BOREALIS

Funded by the European Union
NextGenerationEU

BUSINESS FINLAND

SPIRIT

Sustainable Plastics Industry Transformation

May 2023

SPiRiT

Borealis at a glance

Ownership structure:

75%
OMV, Austria

25%
ADNOC, United Arab Emirates

120
Countries. Head Office in Vienna, Austria

6900
employees worldwide

Production and distribution of polyolefins solutions, base chemicals and fertilizers

Our JV's: Borouge – one of the world‘s largest integrated polyolefin complexes (Ruwais, UAE)


Borealis Porvoo

#2
Among polyolefin producers in Europe

#8
Among polyolefin producers worldwide

1.4 bnEUR
net profit, total sales 12.3 bnEUR (2021)

>100
Priority patents filed in 2021, #1 in Austria

3
Polyolefin recycling operations in Europe

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SPIRIT mission
Sustainable plastics industry transformation

- Plastics are irreplaceable materials of modern society which enable growth and help us save resources

"The plastics dilemma"

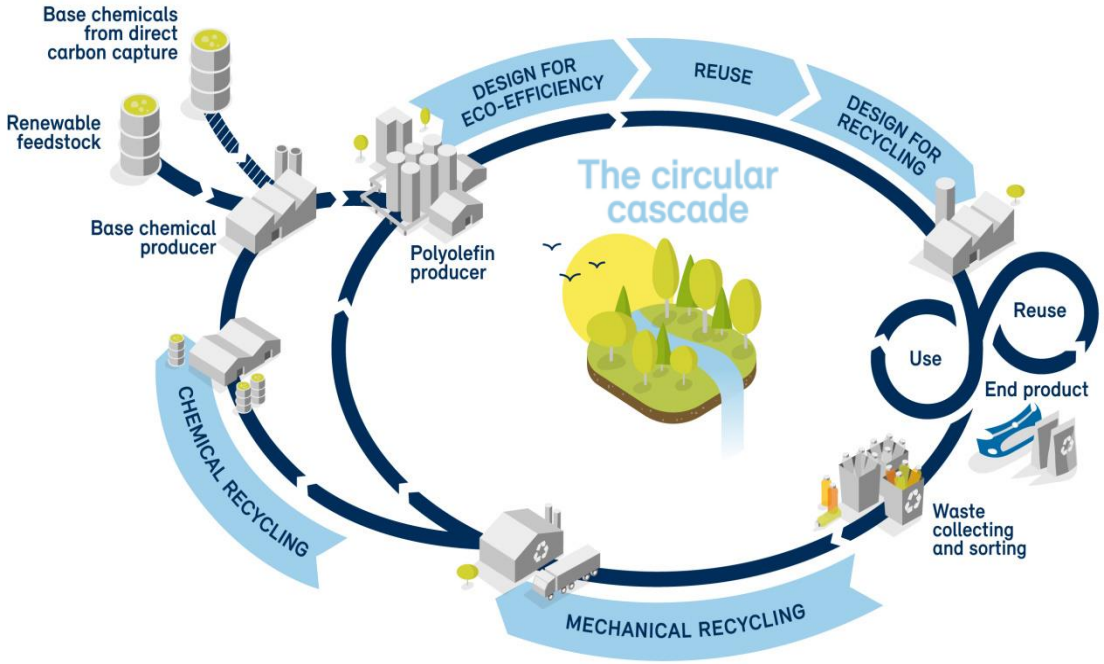
- To create a more sustainable future, we have to solve the current three key challenges of plastics industry

SPIRIT programme
Active co-operation across the value circle

- We need to replace fossil raw materials, transform plastics industry into circular economy and achieve carbon-neutral production
- SPIRIT programme leads this transformation via active ecosystem co-operation across the entire value circle

Borealis Finland has set concrete targets:

