BLACK CYCLE

Move to the green revolution


Namaste
مرحبا
Willkommen
Bem Vindo
Selamat Datang
Welcome
Namaste
Croeso
Bienvenue
Bienvenue
Welcome
Bienvenidos
أهلا وسهلا
Bienvenidos
Benvenuti
Welkom
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добре дошъл
Benvenuti
Willkommen
Καλώς ήλθατε
Benvenuti

A MAJOR EUROPEAN PROJECT FOR RECYCLING END-OF-LIFE TYRES INTO NEW TYRES

BLACK CYCLE

Move to the green revolution

1ST WORKSHOP

Animators

Didier Pradeilles – Waoup

Sébastien Béclin – Axelera

Goals of the Blackcycle Workshop

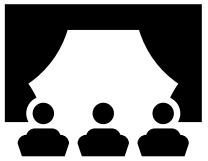
to create a connection between players in the tyre sector and beyond on the Circular Economy

to share the progress of EU projects within the framework of the circular economy

to share good practices and key success factors for setting up a circular economy

9.30 am

Plenary session

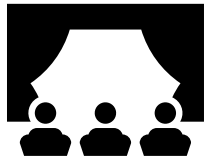


Blackcycle project
Euromaster Circular Economy

10.45 am

Coffee Break

11.10 am



Iceberg H2020 project
iCAREPLAST H2020 project
Re-sourcing H2020 project
Polynspire H2020 project

12.30 am

Networking lunch

Networking lunch
Posters session

2:00 pm

Networking session

- End-of-Waste Status
- Raw material for the mobility
- Pyrolysis Overview
- Circular Economy

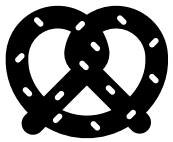
3:45 pm

Visits

- Visit of the tracks
- Visit of the Innovation Pavilion

5:45 pm

Cocktail



To end this day and continue to interact together

6:45 pm

End of the day

Bus departure to hotels

BLACK CYCLE is a project funded by the European Commission - Project Number : 869625

Plenary session

9.30 am

Welcome - Christophe Moriceau
Senior Vice President Advanced Research, Michelin

9.45 am

Blackcycle project
Michael Cogne - Michelin
Ramon Murillo - ICB-CSIC
Eleni Paxatouridou - CERTH/CPERI
Robert Meyer - Orion

9.25 am

Euromaster Circular Economy
Benoit Heubert - Directeur général chez Euromaster

10.45 am

Coffee Break

11.10 am

H2020 related project

Iceberg
David Garcia (Tecnalia)

11.30 am

iCAREPLAST
Dr Laura Almar (CSIC)

11.50 am

Re-sourcing
Alexander Graf (Institute for managing sustainability)

11.10 am

PolynSpire
Alfredo Elias (Circe)

12.30 am

Networking lunch

Networking lunch
Posters session

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Welcome to the 1st BlackCycle workshop !

Christophe Moriceau

Senior Vice President Advanced Research

MICHELIN
UNE MEILLEURE FAÇON D'AVANCER

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A MAJOR EUROPEAN PROJECT FOR RECYCLING END-OF-LIFE TYRES INTO NEW TYRES

INTRODUCTION AND HIGHLIGHT

BLACK CYCLE

Move to the green revolution

Michael Cogne - Michelin
Ramon Murillo - ICB-CSIC
Eleni Paxatouridou - CERTH/CPERI
Robert Meyer - Orion

A MAJOR EUROPEAN PROJECT FOR RECYCLING END-OF-LIFE TYRES INTO NEW TYRES

BLACK CYCLE

Move to the green revolution

TOPICS : CE-SC5-07-2018-2019-2020 - Raw materials innovation for the circular economy: sustainable processing, reuse, recycling and recovery schemes

CALL: H2020-SC5-2019-2

Horizon2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 869625.

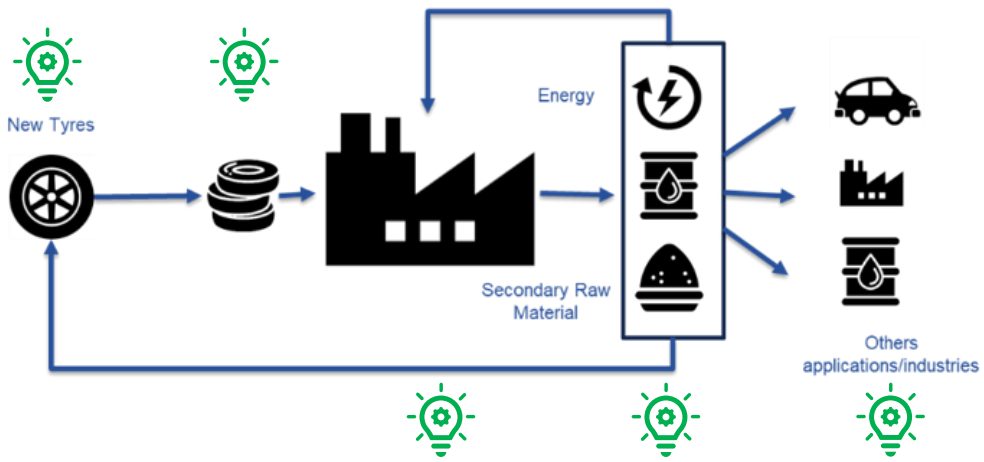
Only a limited amount of secondary raw material that **can be reused in the tyre** industry.

In Europe, **more than half of these are exported** to other countries.

Offering a **great potential for material recovery**, which is only partially exploited.

BLACKCYCLE project aims to enable a massive circular economy of tyres

BlackCycle aims at addressing these technological hurdles **to transform ELTs into high quality Secondary Raw Materials** (SRMs) that could be used not only by the tyre industry, but also in other technical applications, closing the loop and supporting the development of a circular economy.



