Final Report

Demonstrating Increased Recycled Content in Welsh Manufacturing

Project to demonstrate how barriers to increasing recycled content in Welsh manufacturing can be overcome - Medical and Housewares Product sectors

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WRAP's vision is a world in which resources are used sustainably.

Our mission is to accelerate the move to a sustainable resource-efficient economy through re-inventing how we design, produce and sell products; re-thinking how we use and consume products; and re-defining what is possible through re-use and recycling.

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Front cover photography: Vernacare Sharpsafe© containers and accessories, and Addis Housewares kitchen caddy

Executive summary

The Welsh Government, through Beyond Recycling, has set out their ambition to deliver and accelerate the country's transition towards a circular economy. This is key to the achievement of key environmental, economic and social outcomes. The strategy has a number of headline actions, several of which necessitate the more efficient use of material resources by eliminating unnecessary resource usage (such as single use plastic), reducing waste, encouraging reuse and increasing recycling. The use of recycled materials underpins the achievement of the strategy.

The practical delivery of a circular economy in Wales, particularly with respect to plastics, is a complex problem requiring consideration of product design for recyclability, collections and reprocessing infrastructure, and the performance of recycled materials, among others.

This project was commissioned as one of a series of demonstration trials seeking to overcome technical and commercial barriers that limit the use of recycled plastics, focussing specifically on products used within the medical and housewares sector.

The project's primary aim was to overcome a lack of market confidence, whereby manufacturers consider the uncertainty of supply volumes, and poor long-term consistency of the recycled plastic that is available, to represent too high a risk to introduce recycled content into their products.

The work focussed on specific products in everyday use within the medical and housewares sectors that are manufactured from polypropylene (PP) including:

- a 2.5 litre household kitchen caddy;
- a series of 0.2 litre to 1 litre medical sharps containers which are black in colour and supplied to the Harm Reduction market; and
- a natural-coloured translucent inner safety shield, supplied as part of a range of 2, 3, 4 and 7 litre yellow medical sharps containers.

All have one or more demanding requirements with respect to the use of recycled content, in this case primarily needing low melt viscosity, low temperature impact strength and resistance to needle penetration, and optical translucency respectively.

Lessons Learned

Management Commitment and Resources

Successfully replacing virgin materials with recycled content requires focused development activity, coupled with the availability of appropriate personnel and financial resources. Board-level buy-in and a corporate commitment to sustainability made a tangible difference when seeking to overcome internal barriers and achieving development timelines.

SME manufacturers in particular may lack the necessary resources and finances needed to introduce recycled content. Targeted intervention will be essential to facilitating change across all areas of the manufacturing sector.

Availability of Materials

A wide variety of virgin grades, tailored to specific manufacturing and performance requirements are available. This makes designing and purchasing materials relatively easy for manufacturers compared with using recycled content where, particularly for more challenging applications, "drop-in" replacements are unlikely to be readily available.

Although there was a general lack of availability of large volumes of suitable materials, sufficient quantities were identified within Wales and further afield to satisfy the requirements of all of the products. Quantities of non-black plastics were particularly limited, with those identified being available in small, inconsistent volumes, arising from specialist manufacturing processes and/or having properties that did not facilitate high recycled content usage. Natural or light coloured plastics commanded a premium, sometimes disproportionately high given their often poor mechanical performance.

With demand for a number of recycled plastics exceeding the supply capability of local and regional markets, manufacturers are turning to overseas sources of supply. Cost-competitive recycled plastic was identified from overseas sources, although with a few notable exceptions in Western Europe, these were generally poor performing or on further investigation, not available in consistent volumes. Continued investment in recycling infrastructure is likely to improve material quality in coming years and lead to more extensive sourcing from overseas suppliers.

With transportation of materials being identified as a significant contributing factor in achieving CO_{2e} savings, importing recycled plastics will reduce or eliminate any environmental benefits from using recycled content.

Materials Development

Where materials were not suitable in their as-received form, within limits it was possible to identify reprocessing approaches, using blending or additives where appropriate, to improve their performance. Polypropylene is more adaptable in this respect than other polymers.

Contamination was a particular issue that, with a limited number of exceptions, necessitated the compounding of the majority of rPPs identified. This added approximately £300 per tonne plus transport to the cost of materials. Additives, where required, further increased this cost by £35 to >£300 per tonne of recycled plastic. The high cost of some additives made their use commercially unviable.

