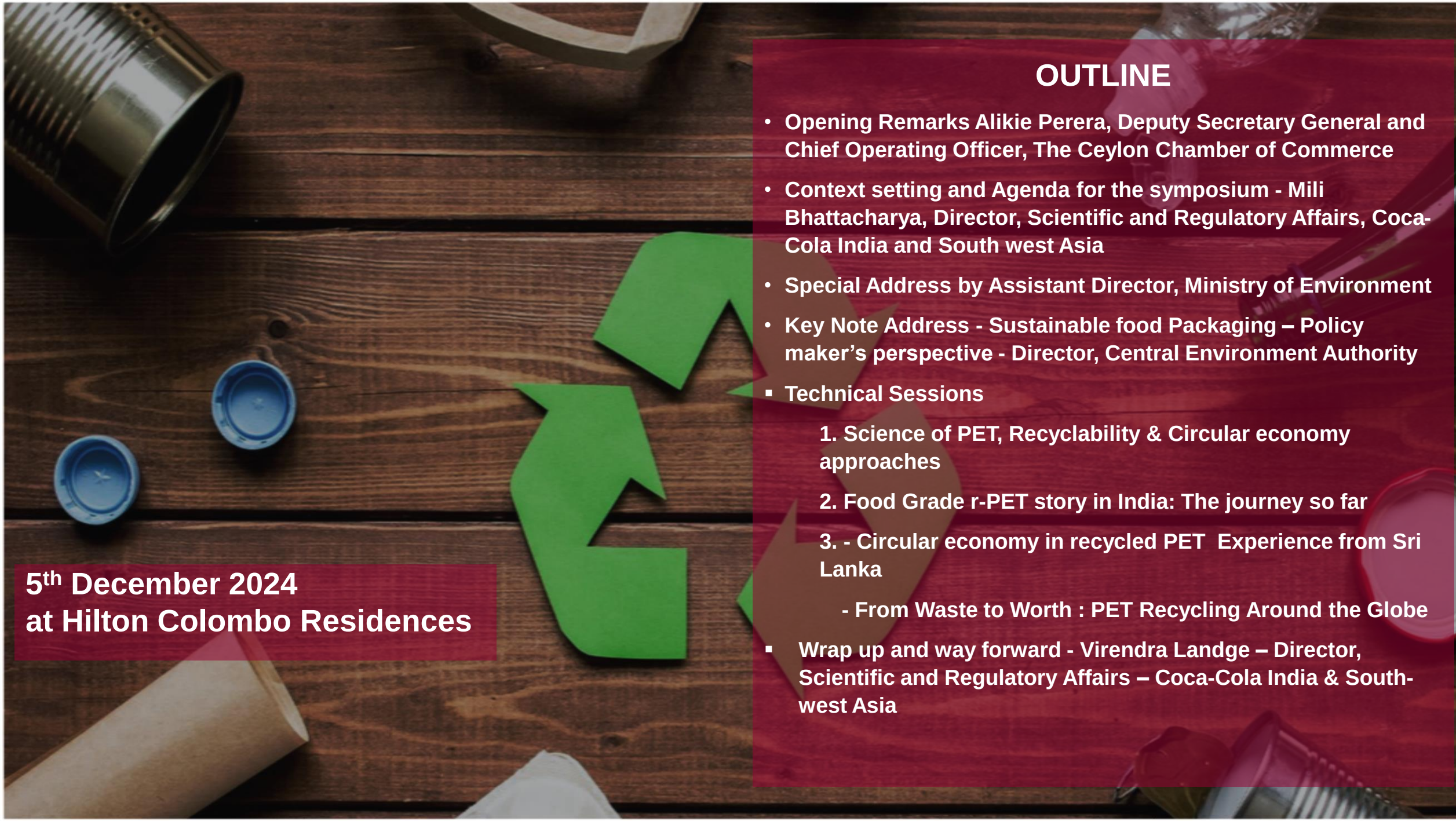

International Symposium on
Science behind Recycled PET and enabling circular economy approach in sustainable food packaging



