economists. In particular, institutional economists take the view that institutions – the rules and norms through which society is constructed, and which, in turn, are developed by society – structure all markets. Markets do not ‘fail’ as such – they simply generate the outcomes which pertain to the institutional configuration in which they function. A key issue then becomes the normative judgement concerning what might be considered the most desirable outcomes – relating to, for example, distribution of wealth, or of opportunity – and how institutions could be configured so as to allow markets to deliver such outcomes.

The ‘unfailing market’ which is implicitly used as the reference point against which ‘failures’ are measured is one which is based on increasingly shaky foundations (regarding the nature of rationality of the actors participating in markets). As an exercise in elaborating a rationale for policy intervention, however, the approach is not without its merits.

³⁷ The Green Book, published by HM Treasury, is the central source of guidance on the economic assessment of spending and investment options within the public sector, based on a standardised set of methodologies. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

could lead to moral hazard or adverse selection. This affects markets such as life insurance, as companies may not be able to verify information (e.g. whether an individual is a smoker) and may not be willing to sell insurance to everyone willing to buy it

- **Moral Hazard:**

This occurs when individuals or businesses change their behaviour and takes risks because they are protected from negative consequences e.g. someone else bears the costs.

- **Externalities:**

These occur when an activity produces benefits or costs for others. Negative externalities are associated with, for example, passive or second-hand smoking. An individual may smoke tobacco indoors, in the presence of others, who inhale the tobacco smoke and damage their health. The smoker imposes an external cost on others, which would not be accounted for in the price of cigarettes without government intervention.

- **Market Power:**

This results from insufficient actual or potential competition to ensure that a market operates efficiently. High start-up costs can deter entry by competitors and create market power. This situation may be exacerbated by organisations acting strategically to protect their market position. For example, when an organisation engages in a practice known as 'predatory pricing', where prices are set low to drive out competitors and then raised once they have left.

Most market failures can be classified under one or other of these headings. However, the terminology used in different studies tends to lead to apparent, as opposed to real, differences in the analytical framework being used. For instance, a 2005 study by the OECD identified several sources of market inefficiency affecting recycling rates:³⁸

- **Transaction and search costs** in PCR markets. This includes costs related to price discovery, "search" costs, administrative costs, negotiation and bargaining costs;
- **Information failures** ("adverse selection") related to waste quality;
- **Consumption externalities and risk aversion**, i.e. the information failures and commercial disincentives to the use of PCR in *final* products;
- **Technological externalities** related to products. This arises when one firm manufactures a product such that it reduces the cost of recycling for the downstream processor, but cannot be compensated for changing its product design; and
- **Market power** in primary and secondary markets.

The OECD report did *not* cover the imperfect internalisation of the externalities from raw material extraction and waste management, such as leaching of pollutants into

³⁸ OECD (2005) *Improving Recycling Markets*, Report for the Working Group on Waste Prevention and Recycling, ENV/EPOC/WGWPR(2005)/FINAL.

groundwater or air pollution. Accepting this, the main differences between the OECD classification and that of the Treasury are the inclusion of Transaction and Search Costs as a specific category, the OECD's reference to Technological Externalities and Consumption Externalities and Risk Aversion and the Treasury's reference to Public Goods.

In 1993, Mt Auburn Associates and Northeast-Midwest Institute conducted a study for the US Environmental Protection Agency, "*Developing Markets for Recyclable Materials*".³⁹ It identified the following barriers to market development:

- Imperfect flow of existing information;
- Uncertainty about future markets (arguably, a specific form of information failure);
- Undervaluing of the public costs and benefits (i.e. externalities);
- High transaction costs;
- An initial small market can mean higher per-unit costs;
- Aversion to risk; and
- Barriers to investment in R&D when the profits of innovation cannot be appropriated, which one might call a specific case of Public Goods, or of missing markets / absence of property rights.

The only genuine addition to our list concerns the 'size of market' issue. We refer to this under the heading 'network effects'. However, this category of externalities can be considered more generally to reflect the way in which the actors in a given market are, or are not, coordinated. In this respect, there are overlaps with the information-related externalities below.

ECOTEC Research and Consulting conducted a study for the UK Department for the Environment, Transport and the Regions concerning Policy Instruments to Correct Market Failure in the Demand for Secondary Materials.⁴⁰ The purpose of the study was: to assess the case for government intervention to promote an increase in demand for PCR in the UK, to identify policy instruments that could be used to correct market failures for demand for PCR, and in particular to provide advice on the applicability of economic instruments in this context.

On top of the market failures considered in the other studies already mentioned, the ECOTEC study also analysed the following issues:

- Divergence of private and social rates of discount; and
- Government failure / issues of regulatory capture.

³⁹ Mt Auburn Associates, Inc, and Northeast-Midwest Institute (1993) *Developing Markets for Recyclable Materials, Policy and Program Options*, Report for the US EPA.

⁴⁰ ECOTEC (1999) *Policy Instruments to Correct Market Failure in the Demand for Secondary Materials*, Report to Department for the Environment, Transport and the Regions.

In what follows, we consider the range of market failures identified, and their potential relevance in regard to the matter of demand for PCR:

- 1) Issues associated with the **absence of property rights**, sometimes the problem of missing markets, leading to under-investment in specific areas and activities; This market failure might well be present in some markets, but seems not to be a category of relevance in respect of its impact on the demand for PCR;
- 2) **Network effects**, where the risk of low take up of services makes for absence, or lack of provision, of a service. This category of market failure is likely to affect the supply of PCR more than the demand. Crucially, the absence of clear coordination can lead to a failure to supply materials of a quality which would facilitate a strengthening in demand. This is a relevant category of market failure in relation to demand, as is evidenced by the fact that materials being collected for recycling are not always recycled. The market for supply is insufficiently focused on the needs of off-takers (demand);
- 3) The presence of both positive and negative **environmental externalities**. Where the impacts of the activities of one person have positive or negative consequences for another, but are not recognised in the market place. **This category of market failure very clearly impacts on the demand for PCR.** Most studies have indicated that the use of PCR has a lower environmental impact than using primary ones (see Table 3-2). This is despite the fact that some of the externalities associated with primary materials extraction, including associated impacts on habitats, are very difficult to quantify. Although some externalities of waste and resource management are internalised, it could not be guaranteed that all are. This category is relevant in considering the demand for PCR;
- 4) The presence of **other externalities**, including technological ones, where the interdependencies of one entity's activities upon another are not recognised within the market place. This market failure might well be present in some markets, but seems not to be a category of relevance in respect of its impact on the demand for PCR;
- 5) The prevalence of **search costs**. Transaction costs and search costs are often grouped together, but transaction costs may be non-zero even where the would-be participants are known to each other. We therefore use the term search costs specifically to refer to those situations where buyers and sellers need to seek each other out and where costs are likely to be incurred in doing so. We believe that **this category of externality is likely to be relevant** in respect of understanding why demand for PCR may be weaker than it ought to be. In some material markets, the suppliers of primary materials are well known. Indeed, there may be global exchanges which allow for widespread trading of primary materials. Although there are some exchanges where PCR are traded, they are less well known, and the companies involved may also be relatively poorly known.
- 6) The existence of **transaction costs**, where transactions may occur unencumbered, but where making transactions incurs a cost to one or other party. This tends to reduce the propensity of would be participants in

transactions to engage in them. In principle, there is no reason why transaction costs (other than search costs) ought to be a particular problem in respect of limiting demand for PCR. However, strictly speaking, this might depend on one's perspective on the scope of such costs. Would-be buyers might consider that they need to take into account risks and associated mitigation measures, which might not be so necessary when they are purchasing primary materials.

Consequently, this category may be of importance;

- 7) The problem of **imperfect information**. Search costs could be considered a specific example of imperfect information, but imperfect information includes other matters concerning ignorance of value, or of the properties of what might be being, or might otherwise be, traded. **This category of market failure is clearly relevant** in respect of the demand for PCR. Would-be users of PCR may be risk averse and might not be in possession of all the facts regarding the quality of, and hence the potential to make use of, PCR. As a result, they may also be unaware of the extent to which they could integrate PCR into their production processes;
- 8) The problem of **asymmetric information**. This is sometimes used interchangeably with the issue of search costs. However, the Treasury uses this to refer to specific cases of asymmetric information and that is the way in which we interpret the term here. Arguably, where the issue is one of search costs, as long as the information is, in principle, available to the party concerned, the information can be acquired. The specific case of asymmetric information is deemed to represent the case where information is simply not available to one or other party because it is in the interests of one or other party to retain that information. In principle, this category of market failure probably affects supply of PCR more than the demand, but **it might be argued that it influences demand indirectly**. If suppliers of PCR 'hide' contaminants in baled materials which are delivered to reprocessors, this may make it more difficult, or more expensive, to achieve the requisite quality of material for end users;
- 9) This is similar to the issue of **consumption externalities**. This refers to the case where consumption decisions made by one party have implications for other parties. If consumers are risk averse, notwithstanding availability of information, then trades may occur at a sub-optimal level. The main reason why **this category of market failure might be important** is that it may affect demand for PCR as a result of risk averse attitudes on the part of would be users.
- 10) **Government failure / issues of regulatory capture**. This problem characterises the case where the failure to improve the existing situation in the market reflects a view that a specific market segment, or group of actors, is favoured by, or is effectively the supplier of most revenue to, the regulator or Government. There is no clearly defined reason why this category of market failure should affect demand for PCR;
- 11) Issues of **market power**, in which the concentration of market influence on the side of either the buyer or the seller allows one or other to dictate the terms of a transaction, or to behave strategically. There are markets for primary and PCR which are characterised by oligopoly and

/ or oligopsony, but these can only be understood in the context of specific markets. What might be more important is where interests coalesce around the manufacture of primary materials, and where these look to exert power or dominance collectively. This could potentially influence government decisions (see previous point). Generally, however, there is no specific reason to highlight this market failure.

Based on the above cursory analysis, key categories of market failure which appear to affect demand for PCR are:

- 1) The failure to fully internalise externalities associated with the extraction, processing and manufacture of all materials, both primary and secondary. In principle, full internalisation would reduce demand for materials overall, but to the extent that the externalities of PCR production are lower, then full internalisation would have the effect of inserting a price wedge between the secondary and primary materials, effectively reducing the price of PCR relative to primary ones. Clearly, achieving full internalisation and doing so with any notionally objective accuracy, is easier said than done. Although widely stated but rarely acted upon, the principle remains sound;
- 2) The fact that the buyers and sellers of PCR do not always know who each other is, or where to find each other, or whether the offer of the one party meets the needs of the other, and so forth, will limit demand for PCR. This is more likely to be an issue in the early stages of the development of a market, when suppliers of PCR may be relatively small, they may be growing in number, and each may be handling relatively small amounts of material. This problem is exacerbated by the fact that the supply chain lacks any coordinating mechanism, leading to under-investment in the necessary infrastructure to sort, and reprocess, materials to the desired quality. In this respect, it is unhelpful that under UK producer responsibility schemes there is a market purely devoted to demonstrating compliance with a given target. The stability in the relationships required to guarantee the supply of materials into facilities designed to sort / wash / reprocess materials is lacking under such arrangements. The competition logically gives rise to a race to demonstrate compliance at least cost. In the current situation where the market is poorly regulated, cost-based competition to demonstrate compliance is inconsistent with the need to deliver the quality of material required by those looking to use PCR;
- 3) The potentially high transaction costs. These can take a range of forms. The costs of engaging in transactions of PCR can include checking that the quality of supply meets the necessary demand and ensuring that the quality of the end product is not adversely affected. This may be a particular issue in food-contact packaging, or in those applications where materials come into contact with animals or humans. It is a general issue however, and might tend to make would-be buyers more averse to using the materials concerned;
- 4) The fact that the market is not well-supplied with accurate and clear information regarding the quality of PCR, and the potential for their use. For some of the more complex and less mature markets, notably plastics, there remains a role for

credible provision of information to lubricate the demand for more PCR. It is often stated that there is a need for some standards, and in some markets, there are relatively well accepted systems of grading for PCR. However, clear standards of a regulatory nature are not always easy to develop. For example, an attempt was made to define an 'end-of-waste' standard for plastics at the European level, but this proved to be extremely challenging. The UK does have a quality protocol in place for non-packaging plastics which effectively establishes the end of waste status; and

- 5) As well as affecting the uptake of PCR, the less than perfect information that exists in the marketplace can manifest itself in limits being placed on consumption in the form of standards, some of which might be unnecessarily strict. Without a detailed review of the standards in existence, it is not possible to unequivocally say that these limit demand. It is definitely true to say that standards have had this effect in the past and the suspicion is that some such effect remains today. Crucially, standards for use of PCR in food-contact applications exist only for PET, and some believe these are overly restrictive, albeit that it is recognised that the protection of health is of paramount importance.