More than **10** innovations along the value chain

The BlackCycle project aims at creating, developing, and optimising a full value chain :

To valorize **100%** ELTs selected

To increase up to **10 times** SRMs rate into a new tyre

To recycle at least **50%** of the European ELTs

To decrease **CO2** emission at least **50%**

By Offering An **Economically** And **Environmentally** Viable Alternative

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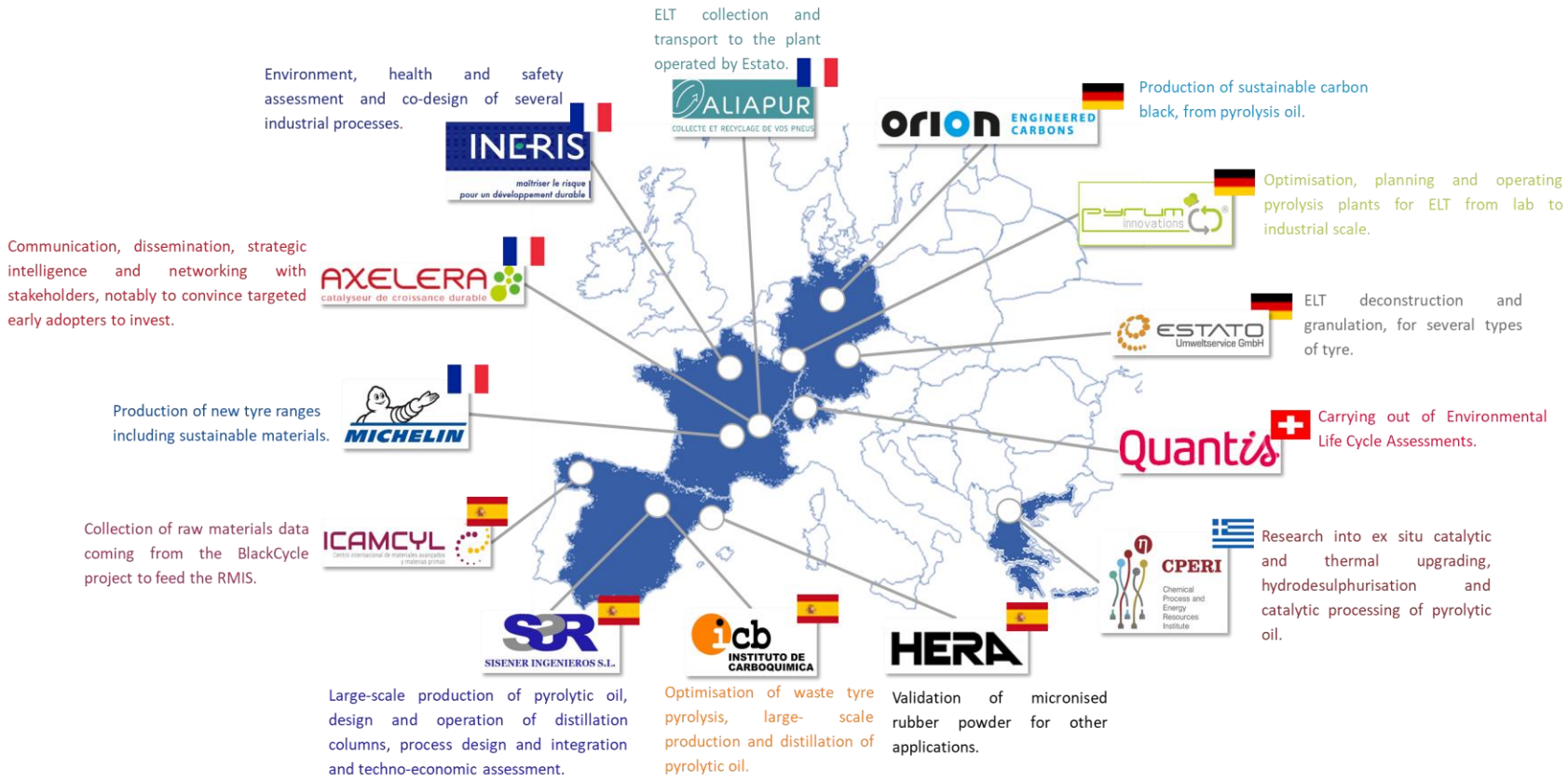
7 Industrial & Start up Partners, 5 Research Centers and an Innovation cluster gathered in a EU Consortium in 5 Countries

May 2020 — Aug 2023



- Waste Managers
- Technology Developers and Providers
- End Users and Validators
- Technology Providers and Manufacturers
- Environmental and HSE Experts
- Dissemination, Communication

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BLACKCYCLE aims at creating, developing and optimising a full Value Chain

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BLACKCYCLE aims at creating, developing and optimising a full Value Chain

Focus on 3 steps of the value chain

A pyrolysis process optimization and scale-up

Ramon Murillo - ICB-CSIC

A refining and post-treatment process oil

Eleni Paxatouridou - CERTH/CPERI

Production of Sustainable CB from refined oil

Robert Meyer - Orion

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Robert MEYER - Orion

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To develop a pyrolysis process to produce pyrolytic oil and r-CB showing relevant properties for the synthesis of quality SRMs

Specifications of the oils for production of **s-CB** & s-**plasticisers** appropriate in tyre applications

To review the pyrolysis process in two technologies

- **Auger Technology**
- **Moving Bed Technology**

To maximize the production of pyrolytic oil suitable either for s-CB and for plasticizers and rCB

To assess **the influence of thermal and catalytic cracking** on the quality of the produced pyrolytic oil in TRL5

To demonstrate the pyrolysis process at TRL 7

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To develop 2 pyrolysis technologies to produce pyrolytic oil and r-CB

Depending on the quality of the of ELTs granulates and the operating conditions of pyrolysis