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- Opening Remarks Alikie Perera, Deputy Secretary General and Chief Operating Officer, The Ceylon Chamber of Commerce
- Context setting and Agenda for the symposium - Mili Bhattacharya, Director, Scientific and Regulatory Affairs, Coca-Cola India and South west Asia
- Special Address by Assistant Director, Ministry of Environment
- Key Note Address - Sustainable food Packaging – Policy maker's perspective - Director, Central Environment Authority
- Technical Sessions
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  - 2. Food Grade r-PET story in India: The journey so far
  - 3. - Circular economy in recycled PET Experience from Sri Lanka
  - - From Waste to Worth : PET Recycling Around the Globe
- Wrap up and way forward - Virendra Landge – Director, Scientific and Regulatory Affairs – Coca-Cola India & South-west Asia

5th December 2024
at Hilton Colombo Residences

Opening Remarks

Mrs. Alikie Perera

Deputy Secretary General and Chief Operating Officer
The Ceylon Chamber of Commerce (CCC)

- The symposium focuses on the science behind recycled PET and aims to promote a circular economy approach in Sri Lanka's plastic packaging and recycling sector.
- PET is widely used in food-grade packaging, especially in the beverage industry. The challenge is to ensure its sustainable use while maintaining food safety and quality standards.
- The event will discuss technical, regulatory, and policy aspects of PET recycling, aiming to create a circular economy framework for Sri Lanka.
- Discussions will cover advanced recycling technologies, global regulatory frameworks, and practical solutions for transforming PET waste into high-quality, reusable materials.
- The symposium aims to reduce reliance on virgin PET imports, address plastic waste issues, and drive economic, social, and environmental benefits for Sri Lanka.
- Emphasis on the importance of collaboration among policymakers, academic researchers, recyclers, and industry leaders to achieve sustainable PET recycling solutions.
- The Ceylon Chamber of Commerce appreciates the contributions of all participants and is confident that the discussions will lead to valuable insights and actionable outcomes for sustainability in Sri Lanka.

Context setting

Ms. Mili Bhattacharya

Director, Scientific and Regulatory Affairs
Coca-Cola India and South-west Asia

"Sustainability requires rigorous, research-backed evidence to guide strategies, policies, and actions, ensuring solutions are effective and scientifically validated"

- The symposium recognizes the contributions of policymakers, industrial leaders, and academics, emphasizing the importance of collaboration to address sustainability in food packaging.
- The event highlights PET as a critical material in the food and beverage industry, advocating for incorporating post-consumer recycled PET into new packaging to promote circularity.
- The seminar builds on prior discussions about sustainable food packaging, aiming to reduce plastic footprints, dependence on virgin PET, and advancing Sri Lanka's Sustainable Development Goals.
- While PET is essential for food preservation and safety, its mismanagement poses environmental threats, necessitating policy reviews and sustainable practices.
- Leveraging global insights, the symposium aims to activate sustainable approaches in Sri Lanka's food packaging sector.
- Engagement with government, industry, and academia is crucial to developing sustainable, science-based solutions that align with environmental and societal needs.
- The symposium addresses PET recycling with a focus on food safety, quality, technical processes, and policy implications to advance sustainable plastic packaging.
- Expert-led sessions provide in-depth exploration of PET recycling processes, including chemistry, collection, decontamination, and the adoption of globally validated technologies.
- Discussions cover international regulatory practices, opportunities for Sri Lanka to enable circularity, and infrastructure needs for sustainable PET packaging.
- Sessions highlight real-world experiences in implementing recycled PET, emphasizing collection systems, material recovery, and circular economy strategies.

Special Address

Mrs. Jeewa Palugaswewa

Assistant Director
Ministry of Environment

"Developing nations bear a disproportionate burden of plastic pollution. Addressing this requires international collaboration to build equitable and effective plastic management systems"

- Improper disposal of plastics contributes to extensive environmental damage and is a significant public health concern.
- Addressing plastic waste requires a collaborative approach involving governments, industry leaders, Chambers of Commerce, and society at large, as no single entity can tackle the problem alone.
- The Ministry of Environment, in collaboration with stakeholders, has introduced a National Action Plan on Plastic Management. This aims to ensure compliance with safety standards, promote durable product production, and enhance recycling rates by 2025.
- The UN report identifies over 13,000 chemicals associated with plastics, of which approximately 3,200 are highly hazardous to human health and the environment This highlights the urgent need for transparency and regulation in chemical usage.
- Degradation during recycling reduces material quality, limiting their usability and undermining the circular economy. Innovative approaches, including new additives and chemical formulations, are needed to enhance recyclability without compromising performance.
- A paradigm shift is needed to ensure chemical transparency across the entire plastic lifecycle. Mechanisms to provide information on chemical usage, risks, and traceability in supply chains must be established.
- Innovative solutions to reduce/mitigate plastic pollution are available but require commitment from all stakeholders to act decisively. Transitioning to sustainable practices and creating an environment friendly future is essential for environmental and human health.