As noted above, to the extent that asymmetric information allows sellers of PCR to 'hide' the quality of the material they sell, this may create issues for reprocessors that can have an indirect effect on demand. However, the indirect nature of this effect indicates that it might be best considered as a supply side issue whose effect might be to enable buyers to (further) justify their risk averse approach.

3.1 Potential Policy Measures

The above analysis of market failures suggests that a range of policy interventions could be used to correct them. Some of these are listed in Table 3-1. Based upon the literature, we have not included voluntary agreements which do not encompass any backing / possible sanction. In any case, formally speaking, such an agreement does not constitute a policy in the normal sense of the word (something which 'changes the rules' under which actors operate).

Table 3-1: Policy Instruments to Address Key Market Failures

Market Failure	Policy Instruments
Lack of full internalisation of externalities	Removal of subsidies Resource taxation Charge-refund schemes Material-based fee-rebate scheme Recycled content mandates (albeit these will be less efficient than economic instruments) Tradable credits for using PCR Eco-modulation of PRO fees Hybrid voluntary agreements (incorporating incentives)
Search costs / Transaction costs	Improve supply chain coordination to deliver quality PCR Directories of buyers and sellers Trading platform Networking approaches (possibly under voluntary agreements)
Imperfect information	Standardisation / quality assurance mechanisms (and links to GPP)
Inappropriate standards.	Product specific mandates for recycled content

The measures related to addressing search costs and transaction costs, as well as imperfect information and inappropriate standards, are measures which will help to lubricate the market for PCR.⁴¹ These types of measures are desirable irrespective of the wider policy environment. In the discussion below, we concentrate on the measures which address the lack of internalisation of externalities. There is one exception to this, which we consider in Section 3.11 below, and this relates to the competition in the market for compliance.

⁴¹ The potential of green public procurement (GPP) is often highlighted as a means by which various environmentally beneficial outcomes might be achieved, and as a way in which the supply of the associated product or service can be scaled-up, with a view to such approaches being subsequently adopted by other actors in the economy. However, GPP is not a new policy instrument as such, it is an existing means to increase uptake specific types of products or services, the identification of which will require certain pre-conditions, such as standardisation and mechanisms for quality assurance. Accordingly in this study we will not look any further into GPP *per se*.

We consider each of these in turn from the perspective of the feasibility of their being implemented in the UK, giving consideration to the practicalities of designing an instrument which is:

- 1) Fair (across materials); and
- 2) Does not place UK businesses at a disadvantage relative to competitors.

In light of this, we discuss their suitability for further consideration in terms of how these might be designed in more detail. Before doing so, we address the important issue of how the use of recycled material might be measured and verified. All policy mechanisms which imply either an incentive, or which require the meeting of a target backed by some form of sanction, would need to be confident regarding the measurement and reporting mechanisms in use.

3.2 Measuring and Verifying the Use of PCR

All the measures considered below need to be able to identify, in a credible and verifiable manner, the amount of PCR used in a given material / package / product. This raises a key question regarding the ease with which this can be done.

With a view to shedding light on this question, we have undertaken a small number of interviews to help understand how straightforward it might be to identify and track the use of PCR of a given material. A summary of the interviews is given in Appendix A.1.0, but the key observations are that:

- Establishing the PCR content of a given material cannot, as far as we are aware, be achieved through simply assessing the end material/product;
- It follows that the use of PCR has to be understood earlier in the supply chain and tracked forward;
- For the key materials, there is a point in the materials supply chain where the PCR content of the material concerned is known to a relatively high degree of accuracy; and
- In the absence of an approach that establishes a chain of custody from the point at which the PCR content is known to the point where it becomes integrated in products or packaging, then any instrument that carries 'value' associated with the use of PCR will be vulnerable to fraudulent declaration.

It follows that this final point is a crucial hurdle to be overcome if an economic instrument which rewards the use of PCR is to be implemented without incurring

significant levels of fraud.^{42,43} One approach would be based on reliable data regarding materials entering recycling operations and then tracking the outputs from that point forward, potentially accompanied by the transfer of relevant certificates. There are precedents for this, such as in respect of glass or newsprint. Currently however, neither of these function in the context of a policy which brings incentives, or sanctions, into play. There are technologies, such as blockchain, that are emerging which could facilitate tracking of materials through the supply chain from collection through to integration into materials and products, and through to the point of sale.

Depending on the point at which a measure is implemented, whether at the point when PCR are first transformed into materials / packaging, or whether at the point of manufacture of products, the nature of the evidence required to demonstrate 'recycled content' may vary in the ease with which it can be verified.

The approach to dealing with imports and exports is also likely to be dependent on the measure used.

3.3 Removal of Subsidies for Raw Material Extraction

It has been a source of considerable frustration on the part of environmental economists and those seeking to ensure that fiscal systems are aligned with basic principles of economic efficiency, that subsidies for environmentally damaging activities have endured for so long. Environmentally harmful subsidies can be either explicit or implicit:

- Explicit subsidies might be where a particular activity is offered favourable treatment through price support. Where materials are concerned, this could be where the usage of a given material triggered a reward on a per unit basis;
- Implicit subsidies are somewhat more common in the case of materials. They exist where an activity is exempted from taxes that are otherwise, generally applied to a range of activities which would normally include that activity being exempted. Good examples here relate to accelerated depreciation allowances, exemptions from environmental taxes and the offer of grants and low-cost loans.

An extended interpretation of the implicit subsidy is to consider that wherever an externality remains uninternalised, then the activity is the beneficiary of an implicit subsidy. Although, this can make it difficult to understand whether such a subsidy exists. For example, is the level of fuel duty higher such that a subsidy exists, or is the externality fully internalised? Increasingly, estimates are made of this.

⁴² In the case of the Californian Rigid Plastic Packaging Container (RPPC) Program, which has a requirement for the container to be made from at least 25% post-consumer material, it is understood that there is no mandatory reporting requirement, but a selection of producers are subject to checks every year, and have to provide evidence of compliance. There appears to be no standard approach towards the nature of the evidence that is required.

⁴³ In France's EPR scheme (Citeo) paper and cardboard using recycled content is eligible for a 10% fee reduction if over 50% by weight is recycled content. To claim this reduction a packaging supplier's certificate is mandatory.

It would take some time to highlight the existence of all subsidies, explicit and implicit, which have an effect on the cost of extraction and processing of primary (and secondary) materials. Suffice to say that subsidies for the extraction and processing of fossil fuels have been the subject of a number of studies, with these identifying the nature and scale of the subsidies to varying degrees. Whilst, in principle, all materials might, depending on the origin of the fuel, and the subsidies in that location, be beneficiaries of these subsidies, it seems reasonable to suggest that of all the materials, plastics are likely to benefit most significantly because the subsidies affect the costs of the main raw material used for manufacture.

In 2015, The International Monetary Fund (IMF) estimated that global fossil fuel subsidies totalled a staggering USD 5.3 trillion.⁴⁴ This included the uninternalised externalities (or as the study termed them, the post-tax subsidies). The study reported 'pre-tax subsidies' at \$333 billion in 2015, but it was the post-tax subsidies, primarily the uninternalised externalities, that were responsible for the majority of the subsidy. Furthermore, the impacts which were most strongly subsidised were not those related to climate change, but those related to local air pollutants. In a very real sense, it can reasonably be argued that governments are subsidising a means by which to condemn their residents to ill health.

Another study, which did not consider the uninternalised externalities, indicated that G20 countries were supporting their fossil-fuel industries to the tune of \$444 billion annually in 2013 and 2014, this relating only to fuel production (exploration, extraction and development). The report also noted, regarding the UK:⁴⁵

The UK is also one of the few G20 countries that is increasing its fossil fuel subsidies while cutting back on support for the renewable energy investments that are needed to support a low-carbon transition. This is despite recent pledges by the UK government in support of the Friends of Fossil Fuel Subsidy Reform

According to the study, the UK offered an average of £5.9bn worth of subsidies each year to fossil-fuel industries in 2013 and 2014, most of it in the form of tax breaks to help boost declining North Sea production. In addition, the UK introduced a new North Sea tax break in 2015 which Government estimated would be worth £1.7bn over the ensuing five years. The definition of a subsidy used in the report appears to have been less restrictive than the IMF study used for pre-tax subsidies.

The continued existence of these subsidies is a major problem in the context of discussions around climate change. It also has the potential to exacerbate the difficulties being faced in transitioning to a more circular economy for materials use, and notably, the use and management of, plastics. Artificially low prices for the feedstock for plastics

⁴⁴ Coady, D., Parry, I., Sears, L. and Shang, B. (2015) How Large Are Global Energy Subsidies? Washington, DC: International Monetary Fund.

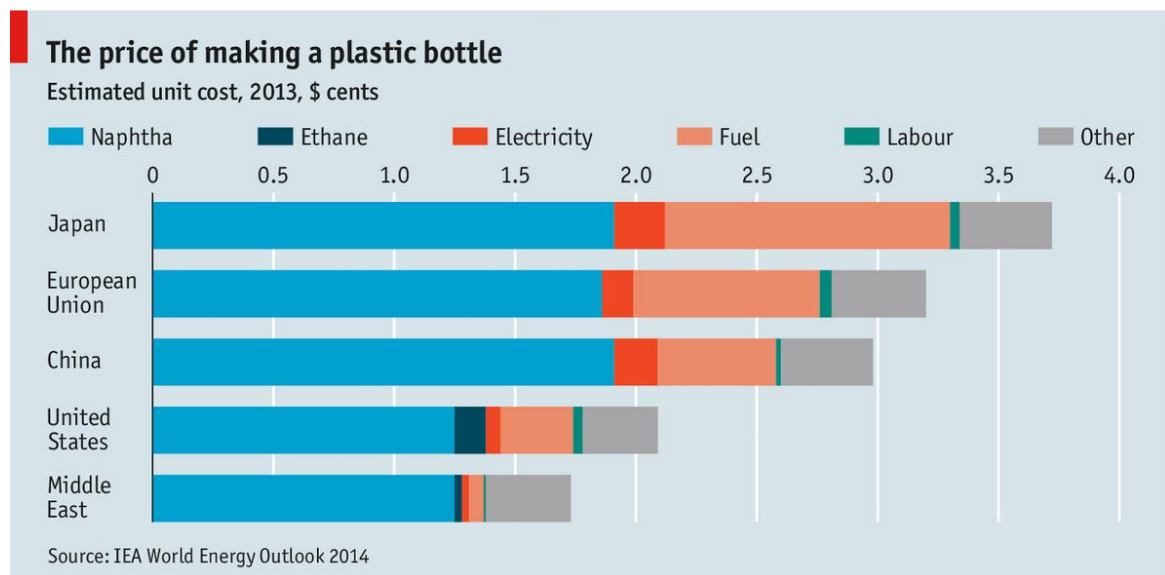
⁴⁵ Elizabeth Bast, Alex Doukas, Sam Pickard, Laurie van der Burg and Shelagh Whitley (2015) Empty promises: G20 subsidies to oil, gas and coal production, November 2015 (available from <https://www.odi.org/publications/10058-empty-promises-g20-subsidies-oil-gas-and-coal-production>)

is likely to increase overall demand for plastics and increase the market share of resin of primary origin relative to post-consumer recycle.

We are not aware of studies that have considered the extent of the implicit subsidy and its impact on the cost of producing plastics, but the problem may be exacerbated also by the implicit subsidy offered by extra-EU production of plastics by virtue of such plastics coming, potentially, from countries / states with no incentive with an effect equivalent to that of the EU-Emissions Trading Scheme (ETS).

The IMF study noted that moving to efficient energy pricing would imply increases in the global average price of petroleum products and natural gas of 52% and 45% respectively. If one excludes the 'post-tax' subsidies, then the change due to the pre-tax subsidies might be of the order 3%. Some indication of how this might translate into the price of manufacturing plastics from primary resources can be gained from Figure 3-1. The suggestion is that Naphtha always contributes more than 50% of the cost of production, though clearly this would change as the costs of producing naphtha rise and fall. Naphtha prices are closely correlated to those of oil. A simple estimate would suggest that if removing subsidies led to a global average increase in petroleum prices of 3%, then if naphtha costs are closely correlated to those of petroleum, and if 50% of the costs of the production of plastics are related to naphtha costs, then the increase in plastics prices resulting from subsidy removal might be of the order 1.5%. The equivalent analysis on the externalities (post-tax subsidies) is repeated in Section 3.4.