Auger Reactor

TRL5
Hundreds kg samples

TRL7 - dozens tons samples

Moving Bed Reactor

TRL4
kg samples

TRL7 - dozens tons samples

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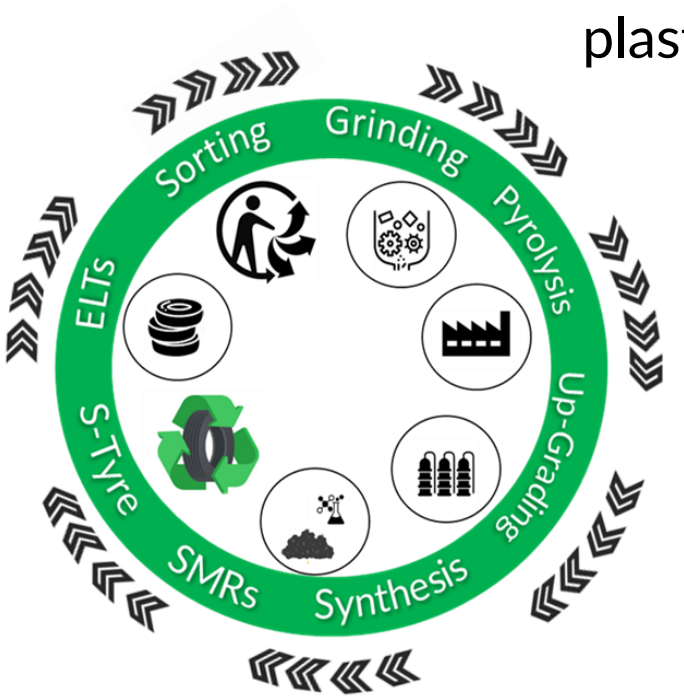
Pyrolysis optimization levers validated and first scale-up tests succeed



Optimizing conditions with focus on Crude Tar Tyre for s-CB & s-plasticizers

Identify promising catalysts to maximize pyrolysis oil aromatics content

Development a pyrolysis **rubber particle mathematical model**

Hundred samples from TRL4/TRL5 test sent to partners

Production of **dozens of tons oils from TRL7** to be refined

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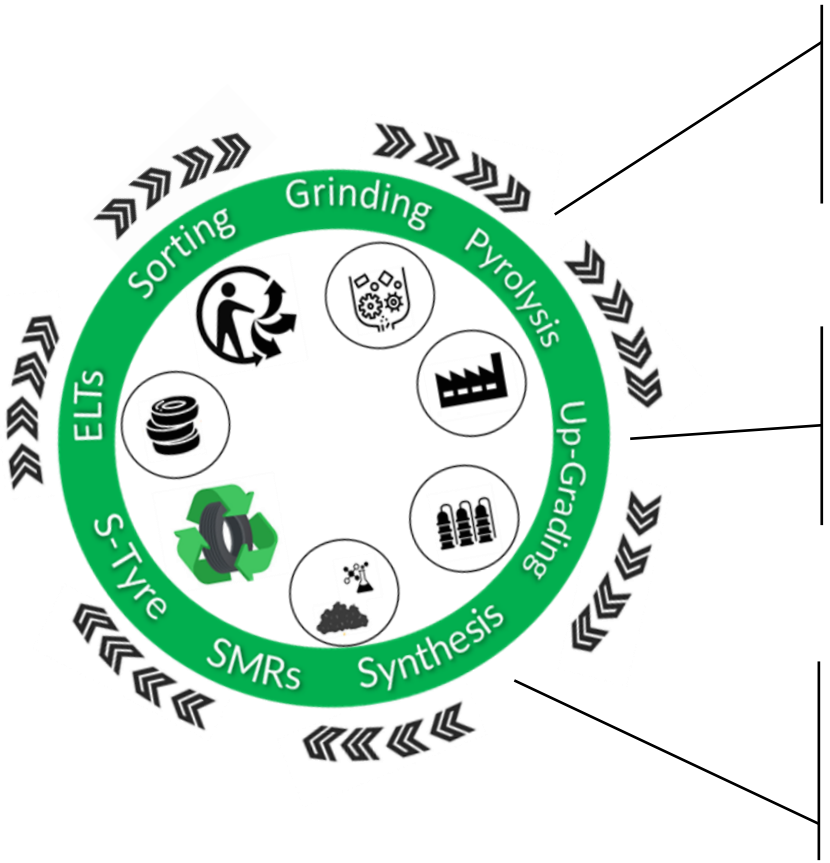
BLACKCYCLE aims at creating, developing and optimising a full Value Chain

Focus on 3 steps of the value chain



A pyrolysis process optimization and scale-up

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A refining and post-treatment process oil

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Production of Sustainable CB from refined oil

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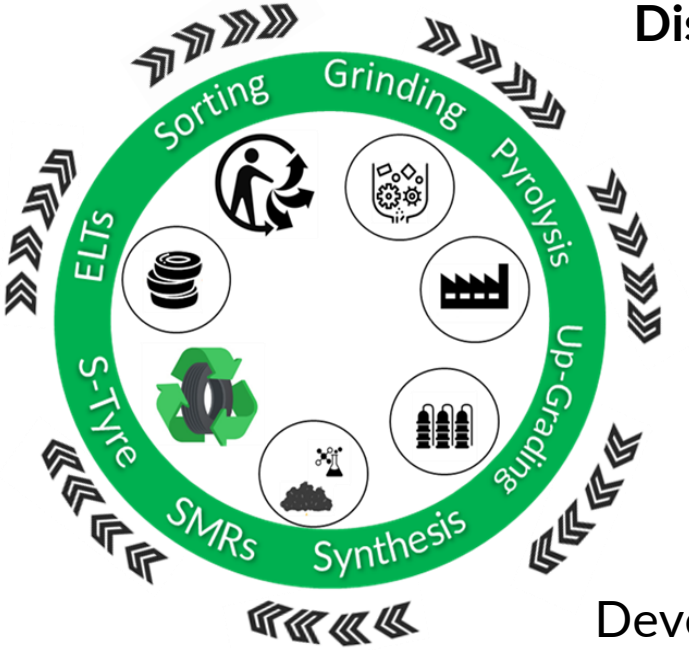
A refining and post-treatment process to extract relevant raw materials as heavy oil, s-plasticisers and by products



