# 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 ultimately 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

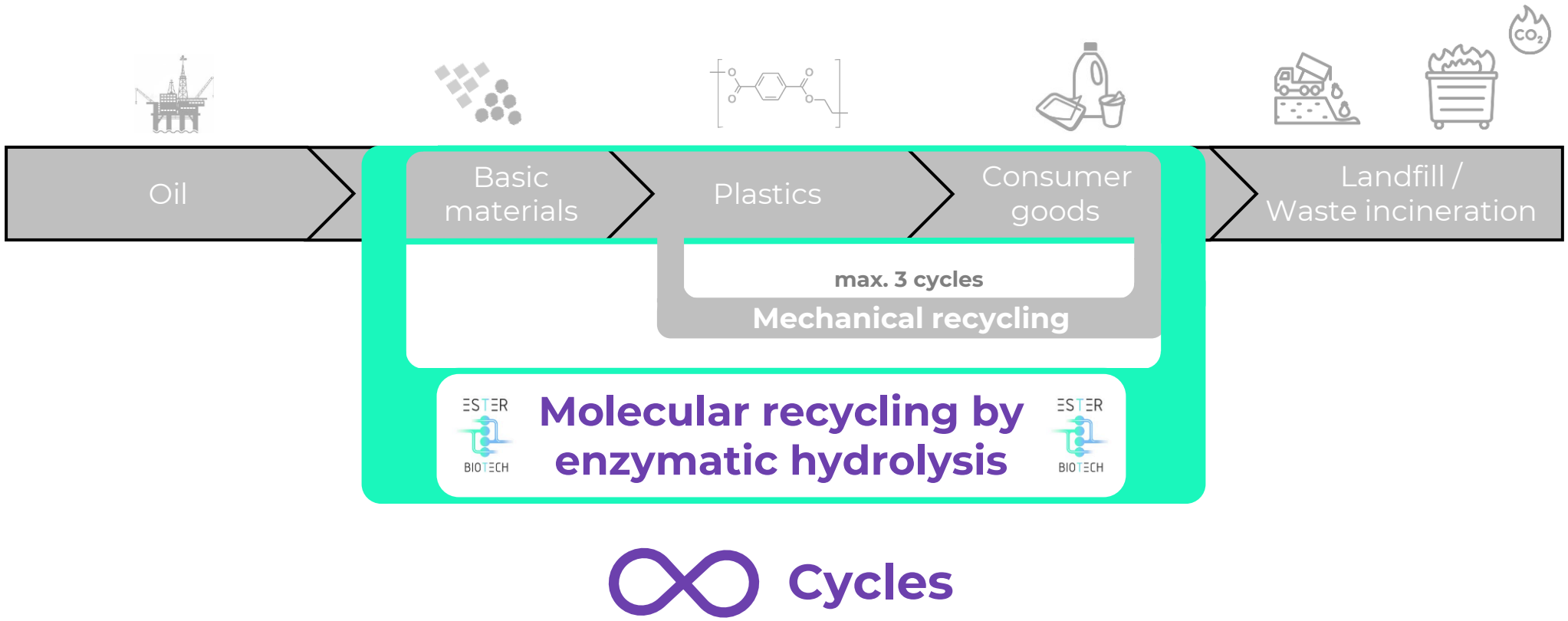

Increasing $CO_2$ costs & plastics tax

Stricter mandatory recycling & recyclate quotas

Prohibition of non-recyclable of materials