Figure 3-1: Key Components of the Cost Making a Plastic Bottle



Source: *The Economist* (2014) *The price of making a plastic bottle*, Nov 15th 2014.

It should be noted that the relevant primary materials here are not just oil, but also gas, including fracked gas, not least in the USA where gas is used as a feedstock for manufacture of naphtha. Although the implicit subsidies being offered to the nascent fracking industry in the UK appear significant, the supply of virgin plastics for example, will be affected by the impact of implicit subsidies across the globe. In this context, we note that the issue of subsidies is not a purely 'developed country' phenomenon. A study

by the International Energy Agency (IEA) showed that in 2010 fossil-fuel consumption subsidies in *non-OECD* countries amounted to USD 409 billion, with subsidies to oil products representing almost half of the total.⁴⁶

As regards this study, in reality, other than the UK removing the existing implicit and explicit subsidies for oil in particular, but fossil fuels more generally, the scope for additional action may be limited. However, the UK could take a lead and actually follow through on commitments which it has already made in the fora of the G7 and G20.⁴⁷ This might trigger some response from other nations to follow suit. Arguably, only if other countries follow suit would there be anything remotely approaching an impact on the price of oil.

Recommendation: This measure may have a relatively limited impact on demand for PCR if the above calculations are indicative of how prices are likely to be affected. It is a measure which is obviously both feasible and desirable. Yet, the current Government is broadly supportive of the fracking industry, even though all other political parties have indicated their concern at the impact of fracking on the prospects for addressing the emissions of gases which are the cause of climate change.

Although we believe this measure should be implemented, we do not discuss it further since there are no ‘design issues’ at stake – the aim is to remove existing subsidies.

3.4 Taxation of Materials

The issue of resource taxation has been much in the news recently. The Budget Commissioner for the EU stated earlier this year:

*“We have too much packaging material and plastic waste, which pollutes our seas and oceans. So, the question arises, should we not tax the production of our plastics?”*⁴⁸

The Welsh Environment Minister, Lesley Griffiths AM, told Sky News a year ago that she was considering a plastic tax on producers.⁴⁹ Norway is also believed to be considering such a measure.

Those who have considered taxes on resources generally tend towards the view that there may be problems if the tax is limited to a single material. The main reason for this is that such taxation can lead, at the margin, to switching away from the use of one

⁴⁶ IEA (2011), World Energy Outlook, IEA, Paris.

⁴⁷ The first time (of many since) that the commitment was made was in 2009 at the G20 summit in Pittsburgh, where the parties committed to ‘*phase out and rationalize over the medium term inefficient fossil fuel subsidies*’. It could, of course, be argued that the wording is suitably opaque (and even, contradictory – how, after all, does one rationalize something defined as inefficient?)

⁴⁸ Politico (2018) *Plastic tax proposal faces resistance*, 15th January 2018, <https://www.politico.eu/article/budget-commissioners-plastic-tax-proposal-faces-resistance/>

⁴⁹ Sky News (2017) Wales could introduce ‘plastic tax’ to tackle ocean litter, 28/09/2017, <https://news.sky.com/story/wales-could-introduce-plastic-tax-to-tackle-ocean-litter-11056813>

material into another: it might be the case that the substitute material will lead to an increase in environmental impact.

If a resource / material tax was being used to correct the market failure in demand for PCR, then in principle, it would be better if it was designed to be applied to a broad range of materials, covering materials that compete for market share in key applications and would be differentiated according to the externalities of the process by which the materials were produced. In practice, whilst the techniques to assess externalities are relatively well developed, capturing all the externalities of materials manufacture, from the point of extraction, is difficult to achieve. Furthermore, the impacts of production of a given primary material can vary considerably depending upon the nature and location of the extractive process, these also being some of the least well characterised externalities of production. That having been said, an agreed schedule of material taxes, differentiated according to their primary or secondary origin, could be established, albeit there might be some concern about the actual levels to be applied among the affected industries.

An alternative approach would be to tax only the primary materials at a level indicative of the differential between the primary and secondary production. However, this is a second-best solution since it effectively overlooks the widely varying externalities of all primary production. For example, the externalities associated with primary production of material x might be five times greater than those associated with primary production of material y, but the *differential* between the primary and secondary production of x might be the same as the differential between the primary and secondary production of y. One of the objectives of a materials tax ought to be to constrain consumption of *all* resources, but if only taxes linked to differential externalities were imposed, this would have a more limited impact on consumption, and be less efficient than the design where all materials are taxed. A somewhat distinct variant, a charge refund system, is considered below.

The magnitude of the external benefits of recycling relative to primary production in relation to specific materials was estimated in work for the OECD (see Table 3-2).⁵⁰ These figures give an idea of the scale of the market failures in relation to specific materials that are typically recycled from household / municipal waste. The final columns give the figures in 2018 pounds sterling, which were derived by inflating using the GDP deflators for the period from 2005-2018 in the euro zone, and then converting to £ sterling. The indication is that the external benefits are considerable, and for some materials, are in the same order of magnitude as the prevailing PCR prices.

⁵⁰ D. Hogg (2006) Impacts of Unit-based Waste Collection Charges, Report for the Working Group on Waste Prevention and Recycling, ENV/EPOC/WGWPR(2005)10/FINAL.

Table 3-2: External Benefits of Recycling (relative to primary production)

Activity	External Benefit (low, 2005) €/tonne)	External Benefit (high, 2005) €/tonne)	External Benefit (low, 2018) £/tonne)	External Benefit (high, 2018) £/tonne)
Recycling of Paper / Card	€ 45.86	€ 94.17	£47.01	£96.53
Recycling of Glass	€ 11.37	€ 44.75	£11.65	£45.87
Recycling of Plastic	€ 46.49	€ 82.79	£47.65	£84.86
Recycling of Steel	€ 54.06	€ 98.32	£55.41	£100.78
Recycling of Aluminium	€ 620.28	€ 1,665.84	£635.82	£1,707.58
Recycling of Inert Wastes	€ 2.90	€ 2.90	£2.97	£2.97

Source: D. Hogg (2006) Impacts of Unit-based Waste Collection Charges, Report for the Working Group on Waste Prevention and Recycling, ENV/EPOC/WGWPR(2005)10/FINAL

Some indication of how the relevant externalities might translate into the price of manufacturing plastics from primary resources can be gained from Figure 3-1. A simple estimate would suggest that if internalising all prices led to a global average increase in petroleum prices of 50%, and if naphtha costs are closely correlated to those of petroleum, and if 50% of the costs of the production of plastics are related to naphtha costs, then the increase in plastics prices resulting from internalisation might be of the order 25%.

One of the main issues associated with resource taxation is that resources are widely traded in various forms, as they are transformed into materials, parts, products and packaging that are ultimately consumed. As such, they enter and exit the UK in various forms, embodied in goods at varying stages in their life cycle. If materials are to be taxed in such a way that all materials in all forms, are captured, then in principle, information would need to be available regarding:

- The embodied materials content of the goods and packaging; and
- The primary or PCR component.

This would be used to calculate the level of tax applicable. Furthermore, in order to ensure that UK businesses were not placed at a competitive disadvantage relative to overseas producers, an approach known as border tax adjustment would need to be applied. This would tax the embodied material content of imports, and refund tax that had been paid up to the point where goods were being exported.

Generally, WTO counsel have advised that border taxes can be simplified somewhat as long as their application does not favour domestic producers over overseas ones. The

principle of non-discrimination must apply, since the alternative would be a raft of policies that are protectionist in their nature. Imported goods could be levied a tax at a default rate based on available scientific information, such as life-cycle inventory data, or other forms of materials balance information. These would be used to establish the tax rate for 'average' or 'typical' products, with the originating company given the opportunity to provide credible information that would suggest an alternative rate should be applied. For example, a certified indication of a ratio of primary to PCR used in the product that was higher than 'the average' would be accepted as the basis for a downward adjustment of the tax on a given product. This would somewhat reduce the information burden that would confront the system.

It is perhaps unsurprising that most taxes on materials that have been applied hitherto have been applied to materials that are not, generally, widely traded. The UK aggregates tax is a good example, but many other countries use taxes on mineral-type materials, including:

- Austria (some regions)
- Denmark
- Sweden
- Belgium (Flanders)
- Italy (some regions)
- France
- Latvia
- Lithuania
- Estonia
- Slovenia
- Czech Rep
- Hungary.

In the last two cases, the taxes take more the form of royalty fees, whereas in the Baltic states, the taxes usually accrue to an environmental fund.

Where materials are widely traded, then especially for a materials tax of broad scope, the information and data requirements clearly become more challenging, albeit not insurmountable. Indeed, it would seem appropriate to consider the use of block chain technology, in future, to track materials, including whether of primary or secondary origin, and it may even be implicit. However, it seems clear that imposing a materials tax on all materials, across all products at all stages of manufacturing would be complex, with the application of such a tax being easier for a restricted range of products.

Recommendation: Without significant efforts to develop a relevant database of information, it would be problematic to apply a materials tax across the board for all materials in all products. This is likely to become possible in future, not least since the tracking of flows of carbon and materials are closely related. However, materials which are not widely traded could be targeted for taxation. In addition, those applications where materials are sold in relatively simple combinations could also be targeted. For example, newsprint, printed papers and packaging materials, could be targeted by such measures. Indeed, packaging already has been. Taxes on imported materials and

packaging could be applied in a non-discriminatory manner to facilitate border tax adjustment, with export refunds given to exporters. The potential to shift demand through such measures appears significant.

3.5 Tax (or Charge)-refund Scheme

One possible variant on the raw materials tax would be to tax all use of (a given range of) materials at the level appropriate for virgin materials. Then to offer a partial refund of the tax in proportion to the amount of PCR being consumed and at a level reflecting the differential externalities between primary and secondary production. Because the refund would be linked to the differential externalities associated with the use of the material, then the refund could readily be linked to the nature of the use, and the associated environmental benefit of that use.⁵¹

An interesting question is whether the refund should apply to all consumption, including imports, or only to the incorporation in production of PCR within the UK, which might include materials that are subsequently exported. In the latter case, importers could argue that they were being placed at a disadvantage relative to domestic production, thereby leading to possible claims that the measure was discriminatory.

The refunding mechanism could be somewhat simpler than under the tax regime since effectively, each tonne of PCR being used (in the UK) would attract a refund, albeit that differentiation by end use could take place.

Otherwise, the application of the instrument has similar features to the tax approach described above.

It should be noted that another way of achieving the same end is to set a tax that declines with the level of PCR used. The two are, essentially, equivalent. However, the separation of the mechanism into a two-stage process arguably renders the instrument simpler to administer, and this also allows for end use of the PCR to be considered.

It should be noted that a report for the EEA considered a tax which is applied to all primary material and for which revenue is then earmarked for use of PCR.⁵² This might be an interesting way to stimulate the use of PCR in the early phases of their use. The approach would lead to very high levels of price differentials at low levels of recycling, with the differential diminishing, on a dynamic base, as the use of PCR increases. From a purist perspective, this would not give certainty regarding the magnitude of the price differential. Although, this could be achieved, approximately, by adjusting the tax on primary material use as the use of PCR increased. This mechanism would have the possible merit, in political terms, of being revenue neutral in the round.

⁵¹ For example, the benefits of using glass cullet in the manufacture of container glass are greater than where the glass is used as a substitute for aggregates. Similarly, the use of plastics as a form of furniture, displacing wood, has lower benefits than using the same material in the production of new plastic products and packaging.

⁵² European Environment Agency (2015) *Material Resource Taxation: An analysis for selected material resources*

Recommendation: Like the tax-based measure, if one accepts that the mechanism could be challenged on the basis that it is discriminatory if the refund is applied only to UK based production, then the measure would be restricted to materials which are not widely traded, and relatively simple (in terms of material combinations) products / packaging. Hence, the same materials – mineral-based materials, packaging, newsprint and printed papers – might be suitable candidates. The advantage of this mechanism over the previous mechanism is likely to be the ease of administration. In principle, this measure can be designed as a tax on consumption, which is difficult to evade, combined with a refund for the activity which is to be rewarded, which in order to stimulate demand, needs to be as close to the point of use of PCR as possible.

3.6 Material-based Fee - Rebate Scheme

This kind of approach is similar in effect to a deposit refund schemes (DRS) which is defined as follows by the OECD:⁵³

“A deposit-refund system is the surcharge on the price of potentially polluting products. When pollution is avoided by returning the products or their residuals, a refund of the surcharge is granted.”