Specifications of the oils for production of **s-CB** & s-**plasticisers** appropriate in tyre applications

Distillation of the pyrolytic oil at **TRL4** & **TRL5 distillation column**

Demonstrate the process at **TRL7 distillation column**

Hydrodesulphurisation & **Aromatization** of the heavy fraction for production of **s-CB**

Develop post-treatment process to produce **s-plasticisers** for tyre mix formulation

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Developing distillation process at TRL4 & TRL5 and scaling up validation to TRL7

Innovative process to reach specifications of the oils for production s-CB & s-plasticisers

TRL4 **TRL5** **TRL7**

kg to dozens of tons samples for test & validation

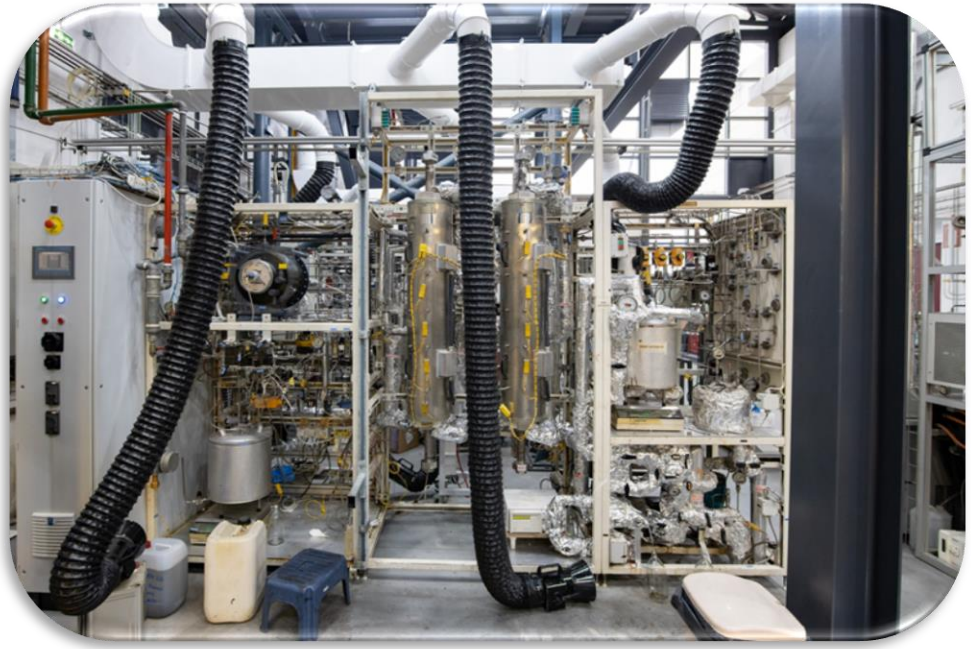
kg samples ~20 kg/h ~500 kg/h

New distillation equipments for developing pyrolytic oils distillation

Upgrading of pyrolytic oil - Hydrodesulphurization

Pyrolytic oils, depending on the origin and type of ELTs and the conditions of their treatment, could contain large amounts of Sulphur & Nitrogen.

High-pressure bench-scale unit



High-pressure pilot-scale unit

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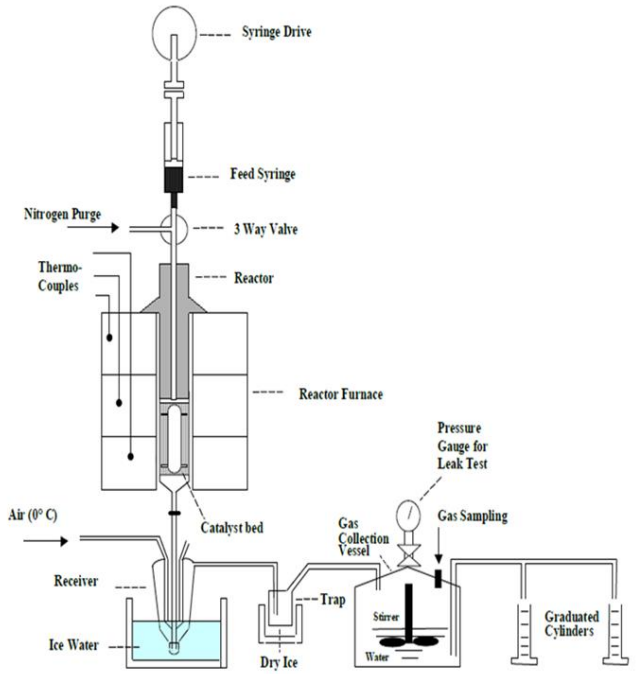
Upgrading of pyrolytic oil - Aromatization

Development of an innovative process based on the FCC concept, under milder operating conditions, to increase the aromatics in the oil, preventing as much as possible the cracking side reaction.



Micro-activity unit

FCC pilot-scale unit

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BLACKCYCLE aims at creating, developing and optimising a full Value Chain

Focus on 3 steps of the value chain

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Production of Sustainable CB from refined oil

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Pyrolytic oil to reach specifications to production of sustainable CB

Properties of crude- and heavy tire tar

Productivity:

Yield is lower than usual CBO so far

Quality:

Very clean oil, low Ash and Sieve-Residue.
Sulphur = 1%, low asphaltenes.

Process Ability:

- Makes no Trouble. Viscosity like water. No heating in Tank required.

Density less than 1 kg/Liter!