Dr. Ajith Gunawardana

Director
Central Environment Authority

"Sri Lanka has the potential to position itself as a leader in environmental sustainability by adopting innovative waste management practices and emphasizing recycling"

- PET is a versatile polymer widely used in packaging, particularly for beverages, due to its durability, resistance to moisture, and other.
- While PET is useful, its durability contributes to significant environmental challenges, especially in ecosystems like Sri Lanka's coastal regions and central highlands, which are rich in biodiversity but increasingly threatened by plastic waste.
- The country faces challenges with inadequate recycling and waste management systems.
- There is potential to adopt a circular economy approach to manage PET waste effectively.
- Innovations in recycling and reducing pollution can transform waste management strategies, reducing environmental harm.
- Rising consumption and production demand a shift towards sustainable practices to manage waste and minimize pollution.
- Alternatives and innovative solutions are necessary to align economic growth with environmental stewardship.
- A study conducted on Sri Lankan dumping sites revealed that over 70% of these sites are within 100 meters of water bodies, contributing to water pollution and public health concerns.
- Recycling technology and infrastructure need improvement to reduce plastic waste effectively. This includes advancing PET recycling systems to transform waste into valuable resources.
- Embracing a circular economy by recycling and reusing plastics can protect the environment while creating jobs and stimulating local economies.
- Government, businesses, NGOs, and communities must collaborate to share best practices, build awareness, and actively engage in recycling initiatives.
- Programs such as the "Echocut Program" and "Environmental Pioneer Program" aim to instill environmental values in students, encouraging them to engage in recycling, conservation, and research projects.
- The recent rise in the Air Quality Index in Sri Lanka highlights the urgency to address pollution. The unknown impacts of microplastics on health and ecosystems require further research and mitigation.

Science of PET, Recyclability & Circular economy approaches

Dr. Shreeram Wadekar

Head, Recycled PET Product Management
Reliance Industries Limited and Chair, r-PET standard of Bureau of Indian Standards, Govt of India

"Switching to 100% recycled PET (rPET) can reduce greenhouse gas (GHG) emissions by up to 60%, significantly lowering the environmental footprint of plastic production"

- PET is a semi-crystalline, 100% recyclable thermoplastic polymer formed by a chemical reaction between Monoethylene Glycol (MEG) and Purified Terephthalic Acid (PTA), available in three grades Bottle, Textile, and Film with bottle-grade PET produced through a specialized process.
- In 2024, Asia dominates the global Virgin PET market with the highest capacity (66% share) and demand (48% share), growing at 8.3% YoY, while Africa exhibits the fastest demand growth at 9.3%.
- The global demand for Virgin PET is projected to grow steadily from 28.7 MMT in 2024 to 33.8 MMT by 2028, despite a declining operating rate.
- PET packaging, with over 450 million MT already used globally, is widely recognized for its safety, supported by global acceptance of USFDA and EFSA approvals for PET and rPET materials.
- PET recycling follows two primary routes mechanical and chemical. Mechanical recycling, producing rPET resin, is the dominant method (77% of global rPET production) and is well-established for rigid packaging, with approvals from major brands like Coca-Cola and PepsiCo.
- Chemical recycling offers a less GHG-intensive alternative, capable of processing feedstock unsuitable for mechanical methods, with outputs like BHET or monomers (rPTA/rMEG).
- For food contact approvals of PCR PET, strict regulations mandate prescribed feedstock use, decontamination efficiency, and technology approval, addressing contaminants from household chemicals, non-food products, and unknown substances.
- The decontamination efficiency of rPET recycling is assessed through a "challenge test," where PET is spiked with surrogate contaminants representative of potential risks, ensuring safety standards are met.
- For effective recycling, residual contaminant levels (Cres) after processing must remain below the modeled concentration (Cmod), ensuring safe migration limits for infants, toddlers, and adults.