A DRS encourages the return of the materials into an organised reuse, recycling or treatment / disposal process. The producers typically finance the process through the payment of an administration fee on each item.

Drinks containers are the most common target of DRSs, though economic theory suggests the schemes could be applicable to hazardous materials and other waste streams, subject to transaction costs being minimised.⁵⁴ As Walls puts it:⁵⁵

By imposing an up-front fee on production or consumption and using those fee revenues to rebate “green” inputs and mitigation activities, a deposit-refund policy may be able to efficiently control pollution in much the same way as a Pigovian tax.

The same policy mechanism – an upfront fee followed by a rebate- can also be used to target difficult to dispose of, or hazardous, items to ensure that these do not reach the residual waste stream. This can be considered a waste prevention policy as it reduces the hazardousness of materials in the waste stream. Examples include:

- Lead-acid batteries (common in the USA, but also used Germany);⁵⁶ and

⁵³ OECD, Glossary of Statistical Terms, available at <http://stats.oecd.org/glossary/detail.asp?ID=594>

⁵⁴ See, for example, K. Palmer and M. Walls (1999) Extended Product Responsibility: An Economic Assessment of Alternative Policies, *Discussion Paper 99-12*, January 1999, Washington DC: Resources for the Future; Richard C. Porter (2004), Efficient Targeting of Waste Policies in the Product Chain, in OECD (2004) *Addressing the Economics of Waste*, Paris: OECD.

⁵⁵ M. Walls (2011) *Deposit-Refund Systems in Practice and Theory*, Resources for the Future Discussion Paper, RFF DP 11-47, November 2011.

⁵⁶ <http://www.eeb.org/activities/waste/EEB-mini-brief-deposit-schemes-for-Batteries-March2004.pdf>

- Tyres (e.g. Maine, USA, but several other States implementing similar measures).

Some countries, such as Sweden, make use of vehicle scrapping charges, which discourage the dumping of vehicle bodies in rural areas and ensure that cars are returned to registered scrapping destinations at the end of their life.⁵⁷ Many extended producer responsibility (EPR) schemes can be considered to play a similar role in that they charge obligated companies an advanced fee, and then use this to support the costs of recycling. However, the mechanisms are not always explicit and they rarely target the financial support in such a way as to bolster demand for PCR. Finally, we have previously recommended the use of such schemes in relation to the recycling of small WEEE items.⁵⁸

It should be clear that the fee-rebate scheme being envisaged is essentially a variant of the charge-refund scheme discussed above. Arguably, the only difference is in relation to the nature / magnitude of the deposit, or charge, and the way the refund mechanism works (who gets what proportion of the deposit as a refund).

Recommendation: For the reason just given, we take this measure forward as a variant of the charge/refund scheme. In principle, the mechanism is versatile, and could be used for a range of purposes. It might be more straightforward to implement than the charge/refund scheme if it can be demonstrated that it has fewer complications in terms of the potential accusation of its potential for being considered discriminatory, which might apply if the deposit is effectively charged at the point of sale.

3.7 VAT Differentials

VAT differentials can be used to give an advantage to PCR relative to primary ones. The VAT differentials would apply only to the material being consumed, but this would be reflected in VAT payments as the materials are processed in subsequent stages. There are two possibilities for implementation. Either reduce the rate of VAT applicable to PCR, or disallow the offset of input VAT that a company is charged on purchases of primary material against their output VAT liability

VAT differentials do not bear any relation to environmental impact. Similarly, they are necessarily limited, in their magnitude, to the proportion of the price of the material covered by VAT: if externalities are a higher proportion of the material value, then the existing level of VAT effectively becomes a constraint on the level of the tax. The approach does, however, shift relative prices in favour of PCR. As such, the rationale for the measure is really to provide a “signalling device” to encourage the greater use of PCR.

⁵⁷ The (sometimes temporary) scrapping charges which have become popular across nations in the context of the current economic decline have their precedent in the more permanent schemes which some countries employ to ensure that end-of-life vehicles are returned to an appropriate recycler.

⁵⁸ E. Watkins, D. Hogg, A. Mitsios, S. Mudgal, A. Neubauer, H. Reisinger J. Troeltzsch, M. Van Acoleyen (2012) *Use of Economic Instruments and Waste Management Performances*, Final Report, 10 April 2012

The application of VAT differentials may be less than straightforward in the context of traded materials: imported goods may or may not incorporate VAT in their pricing, and it would be difficult to understand the share of this which related to primary materials use. To the extent that it was considered relevant to resort to border tax adjustment, to maintain competitiveness of UK industry, then this would not be straightforward.

Recommendation: We do not propose this measure for further consideration.

3.8 Recycled Content Targets

Recycled content targets could be established for specific products, or more generally, for a specific material. In the former case, the use of the targets would be expected to pull more recycled material into consumption for the specific purpose. This could have the effect of simply shifting demand for the recycled material away from one purpose and towards the one targeted by the measure. A more general application of a recycled content target, applied across materials, would be somewhat less vulnerable to this effect, but the effect could possibly be to see demand for PCR increased in one country relative to another.

The minimum recycled content target could be imposed at different points in the value chain and could be applied to materials manufacturers, end use manufacturers, or even to retailers, though this seems less likely. Of these options, likely the most feasible in terms of flexibility and administration, would be an average standard on UK manufacturers and importers. This allows some degree of flexibility to producers in how they meet the target as it would mean that the recycled content standard would need to be met only on average across the range of production. As such, where inclusion of recycled content is more expensive, or more challenging, this could be compensated for with higher (than the target level) recycled content in other products.

One benefit of a recycled content mandate which enforces a level of recycled content is that it is robust to fluctuations in the price of raw materials, in the case of plastics, of crude oil.⁵⁹ In this instance, there is some surety for reproprocessors of the demand for PCR. This contrasts to voluntary targets of a comparable nature whereby producers may revert to use of raw materials without sanction.

Recommendation: We have not considered this measure further as we believe that in its most targeted form, any reported benefits might simply arise from shifts in the location of use of PCR, rather than enhancing demand overall. In the broader approach, we believe that the tradable credits approach (see below) offers an opportunity to introduce incentives into the scheme, also allowing for efficiency gains to be made in delivering a given target.

⁵⁹ European Parliament (2017) *Plastics in a Circular Economy - Opportunities and Challenges*, 2017, [http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/603940/EPRS_BRI\(2017\)603940_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/603940/EPRS_BRI(2017)603940_EN.pdf)

3.9 Tradable Credits for Using PCR

One way in which the above material-based target could be introduced is through using a tradable credit scheme. This would allow for an economically efficient means of achieving a target, ensuring that producers who are not contributing to the overall target are effectively contributing financially to the meeting of the target.

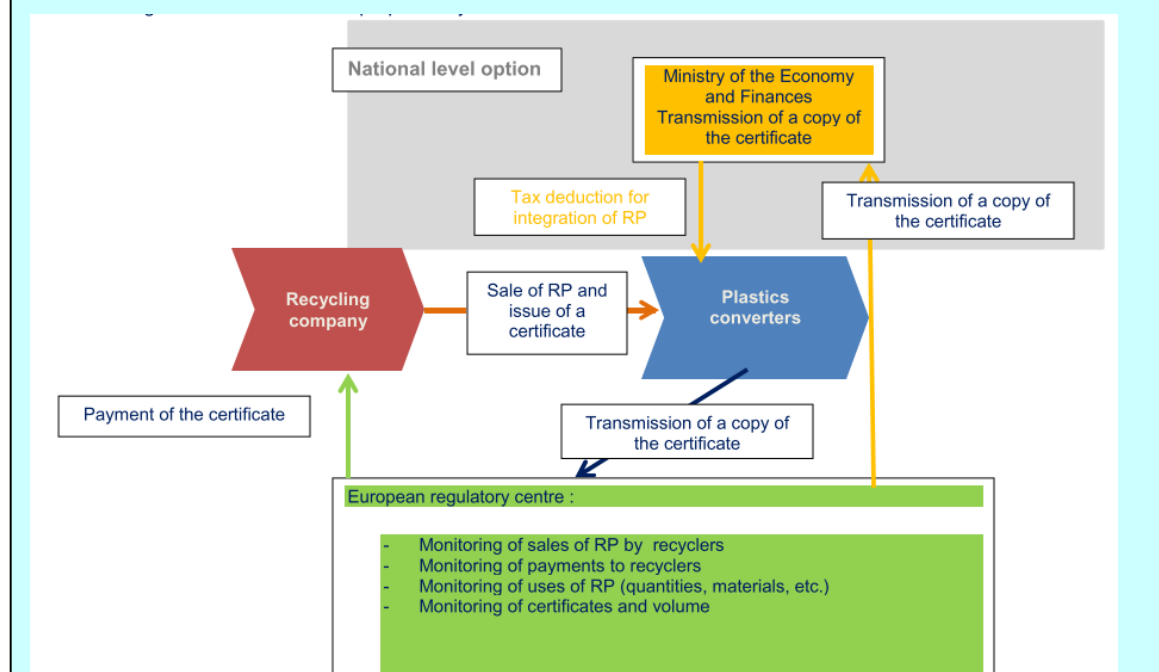
Under this approach, a material-based PCR target, for a given range of applications, would be supplemented by the use of a flexible implementation mechanism, in the form of credit trading. An overall target would be established for the PCR content of production by UK manufacturers and importers. However, individual manufacturers, or importers, who were using a higher level of PCR than was specified by the standard would generate credits, which could be sold to others. The purchaser of the credit would be entitled to use this as evidence of contributions towards meeting their target. There would be no restrictions on who could generate credits, or to whom these could be sold (e.g. UK manufacturers can trade with one another, and/or with importers). The credits would be expected to achieve a value in the market which was linked to the marginal additional cost of integrating PCR into production.

In a variant of this approach, Eunomia has previously given some consideration as to how the carbon savings related to enhanced recycling could be valorised through generating credits which link to the value of emissions reductions, either through the EU-Emissions Trading Scheme, or through other market mechanisms.⁶⁰ The French-based Association for Action on Chemicals and Recycling (2ACR) has been working with ADEME to work up this approach in more detail. The mechanics envisaged by 2ACR are shown in the Box below.

⁶⁰ This has been considered in work for the metals recycling industry, and for the plastics recycling industry.

France – Developing Financial Support Mechanism for Increasing Use of PCR for Plastics Industry⁶¹

The France-based Association for Action on Chemicals and Recycling (2ACR) is working closely with the Ministry of Environment on developing a financial support mechanism, Orplast, to address the cost gap between virgin and secondary plastic raw material. The proposed approach is for a pan-European mechanism utilising "recycling certificates" issued by European recyclers to their customers, which are then redeemable by the purchasing companies. The certificates would state the quantities of recycled plastic sold to the converters and the associated environmental benefits such as avoided greenhouse gas emissions, as well as energy savings. These savings would then be transferred to the overall material/product price. A diagram of the intended mechanism is below.



Recommendation: This measure is taken forward for further consideration.

3.10 Eco-modulation of PRO fees

There has been much discussion around the eco-modulation of fees in producer responsibility schemes especially for packaging. The amended Waste Framework Directive includes, under Article 8a(4)(b), suggests specific criteria should be taken account in fee modulation for producer responsibility, namely: durability, reparability,

⁶¹ http://www.2acr.eu/content/download/1600100/18695043/file/2017-07-27_Proposition-de-mecanisme-EN.pdf

re-usability, recyclability, and the presence of hazardous substances. This provision also indicates that fee modulation should be applied, where possible, for individual products or groups of similar products.

In principle, fee modulation can be used to incentivise the use of recycled materials: lower fees would apply to products where (different levels of) recycled content were used in the product or packaging. This is already the case for paper and card packaging in the French system (CITEO – see Section 2.2.3.1). This gives a financial incentive for the use of recycled materials.

In the context of PRO schemes, where the main objective is cost recovery, modulation may be constrained by the need to achieve an overall level of cost coverage. If modulation generates incentives which are too great, this could stimulate the market so strongly that the cost recovery objective is not met. However, this could be overcome by structuring fees to ensure an additional margin of revenue generation and periodically adjusting fees to minimise any surplus.

As with other measures described above, there would need to be a clear mechanism in place allowing for verification of the recycled content.

Recommendation: It is understood that the European Commission is currently in the process of developing guidance regarding the way in which eco-modulation should be applied to some key waste streams. The Waste Framework Directive indicates that the Commission will consider introducing a delegated act if the pattern of introduction of eco-modulation fragments the single market. Eco-modulation presumes the existence of EPR schemes. The UK's scheme is currently under review. Whilst the potential for eco-modulation to support the use of recycled content is clear, we do not consider it further in this study: in principle, eco-modulation can add support to any of the measures considered in Section 4.0.

