4Recycling ecosystem RDI roadmap

Recycling of bulky fibre-reinforced plastic products and industrial side-streams

24.8.2022

SYSTEMIC CHALLENGE

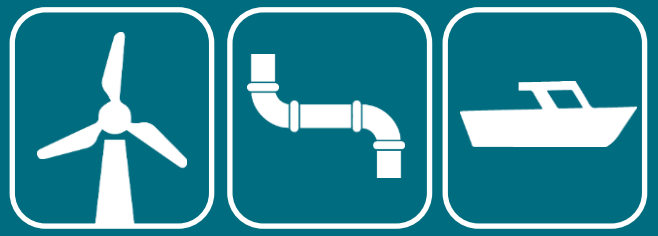
that stems from diversified waste material streams

FUNCTIONAL BIO-BASED AND CIRCULAR SOLUTIONS FOR RETAIL PACKAGING

RECYCLING TECHNOLOGIES FOR RETAIL PACKAGING

PLASTICS AND COMPOSITES IN CONSTRUCTION INDUSTRY

RECYCLING OF BULKY FIBRE-REINFORCED PLASTIC PRODUCTS AND INDUSTRIAL SIDE-STREAMS



RECYCLING OF BULKY FIBRE-REINFORCED PLASTIC (FRP) PRODUCTS AND INDUSTRIAL SIDE-STREAMS

GOALS

2025

Enforcing regulation in place

Basic infrastructure for FRP recycling with related logistical value chains and collecting & sorting processes defined and in place

National target for Finland:
1st generation recycling plant for FRP products in operation and turning waste into recycled feedstocks

2030

Value & logistical chains and collecting & sorting infrastructure in place for recycling of all FRP products

New recycling technologies in use and data ecosystem in place

National target for Finland:
Several large-scale demonstrations

2035

Industrial-scale operations 'up & running' for recycling of all FRP products and industrial side-streams

Value chains for recycling working efficiently for large volumes of FRP products and industrial side-streams

System development

- Mapping of FRP **waste stream variety and volumes**
- Sustainable recycling **system design,** incl. logistics

- **Environmental impact assessment** for the chosen recycling options

- **Full value networks** with working **business models**
- **Material data needs** essential for FRP recycling
- **Design for recycling** to improve sustainability of FRP products

- **High-value products** out of recycled FRP
- **Logistical system** for all FRP products
- **Impacts of** the presence of FRP containing **novel materials in the recycling system**

Data ecosystem to support FRP recycling

- **Scaling up**

Recycling technologies

- **Development of** selected existing and potential new recycling **technologies** for FRP products

- **Processing solutions for material mixtures**
- Utilisation of recycled FRP in **geopolymers**

- **Specific repair and modification technologies** for reuse and repurposing

- **Recycling concepts for new high-value products**
- **New recycling technologies for challenging FRP products,** including products containing novel materials
- **Pilots** for climate-neutral zero-waste recycling & for processing multiple waste streams together

- **Scaling up**

Material solutions

- **Mapping of material performance demands** for FRP products in different application areas

- **New environmentally friendly materials** for bulky FRP products
- **Replacing inorganic fibres** with natural ones
- **Design to last and for recycling** of FRP products with new material solutions

- **Novel environmentally friendly and easily recyclable materials** for bulky FRP products

- **Continuous development of new sustainable material solutions** for FRP products

Goals 2025

Return

- ✓ Enforcing regulation & legislation in place in EU and Finland
- ✓ Basic infrastructure for FRP waste recycling in place
- ✓ Processes defined for collection, identification and sorting of FRP products and industrial side-streams
- ✓ Needed logistical chains identified
- ✓ New FRP recycling technologies developed

National target for Finland:

1st generation recycling plant for FRP products in operation and turning waste into recycled feedstocks in Finland

Goals 2030

Return

- ✓ Value chains created for recycling of all FRP products
- ✓ Logistical chains and infrastructure for collecting & sorting in place for all FRP products
- ✓ New technologies for recycling FRP products in use
- ✓ Recycled FRP materials available and in use
- ✓ Data ecosystem in place; standardized material data available for both virgin and recycled feedstocks (data follows the products)