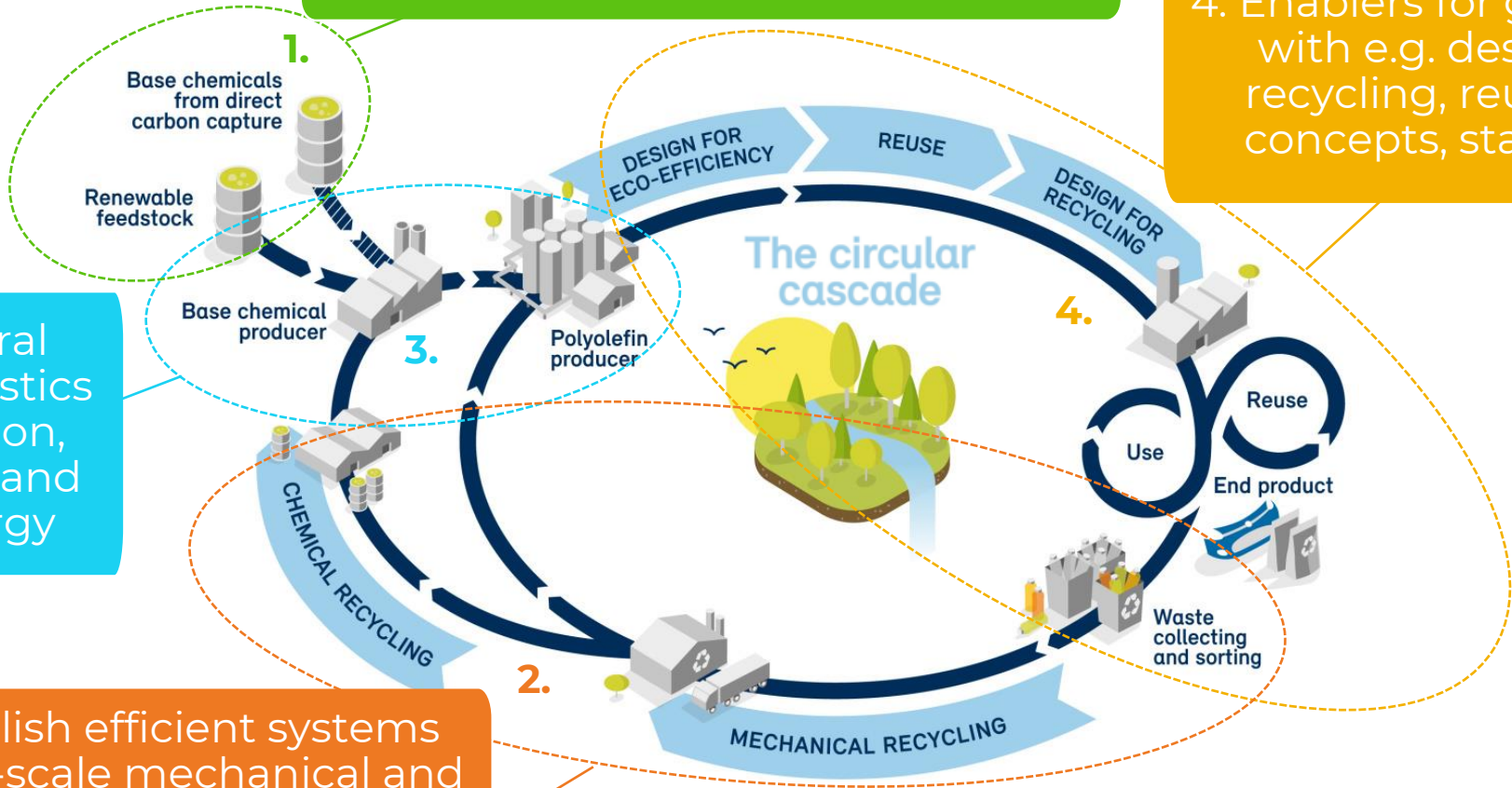
- Replacing 33% of fossil feedstock with renewable or recycled feedstock by 2030
- Turning production processes carbon neutral latest by 2045
- True circular economy of plastics



