NSSN
NSW Smart Sensing Network

FACT SHEET

PATHWAYS TOWARDS CIRCULARITY IN HDPE PACKAGING: MATERIAL FLOW ANALYSIS AND BEST PRACTICE GUIDANCE

2021

RESEARCH UNDERTAKEN BY UTS AS PART OF THE CRC-P: INCREASED RECYCLING OF PLASTICS BY SENSING AND TREATING LABEL CONTAMINATION

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Pathways towards circularity in HDPE packaging: material flow analysis and best practice guidance

Institute for Sustainable Futures based at the University of Technology Sydney (ISF UTS)

This CRC-project aims to identify how to dramatically increase the recycling rates and recycled content for plastic packaging. This supports efforts to meet the 2025 National Packaging Target of *70% recovery rate for plastic packaging* and the transition to a circular packaging economy. By targeting HDPE packaging resin, one of the most widely used, and with the largest market share in Australia, this project will have a significant impact.

In 2017/18, about 350,000 tonnes of HDPE packaging was consumed in total, including 265,000 tonnes of rigid formats, of which, 40,000 tonnes is estimated to be used for clear HDPE milk bottles, the focus of this project.[1] Currently, rigid HDPE has only 25% post-consumer recovery rate and contains about 1% recycled content. There are a range of factors contributing to low recycling rates for HDPE, including low collection rates of used HDPE packaging. However, the key problem that this project is addressing for the HDPE milk bottles is contaminants from the labels and the glue fixing the labels to the containers. Addressing this problem is crucial to achieve 100% recyclable HDPE milk bottles.

To solve this problem, we are taking a transdisciplinary approach with a team, including technology developers, recyclers, label maker and university researchers. The ISF UTS researchers bring whole-of-system thinking and circular economy policy expertise ensuring that the technical solution aligns with the broader systematic changes affecting the packaging sector. Moreover, solutions developed in this project are expected to be transferrable to other packaging resins and this broader impact will support the transition to a circular economy.

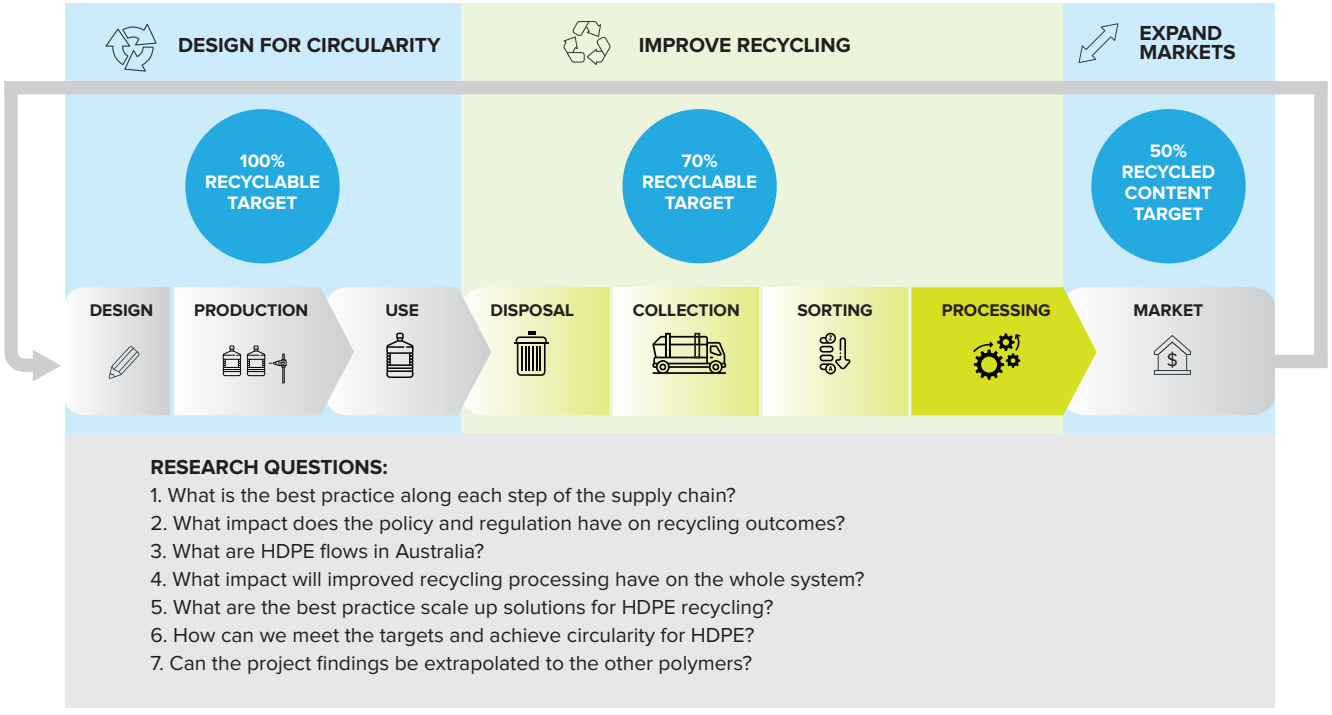


Figure 1: Overview of the HDPE supply chain and project research questions.

