# ESTER BIOTECH

SOLVING FRONTIERS

Bundesministerium
für Wirtschaft
und Klimaschutz

Funded by the
European Union

eXIST
Existenzgründungen
aus der Wissenschaft

# CHALLENGE


## > 99 % of plastic packaging are leaving the cycle

## Strong negative impact for human living conditions and health

### Side facts

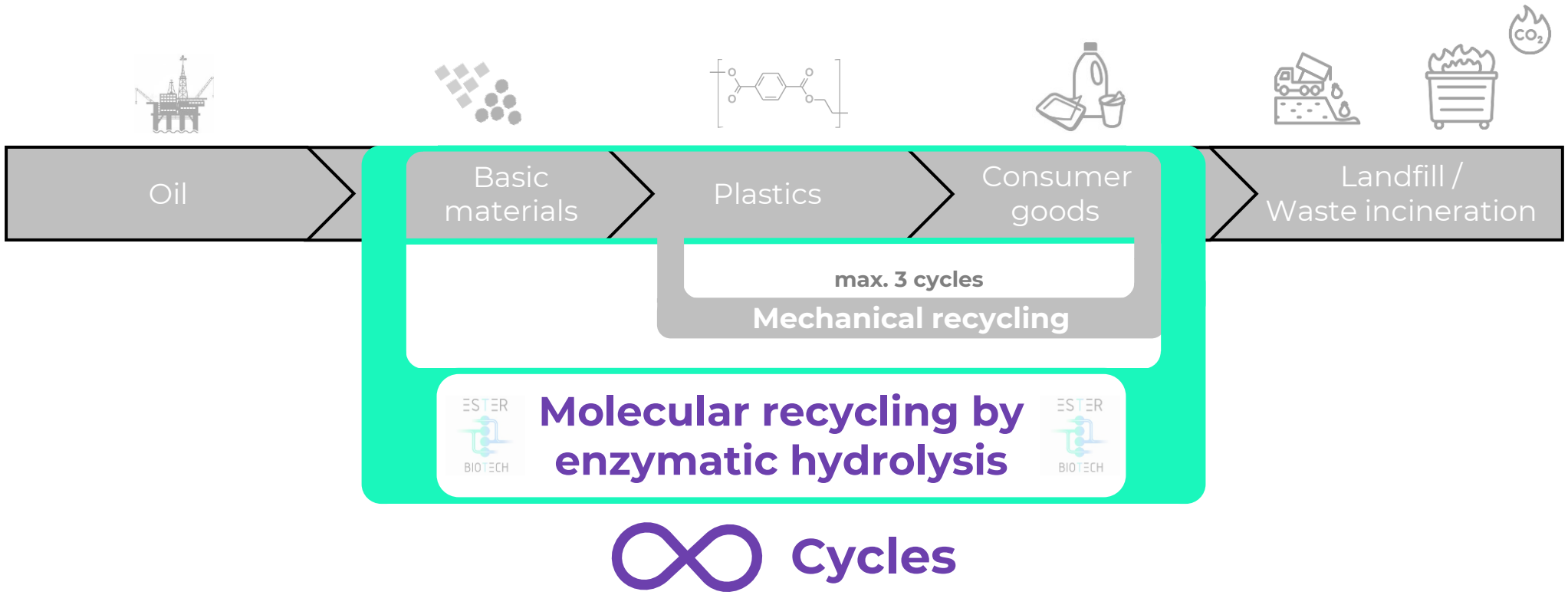
- > 300 Mio. Tons of plastic packaging waste per year
- Plastic production uses around 10 % of crude oil
- Hidden cost of plastics ≈ 10x production

### Trends & regulatory

- Increasing sustainability awareness of end customers
- Increasing $CO_2$ costs & plastics tax
- Stricter mandatory recycling quotas
- Prohibition of non-recyclable of materials