SPIRIT programme themes
Four R&D areas

1. Transform the fossil feedstock into renewable and recycled feedstock

4. Enablers for green transition with e.g. design for/from recycling, reuse, recycling concepts, standardisation



3. Carbon-neutral production of plastics with electrification, green hydrogen and renewable energy

2. Establish efficient systems for large-scale mechanical and chemical recycling of plastics

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SPIRIT programme themes

Area

1. Renewable feedstock	2. Circular plastics	3. CO_2 reduction	4. Enablers for green transition
Transform plastics feedstock from fossil to renewable/ recycled	Quantum leap in plastics recycling – minimise incineration and maximise material to material recycling	Carbon neutral production of plastics	Shaping the market to create pull for circular products

Ambition

Cross-cutting topics: new business models, digitalisation solutions, emerging technologies, piloting, analytical methods

SPIRIT roadmap (available via Business Finland's home page)

SPIRIT roadmap (available via Business Finland's home page)

Area	1. Renewable feedstock	2. Circular plastics	3. CO_2 reduction	4. Enablers for green transition
Ambition	Transform plastics feedstock from fossil to renewable/recycled	Quantum leap in plastics recycling – minimise incineration and maximise material to material recycling	Carbon neutral production of plastics	Shaping the market to create pull for circular products
"Topics"	• Mapping of various renewable feedstock alternatives, including on-purpose production and CCU (e.g. alcohols, gasification, CO_2 derivatives, etc.) • Opportunity assessment of identified renewable feedstock • Concept and portfolio development for renewable feedstock, including production technologies, pre- and post-treatments, logistics and infra • Testing the processing of renewable / recycled feedstock • Development of analytical methods for new feedstock	• Mapping the raw material potential of plastic waste vs. recycling capacity • Explore plastics recycling value chain and business model; from plastic waste collection to sorting and extrusion • Identification of current bottle necks in mechanical recycling • Concept development for chemical recycling technology including pre- and post-treatment and logistics • Integrated mechanical/ chemical recycling approach • Quality of recycled plastics	• Evaluate the effect of renewable / recycled feedstock to furnaces • Evaluate other alternative routes to by-pass furnaces • Develop new furnace concepts like electrification, H_2 firing and efficiency improvements to establish furnace road map • Methane valorisation concepts • Evaluate CO_2 capture (CCS/CCU concept) • Evaluate H_2 and electricity concepts and infra (renewable energy, electricity grid, etc.)	• Develop circular product offering to meet value chain demands: Design for recycling, recycled content and reduced CO_2-footprint • Development of analytical methods for circular products and their raw materials. • Development of environmental product declarations of circular products • Market shaping and ecosystem development for circular products, including new business models like reuse and recycling concept developments • Advocacy in standardisation and regulatory areas – topics like mass balance, recyclability, recycled content, ecolabels, etc.

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SPIRIT is a Business Finland programme

Ecosystem funding

- 4-year RD&I programme 2022-2025 (TRL ≤ 6)
- Borealis became a “Veturi company” in Feb 2022 (BF leading companies challenge competition)
  - Committed to invest 50 M€ more into R&D, for which 40% funding decision at 20 M€ (RRF)
- BF reserves additional funding resources
  - Parallel partnership projects fitting the SPIRIT roadmap can separately apply additional funding (40-70% of costs)
  - Up to max 50 M€ budgeted for the entire ecosystem
  - Three calls annually (Jan, Apr, Sep)