Manufacturing Transfer

Manufacturers wanting to use recycled content may need to design, or redesign their products or tooling to facilitate the use of recycled materials. For example, it may be necessary to use thicker wall sections, strengthening ribs and modified manufacturing processes to accommodate differences in mechanical and physical properties.

Capital expenditure in materials handling, storage, drying, dosing, mixing and testing equipment, alongside additional quality control checks on incoming material (at least until manufacturers are comfortable with the source of supply), should also be anticipated.

Impacts of Covid-19

The onset of the pandemic in March 2020 introduced additional challenges for the project, over and above access to development and testing resources posed by the various lockdowns.

The plastic manufacturing sector is highly reliant on overseas supply chains. Disruption to these supply chains due to Covid-19 and increased trade friction resulting from Brexit have highlighted the weak points in current practises. Although outside of the scope of the project, increased interest in reshoring or near-shoring manufacturing appears to represent an opportunity for Wales' manufacturing sector.

Of particular note was the rapid increase in demand observed for recycled materials when supply chain shortages arose for virgin polymers. These shortages were predominantly the result of reductions in the upstream supply of raw materials, planned shutdowns in virgin polymer manufacturing and a reduction in inbound freight capacity. Multiple suppliers declared Force Majeures on virgin polymer supply agreements as a result, with this particularly affecting PP, PE and PVC. As would be expected, pricing for virgin polymers increased sharply. Historic reluctance to use recycled materials in the wider market reduced as virgin polymer shortages became more acute, with recycled polymer prices increasing rapidly as a consequence.

Demand for housewares products increased rapidly as a result of a marked increase in on-line shopping. Similarly, demand for sharps containers also increased in advance of the start of the vaccination programmes. Significant increases in sales volume compared to pre-Covid levels, whilst also managing supply issues, was a particular challenge for all manufacturers.

Financial Benefits

Depending on the cost of recycled plastic, transport miles between supply chain partners, reprocessing costs, etc., a cost saving on materials of up to 25% may be possible replacing virgin with recycled plastic in the products investigated in the project. Savings are application-specific and it should not be assumed that this situation is replicable across all products and markets. In some cases, high demand, and an elevated price for specific grades of recycled plastics, will mean that cost savings cannot be realised.

It should be recognised that whist direct material savings may be achievable, in many cases incorporating recycled content requires significant capital expenditure in materials handling, storage, drying, dosing, mixing and testing equipment. Additional operational expenditure, for example for quality control checks on incoming material, should also be anticipated.

There appears to be a widely-held belief that recycled plastics, or products manufactured from recycled plastics, should be lower in price than those produced from virgin plastics, irrespective of whether their performance is comparable. This view rarely appears to takes into account the cost of development, capex investments and additional operational requirements directly associated with the use of recycled content.

Environmental Benefits

A Life Cycle Assessment for two of the rPPs sourced for use in the project were both calculated to be around 0.5kg CO_{2e}/kg. These results are specific to the materials,

processes and modelling parameters used in the assessment, and were significantly lower than virgin PP which typically has a footprint of around 1.97 CO2e/kg for average production in Europe, and 2.36 CO2e/kg when sourced from the global market.

Project Outcomes

Through this work we have identified ways in which businesses can overcome barriers to the use of recycled content, develop resilient local supply chains, and in turn, reduce the environmental impact of their products.

Suitable rPPs have been identified and where necessary, adapted to meet the needs of the identified products.

The rPP identified for housewares applications is currently being subject to more extensive manufacturing trials and testing before a final decision is taken on its adoption in manufacturing.

The rPPs identified for the sharps container have completed testing and been introduced into manufacturing. Having identified and demonstrated the suitability of the black rPP for the smaller sharps containers, the same material has been trialled, tested and accredited for use in the bases of larger medical sharps containers used in healthcare settings. The rPP identified for the inner safety shield has also been adopted in a range of trays and accessories, as well as an external closure shield for larger sharps containers. These represent significant windfall benefits for the project both in terms of tonnes of recycled content used and the associated environmental benefits. Furthermore, it demonstrates that creating confidence in recycled content can lead to its more widespread adoption by manufacturers.

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