Safety:

- Flashpoint of Heavy Tire Tar increased by removing the low-Boilers by Distillation. Undistilled Pyrolysis Oil´s (CTT)

Flashpoint low

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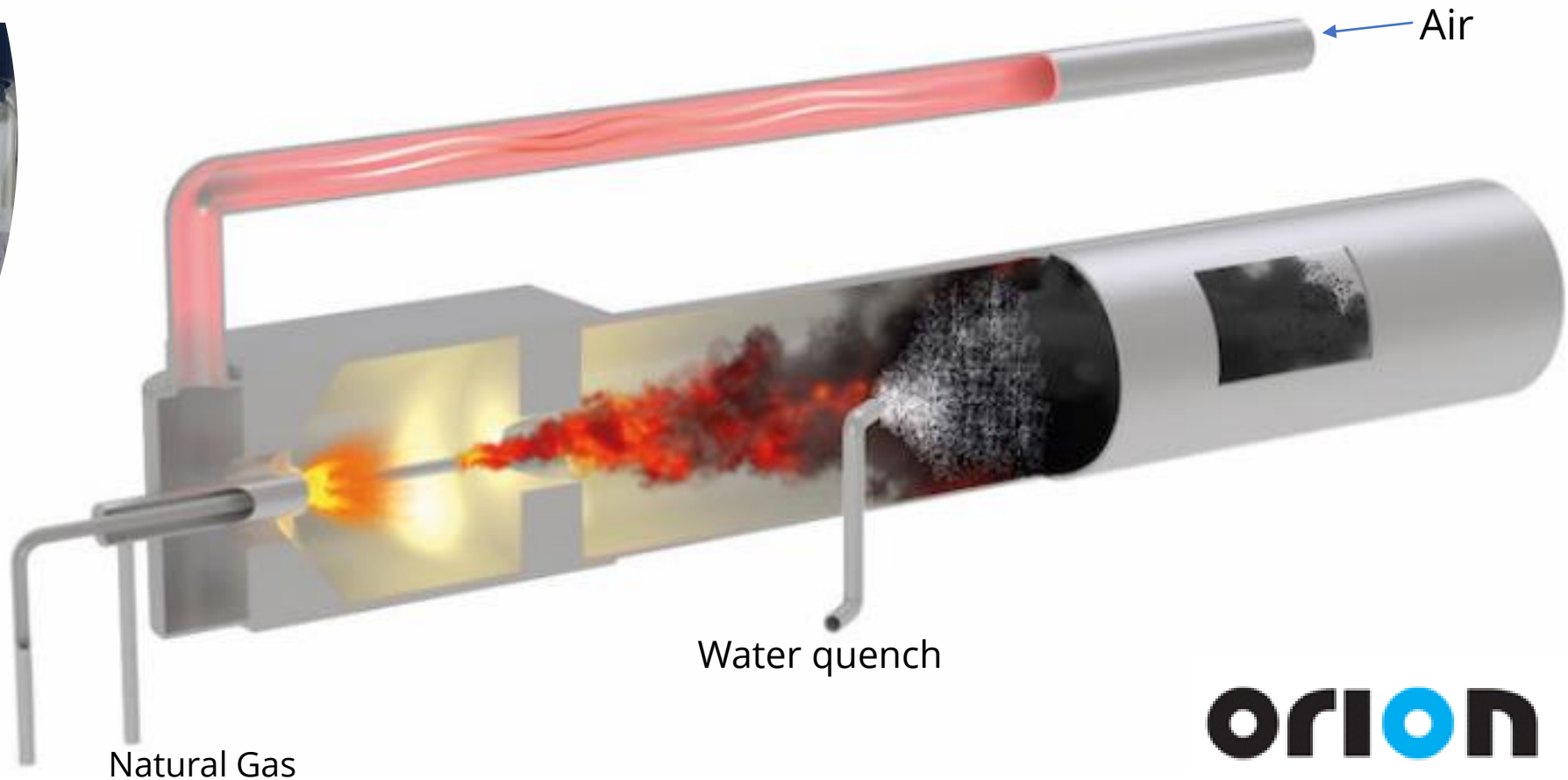
Production of sustainable CB using Heavy Tire Tar
Furnace process optimization



Oil – **instead of fossil Oil the Heavy Tire Tar (HTT) was used**

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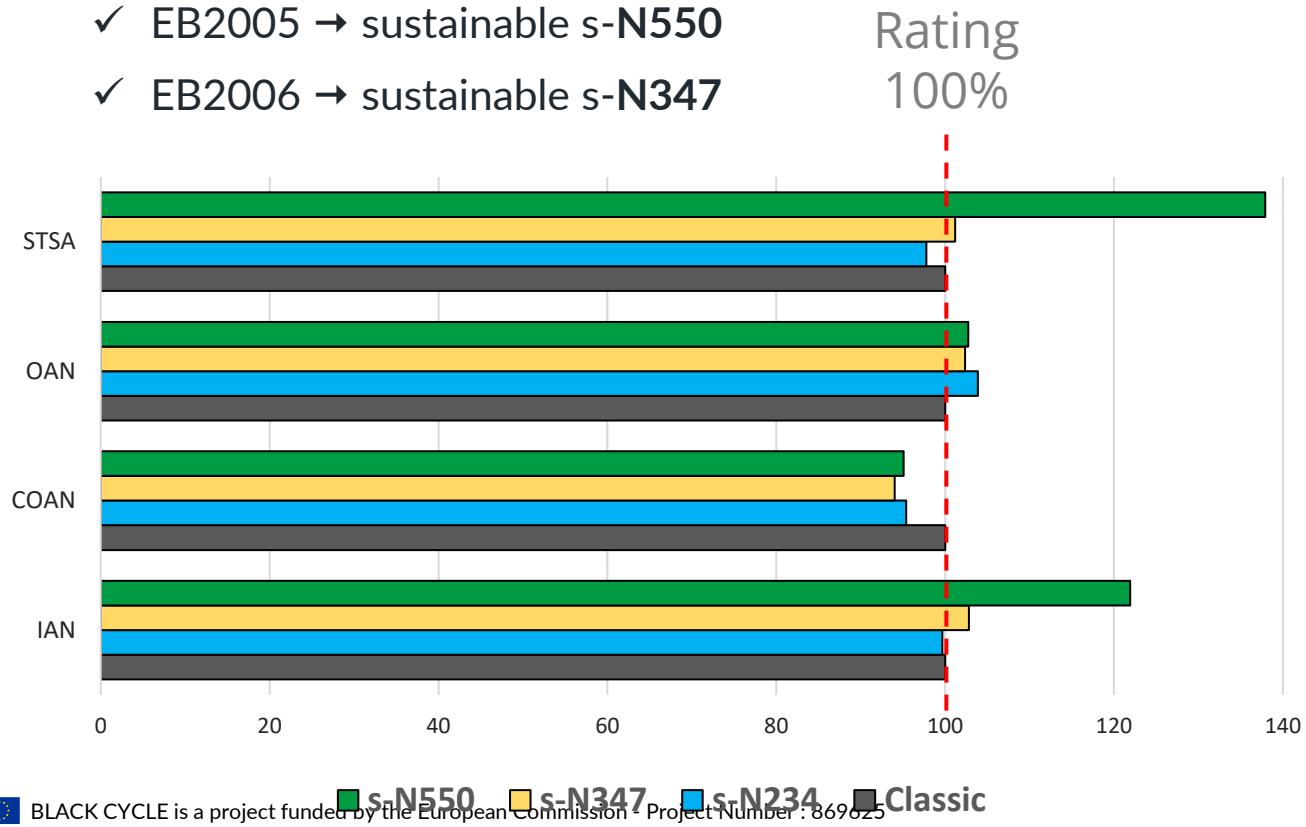
Production of Sustainable CB using Heavy Tire Tar
Analytical testing of s-CB obtained from TRL5 plant