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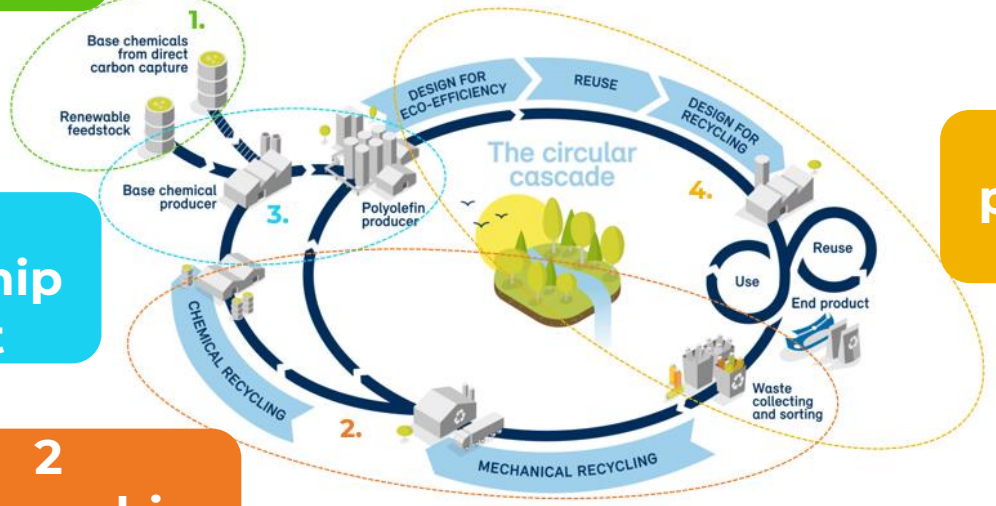
Notes: TRL = Technical Readiness level, “Veturi” means locomotive

Currently 11 approved partnership projects...

2 partnership projects

1 partnership project

2 partnership projects



6 partnership projects

5 company projects

6 co-innovation / co-research projects

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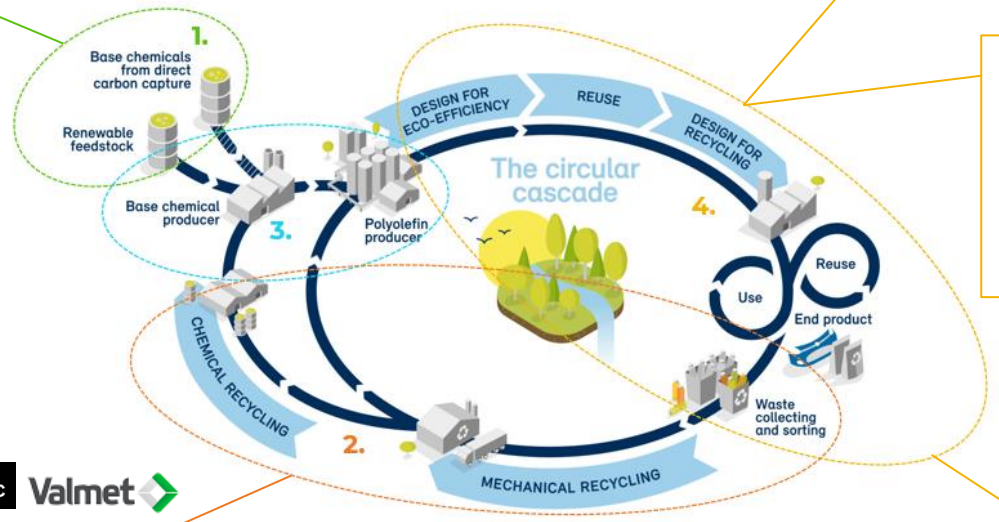
Examples of partnership projects...