3.11 Moving Towards a Unified Compliance Regime

There have been several attempts to describe why a market orientation is important in the current system. Yet the only 'market' which is created by existing scheme is the market for PRNs and PERNs. A report by the dominant compliance scheme, Valpak, indicates how ineffective this measure is in generating significant increases in recycling and reprocessing.⁶² A rational response to this observation might have been to accept that whatever market was developed under the existing scheme, it has not been especially effective and was probably created 'for the wrong thing', or equivalently, 'in the wrong place'.

In Valpak's 2025 report, the benefits of competition are described as follows:

The UK's market-based, competitive packaging compliance system delivers the lowest cost system to producers of the six European countries studied. (Please see Section 5.5 and the Appendices for some indication of the total costs of the

⁶² A. McCaffery, H. Thomson and M. Jefferson (2017) Packflow 2025: Full Report, September 2017.

systems studies, not just the costs to producers). One of the key reasons for this is because the UK system is designed to move towards £0 subsidy once the recycling target is met. In other countries, a fixed fee is generally paid on all packaging collected, whether the target has been met or not. Low costs to producers are further achieved due to the fluctuating supply-demand driven PRN prices.

First of all, the point being made has nothing to do with the overall cost of achieving a given target, and everything to do with keeping the costs to producers down. This has nothing to do with the PRN / PERN market, and much more to do with the fact that producers are paying for completely different things here in the UK to what they are paying for in other countries. In the UK, what producers pay is unrelated to the overall costs of delivering the necessary infrastructure. The terminology is also incorrect. The reader is being asked to consider the payments by producers as ‘a subsidy’ to recycling. The point is that the cost of achieving a given level of performance is simply not being funded by industry, but by local authorities. The question of ‘subsidy’ does not arise. Rather, it is a matter of who covers the costs of meeting a given target.

The report then makes a rather odd claim:

The market based system has also delivered full net costs for some packaging materials, whether by design or not. For example, an estimate of the cost of collection of aluminum cans by a local authority (LA) is £300 per tonne, including baling and sorting. The current value received for a tonne of baled aluminum cans is £850, which leaves a positive value of £550 per tonne, meaning that more than full net costs are covered. In the current UK system this positive income stream will go to the local authority and the compliance scheme will pick up the administrative cost, which is reflected in the PRN price.

The suggestion that the reader is being invited to make is that somehow or other, ‘the market based system’ delivers this outcome. Once again, none of this has anything at all to do with the UK’s producer responsibility scheme. The ‘market-based system’ being referred to appears to be ‘commodity markets’. It is also unclear what this is being juxtaposed with: there are no producer responsibility systems, to our knowledge, that seek to ‘face down’ the influence of commodity markets. Indeed, because the PRN price shows no sign of compensating for shifts in material prices, but other producer responsibility schemes effectively give ownership of materials to the schemes, then those other schemes have a far stronger orientation to ‘real world’ markets than does the UK’s PRN / PERN scheme: PRN / PERN prices are not linked to commodity prices.

In summary, it remains completely unclear what it is that people feel should be retained in the existing market-based system. The one ‘market’ created is:

- **thin** - a small proportion of transactions take place in the open market, making the market susceptible to influence by strategic purchases and sales;
- **extremely volatile** - the price of PRNs and PERNs are more volatile than oil prices
- **unable to achieve what was intended for it** - the PRN / PERN market is too unstable to foster meaningful investment.

For this reason, the foundational principle of a new producer responsibility scheme should be that it embraces the market where the market has a role to play in reducing costs without jeopardising the quality of outcomes.

3.11.1 Compliance Schemes

Recognising that a desirable feature of any system would be to introduce competition where it delivered clear benefits, then it seems reasonable to ask whether the existing system passes this test. The basis for competition in the existing scheme is that compliance schemes compete:

- a) for custom from obligated companies to be the scheme responsible for delivering compliance. The main basis for this is expected to be ‘cost of delivering compliance’, although the frequency of switching between compliance schemes is known to be low: scheme’s compliance fees are not widely advertised. Some schemes are clearly seeking to compete on wider issues, related to the traceability of outcomes, or the location of reprocessing, in order to attract custom;
- b) with each other, to secure the requisite evidence in the form of PRNs and PERNs. The way in which transactions are undertaken to buy and sell PRNs and PERNs is not always clear. Many ‘transactions’ take the form of a gentleman’s agreement, and the proportion of PRNs and PERNs that are bought and sold on the open market is small. The potential for the exercise of market power is significant.

These two areas are not unrelated, of course: to the extent that schemes close good deals with reprocessors / exporters to supply PRNs, or to the extent that they generate PERNs at low cost / strike good deals for PERNs, then they are more able to compete for ‘customers’ on ‘cost of delivering compliance’.

At one level, this seems a perfectly reasonable area for competition to take place. It must, however, be questioned as to whether the wider features of the scheme, and the lack of adequate oversight of the quality of reporting what is recycled, combined with features for which the schemes themselves have no responsibility, the differential treatment of PRNs and PERNs, compromise the nature of the outcomes. Furthermore, the competition across schemes, makes any form of strategic view across the entirety of the supply chain more or less impossible. No one scheme faces incentives that justify long-term investment, or indeed, much by way of long-term strategy other than in the purely commercial sense.

Given these points, ‘competition’ across compliance schemes should not be considered as a cornerstone for any scheme. On the contrary, there may well be very good reasons for consolidating the compliance function within a single scheme, whose principle role would be to act as a conduit for fees paid by obligated producers to those, such as local authorities, incurring costs. One can reasonably ask whether ‘giving evidence value’ has really helped when the quality of the evidence being generated has been so questionable.

3.11.2 Taking Responsibility for Collected Materials

To the extent that producers are going to cover the costs of collection, for example, of packaging from households, then this cost is effectively removed from the purview of local authorities. Producers would not be expected to do this without seeking to benefit from the revenues generated from the collected materials. There are some important ramifications of this:

- First, the instability of revenues associated with the sale of dry recyclables in the period over which contracts for collection are agreed between contractors and authorities is placed with the system itself. This means that implicitly, this risk would be transferred to producers. As we have argued elsewhere, they are the more appropriate actors to be taking on this risk. The net cost to producers would rise and fall as PCR revenues fall and rise, respectively. This means that the producers' contributions will need to be higher when commodity prices are lower, and vice versa. Note that the existing scheme has largely failed to provide any meaningful support of this nature. Logically, if the PRN / PERN price was doing what was intended for it, prices should have risen in times of lower commodity price. The absence of this response reflects the fact that the costs of collecting materials are effectively determined completely independently of PRN / PERN markets;
- Second, the issue of where and how a producer responsibility scheme takes over responsibility for marketing recyclables becomes a relevant issue that needs to be resolved. This clearly affects the scope of what the scheme should pay others to do, and what activities the scheme should arrange for itself.

The last of these points bears some examination. Where packaging is concerned, for example, local authorities can contract for the collection of waste only, with requirements for sorting services procured separately, or for collection as well as sorting. For many local authorities opting for commingled services, our understanding is that the contract for sorting is probably more often separate from the arrangement for collection. As such, whether collecting dry recyclables 'commingled', or through 'kerbside sort' schemes, it might be appropriate for a scheme to pay local authorities for the collection service, and then for the scheme to arrange and pay for sorting, and to be responsible for (and be the beneficiary of revenue from) the marketing of PCR.

3.11.3 Facilitating Investment in Sorting / Reprocessing

There remain concerns that the whilst much of the export of plastics for recycling is legitimate, the losses of materials from the point of export to the point where materials finally enter a recycling plant may be significant. Naturally, this is the way that Article 6a will require recycling to be measured in future. Although the details for this measurement are not yet clear, it seems likely to make meeting the targets more difficult, and reduce currently reported rates of plastic packaging recycling, potentially quite considerably.

As long as the UK retains a system whereby a number of schemes offering compliance related services are competing, then it seems more likely that the scheme will be

focused on delivering the least cost approach to deliver the requisite evidence. As suggested above, the basis for and logic of, this competition remains unclear. None of the compliance schemes exerts any influence over the procurement of the recycling services by local authorities for example. In this respect, there is no influence on the actual costs of compliance. Competition is a meaningful concept only to the extent that the evidence can be generated more or less cheaply by one scheme than another. In the current scheme, other things being equal, the logic of the incentives in play is that at times when PRN prices are non-zero, the compliance schemes export materials, notably plastics, with as high a content of non-target material as they can get away with. This will typically have incurred lower costs in the sorting stage and will maximise the revenue derived from PRNs. Obviously, the terms on which the materials are accepted by the receiving company are also relevant, but if the scheme was not under pressure to ensure the materials were recycled at all, then presumably, the recipient's terms might be invariant to the quality of what is being exported.

In the process, what is lost is the potential for implementing some form of coordinating mechanism to ensure that the collection, sorting, and reprocessing of materials takes place with a clear focus on the quality of the output. The UK scheme is clearly not 'a commodity operation'. Rather, it is a 'what can we get away with in order to demonstrate compliance' operation.

A single non-profit entity, with appropriate governance arrangements in place, such as prominent board representation on the part of obligated producers, could help to ensure that all the materials collected under the scheme were directed to credible reprocessors. Indeed, unencumbered by uncertainty in terms of access to feedstocks, a single scheme would be in a position to put out to tender the reprocessing services it believed would give rise to high quality materials that met the demands of end-users. This could also be reflected upstream in investments in upgrading of sorting infrastructure, and the single entity also influencing the specification of a minimum level of collection service on the part of local authorities. Such an outcome is extremely difficult to envisage as long as schemes effectively compete for delivery of low-cost compliance.

Recommendation:

The ongoing considerations regarding how to reform the UK's system of producer responsibility for packaging provide an ideal opportunity to reconceive the way in which we manage PCR, especially from packaging. Given that producers will be required to pay for all or 80% of the relevant costs, then the basis for influencing the actual costs incurred in delivering the required outcomes would be limited unless competition made it more likely that schemes would enable procurement of services by local authorities at lower cost: the mechanism by which this would be achieved is far from clear. Giving a single non-for-profit scheme, with producers on the board, responsibility for sorting and marketing materials gives the producers a stake in the collection, sorting and reprocessing of quality materials. This measure is taken forward for further consideration below.

4.0 Shortlisted Policy Measures

Following the review in Section 3.0, the following measures are considered in this Section for closer consideration in terms of their potential design:

- 1) Material taxation;
- 2) Fee-rebate scheme;
- 3) Tradable credits for using PCR; and
- 4) Establishing a single producer responsibility organisation.