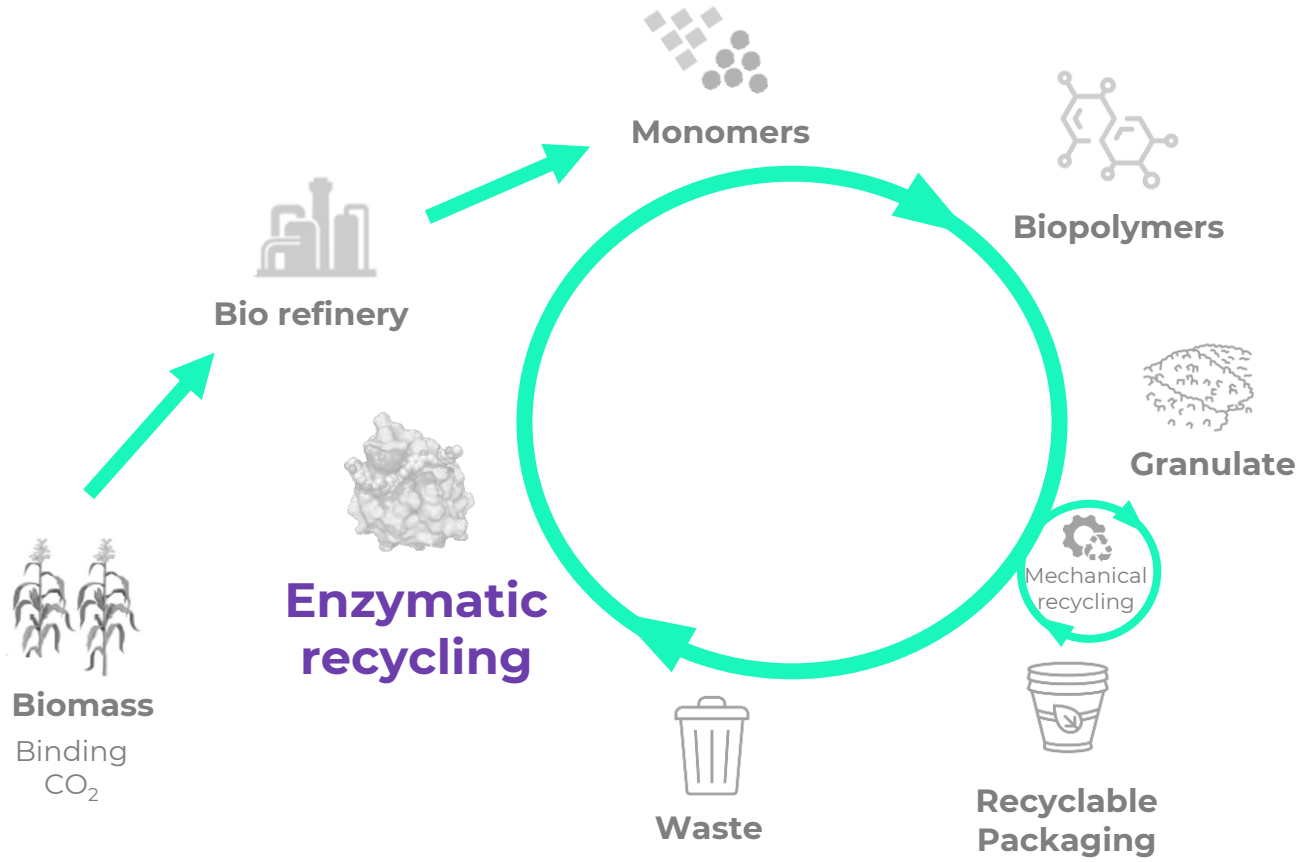
SOLUTION

# Our solution enables a truly sustainable plastic circular economy



VISION

# A bio-based plastics circular economy through molecular recycling

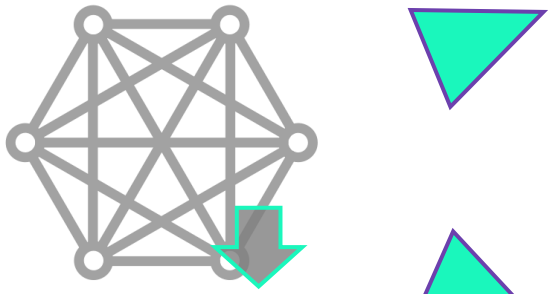



- **No incineration**
- **$CO_2$ neutrality**
- **Independency from fossil supplies**

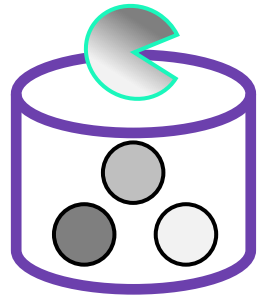
VISION

# A bio-based plastics circular economy through molecular recycling

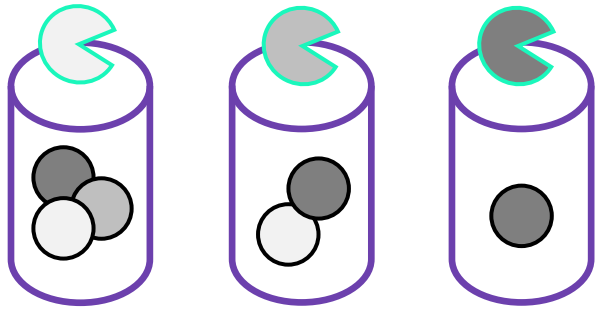
## - Streamlining of the overall recycling process -



