



Emerging Circular Economy Technologies in 7 Different Cities

**Global Forum on Human Settlements and Sustainable Cities and Human Settlements,
Online Forum,
27-29, October, 2021**



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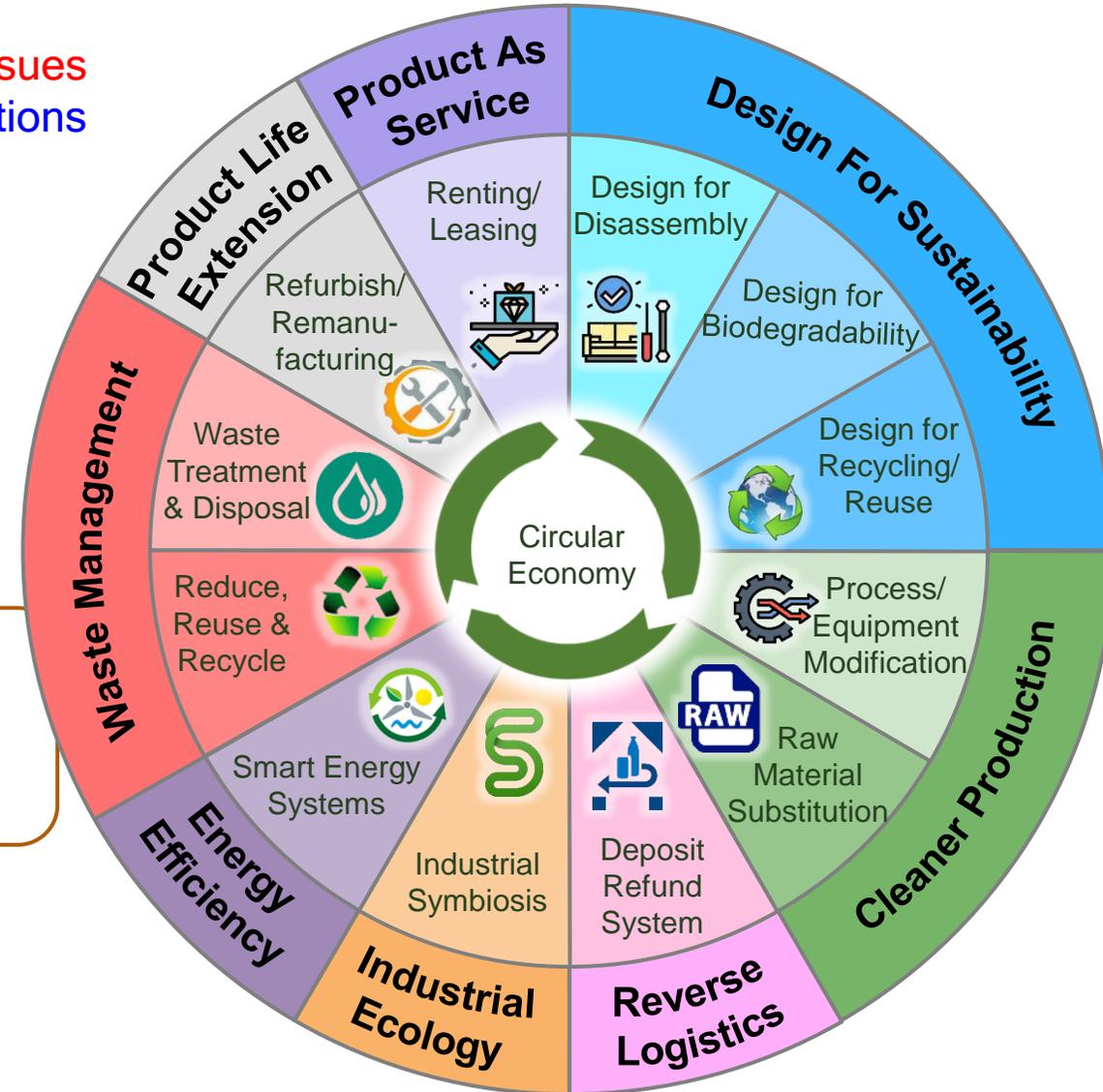
Circular Economy is Collaborative!