Science of PET, Recyclability & Circular economy approaches

- The first stage of the recycling process, "Bales to Flakes," involves two critical steps to ensure the quality and purity of recycled PET (rPET)
  1. Container Sortation - Mixed post-consumer PET containers are sorted to remove non-PET materials, contaminants, and non-recyclable items, preparing the material for further processing.
  2. Flake Sortation - The sorted PET is shredded into flakes, which are then meticulously sorted to eliminate impurities, colored flakes, and unwanted materials, ensuring that the resulting rPET flakes meet the required quality standards for downstream applications.

- Ensuring high-quality rPET flakes depends on monitoring key parameters, including flake dimensions, bulk density, moisture content, color, and the presence of non-PET materials (e.g., PVC, polyolefins, adhesives, metals, paper, and dust).

- In the mechanical recycling process, the second stage, "Flakes to rPET," involves PET flake extrusion followed by Solid State Polymerization (SSP). This stage achieves a typical yield of 96-98%, efficiently converting high-quality flakes into rPET chips suitable for reuse in various applications.

- The quality of PET flakes is important for achieving the desired rPET resin properties, particularly for food contact applications and specific product attributes. Each rPET technology supplier defines its own flake specifications to ensure compliance and performance standards.

- Chemical recycling allows large-scale processing of low-quality, diverse feedstocks with efficient decontamination, but faces challenges like high costs, regulatory demands, and higher GHG emissions compared to mechanical recycling.

- India's Plastic Waste Management Rules 2022 mandate increasing recycled plastic content in packaging, with PET rigid packaging targets rising from 30% in 2025-26 to 60% by 2028-29, and lower targets for flexible and multi-layered packaging.

- The EU's Packaging and Packaging Waste Regulation mandates 50% recycled content for PET and 65% for single-use plastic beverage bottles by 2040, with all plastic packaging required to be 100% recyclable by 2030.

- Various U.S. states, including California, Washington, and New Jersey, have implemented mandates for post-consumer recycled (PCR) plastic content in packaging.

- India has progressively eased restrictions on the use of recycled PET (rPET) for food contact, with key regulatory changes in 2021, 2022, and 2023, and draft guidelines for rPET in food submitted in October 2024, while maintaining restrictions for pharmaceutical use.

Food Grade r-PET story in India: The journey so far

Dr. Rajeev Kumar Dwivedi

Director, Technical Training and Research Centre, Lohia Corporation Ltd, Former Head of Technology and Business Development, Central Institute of Petrochemical Engineering, Govt of India

"Bottle-to-bottle closed-loop mechanical recycling preserves PET material quality by recycling it into the same application, ensuring food safety and product integrity. The process, approved by EFSA and the US FDA, has been in practice for over 30 years"

- PET (Polyethylene Terephthalate) is the most widely recycled plastic in the world, used in products like fibers, bottles, and films. Discovered in 1941, it has been commercially applied since 1952 and is considered sustainable due to its recyclability.
- Plastics offer numerous advantages in food and beverage packaging, including protection from contaminants, lightweight and durable properties, cost-effectiveness, versatility, recyclability, and the ability to extend shelf life while maintaining visibility and easy sealing.
- Closed-loop recycling is the preferred method for PET recycling, supporting circularity by reusing the material in a continuous cycle, in contrast to linear recycling, which does not prioritize material reuse.
- The rPET decontamination process for food contact applications involves two routes, mechanical and chemical recycling, both effectively removing contaminants and volatile substances to ensure the safety and suitability of rPET for food packaging, while also improving its intrinsic viscosity for bottle applications.
- The PWM (Amendment) Rules, 2022 set the following EPR milestones and recycled content targets,
  - 100% PET collection by 2023
  - 30% recycled content in rigid packaging by 2025, 60% by 2028
  - 10% recycled content in flexible packaging by 2025, 25% by 2028
- The Government of India has progressively enabled the use of rPET in food packaging, with regulations evolving from restrictions in 1998 and 1999 to the 2018 Food Safety and Standards regulations, which now allow the use of recycled plastics for food packaging under specific conditions.
- In 2022 amendments to IS: 14534 and IS: 10171 to allow rPET use, along with the 2021 Ministry of Environment regulations mandating recycled plastics in food packaging by 2025-26.