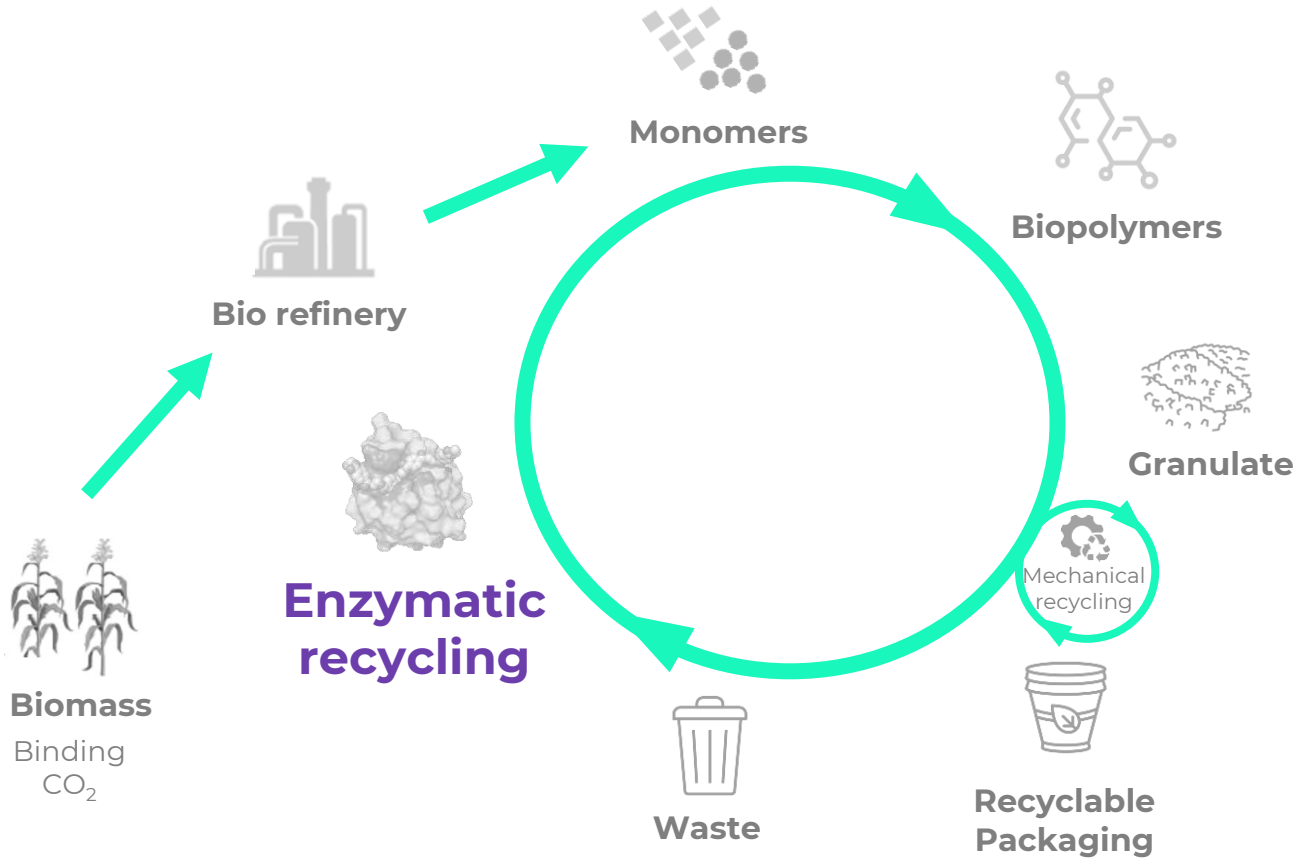
SOLUTION

# Our solution enables a truly sustainable plastic circular economy



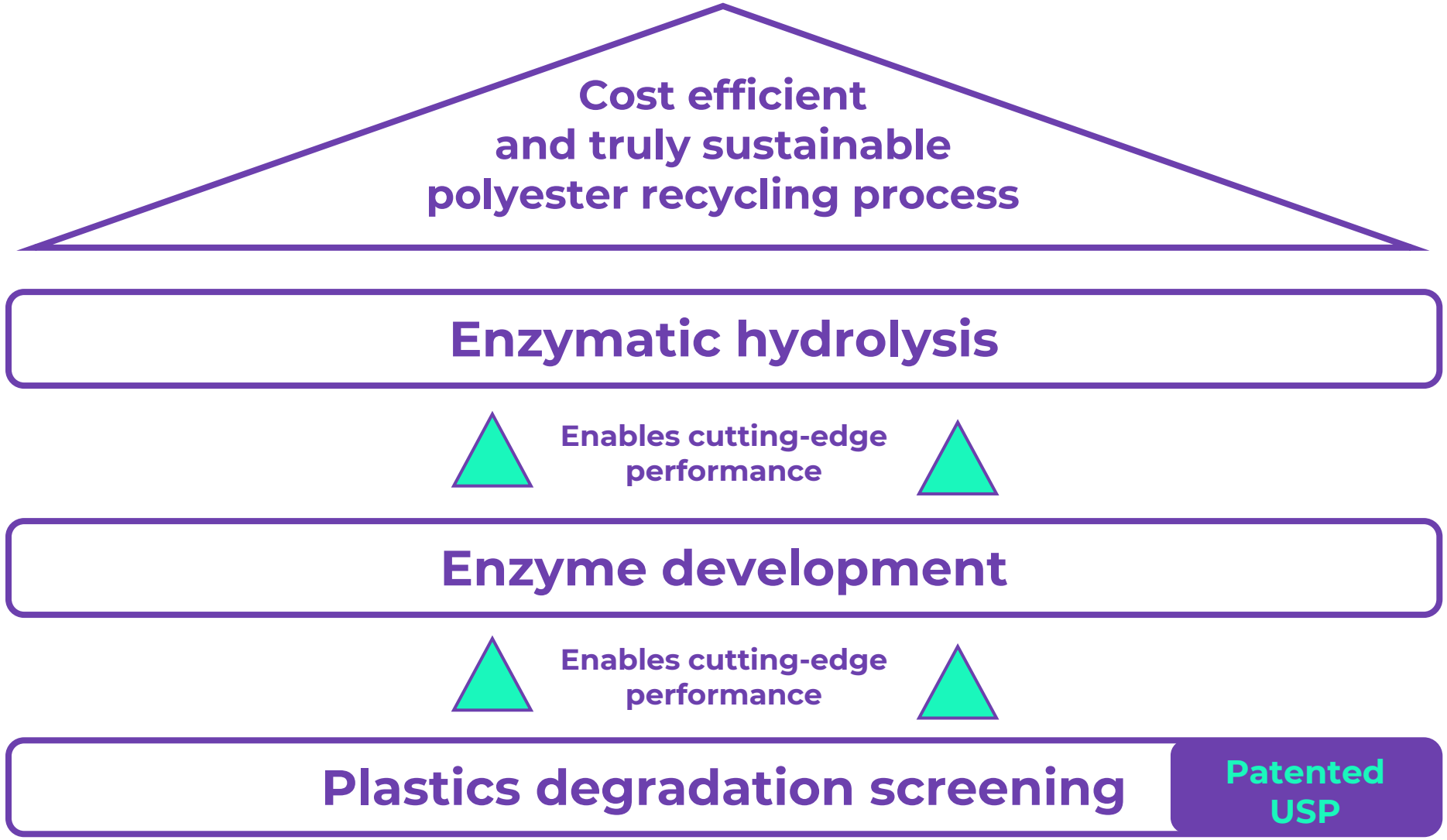
VISION

# A bio-based plastics circular economy through molecular recycling

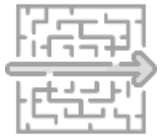