This presentation will bring the major waste management issues across various cities and their *emerging technologies* and innovations across multiple domains of CE.



Linear Economy is Individualistic!

Circular Economy is collaborative and thus difficult to implement!



#1 Design for Sustainability – Packaging Wastes

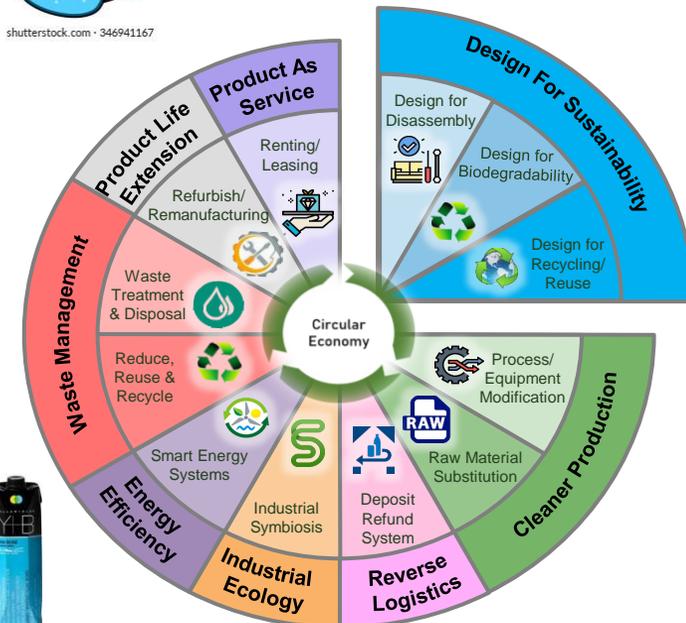
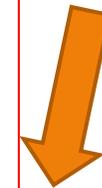
Jakarta 10-11 million population...
A Mega city with 7000 Tons/per day with 13- 15 % Plastic Waste

Jakarta is looking for biodegradable solutions to the current problem. Beverage Packaging is Expected to be One of the Most Significant Applications

- The market for biodegradable packaging in the Beverage sector in Jakarta is anticipated to witness growth with the never-ending. The demand for bottled-water is credited to consumers' propensity for specifically demanding high-quality drinking water
- US-based Crown Holdings Inc. has opened a new facility in Jakarta, Indonesia. Considering the country's robust economic growth and sizable population, such eco-friendly initiatives offer significant potential for biodegradable beverage packaging.



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New Materials for Sustainability!

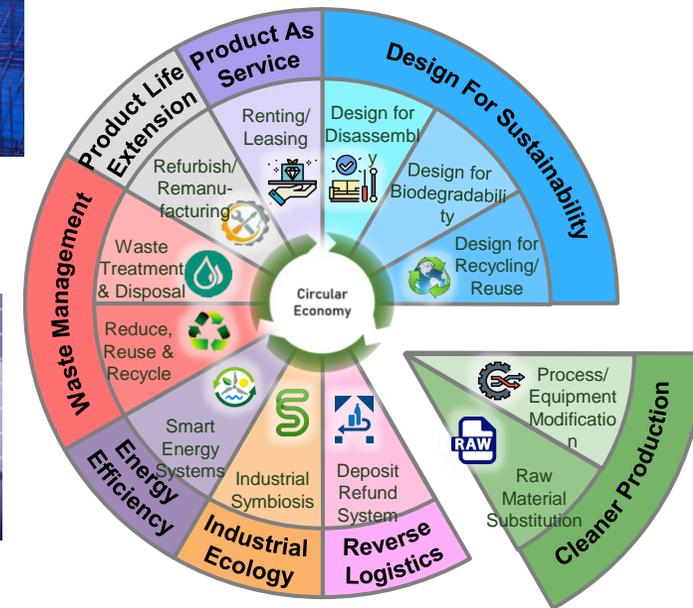
Source: <https://apnews.com/press-release/pr-businesswire/b45d472d932048069e4e7720de51ebdd>



#2 Cleaner Production – C & D Wastes

- **Location: Brussels, Belgium.** The city of Brussels is one of the finest examples of C&DW management in Europe. Due to landfill banishment of unsorted and separately collected wastes, C&D wastes are readily recycled in the city. In the Brussels-Capital Region, inert C&DW generated account for 480,000 tons in 2018, excluding excavated soils.

