INDIA PLASTICS PACT

Food grade rPET in India: business opportunities

Developed by

Confederation of Indian Industry

CII-ITC Centre of Excellence for Sustainable Development

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UK Research and Innovation India भारत

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Consultations: This report is a product of primary and secondary research, based on interactions with stakeholders across the plastics value chain. The India Plastics Pact is grateful to individual experts and specialists for valuable inputs and insights during the preparation of this report. The support of India Plastics Pact Member and Supporter organisations is appreciated and acknowledged as is the contribution of India Plastics Pact's co-partners at WWF-India, Mahashweta Mukherjee and Yuvraj Singh Bankavat.

Reviewers: Peter Skelton and Megg Humphrey at WRAP

Funder: UKRI India

Date of publication: September, 2022

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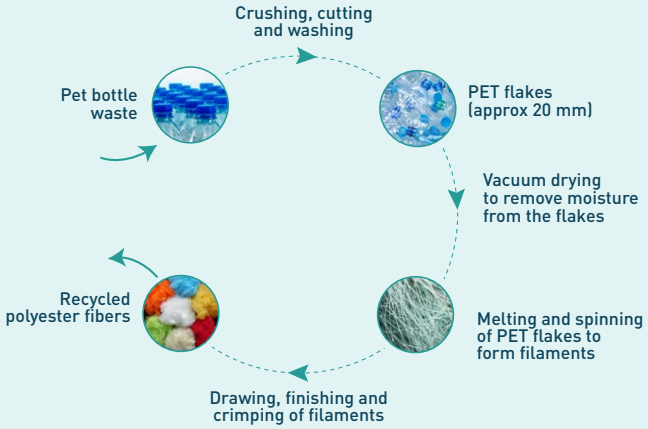
List of abbreviations

AA	Acetaldehyde
BIS	Bureau of Indian Standards
B2F/B-t-F	Bottle-to-fibre
CPCB	Central Pollution Control Board
CSD	Carbonated soft drink
EPBP	European PET Bottle Platform
EPR	Extended Producer Responsibility
FCM	Food contact material
FIBC	Flexible intermediate bulk container
FMCG	Fast moving consumer goods
FSSAI	Food Safety and Standards Authority of India
IV	Intrinsic viscosity
KTPA	Kilo ton per annum
MoEFCC	Ministry of Environment, Forest and Climate Change
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
PETCORE	PET Container Recycling Europe
ppb	Parts per billion
ppm	Parts per million
PRO	Producer Responsibility Organisation
PWM	Plastics Waste Management
rPET	Recycled PET
vPET	Virgin PET

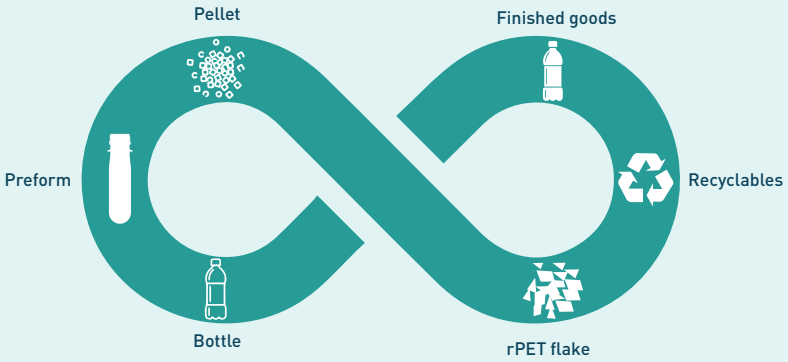
Introduction

Polyethylene terephthalate is the most widely used polymer for beverage packaging in India as well as globally, because of its many advantages over other materials. In respect of its use in beverage bottles, it provides a better oxygen barrier, higher rigidity, strength-to-weight ratio and higher clarity than polypropylene or polyethylene bottles.

PET beverage bottles are highly recyclable: post-consumer PET bottles can be recovered and recycled numerous times by conventional mechanical recycling into washed flakes/pellets, which are then used to make new PET products. PET recycling can be open-loop, or linear, and closed-loop, or circular.[1] PET bottle recycling into non-bottle applications, such as fibre for textile and strapping for industrial use, are considered open-loop recycling: these are the primary end-uses of rPET flakes in India at present.