Reduction of material diversity

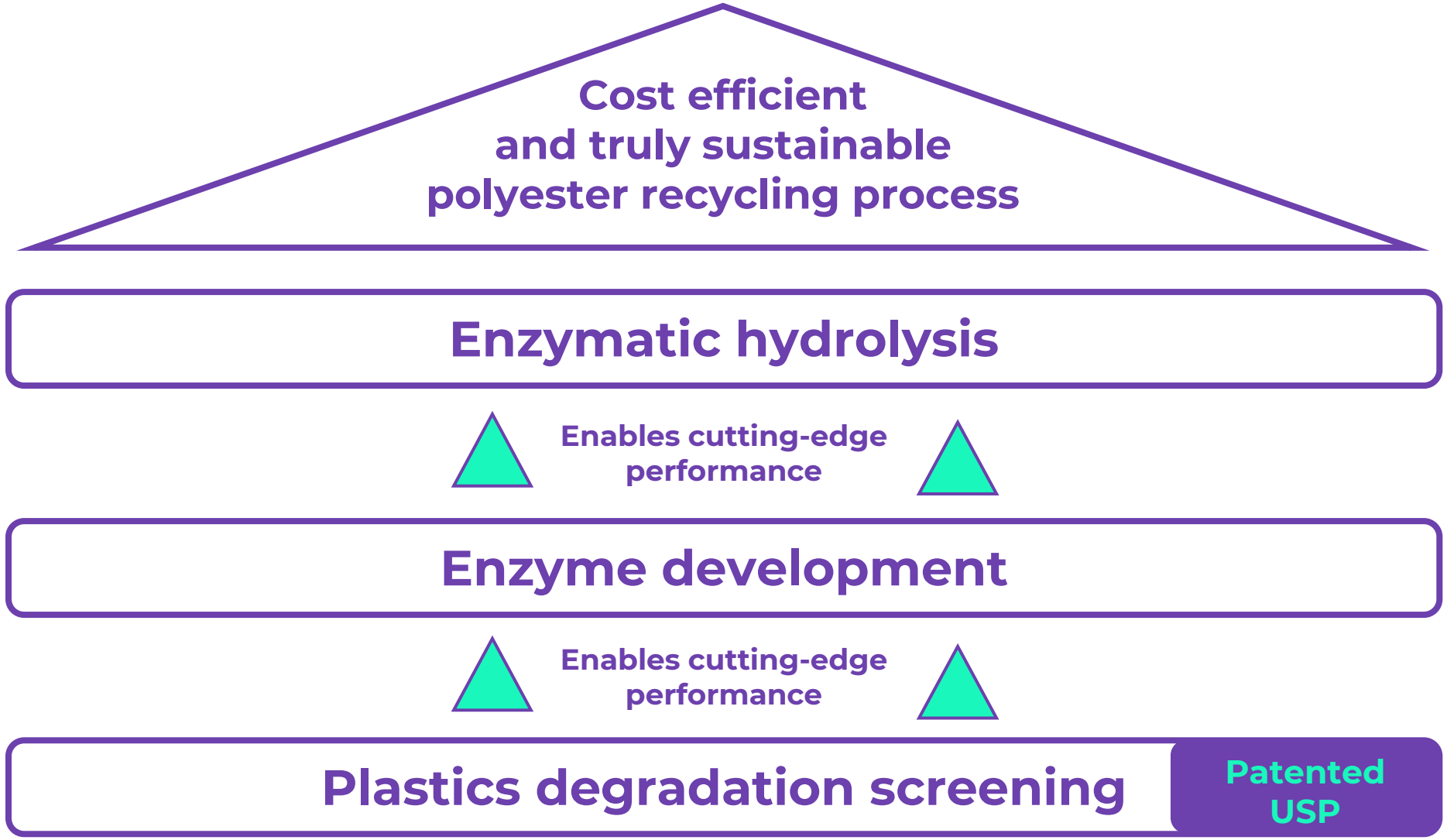


One-pot process with all-rounder enzyme

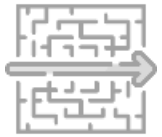


Multi-stage process with specific top scorer enzymes

# TECHNOLOGIES



# Enzymatic hydrolysis



## Straightforward process

Our process can be operated in a low-temperature range and under ambient atmosphere which allows a lean technical setup. This enhances high reliability while minimizing both CAPEX and OPEX, enabling.