[1] APCO (2019) Packaging consumption and recycling data – 2017-18 Base line data

Project impact

The linear plastic economy of “take-make-waste” is setting us on track such that by 2050 there will be more plastics by weight than fish in the ocean[2]. In addition to the negative environmental impact, this approach has an economic downside as well. An alternative circular economy system, that is aiming for positive social and environmental impacts by design, is based on the principles of preserving and enhancing natural resources, improving material efficiency and management. In the circular plastic economy:

1. After-use plastic is effectively managed with efficient collection and separation for reuse or recycling of materials for high quality material recovery;
2. Leakage of plastics into natural system and other negative extrenalities are eliminated; and
3. Plastic is decoupled from fossil feedstock.

While this project is focussed on after-use plastic management it is clear that a transition to a circular economy requires changes upstream, e.g. designing products for treatment at the end of life, as well as downstream, e.g. collection, sorting and recycling technology innovation. We focus on the Australian HDPE system and we are benchmarking with the best practice globally, identifying the enablers and policy drivers for recycling of HDPE food grade to HDPE food grade and seeking to increase the recycled content.

To better understand the impact of broader strategies to support a circular economy transition and to evaluate the impact of the proposed technological solutions this project is undertaking a Material Flow Analysis (MFA) of the HDPE milk bottle system from consumption to recovery at end of life. MFA quantitatively assesses the state and change of flows and stocks of materials within a system. It allows us to pin-point material losses and performance weaknesses along the supply chain, as well as unveiling leverage points for the most significant impact. This system approach could be extrapolated to the other HDPE applications (coloured HDPE) as well as other container polymers, such as PET.

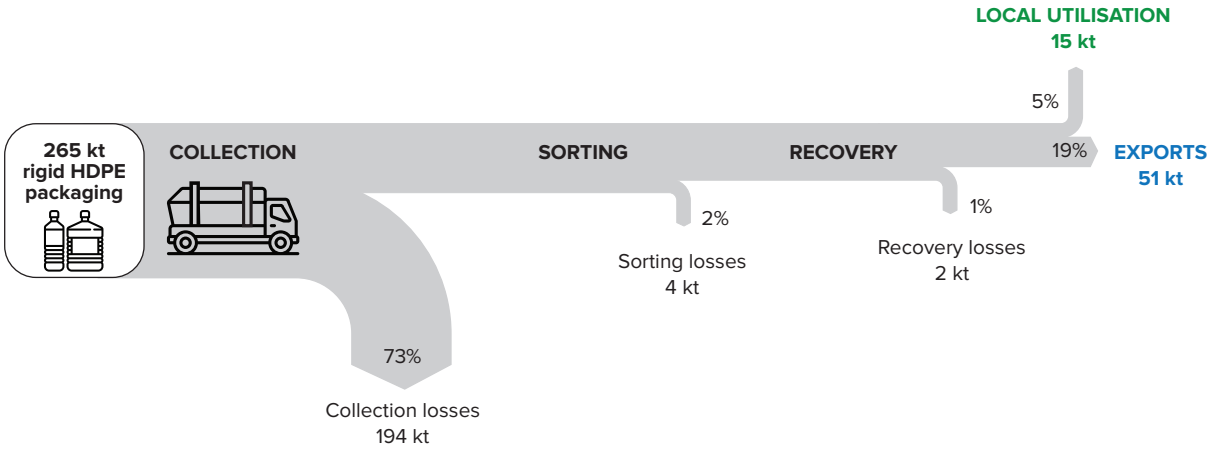


Figure 2: Material flow, including losses and recycling rates for all rigid HDPE packaging in Australia.

[2] World Economic Forum, Ellen Macarthur Fundation and McKinsey & Company, The new plastic economy – Rethinking the future of plastics, 2016.

Project achievements

In the first 6 months we have conducted a detailed background literature review to better understand best practice circular economy and recycling approaches for plastic globally with the focus on the application for milk bottles produced with natural HDPE.

While recycling rates can be significantly improved in the recycling facility by addressing contaminants, there are also other factors impacting recycling rates, from packaging design, post-consumer separation, collection infrastructure, as well as the broader policy context that is driving the development of a resource management system fit for the future circular packaging economy.