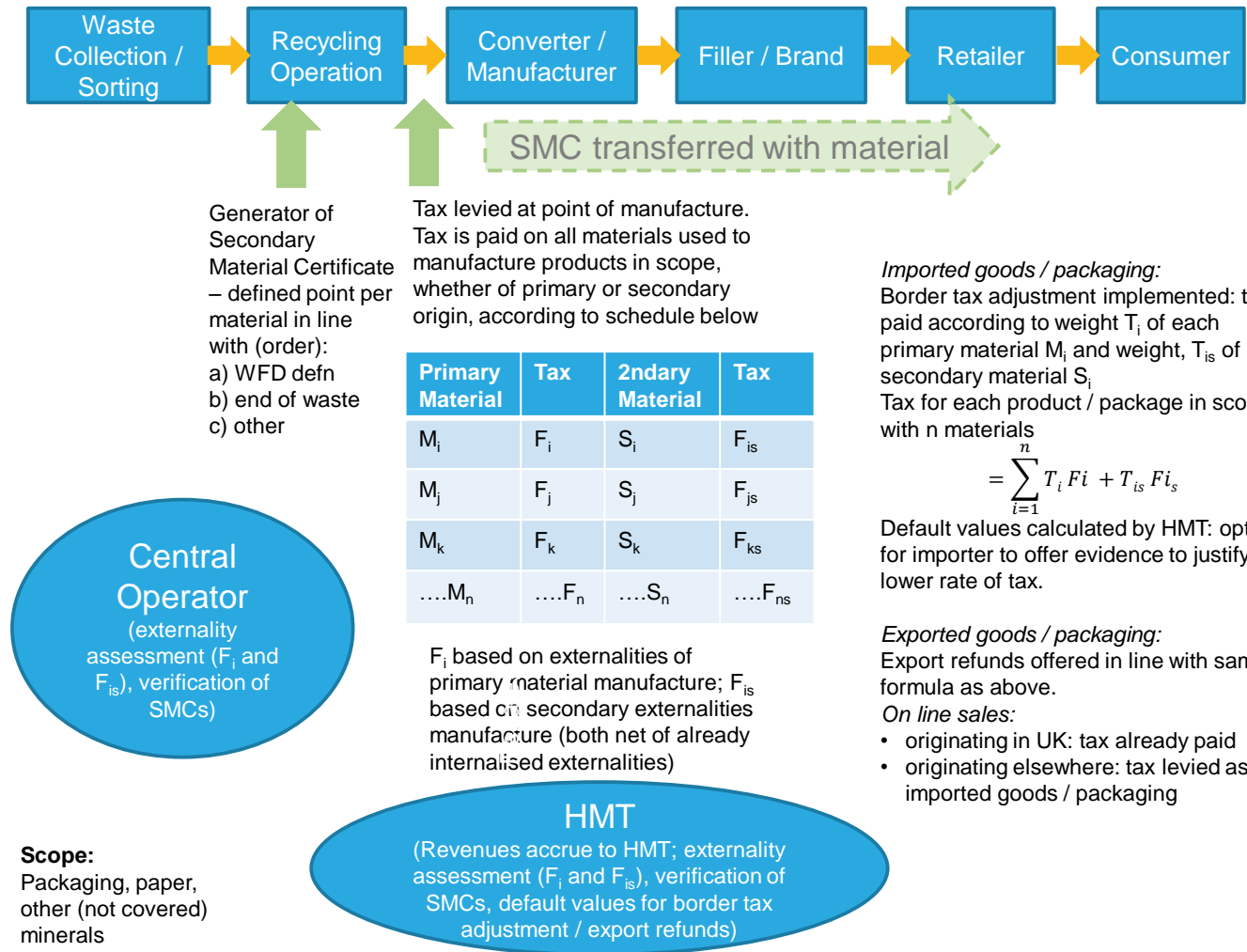
The design configurations are considered in the following pages.

4.1 Material Taxation

Material taxation is based on a simple principle; a cost per unit is applied to the purchase of the raw materials and PCR in scope, reflecting the externalities of primary and secondary manufacture as appropriate. The revenue generated as a result would accrue to HM Treasury. The key design features are shown in Figure 4-1. In this option:

- The option includes identification and internalisation in the product price of the environmental cost of primary and PCR production.
- This should create conditions whereby the use of PCR is made more favourable, in economic terms, relative to primary materials.
- The taxable event is the first sale or use of primary or PCR. This might be where they are used to manufacture products or packaging.
- The tax payable would vary according to whether the material used was of primary or secondary origin. The applicable tax rates, per unit weight, would vary by material, and could be linked to the externalities associated with primary and PCR;
- In order to verify the origin of material as 'secondary' in nature from a PCR source, a Secondary Material Certificate (SMC) is proposed which is generated at a defined point in the material supply chain, and is, subsequently, transferred along with the material. This SMC approach is used in all the measures proposed.
- To ensure domestic producers are not placed at a competitive disadvantage, border tax adjustments (BTA) would be required with this measure. This would allow domestic exports to be exempted from the tax, but would require all imports to be taxed in line with the schedule for the tax.
- The information requirements for such a BTA are somewhat demanding, especially since imported products and packaging can arrive in various stages of the production process. Default levels for the adjustment could be set, with options for importers to offer up evidence in support of their case for a lower level of tax.

Figure 4-1: Design Option for a Materials Tax



Given the fact that complexities of the BTA would increase with the complexity of the product and the range of materials used, then for the foreseeable future, the main targets would likely be packaging, paper, and perhaps, some minerals not yet subject to tax under the aggregates tax.

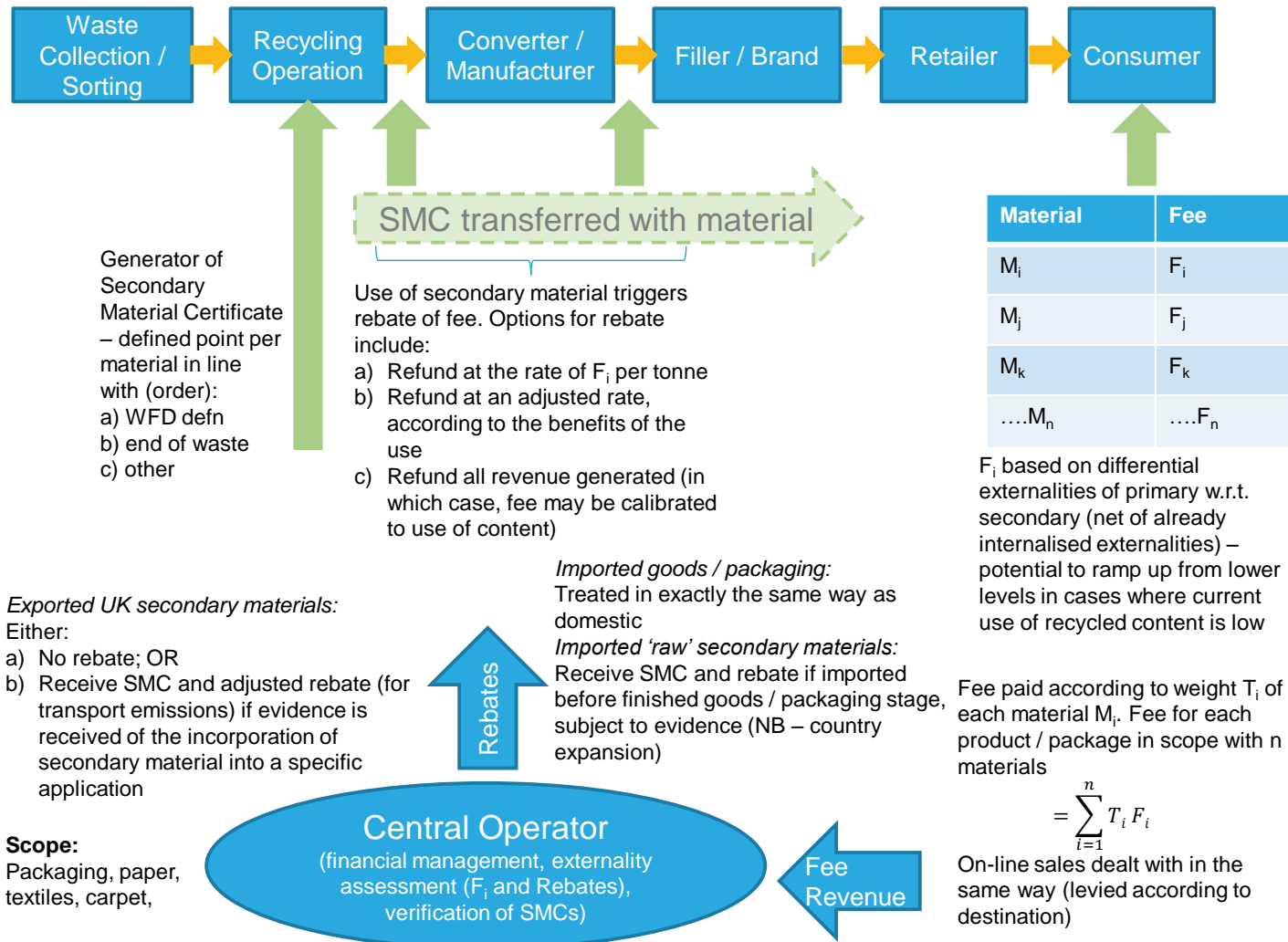
4.2 Fee-Rebate (Feebate) Scheme

This policy measure takes the approach of introducing a levy on all use of (a given range of) materials, but then offers a full or partial refund of the levy on the basis of the amount of PCR being used.

- As illustrated in Figure E-1-2 the proposed design is that a levy is implemented at the point of consumption;
- The levy rate could be based, for example, on the differential externalities of primary production compared to secondary (before already internalised externalities), or on the level of externalities associated with primary production;
- In order to verify the origin of material as 'secondary' in nature, from a PCR source, a Secondary Material Certificate (SMC) is proposed which is generated at a defined point in the material supply chain, and is, subsequently, transferred along with the material;
- Depending on the level at which the levy was raised, it would be fully or partially rebated where PCR was used in the manufacture of the product or packaging. The SMCs would be used as evidence against which the rebate would be made;
- There are then several options for how the rebate would be paid:
 - where the levy was raised at the level of the primary material externality, the rebate would be made in line with the differential externality (externality associated with primary production minus externality associated with secondary production);
 - where the levy was raised at the level of the differential externality (as in the Figure), the rebate could be made in full. However, one possibility would be to differentiate the rebate according to the nature of the use of the PCR and the associated environmental benefit of that use.
- This would require the holder of the SMCs to also demonstrate the nature of the application to which the material was put. This would incentivise the use of the material in the applications generating the highest benefits.
- For imported goods / packaging the measures could be applied in the same way as domestic whereas for imported 'raw' materials then a SMC could be issued and rebated subject to provision of adequate evidence. For exporters either no rebate would be paid, or an adjusted rebate, accounting for the relevant transport emissions, could be paid.

The level at which the levy is set would have impacts for the way in which revenue is captured, and hence, how it is collected. On a per unit of packaging basis, for example, collecting the levy revenue through sales would not necessarily be appropriate (for example, an item of packaging might be subject to a levy of 0.1p).

Figure 4-2: Design Option for a Fee-Rebate System



Given this point, the alternatives would be either: a) to set the levy at a level high enough so that the levy on items was not fractions of a penny, which, assuming a high level of rebate, would lead to a very strong incentive not only to use PCR, but to design the product / packaging so that it was readily recyclable, or b) to set the levy at a lower rate, and collect the fees indirectly: where producer responsibility schemes are in place, reporting of quantities sold / placed on the market would offer a route to collection of the revenue.

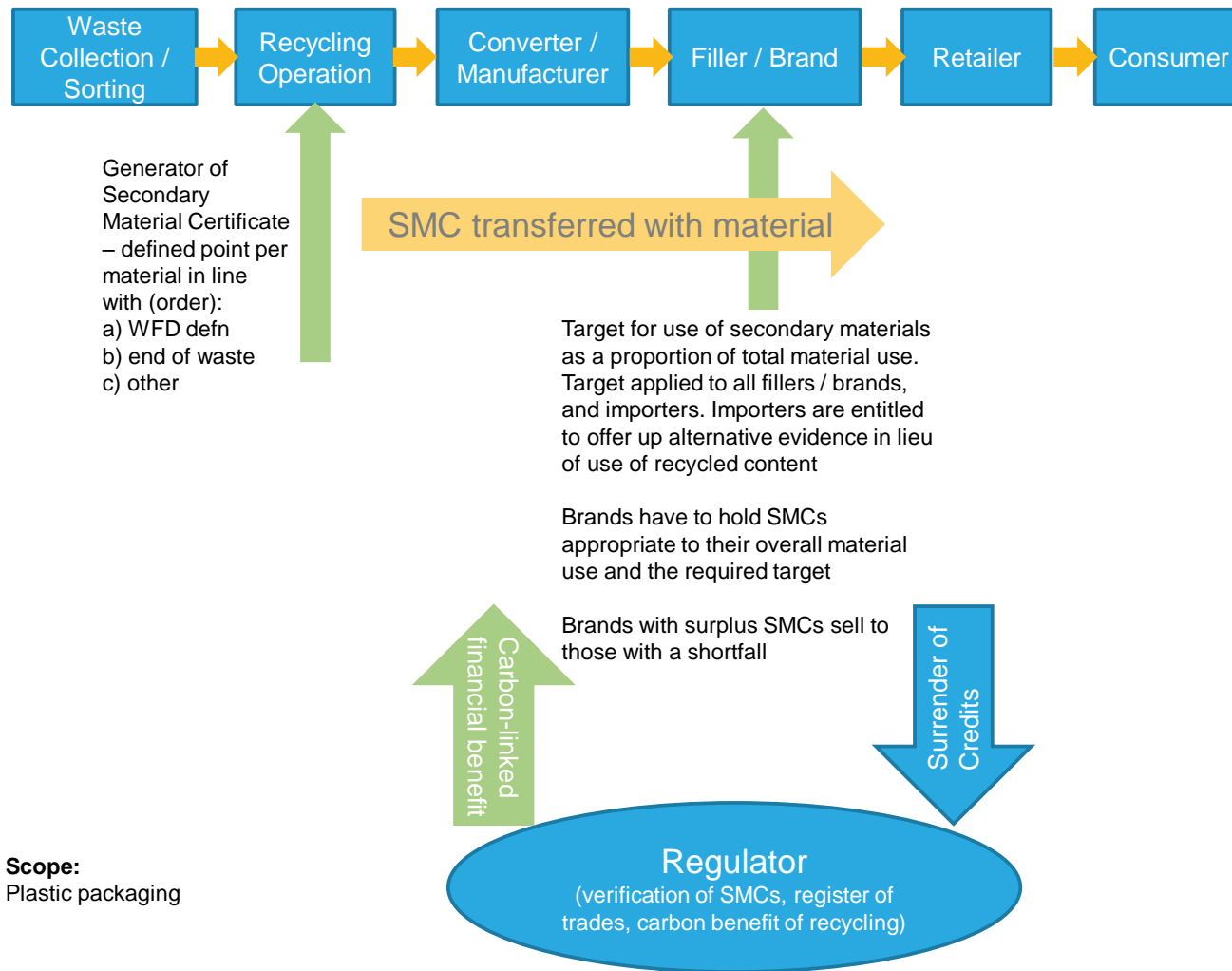
4.3 Tradable Credit Scheme

In its most focussed form, a recycled content target risks simply shifting the location of use of PCR, rather than enhancing demand overall. If the material coverage is broadened, a tradable credit scheme offers the opportunity to introduce incentives to increase the use of recycled materials, whilst allowing the target to be met in the most efficient way, thus also enabling the target to be met by those for whom use of PCR was most straightforward.