- In terms of volume, construction and demolition waste represents the largest single group of all waste types in Brussels and other cities in Europe, and a substantial part of this waste is concrete.
- Cement production may be able to provide a solution by reintegrating crushed, or otherwise treated, concrete as a substitute for limestone.
- Ashes from lignite or coal, blast furnace slag, concrete crusher sand, aerated concrete meal and fractions from demolition waste have already been decarbonated and could be used as an alternative to 'virgin' limestone thus avoiding CO₂ emissions during its transformation to lime in the production process.



European Cities Towards Low Carbon Concrete

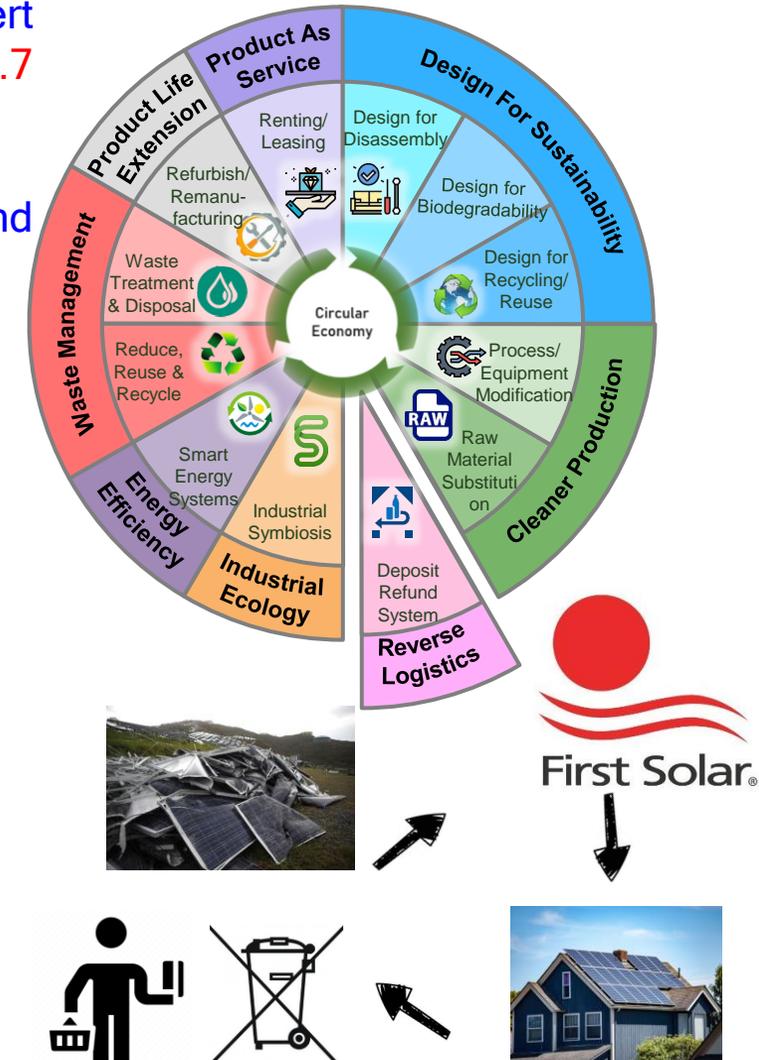
Source: <https://resourceefficientcities.org/wp-content/uploads/2019/10/GI-REC-Pilot-City-Brussels-FINAL.pdf>

Researchgate: https://www.researchgate.net/publication/341251784_Construction_and_Demolition_Wastes_specific_conditions_for_recycling_in_North_West_Europe/link/5eb57d3fa6fdcc1f1dcacd3b/download

#3 Reverse Logistics – Solar Panel Wastes

- The International Renewable Energy Agency (IRENA of U.S) official projections assert that “large amounts of annual waste are anticipated by the early 2030s” and could total **1.7 - 8 million metric tons by the year 2030**.
- Experts expect that more than **0.72 tons** worth of gargantuan wind turbine blades will end up in U.S. landfills over the next 20 years.