Open loop recycling
(example: PET bottle to polyester fibre production)



Closed loop recycling
(example: PET bottle-to-bottle)

Figure 1: Open and closed-loop recycling of PET beverage bottles

[1] Sarioglu, E., & Kaynak, K. (2017). PET Bottle Recycling for Sustainable Textiles. IntechOpen Book Series. https://doi.org/10.5772/intechopen.72589

It is possible to retain the value of PET bottles in the economy through bottle-to-bottle recycling, but such use for food contact, was not permitted by regulation. The Government of India has now, in 2022, brought out the 'Draft Food Safety and Standards Packaging (Amendment) Regulations' on the use of recycled plastic as food contact materials, after enablement through the Plastic Waste Management (PWM) Rules, 2022 Directives from the Ministry of Environment, Forest and Climate Change.[2,3] Guidelines and acceptance criteria for use of rPET in food contact will be set out after these regulations are finally notified: the changes will make it possible to use rPET in contact with food.

Around the same time the Extended Producer Responsibility guidelines, under the PWM Rules, were notified placing a statutory responsibility on manufacturers with ambitious targets for collection, recycling, reuse, and use of recycled content in plastic packaging.[4]

Both the above developments strengthen the case for encouraging the use of rPET in bottles, thereby proportionately reducing the consumption of virgin PET.

This document aims to encourage manufacturers, convertors, brands and retailers operating in India, and who manufacture or use PET beverage bottles, to use rPET.

[2] Ministry of Environment Forest and Climate Change. (2021). Plastic Waste Management (Second Amendment) Rules, 2021 (Notification No. G.S.R. 647(E)). https://egazette.nic.in/WriteReadData/2021/229867.pdf

[3] Food Safety and Standards Authority of India. (2022). Food Safety and Standards (Packaging) Amendment Regulations, 2022 (Notification No. STD/SC/A-40). https://www.fssai.gov.in/upload/advisories/2022/01/61ea5c8e8713cDirection_Recycled_Plastics_19_01_2022.pdf

[4] Ministry of Environment Forest and Climate Change. (2022). Plastic Waste Management (Second Amendment) Rules, 2022 (Notification No. G.S.R. 133 (E)). https://egazette.nic.in/WriteReadData/2022/233568.pdf

The benefits of using rPET bottles

A circular economy is restorative and regenerative by design with materials flowing in a 'closed loop' system, rather than being used once and then discarded. For plastics, this means retaining the value of plastics in the economy to prevent leakage into the natural environment. Recycling can reduce negative environmental impacts as new goods can be replaced by recycled goods: it reduces the demand for raw resources, cuts down the energy used for processing compared to using virgin material, and reduces the quantity of plastic in landfill.

The system for post-consumer collection and segregation of PET bottles is well developed in India. In closed-loop bottle-to-bottle recycling, post-consumer PET bottles are collected, sorted, and baled by MRFs and delivered to a recycling plant, where labels and caps are removed. The bottles are sorted by color and shredded into flakes. The flakes are washed, dried and decontaminated, then melted at 270^{0}C and extruded. These rPET pellets are mixed with virgin PET pellets, then fed into injection moulding machines to produce "preforms". The preforms are transported to the filling plant, where they are heated and blown into PET bottles for refilling and sale. The circle is closed as they begin a new life.[5] Such a system has numerous benefits for businesses and these are elaborated below.

Strategic benefits

Used PET bottles are a valuable resource for the packaging sector and other industries. Recycling PET reduces the environmental impact of the PET industry in different ways:

- **Raw material conservation:** Crude oil is the primary raw material for virgin PET (vPET). Recycling one metric ton of PET bottles (amounting to about 36,000 500 mL carbonated soft drink or juice bottles or 72,000 500 mL water bottles) can save an estimated 16 barrels of crude oil.[6] In 2019, India consumed around one million tonnes of virgin PET resin for making PET bottles: if 30% of rPET content is achieved in several years time, based on current consumption, India can reduce imports of up to 5 million barrels of crude oil per year.

