TREASoURcE

Territorial and regional demonstrations of systemic solutions of key value chains and their replication to deploy circular economy

TREASoURcE aims to initiate systemic change by developing technologies and systemic circular economy (CE) solutions in cities and regions for currently underutilized or unused plastic waste, end-of-life electric vehicle batteries and bio-based side and waste streams.

Implementing these solutions together with companies, societies (including citizens, consumers, communities and regional actors) and experts in the field is expected to significantly increase product and material circulation in the Nordic and Baltic Sea Regions.

Systemic Circular Economy Solutions

Key Value Chain Demonstrations

- Circular plastics
- Circular batteries
- Circular biobased side and waste streams
- \+
- Stakeholder Engagement Demonstrations

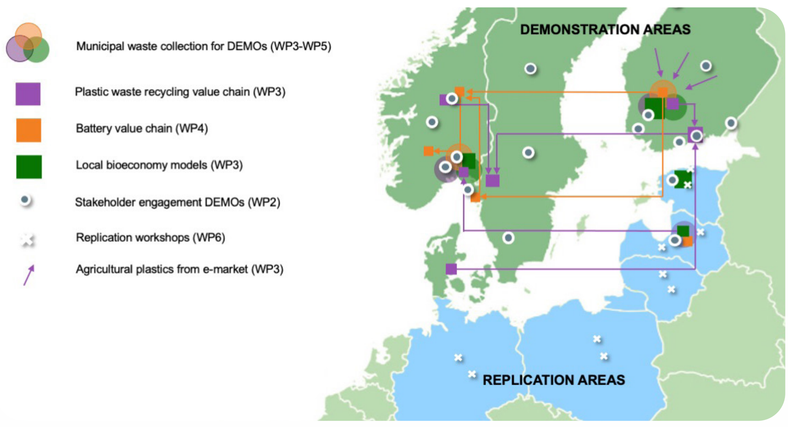
Territories' CE activities and state-of-the-art of CE

The report on Territories' CE activities and state-of-the-art of CE provides a comprehensive overview of the current status of circular economy in the countries and selected regions and municipalities covered by the TREASoURcE project: Finland, Norway, Denmark, Sweden, and Estonia. The overview is developed through a desktop study of existing circular economy strategies, roadmaps, and action plans. A total of 56 documents have been analysed and provide a baseline on which the TREASoURcE project can build upon.

The report identifies three key takeaways based on the analysis:

1. There is a need for cross-regional collaboration to enhance CE of certain materials.
2. There is a need to move from static documents to actions that promote implementation of CE strategies and the transition to CE.
3. There is a need for cross-country learning where latecomer-countries can draw upon experiences and best practices from countries that have progressed further in terms of CE.

Demonstration and replication areas



The stakeholder engagement demonstrations interlink with the key value chain demonstrations, and involve broad range of stakeholders like businesses, decision makers, consumers and local communities and innovate with them. The key value chain demonstrations include development and scale-up of technical solutions that link to circular plastics, batteries and biobased side and waste streams.

Challenges, barriers and gaps inhibiting transitioning to Circular Economy

Repurposing electric vehicle batteries

The master's thesis **The operational environment for repurposing electric vehicle lithium-ion batteries for energy storage applications in the EU** aims define the operational environment and discover challenges and barriers for repurposing battery. To achieve the objective, the literature review of battery regulations and repurposing technologies, in addition to semi-structured key stakeholder interviews with 22 participants from the EU were conducted. As a result, 8 challenges and 5 common drivers affecting the repurpose of electric vehicle lithium-ion batteries for energy storage are discovered.

Challenges

1. Uncertain economic viability of second-life batteries compared to new batteries
2. Low availability of electric vehicle batteries
3. Lack of battery information inducing additional workload for battery assessment
4. Varied electric vehicle battery designs which are not meant for second life
5. Safety concerns for utilizing second-life batteries
6. Competition with the more developed recycling process
7. Regulatory shortcomings causing process and product quality concern
8. Consumer preferences of new batteries over old ones

Common drivers

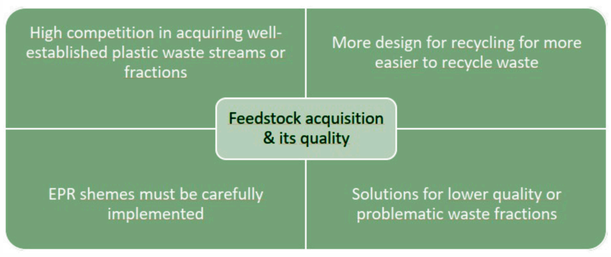
1. Pivotal role of financial aspects in the feasibility of the second-life business
2. Car manufacturers' willingness to provide battery information and design electric vehicle batteries for second life
3. Factors steering electric vehicle batteries towards recycling such as battery design preventing repurposing and recycling target from EU Battery Regulation
4. Reputational harm to second-life batteries due to accidents and safety issues
5. Consumer role in sustainable consumption

Reference: McDougall, N. (2023). The operational environment for repurposing electric vehicle lithium-ion batteries for energy storage applications in the EU. Master's thesis. Aalto University.