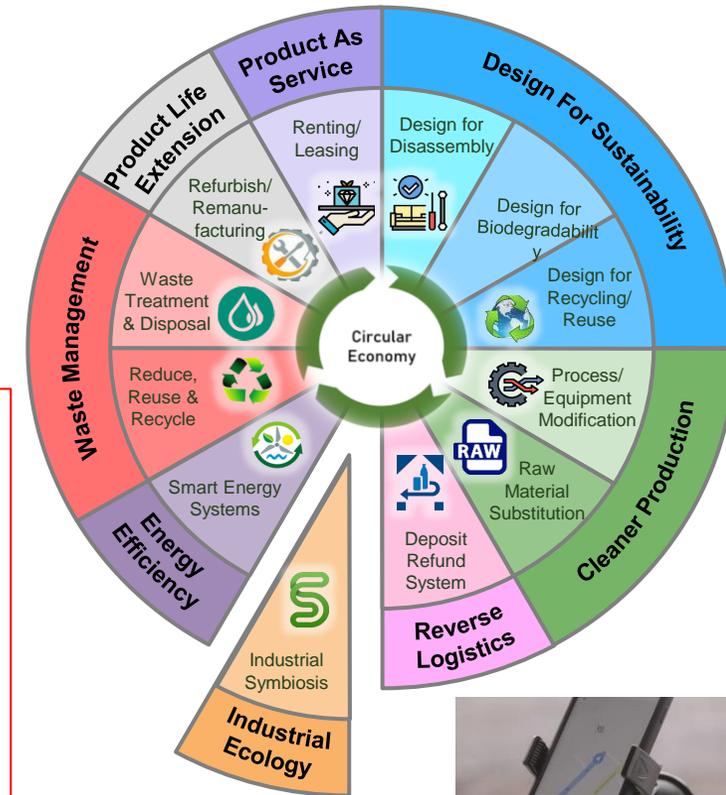
- **First Solar - Arizona, US; Frankfurt, Germany and Kedah, Malaysia**
- First Solar is involved in discussions with EU officials to ensure a level playing field for all companies in the sector, such as the take-back mandates for solar panels under the WEEE directive adopted in 2012.
- Prior to the inclusion of PV panels in the WEEE directive, First Solar had already established a **voluntary collection and recycling program**, which was viewed as an industry best practice for end-of-life management by the EU.
- **Tellurium is a scarce material** and by taking back its products the company ensures a continuous supply, reducing risk and increasing raw material security.



#4 Technology Bringing in Industrial Ecology

- **Location: Cities: Cities of United States and Canada**
- All over the cities in U.S., subterranean garbage heaps called landfills are rising, fueled by the 292.4 million tons of municipal solid waste (MSW) the US produces each year.
- According to the EPA, in 2018, almost 50% of that trash went to landfills around the country.

- Rubicon's cloud-based, big-data platform connects waste producers with a network of independent waste haulers across 50 states in the US and Canada, as well as 18 additional countries.
- This enables higher diversion rates from landfill, creative reuse of waste material, optimized truck routes and the detailed analysis of waste data.
- This business model led Rubicon to emerge as the world's first "green" unicorn in 2018—that is, the first startup focused on environmentally sustainable solutions with an estimated market value of over \$1 billion
- It promotes Industrial Ecology in CE Wheel for wastes to be diverted to the right place.