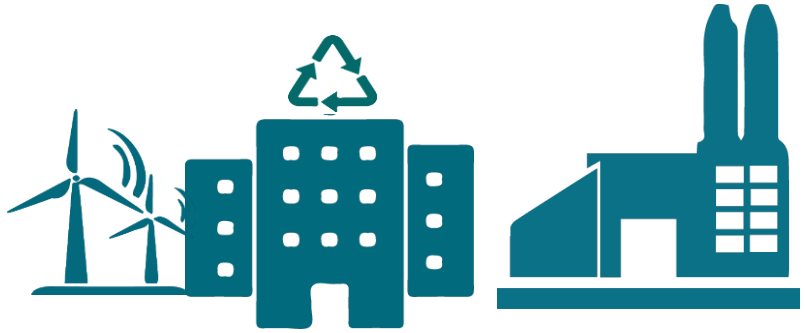
National target for Finland:

Several large-scale demonstrations

Goal 2035

Return

- ✓ Industrial-scale operations 'up & running' for recycling of all FRP products and industrial side-streams
- ✓ Value chains for recycling working efficiently for large volumes of FRP products and industrial side-streams



System-level development - Milestone 2025

Return

- Understanding of the FRP waste stream variety and volumes for the design of a sustainable system for their recycling
- Understanding which of the FRP products and industrial side-streams can be recycled separately and which should/could be mixed
- Environmental impact assessment for the chosen recycling options, taking into consideration the entire lifecycles of the FRP products
- Identification of all the necessary players to the full value network for FRP recycling
- Understanding of the proper design and needed changes in the recycling infrastructure to cope with FRP products and related industrial side-streams
- Development of the sustainable logistical system for the value network of FRP recycling
- Understanding of the material data needs that are essential for FRP recycling
- Design4Recycling knowhow for the design of sustainable FRP products
- Design of innovative business models to support the system change

System-level development - Milestone 2030

Return

- Development of high-value products out of recycled FRP
- Development of economically feasible and environmentally benign solutions for the logistics of all FRP products and industrial side-streams for recycling
- Understanding of the system-level and potential infrastructure impacts of the presence of FRP containing novel materials, *e.g.*, bio-based materials in the recycling system
- Establishment of the data ecosystem with novel data collection and processing technologies to support FRP recycling

Recycling technologies for bulky fibre-reinforced plastic products and industrial side-streams - Milestone 2025

Return

- Benchmarking of existing and potential new recycling solutions and technologies
- Development of selected existing and novel recycling solutions and technologies for the most important FRP waste streams
- Development of processing different FRP waste streams together
- Development of processing different thermoset FRP together with thermoplastic composites in one recycling plant
- Development of specific repair technologies for reuse & modification technologies for repurposing of large FRP products
- Development of utilisation of recycled FRP in geopolymers

Recycling technologies for bulky fibre-reinforced plastic products and industrial side-streams - Milestone 2030

Return

- Development of recycling concepts to produce new high-value products out of recycled FRP
- Development of recycling solutions and technologies for more challenging FRP waste streams
- Understanding of the potential impacts of novel materials, *e.g.*, bio-based materials in FRP products on the performance of the recycling technologies and processes
- Setting up a pilot for a FRP recycling that can process multiple types of FRP products and waste materials
- Setting up a pilot for a climate-neutral, zero-waste recycling mill for bulky FRP products

Development of environmentally friendly material solutions for fibre-reinforced bulky products - Milestone 2025

Return

- Mapping of the material performance demands for the FRP products in different application areas
- Development of new environmentally friendly materials for bulky FRP products in selected application areas
- Design to last and for recycling of FRP products with new material solutions
- LCA of the whole lifecycle of FRP products containing new materials to ensure sustainability
- Understanding of the processing challenges when replacing inorganic fibres with natural ones in the production of bulky FRP products