[5] Recycling Magazine. (2020, August). PET recycling: towards a circular economy. https://www.recycling-magazine.com/2020/06/08/pet-recycling-towards-a-circular-economy/

[6] Stanford University PSSI Recycling Center. (n.d.). Frequently Asked Questions: Benefits of Recycling. https://lbre.stanford.edu/pssistanford-recycling/frequently-asked-questions/frequently-asked-questions-benefits-recycling

- **Energy savings:** It is estimated that the total thermal energy used in producing PET bottles is about 100 MJ/kg of PET (83 MJ/kg to produce PET resin plus 20 MJ/kg to produce preforms and blow them into bottles).[7] According to a 2018 CPCB report[8] the energy required to recycle PET films (collection, transportation, shredding, washing and pellet-making) is about 19 MJ/kg. Assuming a similar number for PET bottles, it can be estimated that using rPET resin saves about 64 MJ/kg (about18 kWh/kg), that is, approximately 77% less energy consumed (including the energy saved by preventing PET from disposal in landfills). Assuming that 200,000 tonnes of rPET are used per year, rPET usage would lead to savings of 3.6 million MWh of power/year. According to figures in the Ministry of Power's, Norms for Coal Consumptions for Thermal Power Plants Report 2019,[9] the amount of coal of G15 grade required to generate one MWh is 0.8 tonnes and thus about 3 million tonnes of coal (equivalent to 800 train rakes of 58 wagons each[10]) can be saved per year in India (the total consumption of coal in India was about 707 million tonnes in 2019-20[11]).

- **Carbon emission reductions:** The use of rPET will lower green house gas emissions. According to a CPCB LCA study report, CO_2 emissions from PET bottle manufacturing are estimated to be 5.80 kg CO_2 eq/kg of PET while the corresponding value using recycled PET is about 2 kg CO_2 eq/kg. It can be estimated that the use of rPET results in a 66% reduction of greenhouse gas during manufacture compared to the use of vPET. The potential reduction of CO_2 emissions if 200,000 MT of rPET are used in place of virgin PET would be 0.8 million tonnes of CO_2 eq/year (equivalent to 22 months CO_2 emissions of 110,000 autorickshaws in Bengaluru, India[12]).

- **Reduced quantities going to landfill:** In India, dumping in landfills or on open ground are the cheapest, short-term ways to manage solid waste. However, it is well known that landfills are not sustainable and can have serious impacts on ground water and air quality. Causing public health problems and environmental damage. Fewer plastics in landfills will also mean lower emissions of common landfill gases such as carbon dioxide and methane. Recycling 1.4 tonnes of PET bottles saves 33 m^3 of landfill space, equivalent to the space occupied by one full 20-foot container.

Figure 2: Strategic benefits of transitioning towards rPET bottles

[7] Gleick, P. H., & Cooley, H. S. (2009). Energy implications of bottled water. Environmental Research Letters, 4, 014009. http://dx.doi.org/10.1088/1748-9326/4/1/014009

[8] Central Pollution Control Board. (2018). LCA Study of Plastics Packaging Products. https://cpcb.nic.in/uploads/plasticwaste/LCA_Report_15.05.2018.pdf

[9] Ministry of Power. (2019). Norms for Coal Consumptions for Thermal Power Plants (Notification No. 219/GC/BO/TPI/CEA/2019). https://cea.nic.in/old/reports/others/thermal/tppd/acq_norms.pdf

[10] Pannu, S. P. S. (2011, May 25). Railways and Coal India spar over huge coal stocks. Business Today. https://www.businesstoday.in/industry/energy/story/railways-and-coal-india-ltd-spar-over-huge-coal-stocks-23481-2011-05-25

[11] Ministry of Coal. (2022, June 20). Generation of thermal power from raw coal in India. Retrieved June 21, 2022, from https://coal.nic.in/en/major-statistics/generation-of-thermal-power-from-raw-coal

[12] Thakur, P., Pal, S., & Malik, J. (n.d.). Estimating Vehicular Emissions from autorickshaws plying in Bengaluru city. https://www.teriin.org/sites/default/files/2018-07/estimating-vehicular-emissions.pdf

Commercial benefits

Protection from fluctuations in price of PET resin: The cost of virgin polymers depends upon the cost of crude oil and can vary significantly over time but this is not always true for the cost of recycled polymer. Use of rPET could therefore provide stability in pricing as compared to vPET.

Consumer perception

Consumers, FMCG companies, packaging producers and regulatory bodies are increasingly concerned about the environmental impact of discarded packaging material. Many stakeholders are considering the use of recycled content in packaging as a solution to the challenge.