To establish and demonstrate that the quality of the heavy oil is a suitable feedstock and optimize the process to produce s-CBs equivalent to ASTM commercial CB grades:

- ✓ EB2004 → sustainable s-**N234**
- ✓ EB2005 → sustainable s-**N550**
- ✓ EB2006 → sustainable s-**N347**



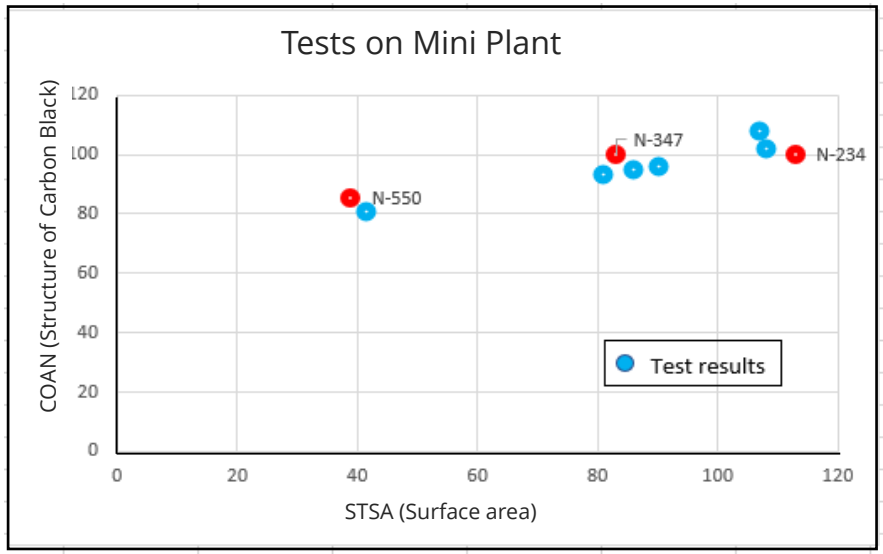


Figure 1: sCBs yield carbon black similar to standard grades

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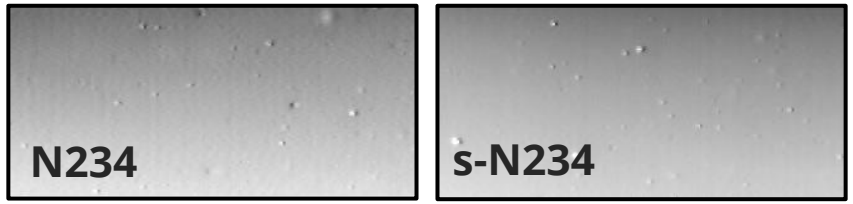
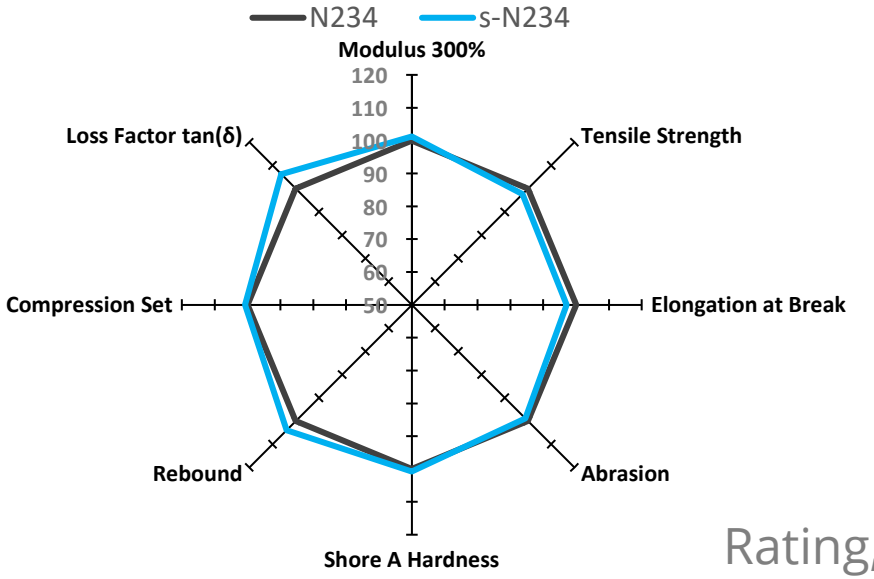
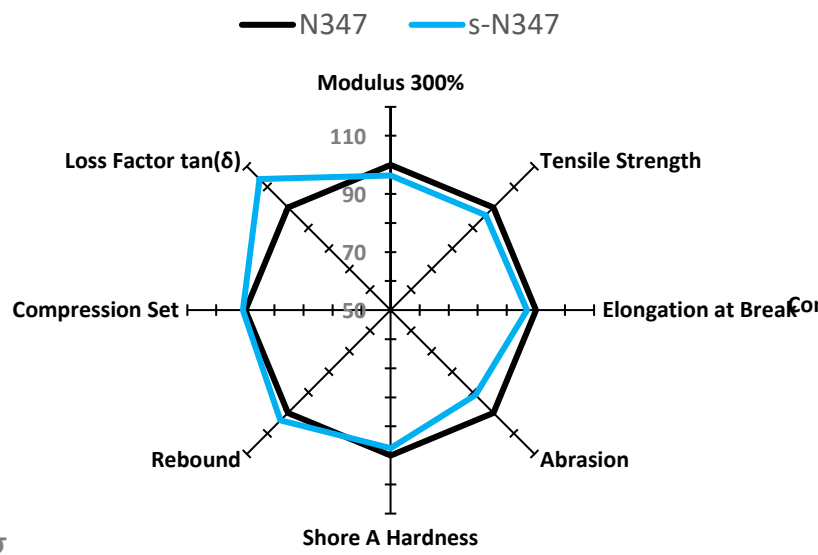
Production of Sustainable CB using Heavy Tire Tar
Application testing of s-CB in rubber compounds