## All polyester

Our process enables the depolymerization of all polyesters. We can potentially process multi-layer products and mixed-material waste. **Feasibility is demonstrated for PET, PLA, PBAT, PBS & TPS**.

## Fast depolymerization

Our high performance enzymes allows us to achieve a complete disintegration in a short time. With PHL7 Generation 3 we can **depolymerize PET post consumer packaging in 13 hours**.

## Lean pre-treatment

Using post-consumer PET packaging allows us to bypass complex and costly pretreatment steps. We only need to perform basic cleaning and cutting of the material before processing.

## Persistent enzymes

Our enzymes are designed to be highly thermostable, ensuring they remain effective during the process. PHL7 Generation 4 enzymes have **demonstrated thermo-stability at temperatures exceeding 95 °C**.

## Low energy input

Our process operates at temperatures **below 70°C**, requiring only a moderate amount of heat. This heat can easily be supplied using **waste heat** or generated from **renewable energy sources**.

# Enzyme development

## AI-driven approach

By integrating AI-driven modeling and machine learning, we streamline enzyme development and surpassing the limitations of conventional methods in both speed and optimization potential.

## Big data with high quality

Our degradation screening platform enables real-time, high-resolution data acquisition at short intervals, providing comprehensive insights into the entire degradation process.

## Broad enzyme portfolio

Through continuous screening of diverse enzyme variants across multiple plastic substrates and reaction conditions, we systematically expand a robust enzyme portfolio optimized for varied recycling applications.

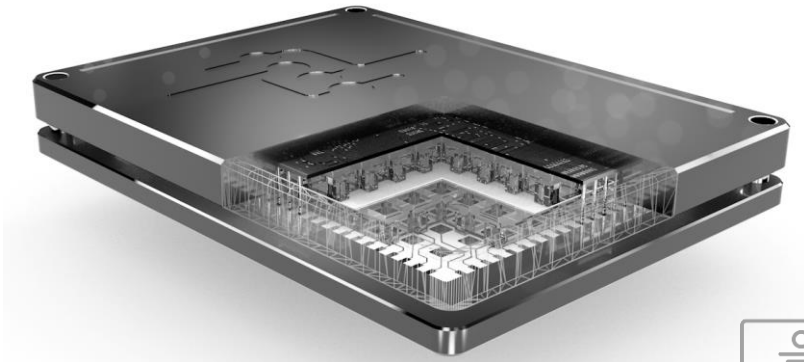
## High prediction quality

Given these advantages, our approach enables high predictive accuracy, leading to more effective enzyme optimization and reducing the number of iterative design cycles.

TECHNOLOGIES

# Plastics degradation screening

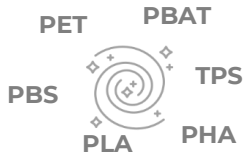
- **Continuous live measurement**
- **High accuracy & sensitivity**
- **Robust measurements**
- **Fast and high throughput**



48 measurement chambers

patented

- **Parallelizing**
- **Automation**
- **Original material test samples**
- **Multi-layer test samples**