ForestCUMP: BF approved co-innovation consortium, VTT & LUT + 11 companies, biogenic CO_2 from pulp mills and energy sector, CCU HT-FT technology targeting light hydrocarbons (olefins), public research budget 2.9 M€ (BF 70%) + company projects

DREAM: BF approved Rani Plast company project, data-driven approach for recycling ecosystem and advanced modelling of environmental performance

SULKI: BF approved Orthex company project CirPE evolving into larger SULKI consortium, closed-loop recycling solution for PP products in food-contact applications



UrbanMill: BF approved co-innovation consortium, VTT & A! + 13 companies, chemical recycling technology, themes like different plastic types (e.g. liquid packaging, PA, etc.), pre- and post-treatment, public research budget 3.0 M€ (BF 70%) + company projects

Zero ink: BF approved Cajo Technologies company project, laser based marking of plastic products/packaging without labels /stickers/printing

SPIRIT website news: key themes, people, partners, ecosystem

SPIRIT in media

Muovi Plast

Borealis haastaa koko muovialan tekemään yhdessä kestävyysmuutosta

Kiertotalouden erikoislehti
UUSIOUUTISET
www.uusiouutiset.fi

Kolmannes muoviraaka-aineista kierrätettäviksi tai uusiutuviksi: Muovien kestävyyssiirtymä sai miljoonarahoituksen

Tekniikka & Talous

Borealis aikoo sähköistää krakkausuuninsa ja tehdä tuotannostaan hiilineutraalia 2045 mennessä – 50 M€ tutkimukseen, osin Business Finlandin tuella

Tuomas Kangasniemi 21.2.2022 12:17 | päivitetty 21.2.2022 14:09 KEMIA INNOVAATIOT RAHOITUS TEOLLISUUS

Yhtiön kestävän kehityksen ohjelmassa on myös muita tavoitteita.

KEMIA 5/2022

Missiona uusiutuva muovi

Kiertotalouden erikoislehti
UUSIOUUTISET
www.uusiouutiset.fi

”Muovien kemiallinen kierrätys on teollisen jättiharppauksen partaalla” – Suomalaiskonsepti saisi kierrätettyä myös sekalaiset jätemuovit

UUSIMAA

Muovi on samaan aikaan hyvis ja pahis – Borealis vetää junaa, jonka tarkoituksena on saada muoviin sitoutunut hiili kiertoon

Muovi Plast

Ympäristöystävälliset lasermerkinnät auttavat varmistamaan polymeerien jäljitettävyyttä ja edistävät kierrätettävyyttä

Cajo Technologies Oy:n kehittämän laser-merkintäteknologian avulla tuotetaan koneluettavia jäljitettävyysmerkintöjä, jotka pysyvät tarkkoina ja kestävät läpi tuotteen elinkaaren myös haastavissa olosuhteissa. Cajo yhteistyökumppaneineen tutkii lasermerkintöjen sovelluksia syksyllä 2022 käynnistyneessä Zero ink -projektissa, joka on osa muovien kierrätysratkaisuihin keskittyvää SPIRIT-ekosysteemiä.

Laserilla voidaan merkitä toiminnallisuuksia, brändiä, säännösten vaatimia tietoja tai tuotteen jäljittämiseen tarvittavia tunnistetietoja

Muovia viinasta? Suomen suurin muovitehdas etsii ratkaisua päästöongelmaan havuista, sähköstä ja etanolista – Lähtöainetta täysin puhtaana

Tekniikka & Talous

Tuomas Kangasniemi 26.10.2022 07:03

osto&logistiikka

Muovikierrätyksessä tarve kemiallisiin ratkaisuihin

Mekaanisen kierrätyksen uusiotuotteiden laatu ei riitä esimerkiksi elintarvikemuoveihin.

yle Svenska Yle

Plasten är här för att stanna – i Borgå görs miljoninvesteringar för att den ska bli snällare mot miljön

Publicerad 11.02.2023 11:00.

SPIRIT

How to join SPIRIT?

- SPIRIT ecosystem is open for all partners with fresh ideas and commitment to contribute to the sustainable plastics industry transformation
- Visit our website **www.spiritprogramme.com** or contact the SPIRIT core team

1. Renewable feedstock

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3. CO_2 reduction

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4. Enablers for green transition

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5. Programme and ecosystem leadership, communications

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Thank you!

www.spiritprogramme.com

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