Food contact grade rPET has been widely accepted in many countries including the US, Mexico, the EU and Japan for many years and consumer research[13,14] suggests that consumers are demanding more environmentally friendly and sustainable packaging. According to the Global Buying Green Report, 2021[15], over 70% of consumers in developed nations are willing to pay more for products which use recycled PET packaging and overwhelmingly support the wider use of rPET in PET bottles. Indian consumers are, so far, not exposed to the use of recycled content in food and beverage containers but recent surveys[16] of Asian consumers (in China, Indonesia, and India), indicates that Asian consumers are also willing to pay for green packaging.

Figure 3: Communication of rPET content through bottle labels

[13] Klaiman, K., Ortega, D., & Garnache, C. (2016). Consumer preferences and demand for packaging material and recyclability. Resources Conservation and Recycling, 115.http://dx.doi.org/10.1016/j.resconrec.2016.08.021

[14] Feber, D., Granskog, A., Lingqvist, O., & Nodigarden, D. (2020, October 21). Sustainability in packaging: Inside the minds of US consumers. McKinsey & Company. https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/sustainability-in-packaging-inside-the-minds-of-us-consumers

[15] Trivium Packaging. (2021). Global Buying Green Report 2021: Sustainable Packaging in a Year of Unparalleled Disruption. https://triviumpackaging.com/sustainability/2021BuyingGreenReport.pdf

[16] Feber, D., Granskog, A., Lingqvist, O., & Nodigarden, D. (2021, March 8). Sustainability in packaging: Consumer views in emerging Asia. McKinsey & Company. https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/sustainability-in-packaging-consumer-views-in-emerging-asia

Brand value

The Government of India notified the Guidelines on Extended Producers Responsibility (EPR) for plastic packaging under the Plastic Waste Management Rules, 2016. The guidelines oblige both brand owners and packaging producers to recycle and utilize recycled material. Many FMCG companies are eager to use recycled material, which will enable them to reduce their dependence on virgin plastic and become more sustainable in the long term.

Recycled content in the packaging material can help to build brand loyalty, change perceptions among customers and shift customer preferences. It will be possible for FMCG companies to communicate the use of environmentally responsible practices to consumers using on-pack messages[17] such as, "Packaging contains 'X' % rPET", 100% recyclable, etc.

Globally, leading brands have been using rPET packaging for a number of different beverages including still water, sparkling water, tea-based drinks and even for carbonated soft drinks bottles, which have to adhere to high standards of pressure tolerance, stress crack resistance and clarity, without compromising on product performance, storage stability or visual appeal.

Social benefits

Bottle-to-bottle recycling will bring in new closed-loop applications and can create jobs for unskilled workers, skilled technicians, machine operators, engineers and scientists in meeting the high-quality standards required. This might trigger significant economic and social change in terms of scale, capacity, and technology in the PET recycling value chain. The realization value of rPET flakes for bottle-to-bottle use is higher than that for bottle-to-fibre use, making it possible for MRFs and waste collectors to raise their earnings in the value chain and help improve the lives and livelihoods of informal workers.

[17] Arthur, R. (2020, September 24). The journey to 100 % rPET bottles. Beverage Daily. https://www.beveragedaily.com/Article/2020/09/24/The-journey-to-100-recycled-plastic-bottles-rPET-in-the-UK

Case studies from other markets

The consistent availability of quality rPET resin will have a significant impact on the adoption and growth of bottle-to-bottle use in India. The quality of rPET available, in turn, depends on the collection and recycling process steps: there is already a shift towards better machinery and recycling technology for new projects in India to improve the quality of recycled PET for bottle-to-bottle use.

To provide impetus and encourage the uptake of recycled PET, it might be relevant to set up a cross-industry consortium, combining the capabilities of resin producers, packaging converters, consumer goods producers to waste management and recycling specialists. Such initiatives can speed up the investment and commercialization of the technology, and infrastructure needed to recycle bottle-to-bottle rPET, as well as accelerate the development of end-markets for recycled material. The India Plastics Pact offers one such platform and there are examples available from outside India, of collaborative initiatives which helped set up rPET recycling systems: features of these models can be contextualized for India and will help ensure that rPET of a consistent quality is available in sufficient quantities for end-users.

PET Recycling Company (PETCO)

The PET Recycling Company (PETCO)[18], South Africa, is a not-for-profit company started in 2004. It is an industry-driven and industry-financed joint-effort to self-regulate post-consumer PET recycling. PETCO is funded by EPR fees paid on the tonnage of PET plastic placed onto the market by producers and brand owners, and it has made a sustained and positive impact on PET recycling in South Africa. Producers of PET bottles (through PROs) have taken responsibility for their own products and ensured that their impact on the environment is minimised, whilst creating jobs and positively contributing to South Africa's economy.