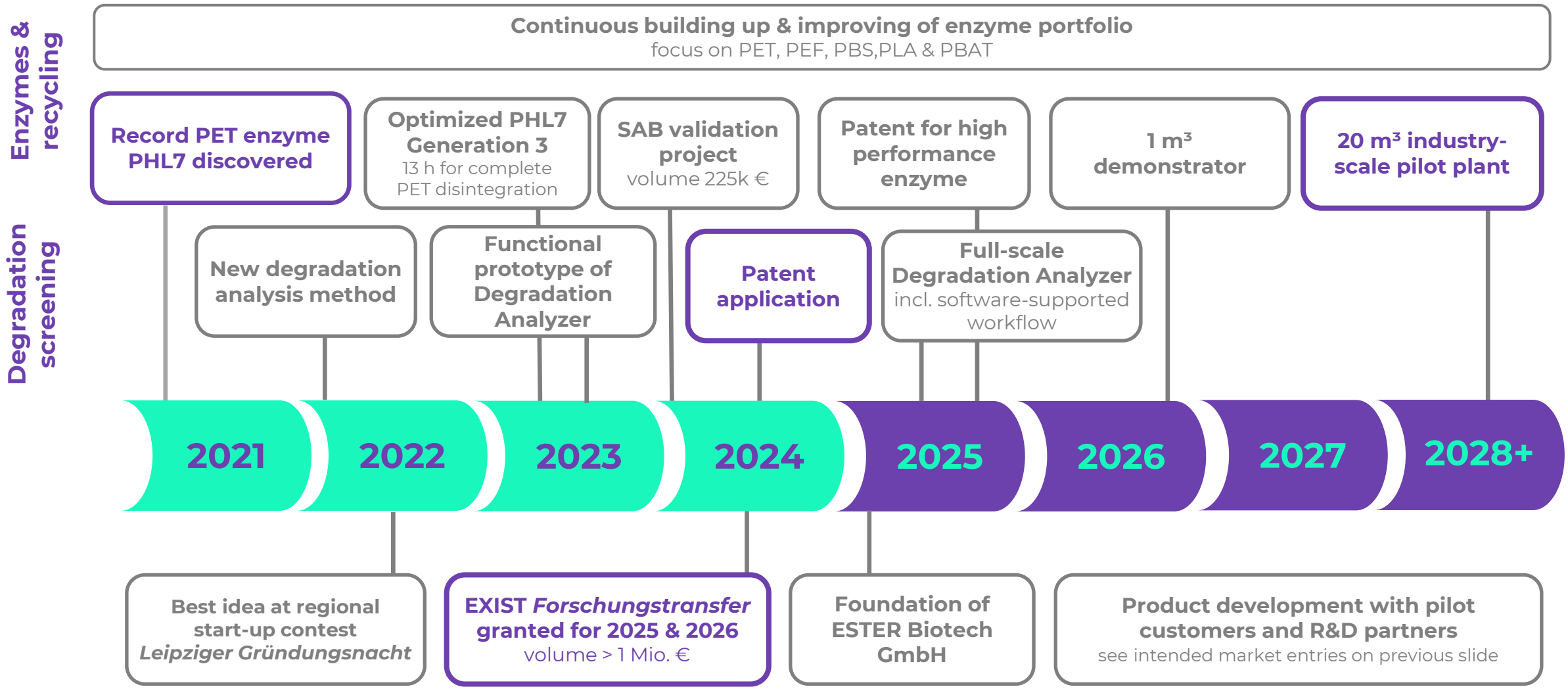



**Universal applicable**

# BUSINESS CASES

| Product / Service | Potential Customer groups | Global market size | Revenue potential & conceivable market entry |
|---|---|---|---|
|  **Licensing of enzyme sequences & Test services for enzyme development** | Enzyme developers & manufacturers |  Industrial enzymes 7+ bn. $ / 6+ % CAGR | Licensing  2025 Testing  2025 |
|  **Test services regarding biodegradability or compostability of plastics** | Bioplastic industry & Test service providers |  Bio plastics 20+ bn. $ / 20+ % CAGR |  2026 |
|  **Technology licensing of recycling process** | Recycling & chemical industry |  Plastic packaging 400+ bn. $ / 4+ % CAGR |  2030+ |

# MILESTONES


Enzymes & recycling
Degradation screening
Continuous building up & improving of enzyme portfolio
focus on PET, PEF, PBS,PLA & PBAT
Record PET enzyme PHL7 discovered
Optimized PHL7 Generation 3
13 h for complete PET disintegration
SAB validation project
volume 225k €
Patent for high performance enzyme
1 m³ demonstrator
20 m³ industry-scale pilot plant
New degradation analysis method
Functional prototype of Degradation Analyzer
Patent application
Full-scale Degradation Analyzer
incl. software-supported workflow
2021
2022
2023
2024
2025
2026
2027
2028+
Best idea at regional start-up contest Leipziger Gründungsnacht
EXIST Forschungstransfer granted for 2025 & 2026
volume > 1 Mio. €
Foundation of ESTER Biotech GmbH
Product development with pilot customers and R&D partners
see intended market entries on previous slide

# TEAM

**Ronny Frank**

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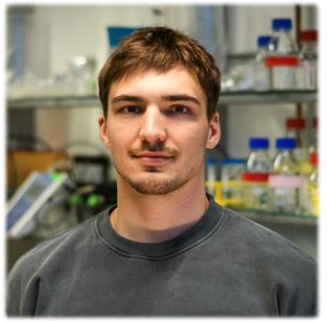

**Alexander Hergett**

**Software Engineer**
M.Sc. Bioinformatics

**BioCity Campus**
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GET IN CONTACT

# Be part of the future and create a plastic circular economy together with ESTER Biotech!

Customers

Funding opportunities

Intrinsic-motivated contributors

Cooperation partners

Strategic investors & Business angels

All other kinds of supporters

Please contact us via info@esterbiotech.com

Get more information @esterbiotech.com

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