- This approach would set a material-based PCR target, for a specified range of applications, covering production by UK manufacturers and importers (e.g. 30% of plastics used in packaging);
- The manufacture of PCR would trigger the generation of a Secondary Material Certificate (SMC);
- Use of PCR would entitle the user to receive the SMCs relevant to the amount of material used;
- At least three options for enabling the credits to realise value are available:
 - Each individual producer would be required to hold a number of certificates equal to the overall percentage target. Those with insufficient credits would have to purchase them from others;
 - A variant on this (shown in Figure 4-3), is linking the value of credit to the carbon savings from utilising a PCR, either through the EU-Emissions Trading Scheme, or through other market mechanisms⁶³; and
 - A further variant, where a fund is established for making rebates via a levy on the materials sold. However, this essentially becomes a passive form of trading which becomes more or less identical to the fee rebate scheme described above.
- The treatment of imports and exports would be as for the fee/rebate scheme above.

⁶³ This has been considered in work for the metals recycling industry, and for the plastics recycling industry.

Figure 4-3: Design Option for a Tradable Credit System



In the example shown, where the credits are linked to CO₂ benefits, the application could be relatively widespread. However, as with the tax example, this would make the required calculations more complicated as materials increase in complexity.

4.4 Establishing a Single Producer Responsibility Organisation

As noted in Section 3.11, there are reasons to believe that the current system in which compliance schemes compete for evidence of compliance with recycling targets, delivers far from optimal outcomes for the overall system. The absence of coordination is illustrated through the contrast between Figure 4-4 and Figure 4-5.

The former highlights the role of multiple compliance schemes in seeking to attain least cost compliance on behalf of their customers. The system offers no basis for stable relationships between the multiple compliance schemes and the off-takers of material if the market is genuinely competitive: where the market is not competitive, the relationships may be stable, but allow for the exercise of market power. There is little or no impact at all of the scheme on the costs of, or quality of, collection and sorting services, and no reward for schemes which seek to enhance quality. This is mainly because to achieve this is a) not straightforward, and b) to the extent that it was not, it may increase costs. This situation could be sustained in a situation where full cost recovery is required, but with limited rationale for the competition which currently exists.

In the latter Figure, a single scheme takes responsibility for materials, and has an interest, in the form of reducing fees paid by producers, in realising value for the materials collected for recycling. Arguably, this arrangement makes it possible to procure sorting and reprocessing infrastructure for a time period consistent with the nature of the required investments. It also makes it possible to support investments in the former to improve the quality of materials, or the yield of materials of the same quality. The control over materials enables the scheme to call on the market to deliver services which are consistent with the interests of the producers and with the objectives of the scheme.

This arrangement is not inconsistent with any of the above options. Indeed, it can complement them. It embraces the use of markets, through going out to the market for procurement of services, where these deliver value to the system. Not least since this value would accrue to the producers, who fund the costs, not of revenues, of the scheme's operation. Indeed, it allows for the nature of competition to be made consistent with the delivery of high-quality material for reprocessing, rather than, as now, competition happening in a market for compliance where the drivers are not aligned with maintaining quality, nor stability in the supply of feedstock that is required on the part of would-be investors in reprocessing infrastructure.

Figure 4-4: Current System – Multi-compliance Schemes Lacking Upstream Linkages

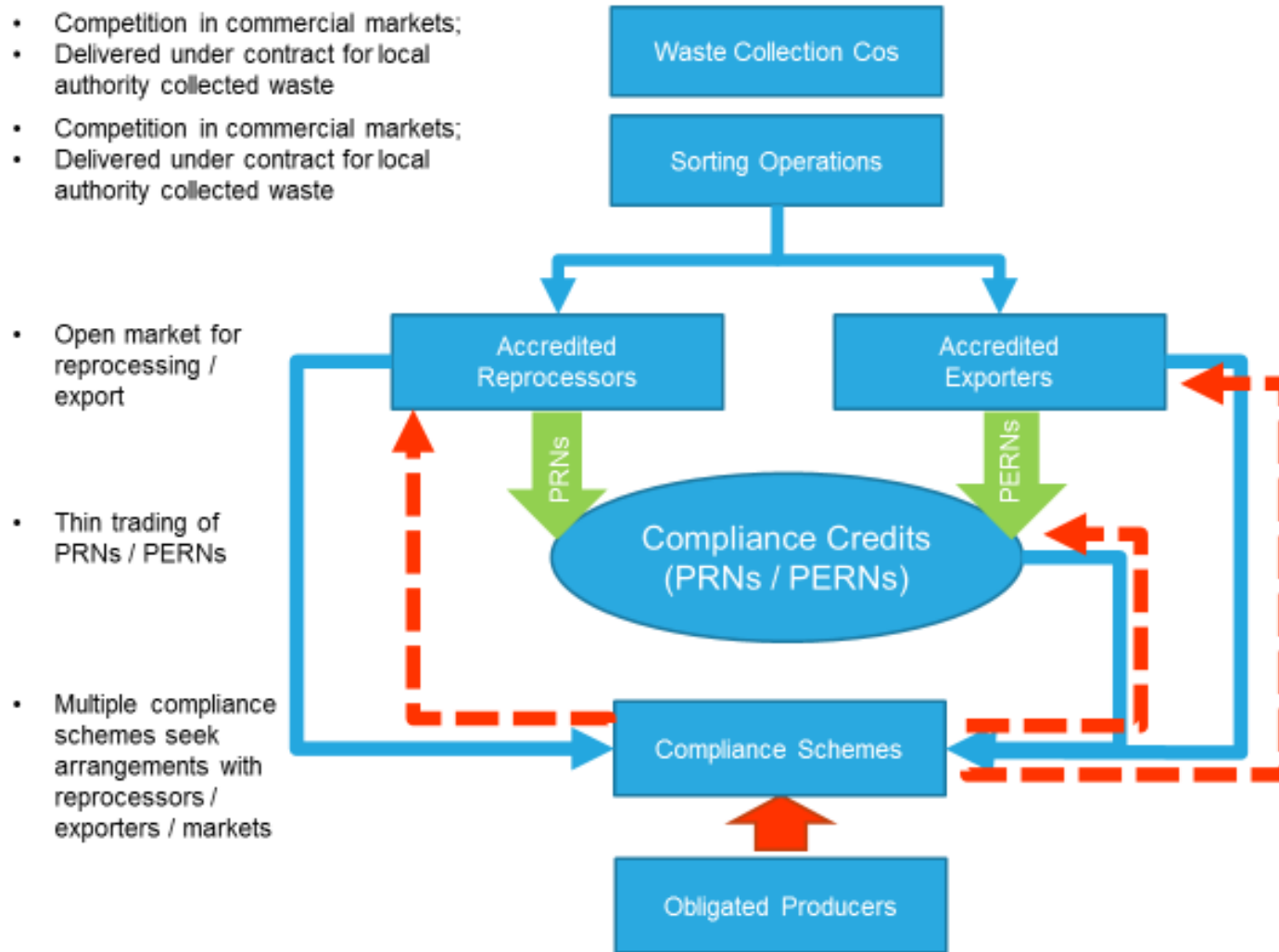
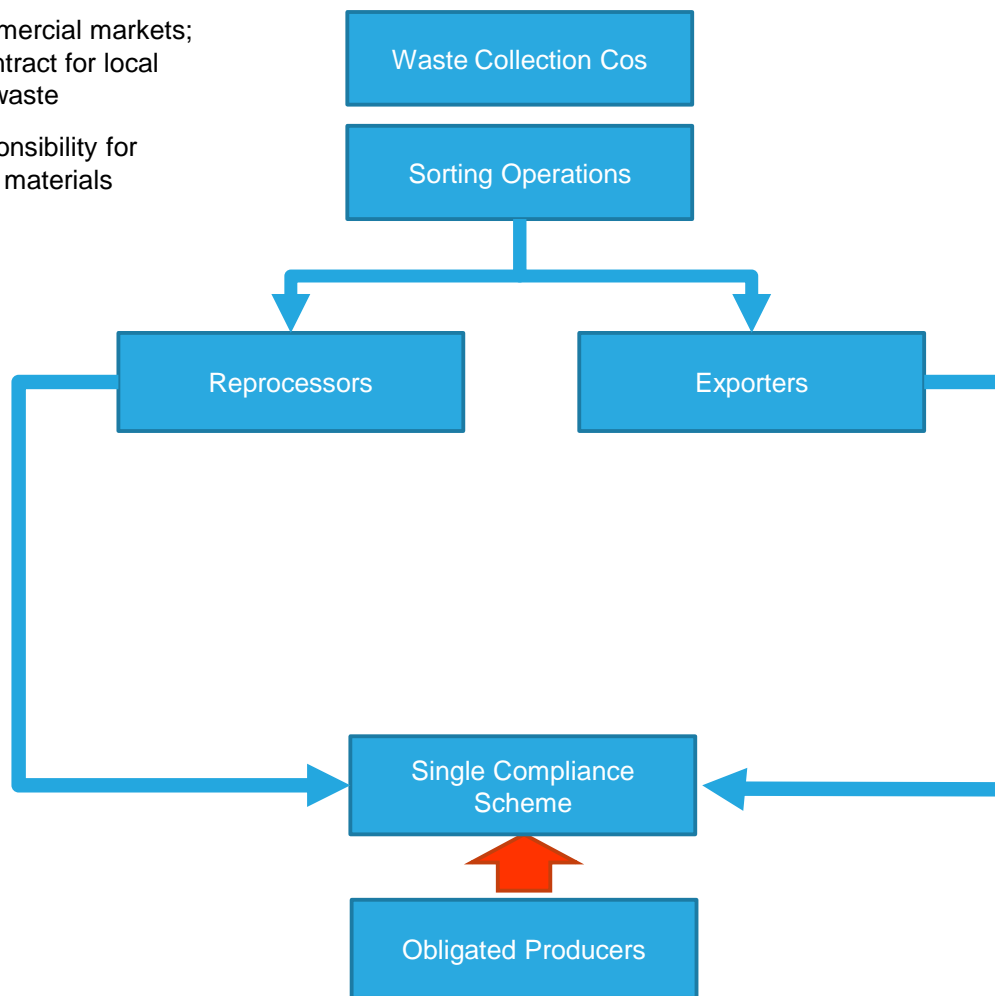


Figure 4-5: Future System – Single Compliance Entity with Responsibility for Arranging Sorting / Reprocessing of Materials

- Competition in commercial markets;
- Delivered under contract for local authority collected waste
- Scheme takes responsibility for arranging sorting of materials

- Scheme procures services for reprocessing / export

- Single compliance scheme procures services for sorting, and reprocessing domestically / overseas: benefits from material value and passes on the producers



The scheme harnesses competition so as to procure activities which can be designed to deliver quality of, and higher value for, the materials being collected, sorted, and reprocessed. The producers and the scheme representing them, have a financial interest in the value derived from the recycling of materials.

This could also be considered a 'fall back option' if the policy measures proposed above are not pursued. The aim is to overcome some of the failures in coordination of linked markets in the current system to encourage investment in quality systems for collection, sorting and reprocessing.