The concept of a circular economy for plastic packaging is gaining significant traction and is supported by government, industry and community. Supporting this shift, innovative policy and regulatory approaches are being implemented. For example, the South Korean government has taken a direct approach in constraining the polymer types as well as product designs that can be placed on the market. Another approach are market-based policy instruments, such as taxing virgin resin as implemented in UK, that aims to ensure that the recycled material is more competitive and can support recycled content targets.[3]

In Australia this transition is championed by APCO, setting and driving the national packaging targets, and this is also supported by the Commonwealth government's waste export ban as well as sustainable procurement policies that require recycled content . We are also seeing prominent packaging brand owners setting their own targets and pledges towards a circular economy.

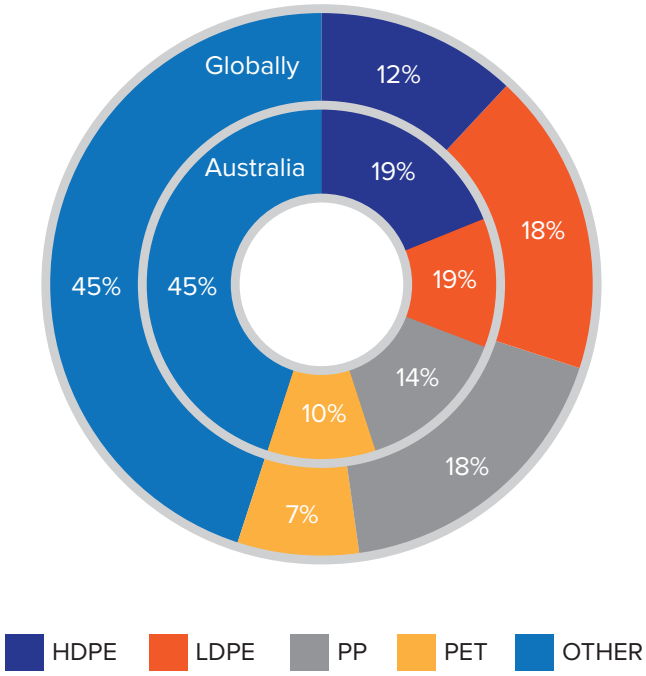


Figure 3: Plastic consumption distribution by polymer type globally and in Australia.

Key take away

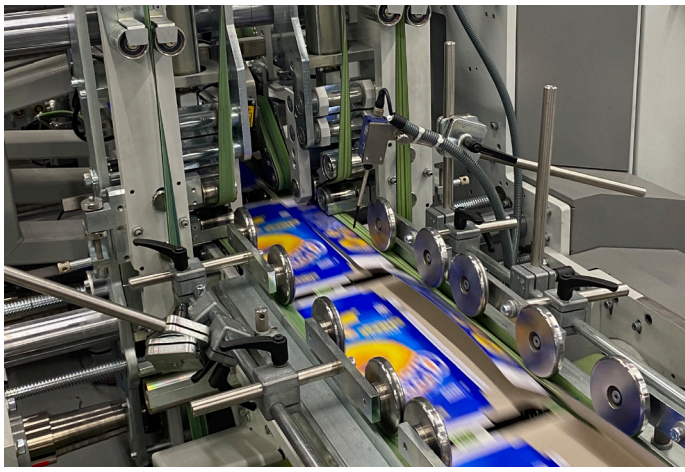
- Due to wide use of HDPE, improved recycling will have a significant impact towards meeting the 2025 National Packaging Targets and supporting Australia's transition to a circular economy.
- Reaching 100% recyclability for HDPE and achieving a step-jump in the recycled content requires a whole-of-system approach.
- Creating a circular economy for plastics requires a number of technical and non-technical changes, including policy levers, across the supply chain that are likely interdependent.

[3] Australian Government, DAWE, National Waste Policy Action Plan 2019.

Industry Partners

The project's industry partners are making an investment in the future by funding this research to the tune of nearly $1.5 Million.

Labelmakers started back in 1987 printing self-adhesive labels, and grew to become Australasia's largest and most innovative label supplier. Packaging has changed considerably over the last three decades and they have developed solutions that have responded to the changing needs of our customers. Self-adhesive labels are now just one of six core labelling products. Labelmakers are supporting this project as part of their commitment to exploring opportunities that expand our business to continue to grow our offerings to our customers while remaining competitive in a global market and looking at ways to further reduce our carbon footprint.



PEGRAS Asia Pacific, is a technical solution consulting company based in NSW. For seneral years they have been collaborating with the NSSN and many industry partners to solve real world problems.

With a network of consultants in Australia, Europe and Asia, PEGRAS has provided solutions for various companies, including Audi, BioOil, Continental, Siemens, and TOYO.

Building on immense background knowledge of print and packaging, their business focus includes developing solutions for the Circular Economy needs of plastic recycling. PEGRAS developed the initial proof of concept chemistry that has evolved into this CRC-P project and provides a chemical and engineering lead.

To find more about the project out how the NSSN can help solve your challenges in other areas, please contact Dr Don McCallum at 0433 496 778 or don.mccallum@nssn.org.au

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