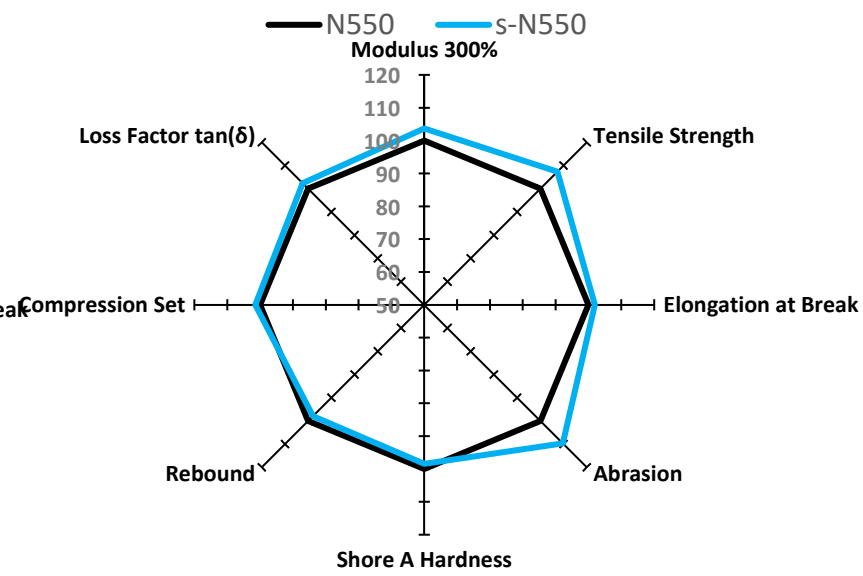
In-rubber data is excellent: especially for s-N234



✓ Dispersibility is on very good level







Rating,
the higher the better

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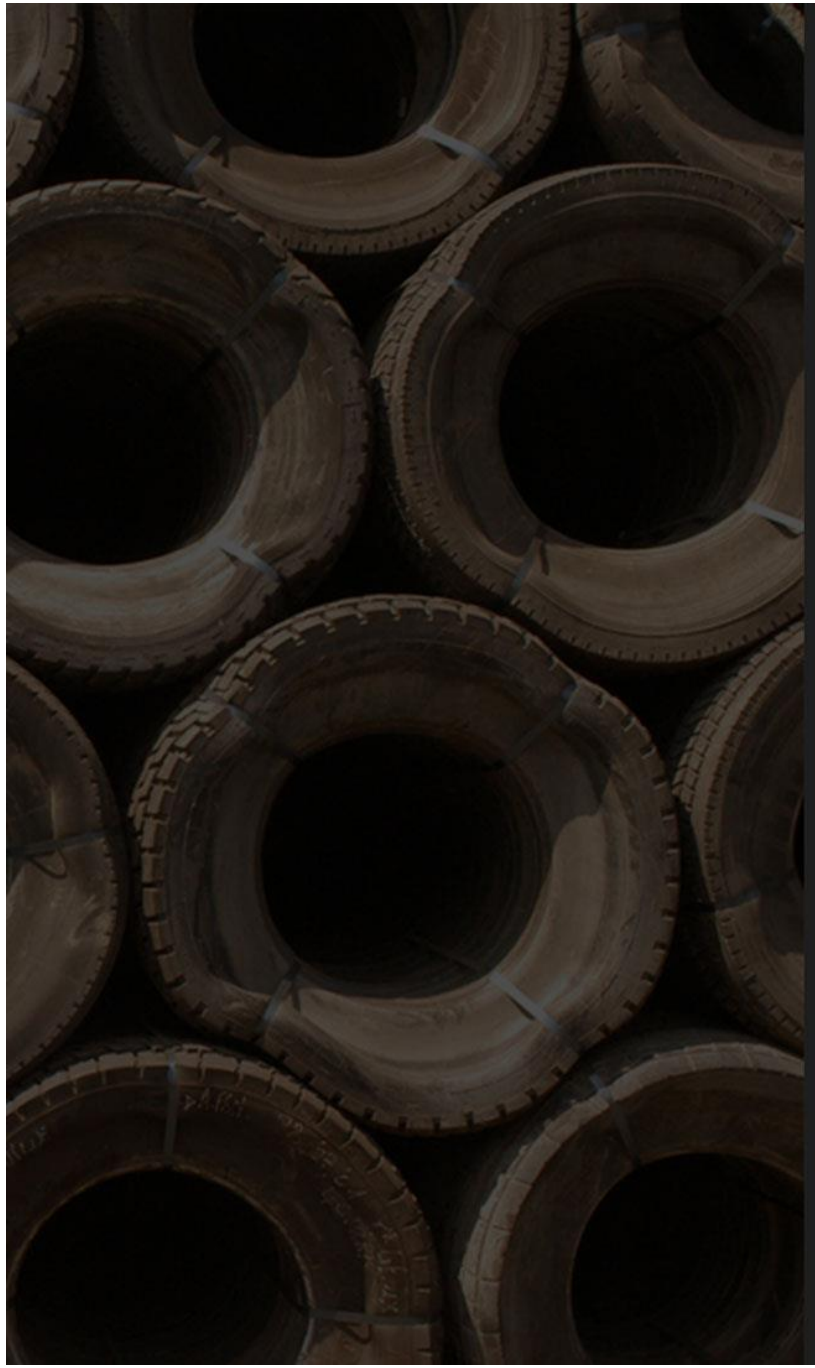