Food Grade r-PET story in India: The journey so far

- The Food Safety and Standards Authority of India (FSSAI) also updated its 2018 regulations to allow recycled plastic products, including carry bags, in food packaging, subject to appropriate standards and guidelines.

- In June 2023, India launched its first water bottle made with rPET, marking a key milestone in sustainable packaging.

- ISO's recycling standardization focuses on five key areas:
  1. Terminology and guidance,
  2. Biodegradability,
  3. Biobased plastics,
  4. Microplastics, and
  5. Mechanical and chemical recycling, aiming to create uniform, sustainable practices across industries and regions.

Circular economy in recycled PET Experience from Sri Lanka

Mr. Roshan Narasinghage

Deputy Chief of party,
USAID Ocean Plastic Reduction Activity

"PET waste collection in Sri Lanka presents a significant opportunity for poverty reduction, as individuals involved in collection can potentially earn above the government welfare benefit range of LKR 15,000, offering a sustainable income source"

- In Sri Lanka, the informal sector plays a key role in PET recycling, contributing the largest share.
- However, the overall collection rate remains low, between 15% and 28%, despite efforts from local authorities, collection centers, and companies like Coke, Elephant House, and Pepsi.
- The low PET collection rate in Sri Lanka is due to challenges like high transport costs, lack of economic incentives, and a fragile business case for recycling.
- The social stigma around waste collection and reliance on investment from EPR companies further hinders progress.
- E-vehicles for plastic waste collection can reduce costs from LKR 20-30 per kg to LKR 1-2 per kg, providing a more efficient solution for plastic waste management.
- **EmpowerECO** introduces plastic credits in Sri Lanka, offering additional revenue for informal collectors, with LKR 150 for ocean-bound plastics and LKR 60 for inland plastics.
- Sri Lanka faces significant PET waste accumulation, with an estimated LKR 51 million in uncollected PET waste per month.

- The global rPET market is growing, with India valued at USD 10.67 billion in 2023, and countries like Bangladesh and companies like Indorama Ventures increasing investment in recycling capacity.
- rPET offers a strategic import substitution opportunity for Sri Lanka, reducing reliance on virgin PET and promoting a circular economy.
- The EU, the US, the UK, Australia, and South Korea, are implementing rPET regulations to increase the use of recycled plastic in packaging.
- Several countries, including India, China, Japan, Saudi Arabia, South Korea, and Brazil, are advancing rPET initiatives without nationwide Deposit Return Schemes (DRS).

Jamie Pero Parker, PHD

Senior Innovation Advisor
RTI International

"PET has a lower leachate toxicity compared to other commodity plastics, making it less of a concern for environmental and health risks"

- Global waste systems and infrastructure must expand in scale to match the increasing production of plastics.
- Annual plastic production has doubled since 2000 and is projected to grow at a comparable pace in the coming decades.
- PET stands out as one of the most recyclable types of plastic compared to other commodity plastics.
- Many brands are transitioning to PET from less recyclable plastics to align with circularity goals, with rPET emerging as a preferred sustainable option.
- As highlighted by NAPCOR, a federal deposit program could significantly boost rPET recycling rates, address key challenges, and unlock the industry's full potential.
- Germany's Pfand Deposit Return System (DRS) achieves a remarkable 98% return rate, showcasing its effectiveness in reducing plastic waste.
- The system includes deposits for both reusable (glass or PET) and single-use containers, with deposit values ranging from €0.08 to €0.25, incentivizing returns.
- Since its introduction in 2003, the program has significantly reduced environmental dumping, addressing the issue of approximately 3 billion disposable beverage containers annually.
- The Brecon Digital Deposit Return Scheme (DDRS) pilot in Wales demonstrated an innovative approach to recycling using QR codes, enabling broader product inclusion and compatibility with existing infrastructure. Results showed high recyclate quality, with PET bottles making up 63% of returns and curbside recycling being the preferred method.
- Stagnant collection rates and increasing brand commitments are driving rPET demand beyond current supply capacity.
- Meeting 25% post-consumer recycled (PCR) content in bottles in the U.S. would require at least 80 new recycling plants with an 18,000 tons/year capacity.
- Sustaining rPET supply hinges on continued growth in imports at the 2017–2020 rate and brand owners fulfilling at least 50% of their public commitments.