PETCO has grown from one recycling plant producing 10,000 tons of PCR PET in 2005, to six recycling plants with a volume of about 100,000 tons in 2018.[19] It has trained and developed thousands of workers and supported them with

[18] PETCO: PET Recycling Company, South Africa, available at: https://petco.co.za/who-we-are/
[19] PETCO NPC. (2018). PET Industry Waste Management Plan. https://static1.squarespace.com/static/54b408b1e4b03957d1610441/t/5ba4cef1f9619a23ee295c46/1537527545092/201809_PETCO+IndWMP+Shared+Cost+Plan+rev00.pdf

personal protective equipment, scales, cages, trailers and baling machines. By providing sponsorship for collectors, PETCO has also helped build many informal operators into small and medium enterprises. PETCO's investment and support system has built a thriving recycling business, recycling thousands of tons of PET each month and supporting hundreds of waste-pickers with income-generating opportunities.

PETCO's activities include contracting and financing PET recyclers; educating consumers about recycling; undertaking joint venture projects with institutions such as municipalities; providing equipment support and sponsorship for collectors; and providing guidance to brand owners relating to design for recycling - ensuring products are compatible with local recycling infrastructure.

PETCO supplies food grade rPET to its members at contracted prices and ensures that waste collectors get a decent return to keep them in the business, even when the cost of virgin PET becomes lower than that of rPET. When PETCO started in 2005, rPET was consumed mainly by bottle-to-fibre applications; bottle-to-bottle applications started in 2009, and now food contact grade rPET accounts for almost half of all processed tonnage.

PETSTAR®

PetStar: PET recycling in Mexico

As the world's largest consumer of soft drinks, the average Mexican citizen drinks and discards two bottles per day. That equals nearly six kilograms of PET bottles per capita annually, contributing to a yearly national total of about 750,000 tons of PET.

PetStar started in 1995 as a collector of post-consumer PET bottles, installed a broad nationwide collection infrastructure, and has been buying PET bottles in bulk format directly from scavengers. At that time, most of the PET bottles were recycled and transformed into polyester fibre. By 2006, PetStar started making recycled food grade resin for bottle-to-bottle applications and achieved production of 20,000 ton/year of bottle-to-bottle rPET resin by 2009. By 2011, PetStar was owned by group of Coca-Cola bottlers. In 2013, PetStar set up a second plant of 50,000 ton/year capacity and was nominated the World's Largest Food Grade PET Recycling Plant by PCI PET Packaging Resin and Recycling Ltd.[20]

In 2016 PetStar launched its PetStar sustainable business model (PSBM)[21], which is fully integrated into the value chain of PET bottles, from the direct collection of post-consumer bottles (with scavengers and collectors), all the way to the production of new PET bottles combining virgin raw materials with recycled content.

PSBM operation generates a triple positive impact on the social, environmental and economic subsystems.

- The environmental subsystem removes bottles from the surroundings and contributes to a cleaner environment by converting them into PET food-grade recycled resin.
- The social system provides fair and stable income rates that dignify the conditions of the scavengers who indirectly work with PetStar through its multiple collection partners.

PetStar directly employs almost 1,000 people and indirectly economically benefits over 24,000 scavengers and collectors. By not engaging any middlemen, PetStar directly purchases post-consumer PET bottles from scavengers, via its own collection trucks, at a fixed price.

- In the economic subsystem, rPET resin is blended with virgin resin, producing new bottles with recycled content that may vary between 25% and 100%, and contributing to the sustainability of the packaging sector.

Through the PSBM Model, the company manages four core processes:

- an inclusive collection system,
- the collection process,
- the recycling process,
- the marketing (bottle-making with rPET) process.

These processes are articulated through a Circular Economy framework that links all stakeholders with the main objective to attain a zero plastic leakage and a sustainable region.

[20] McKenna, L. (2015, January 8). Clear harmony. Recycling Today. https://www.recyclingtoday.com/article/rtge0115-petstar-pet-resin-profile/

[21] Camara-Creixell, J., & Scheel, C. (2019). PetStar PET Bottle-to-Bottle Recycling System, a Zero-Waste Circular Economy Business Model: Texts and Studies in the History of Philosophy. Infinity in Early Modern Philosophy (pp.191-213). http://dx.doi.org/10.1007/978-3-319-92931-6_10

Conclusion

Given that regulation in India is now open to supporting bottle-to-bottle recycling, it is the right time to identify opportunities for quick-wins with PET beverage bottles, whose collection and recycling are already fairly well-established and in place.