5.0 Conclusions and Recommendations

5.1 Key Conclusions

Of the above options, the attractions of a 'close to first best' solution, in the form of a materials input tax, are tempered somewhat by the complexity of the required BTA, and the need to understand the primary and PCR content of all materials imported and exported. We believe these information requirements will be progressively overcome and that in the future, this will allow for the application of this type of approach, based on the use of technologies such as blockchain, allowing information regarding products to be passed along the supply chain, irrespective of the complexity of the manufacturing process.

The tradable credit scheme offers a more flexible approach than one or more standards for product-specific PCR. The value of the credit could be linked to CO₂, but this is complicated by the extent to which the externalities related to CO₂ emissions are already internalised through the EU-ETS, or, on leaving the EU, an alternative measure, which might be tax-related. There might be concerns, therefore, that the interaction complicates an already complicated policy landscape with respect to climate change, albeit that the occasion of leaving the EU offers an opportunity to simplify, and hopefully, re-invigorate, the policies designed to combat climate change.

A second option, which might be politically attractive in that it would retain an element of 'compliance-related trading' in the UK scheme when the arguments for multiple schemes in their current form seems rather weak, would be to require each producer of the targeted products / packaging to acquire the credits, and to allow these to be traded on the open market. However, this leads to an uncertain magnitude of the incentive and would require some careful tuning of the target to retain a given level of incentive.

A third option is to link the value of credits to a defined value, the fund for which is generated from a levy on all packaging. This becomes equivalent to a fee-rebate scheme, which is effectively a form of passive trading. Here, the credits have a value which can be fixed and can vary according to the use to which the PCR is put, giving some stability in terms of the incentive and allowing it to vary with the nature of the use of PCR. For example, those delivering the greatest environmental benefit receive the highest rebate. **On balance, this is the option we prefer on the basis of its versatility in design, its reduced administrative complexity relative to the tax-based measure, and the stability of the incentive it gives.**

We believe that the move to a single compliance scheme for producer responsibility for packaging would help to secure the benefits of the measures we have discussed. Indeed, we believe it is part of the system which ought to be considered as complementary to the other three front-running options.

5.2 The Merits of Joint Action

Although we have considered a scheme for the UK, there is clearly wider interest in supporting the development of markets for recycled materials. Indeed, a range of brands have committed to increasing the proportion of PCR used in their products / packaging. Wherever products or packaging are crossing borders, then market-based instruments would ideally function alongside credible information regarding the PCR content of what is crossing borders. The use of Secondary Material Certificates that we have proposed, or any similar accreditation scheme, would usefully be broadened beyond the UK as other countries consider similar measures. This would facilitate equal treatment at the border and ease some of the administrative complexity of the scheme.

This would be an advantage of joint action. Through accreditation of PCR suppliers, it would offer a means to make different schemes designed to reward use of PCR ‘interoperable’.

5.3 The Nature of the Targets

We have not discussed here the nature of the targets that should be set. Clearly, this will be of great interest, not least for materials such as plastic packaging where there is some uncertainty about the quantity of material which is actually collected and suitable for recycling. The expressed desire on the part of businesses, as well as the targets in the EU circular economy package, to increase recycling of plastics and the change in the measurement method for recycling, will have an impact here. In principle, targets for plastic packaging should increase swiftly over time from their currently low levels, probably of the order 10% or less (see Appendix), so as to pull through material of the desired quality for recycling.

5.4 Accompanying Measures

We highlighted a range of instruments to address market failures in Table 3-1. It is clear that the quality of information and the state of knowledge in one part of the supply chain regarding the capabilities of other aspects of the PCR supply chain, is not what it could be. Mechanisms, networks and platforms that enrich the supply of quality information have a role to play in helping strengthen demand for PCR on the part of would-be users. Inappropriate standards may also still be a barrier in some markets and applications.

Furthermore, if the UK aligns with the EU Waste Framework Directive, we noted that eco-modulation of fees will be a requirement of producer responsibility schemes. In principle, these could support increased use of PCR also. However, one possible alternative, as indicated above, would be for the feebate scheme to be based on revenues collected as a ‘top-sliced’ element of producer responsibility. Those who made use of PCR might then be beneficiaries of the rebates, assuming the benefits of these were fully or partially passed on by manufacturers. The net effect would be a form of modulation.

Finally, in respect of the measures examined in the report, it seems strange that one still needs to point out that offering subsidies, either implicit or explicit, to primary resource extraction is completely antithetical to the efficient operation of the economy, let alone one that aspires to becoming more resource efficient.

It should be noted that as far as packaging is concerned, we have already made a number of recommendations for change in respect of UK policy affecting packaging. These have been elaborated elsewhere. The policy mechanisms proposed here would help complement these changes and ensure that the UK has in place a policy framework for the 21st century, contributing positively to the 'Clean Growth' to which Government aspires.

APPENDICES

A.1.0 Measurement of Use of PCR

In implementing the measures shortlisted to increase use of PCR, manufacturers would be required to measure and report levels of use of PCR in some manner. Understanding the current approaches to measuring this, and the potential for doing so in future, is thus crucial in understanding the level of additional burden such policies might place upon businesses since they will require verification and reporting of use of PCR in some way. We engaged with a number of reprocessors and trade bodies to understand how PCR is incorporated into products at the moment and how this is measured (if at all) to understand how readily such requirements could be fulfilled given current measurement techniques. Some interviewees provided additional views on the topic which have also been captured here. Organisations engaged with included:

- British Glass
- Confederation of Paper Industries
- UPM
- Smurfit Kappa
- Alupro
- Novelis
- British Plastics Federation
- Phillip Tyler Polymers
- Axion Recycling

A.1.1 Glass

There is a common measurement standard adopted by UK industry and agreed by British Glass and UK container manufacturers for measuring recycled content of glass.⁶⁴ This is aligned with ISO14021 Environmental labels and declarations – self declared environmental claims (Type II environmental labelling). This standard excludes glass from internal process losses which is not genuine recycling. If internal process losses are included there can be a notable difference (up to 15%). The current measurement method of reporting is based upon UK manufacturers reporting to British Glass how much PCR is utilised. By extension it is assumed that manufacturers would be able to verify recycled content since they already report this, and on a day to day basis, will know exactly the amounts of different types of cullet going into the mix.

Current levels of recycled content: 38.5% (2016)⁶⁵

⁶⁴ https://www.britglass.org.uk/sites/default/files/1709_0001-E1-17_Recycled%20content_0.pdf

⁶⁵ British Glass (2017) *Recycled content – packaging*, September 2017, https://www.britglass.org.uk/sites/default/files/1709_0001-E1-17_Recycled%20content_0.pdf

A.1.2 Fibres

At a mill level, measurement of the proportion of the fibre which originates from secondary materials is relatively easy, where processing is often 100% recycled content, or 100% virgin pulp, or if blending a known blend. For products with a single component / layer, such as newsprint or graphic papers, or even, corrugated cardboard boxes sold without use of any liners, knowing the proportion of the material derived from PCR is, theoretically, relatively simple. To produce a final product where multiple layers are required it becomes less straightforward, although still possible. For example, a corrugated box contains a fluted corrugated sheet and one or two flat linerboards. These would likely both be 100% recycled content. If required for the performance of a box (e.g. to protect against dampness) a kraft board liner is added, which is likely to be made of a virgin fibre. In this case it is possible to verify the secondary material content of the end product, but to do so would require some calculation, implying an additional burden. Some producers of fibres do label, and report on, the secondary material content of their products, although many do not. Standards available for reporting this include the Forest Stewardship Council (FSC) recycled standard, which follows a certified chain of custody approach, including auditing. Currently, secondary materials content could be reported on an industry wide basis using a mass balance - which would impose a lower burden, but would not necessarily be sufficient for all the policy measures considered. A need for improved quality of fibres to achieve high levels of PCR content was highlighted.

Unlike other materials, fibres cannot be recycled indefinitely in a closed loop. As fibres are processed, there is a loss rate, and virgin fibres need to be introduced.

Concerns were expressed around the use of a PCR content labelling for reprocessors given that virgin and secondary fibres do not have the same properties and so, currently, not all applications can use 100% recycled fibres. The concerns focused around rewarding a reprocessor that was able to use 100% recycled content, if the end application was a box, whilst one that could not (currently) achieve 100% content given the application of the box would not receive such a reward. This issue is not of major significance in the schemes considered. Incidentally, it is also an issue for plastics for instance, where food contact regulations affect the ability to integrate PCR into many forms of packaging.

Current levels of recycled content: 75% (Confederation of Paper Industries estimate).

A.1.3 Metals

The creation of secondary metal content for use in downstream products occurs at the time of re-melting the collected metal ('scrap') into a form which can then substitute for primary material. Mixing of this scrap metal with primary material occurs in a furnace, so from this point, measurement becomes far more challenging as recycled metal goes into a 'pool' with primary metal, and metallurgically, it is not possible to tell the difference. At present, by the time metal sheet reaches a can manufacturer for example, there is no

way to determine the level of PCR content directly. The figures that currently exist around PCR content of metals are based upon a mass balance approach (e.g. amount of primary material coming into production, recycling capacity of plants) which are estimates, and not accurate in 'real time', or for specific items, since the information around the level of PCR content is not linked to the specific piece of material (partly, because it is not required to be).

Metal Packaging Europe has issued an external position statement on PCR content outlining the lack of existing techniques for measuring recycled content in finished products. The position statement also outlines that the objective of the metal packaging industries is on boosting End of Life recycling in a closed material loop and that a recycled content approach is deemed by Metal Packaging Europe to be inappropriate for metals given that the demand for scrap exists, and economic incentives are already adequate for the industry.

Current levels recycled content: Valpak estimates recycled content for aluminium packaging to be 39-40% and for steel packaging, 59-62%⁶⁶. European Aluminium estimates recycled content to be 40-50% for aluminium.⁶⁷

A.1.4 Plastics

Plastics processors, also known as converters, purchasing plastic for manufacturing plastic products will, through the purchasing process, be aware if what they are purchasing is (sold as) PCR content, and could therefore, track and report upon the PCR content of a final product, albeit with some additional calculation required if the end product has multiple components. There is no common measurement standard for PCR content of plastics, and as for many other materials, there is no practical way to verify the PCR content of an end product by directly checking it. Therefore, any requirement to use PCR, or associated incentive, would need an audit trail to validate that material purchased as secondary material truly is what is claimed. The ease with which this process can operate is determined by the nature of the specific supply chain. For example, for Coca Cola, with its joint venture Clean Tech facility, which takes PET plastic packaging sourced from households and Local Authorities and converts it into plastic bottles, this verification is simpler whilst a processor purchasing flakes from an overseas market would require a greater level of due diligence to verify the extent to which the flakes being supplied to them are from secondary material.

The plastics industry is reporting a clear demand for increasing PCR content, and reporting on PCR content to consumers, and notes that there is currently an insufficient volume of PCR-derived material of the required quality, and therefore, significant volumes are being imported to meet demand.

⁶⁶ Valpak *PackFlow 2017*

⁶⁷ European Aluminium (2016) "Recycled Content" vs. "End-of-Life Recycling Rate"

Current level of recycled content: varied by type, generally low, average recycled content of PET bottles in Europe is currently 11%⁶⁸

A.1.5 Summary Themes

For many materials, once they have been prepared to be manufactured into a product (e.g. plastic flakes, metal sheets), distinguishing the proportion of the material derived from recycled materials, or primary ones, becomes difficult, if not impossible. Therefore, any approach to measurement of use of PCR is likely to rely upon a chain of custody approach whereby materials are traced from at least the last point at which it is known that the content is from a secondary source to incorporation into final product. Many of those spoken to indicated that purchasers of their products were increasingly asking for PCR content to be displayed on products and / or reported on to them. Another general theme was support for use of PCR does not necessarily require an entirely closed loop approach (i.e. a can should not have to be recycled into another can to count towards the objective). In referring to materials reprocessing markets other than their own, respondents noted due consideration would need to be given to the “starting point” of each industry for PCR use. On plastics particularly, concerns were raised around incentives for PCR use creating a potential issue around fraudulently claiming material was secondary. This highlights the need for a robust approach to verifying claims regarding the use of PCR.

Those spoken with as part of the research do not capture a number of other smaller material streams such as textiles and other niche streams. However, intuitively it would seem likely that the approach of a verified chain of custody would similarly be needed across a range of material types.

⁶⁸ European PET Bottle Platform *How to keep a sustainable PET recycling industry in Europe*, <https://www.epbp.org/>