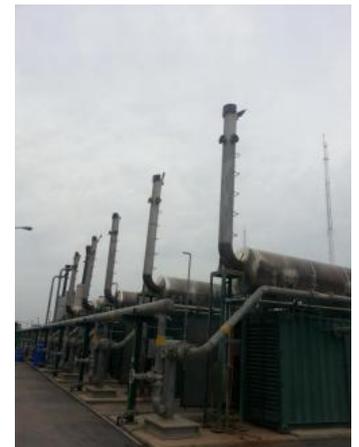


Uber for Trash!

Source: Android App Store
<https://play.google.com/store/apps/details?id=com.rubicon.rubiconcustomer&hl=en&gl=US>
<https://www.rubicon.com/blog/building-the-circular-economy/>

#5 Energy Efficiency and Biogas Production – Agri Wastes

- **Location: Thailand** Smartening Biogas production and Improving Energy Efficiency
- In Bangkok, Bangkok Metropolitan Authority collects 9,940 tonnes per day of municipal waste on average or total in 3,628,100 tonnes/year. In regard to the population this can be calculated as 438 per capita in Kg/year].
- **Bangkok Kamphaeng Saen Landfills** is Bangkok's largest landfill, also one of the largest landfills in Asia.
- Daily waste input is over 5,000 tons/day
- **Kamphaeng Saen Landfill Gas to Energy** is located at the main landfill site. It accepts approximately 5,000 tonnes of waste per day from Bangkok, this project captures and utilises landfill gas (LFG) to generate renewable electricity and avoid the release of potent greenhouse gases (GHGs).
- The Thailand MWE Projects won the Outstanding Green Initiative award in 2011.

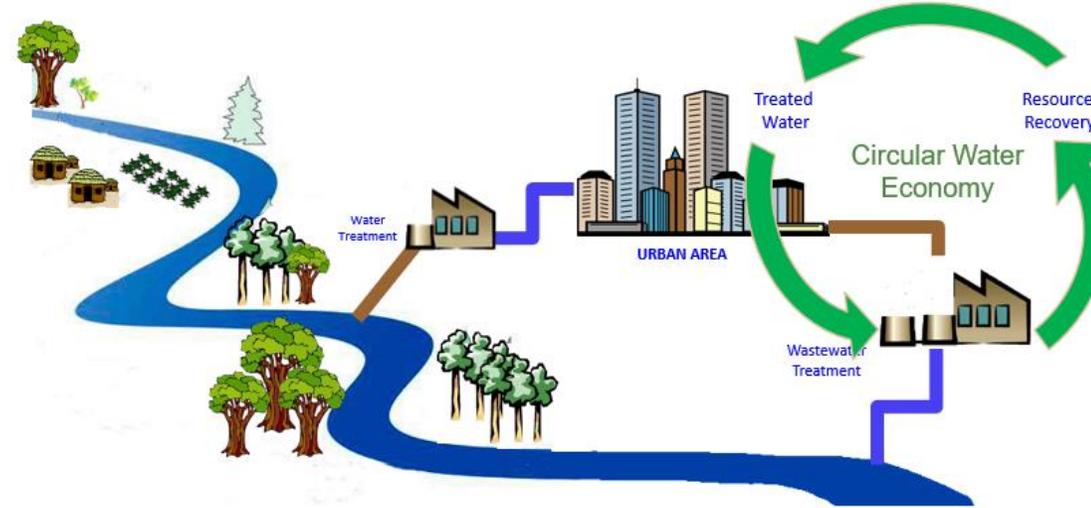


Lighting Bangkok through Wastes!