- The global adoption of both mechanical and chemical rPET is accelerating,
  1. Heinz Brazil transitioned ketchup, barbecue sauce, and mayonnaise bottles to 30% rPET, developed by Valgroup in under a year.
  2. Friesche Vlag shifted from single-use glass bottles to 100% rPET for coffee creamers, adding a convenient wrapper-removal 'zipper.'
  3. The Bottle4Flex project in Spain is developing fully recyclable rPET-based skin-packing containers in collaboration with Aimplas, Covinil, and Eroski.

- Many brands are investing in chemical rPET due to limited mechanical rPET supply. RTI developed a 15-year forecasting model for chemical rPET, which incorporates both technical and business readiness factors, including offtake contracts and feedstock supply agreements, to better predict future supply capacities.

- Colored PET, especially white and opaque, is challenging recyclability by contaminating clear PET recycling streams, leading to calls from brands and regional pacts to eliminate it by 2025.

- While some brands and recyclers, like Sprite and Rumpke Recycling, push for colored PET's continued use in packaging and recycling, tensions persist between recyclability concerns and the technical benefits of colored PET.

- Suntory has played a key role in Japan's 86% PET recycling rate by pioneering bottle-to-bottle recycling technology, transitioning to 100% recycled PET for their wine products, and collaborating with communities and competitors to promote better recycling practices.

- Stakeholders play key roles in advancing the circular economy,
  - Government - Establish policies, incentivize recycling, raise awareness, and promote collaboration.
  - Regulators - Set standards, enforce compliance, and support innovation.
  - Food & Beverage Industry - Commit to rPET use, collaborate, and support awareness campaigns.
  - Collaborative Actions - Foster public-private partnerships, invest in R&D, and join circular economy alliances.

Wrap up and Key way forward

Mr. Virendra Landge

Director, Scientific and Regulatory Affairs
Coca-Cola India & South-west Asia

"PET, a versatile and highly recycled material, proves safe for food contact when processed with the right technology"

- Sustainability is the future of food packaging, with a shift toward circular solutions.
- rPET is a safe and sustainable packaging material, supported by the need for an enabling regulatory framework.
- The regulations, issued under the Food Act, No. 26 of 1980, provide a legal structure to govern the safety and quality of food packaging materials in Sri Lanka.
- This emphasizes the prevention of food contamination caused by harmful substances in packaging materials, ensuring public health safety.
- The regulations strictly prohibits the use of recycled plastic in the preparation, packaging, storage, delivery, or sale of food and highlights the importance of using safe and hygienic materials in food packaging to ensure consumer safety.
- According to the requirements in Section 4.1.1, only virgin polymer materials must be used for plastic containers intended for food packaging. These materials must be food-grade and certified by a recognized body in accordance with international standards, ensuring safety and compliance with global practices.
- Sustainability in food packaging is no longer optional but essential. Embracing circularity through materials like rPET, which is both food-safe and environmentally sustainable, is critical to addressing global challenges.
- Establishing an enabling regulatory regime that supports the adoption of innovative, sustainable packaging solutions while ensuring safety and compliance will pave the way for a greener, more resilient future.
- Multiple stakeholders including Govt, Industry, Academia should come forward to engage, collaborate to initiate review of the regulations for amendments to enable rPET use, through science-based evaluations and analysis.

- **Technical Session 1** - Science of PET, Recyclability & Circular economy approaches by Dr. Shreeram Wadekar

TECH 1 International Symposium - Colombo 5th Dec 2024 Dr Shreeram Wadekar-Final.pdf

- **Technical Session 2** - Food Grade r-PET story in India: The journey so far by Dr. Rajeev Kumar Dwivedi

TECH2 Food Grade r-PET story in India the journey Dr Rajeev Dwivedi.pdf

- **Technical Session 3**

Presentation 1 - Circular economy in recycled PET Experience from Sri Lanka by Mr. Roshan Narasinghage

Technical Session 3 Presentation 1 - Circular economy in recycled PET Mr. Roshan.pdf

Presentation 2 - From Waste to Worth: PET Recycling Around the Globe by Jamie Pero Parker, PHD

Technical Session 3 Presentation 2 - Circular rPET Jamie Pero Parker, PHD.pdf

- **Wrap up and way forward** by Mr. Virendra Landge

Conclusion and Way Forward.pptx

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