BLACK CYCLE

Move to the green revolution

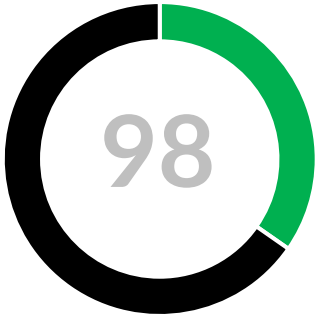
Halfway to the end
Next steps

Michael Cogne - Michelin

Halfway to the end : Next steps

Proofs of concept along the value chain and demonstrate economical and environmental viability

May 2020 — Aug 2023



34 Deliverable submitted

Proofs of concept along the value chain

ELT Deconstruction
Pyrolysis
Refining
s-CB & s-Plasticiser !

Complete technical validation of solutions

Demonstrate scale-up capability

Demonstrate economical and environmental viability

Prepare successful dissemination
regulations, social acceptance and business models

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BLACKCYCLE : A new Path for INNOVATIONS in Circular Economy

Innovation in Circular Economy implies to reinvent **Open Innovation with the Eco Systems**

Life Cycle Assessment is key to drive both **Environmental & Economical** impacts with the right choices

EU Grant is a key enabler to have more impact and onboard key competencies

Innovation is not only on technical streams but also in other streams: Legal, Communication, …

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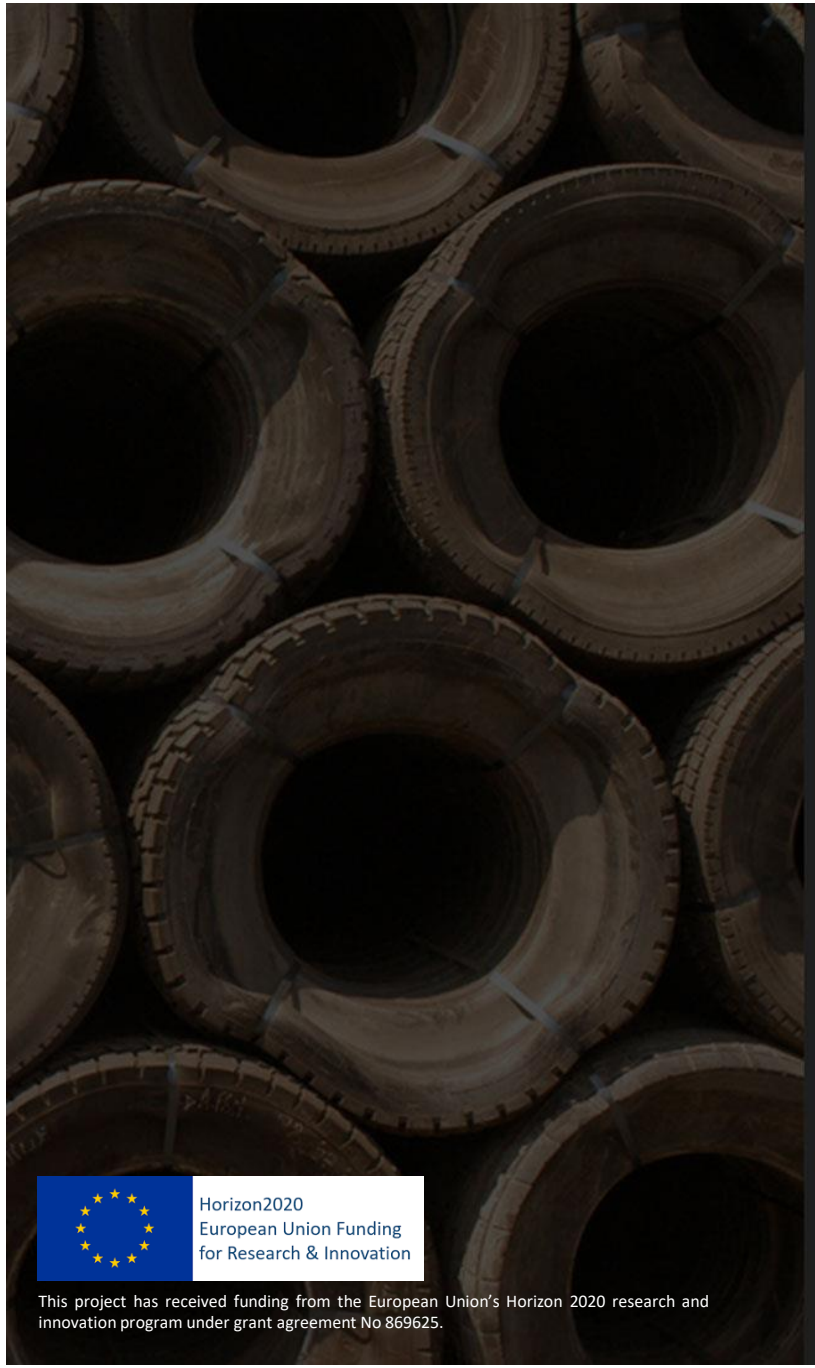

BLACK CYCLE

Move to the green revolution

THANK YOU !

Horizon2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 869625.