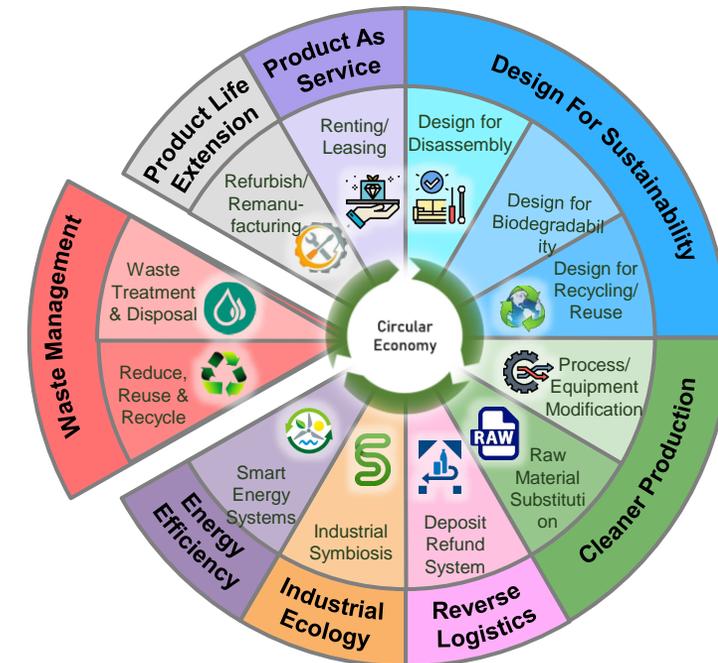
#6 Promoting Social Awareness and Acceptance for Wastewater Reuse: Lessons from NEWater, Singapore

City: Singapore

Singapore lacks natural resources, and it is limited in space, which is why we are always looking for ways to explore water sources and stretch our water supply. Recycled wastewater can meet 40 percent of Singapore's water demand



- 'NEWater': Terminology itself was carefully chosen to emphasize its ultra-clean nature
- Key success factors:
 - Strong governmental and administrative support
 - Credible reference projects
 - Technology demonstration
 - Water safety assessment
 - Assurance and endorsement from experts
 - Media engagement

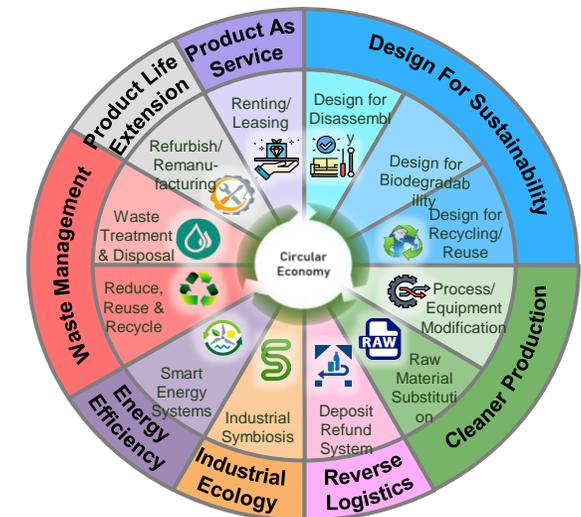


Vertical Farming in Singapore - Global Example

- **City: Singapore**
- With a population of about 5.7 million people crammed on a landmass of just 715 square kilometres the tiny Republic of Singapore has been forced to expand upwards, building high-rise residential complexes to house the country's many inhabitants.
- Currently less than **10% of Singapore's food is grown locally**. The country imports most of its fresh vegetables and fruits daily from neighbouring countries such as Malaysia, Thailand and the China.
- The solution to the problem came in the form of a public-private partnership in 2010, with the launch of what has been hailed as the “**world's first low-carbon, water-driven, rotating, vertical farm**” for growing tropical vegetables in an urban environment.



Planting tall greeneries in Singapore!



#7 – Product as Service – Packaging Wastes

Location: Helsinki, Finland

According to a preliminary report by the Smart & Clean Foundation, only 6% of all recyclable plastics in the Helsinki metropolitan area are refined into new material. The main goal of the **Closed Plastic Circle project** is to get 60-70 percent of the plastics in the Helsinki metropolitan area.