All convertors, bottle manufacturers, retailers and brands should be encouraged to incorporate rPET into their portfolios with advantages to be had in the form of reduced reliance on price fluctuations for virgin resins, energy savings and reductions in emission of greenhouse gases.

Focus on improved collection and development of other alternate end-markets can help minimise leakages to the environment, dumping in landfills and open burning.

About the India Plastics Pact

The India Plastics Pact is a collaboration between the Confederation of Indian Industry (CII) and WWF India that unites businesses, governments, NGOs and citizens to create a circular plastics economy in India. The CII-ITC Centre of Excellence for Sustainable Development (CESD) anchors the India Plastics Pact, within CII. The initiative is supported by WRAP, a global NGO based in the UK.

Launched in September 2021, the India Plastics Pact is the first Plastics Pact in Asia. As of June 2022, there are 13 Plastics Pacts spread across the globe. 33 organizations are currently part of the India Plastics Pact. The Pact works on all plastic resins at all stages of the plastics value chain.

Confederation of Indian Industry

About Confederation of Indian Industry

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government, and civil society, through advisory and consultative processes. For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. CII engages closely with Government on policy issues and interfaces with thought leaders to enhance efficiency, competitiveness and business opportunities for Industry through a wide portfolio of specialized services and strategic global linkages.

India's premier business association has around 9,000 members, from the private as well as public sectors, and an indirect membership of over 300,000 enterprises from around 286 national and regional sectoral industry bodies. With 62 offices, including 10 Centres of Excellence in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with 350 counterpart organizations in 133 countries, CII serves as a reference point for Indian Industry and the international business community.

WWF

About WWF India

WWF India is committed to creating and demonstrating practical solutions that help conserve India's ecosystems and rich biodiversity. With more than 50 years of conservation journey in the country, WWF India works towards finding science-based and sustainable solutions to address challenges at the interface of development and conservation. WWF India is part of the WWF network, with offices in over 100 countries across the world. WWF India works in many states of India, through our state and field offices. The organisation works in different geographical regions and across thematic areas, including the conservation of key wildlife species and their habitats, management of rivers, wetlands and their ecosystems. On the sustainability side, the focus areas are climate change adaptation, driving sustainable solutions for business and agriculture and empowering local communities as stewards of conservation. WWF India also works in combatting illegal wildlife trade and in bringing environment education to students through outreach and awareness campaigns.

[18] PETCO: PET Recycling Company, South Africa,available at: https://petco.co.za/who-we-are/
[19] PETCO NPC. (2018). PET Industry Waste Management Plan. https://static1.squarespace.com/static/54b408b1e4b03957d1610441/t/5ba4cef1f9619a23ee295c46/1537527545092/201809_PETCO+IndWMP+Shared+Cost+Plan+rev00.pdf

About WRAP

WRAP is a global NGO based in the UK. It is one of the UKs top 5 environmental charities and works with governments, businesses and individuals to ensure that the worlds natural resources are used sustainably. WRAP collaborated with the Ellen MacArthur Foundation to launch the first Plastics Pact in the UK in 2018. WRAP is the charity leading The UK Plastics Pact (a world first) and the Plastics Pact in Europe, Canada, US, South Africa, Kenya and India; as well as, Love Food Hate Waste, the Courtauld Commitment, the Sustainable Clothing Action Plan, Textiles 2030, and Recycle Now. WRAP works collaboratively and develops and delivers evidence-based, impactful solutions to reduce the environmental cost of the food we eat, the clothes we wear and the plastic packaging we use. Founded in 2000 in the UK, WRAP now works around the world and is a Global Alliance Partner of The Royal Foundation's Earthshot Prize.

UKRI India

UKRI India plays a key role in enhancing the research and innovation collaboration between the UK and India. Since 2008, the UK and Indian governments, and third parties, have together invested over £330 million in co-funded research and innovation programmes.

This investment has brought about more than 258 individual projects. The projects were funded by over 15 funding agencies, bringing together more than 220 lead institutions from the UK and India. These research projects have generated more than £450 million in further funding, mainly from public bodies but also from non-profit organisations and commercial entities, attesting the relevance of these projects.

Notes

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