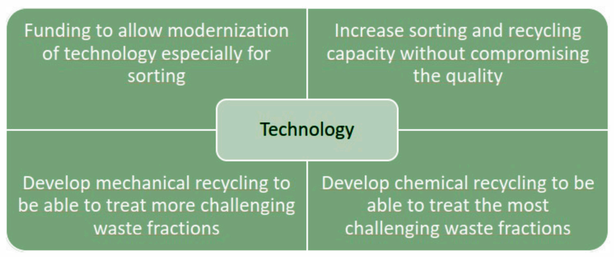
Plastic recycling

The master's thesis **Identifying challenges, technology & knowledge gaps across plastics value chain with a focus on recycling in circular economy** aims to identify the challenges, technology and knowledge gaps related to the circular economy of plastic recycling in the EU. The research work is divided into two parts. First part is a broad literature review including regulatory and state-of-the-art technology review. Second part is an experimental part including stakeholder interviews across the plastics value chain and questionnaire for researchers in the field. Additionally, experimental part contains Modix trial runs of agricultural plastic waste as a pre-treatment step to respond to a known existing challenge. The identified challenges and gaps were divided into four categories:

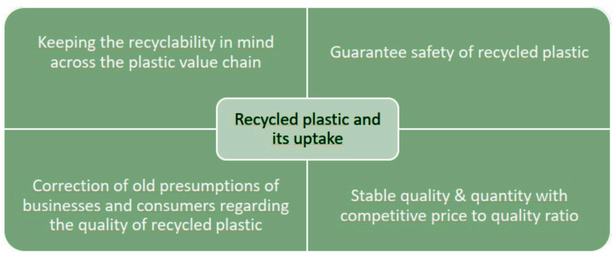
1.



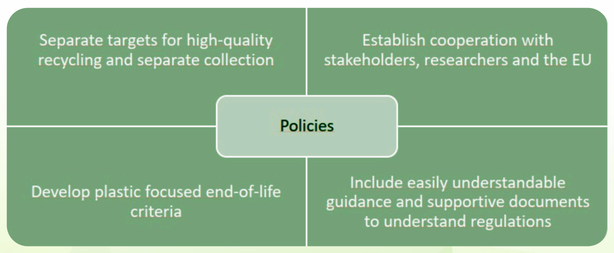
2.



3.



4.



A key takeaway is that every stage of the plastics life cycle has impacts on the future stages. There is no one major challenge, but multiple sometimes very application-dependent issues. Effort across every stage of the plastics life cycle is required.

Reference: Myrä, M. (2023). Identifying challenges, technology & knowledge gaps across plastics value chain with a focus on recycling in circular economy. Master's thesis. LUT University.

Circular bio-based side and waste streams

The master's thesis **The operational environment of circular bio-based side and waste streams for biogas and nutrient recovery** generates an overview of the current circular bioeconomy development and identify its associated challenges and opportunities. The research work was conducted following the literature review of technologies and legislations, in addition to 3 case studies in Finland consisting of 10 stakeholder interviews and a questionnaire to validate the practices. Those 3 case studies represent 3 operational models of self-sustaining circularity, rural-urban symbiosis, and industrial ecosystem that forms the circular bioeconomy operational environment at different scales. PESTLE analysis is utilized to assess the operational environment from different perspectives of political, economic, social, technological, legal, and environmental factors. The key takeaways from the work are:

1. Circular bioeconomy challenges through PESTLE analysis

- **P**olitical: Unharmonized regulation between the new and existing regulations and ununited regulations between the countries
- **E**conomic: Financial access and competition between circular products with other resources (organic fertilizer with traditional fertilizer, biogas with electricity as vehicle fuel)
- **S**ocial: Integrating sustainability into education to prepare the sustainability workforce and raise awareness.
- **T**echnological: Solving the critical issue of low-quality products, which induces costly upgrading process, from the root causes (sustainable material design and feedstock quality)
- **L**egal: Restriction in processing and utilization of bio-based side and waste streams hindering technological innovation and market development for circular bioeconomy
- **E**nvironmental: Decoupling raw material extraction from economic growth by utilizing bio-based side and waste streams as alternative or mix with virgin materials.

2. Recommendation for circular bioeconomy operation

- Small-scale self-sustaining circularity development to improve nutrient recovery at the first place, minimize logistics and its associated impacts
- Medium scale rural-urban symbiosis development to tackle the logistics challenges, make the best use of bio-based and waste streams where self-sustaining practices are not feasible, and prepare the qualified feedstocks for industrial ecosystem
- Large scale industrial ecosystem development to not only recirculate the industrial streams but also uptake the feedstocks processed from rural-urban symbiosis to bridge the feedstock quantity and quality gap between small primary producers and industrial operators

Reference: Ngo, T. (2023). The operational environment of circular bio-based side and waste streams for biogas and nutrient recovery. Master's thesis. Tampere University.

www.treasource.eu
TREASoURcE
TREASoURcE_eu
Treasource Project

Contact us at info@treasource.eu
Project duration 06/2022 – 05/2026

Funded by the European Union