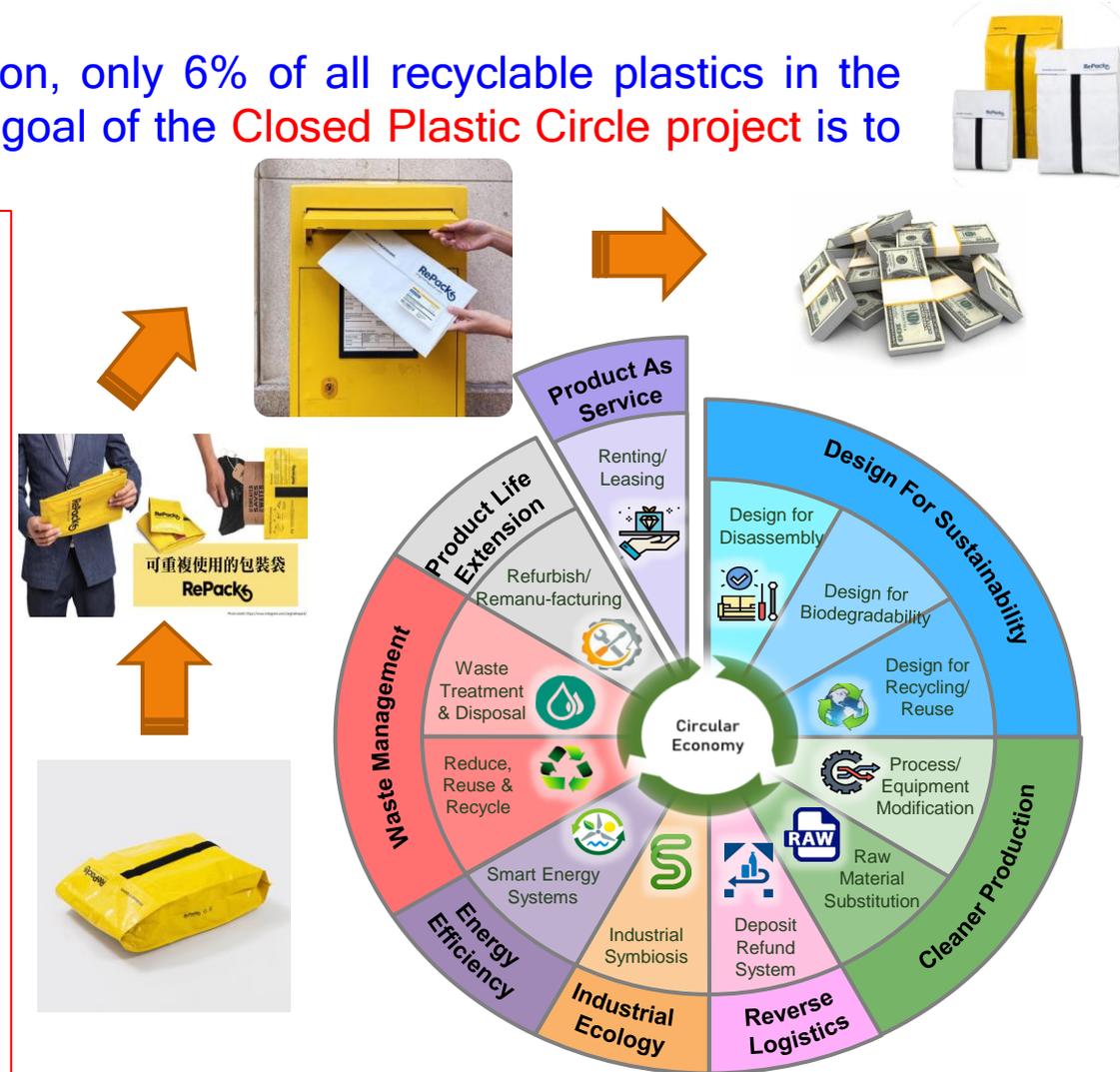
RePack is a company based in Helsinki, Finland which provides packaging-as-a-service for online retailers to reduce overall plastic waste generation rates in Finland.

How does it work?

When customers order from the web store they can opt for RePack's alternative reuse packaging. The order is then delivered to the customer in a **RePack shipper with a prepaid return label**. Subsequently, customers send the shipper back to RePack for a central quality check and redistribution.

Incentives

Each shipper has a **unique barcode** that ensures individual shippers can be identified and linked to a specific shipment. This enables a reward for customers to be triggered when sending back the RePack.





Thank You!