- **No incineration**
- **$CO_2$ neutrality**
- **Independency from fossil supplies**

## 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**

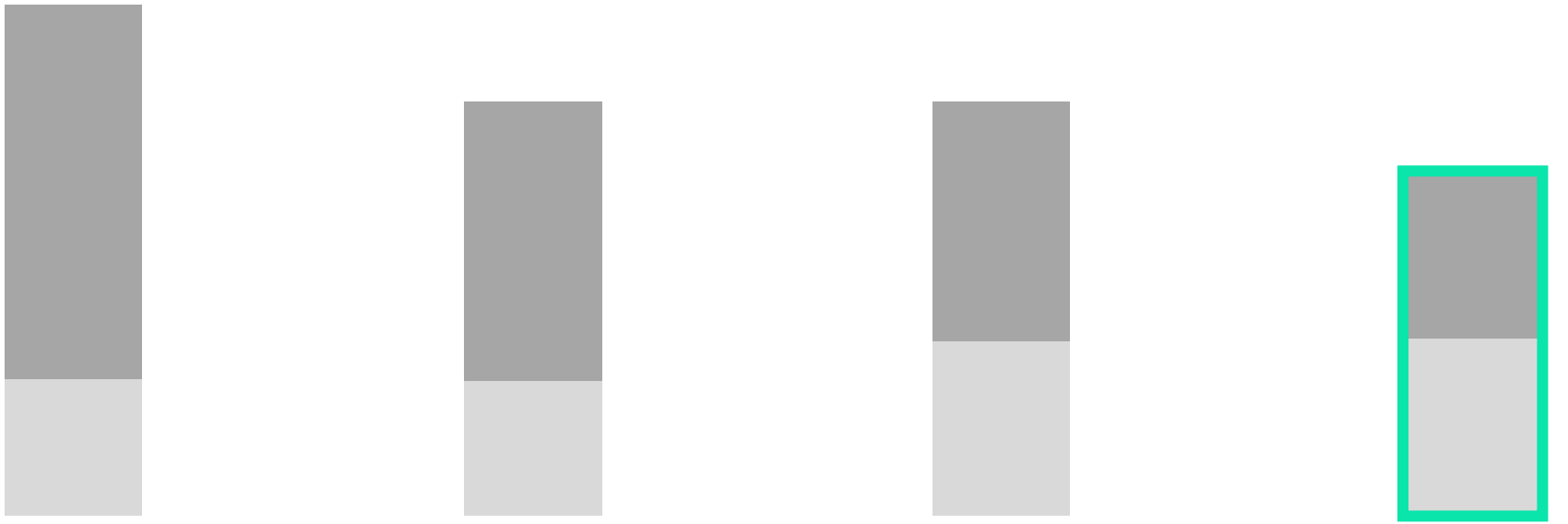
PET PBAT PBS TPS PLA PHA

**Universal applicable**

# BUSINESS CASES

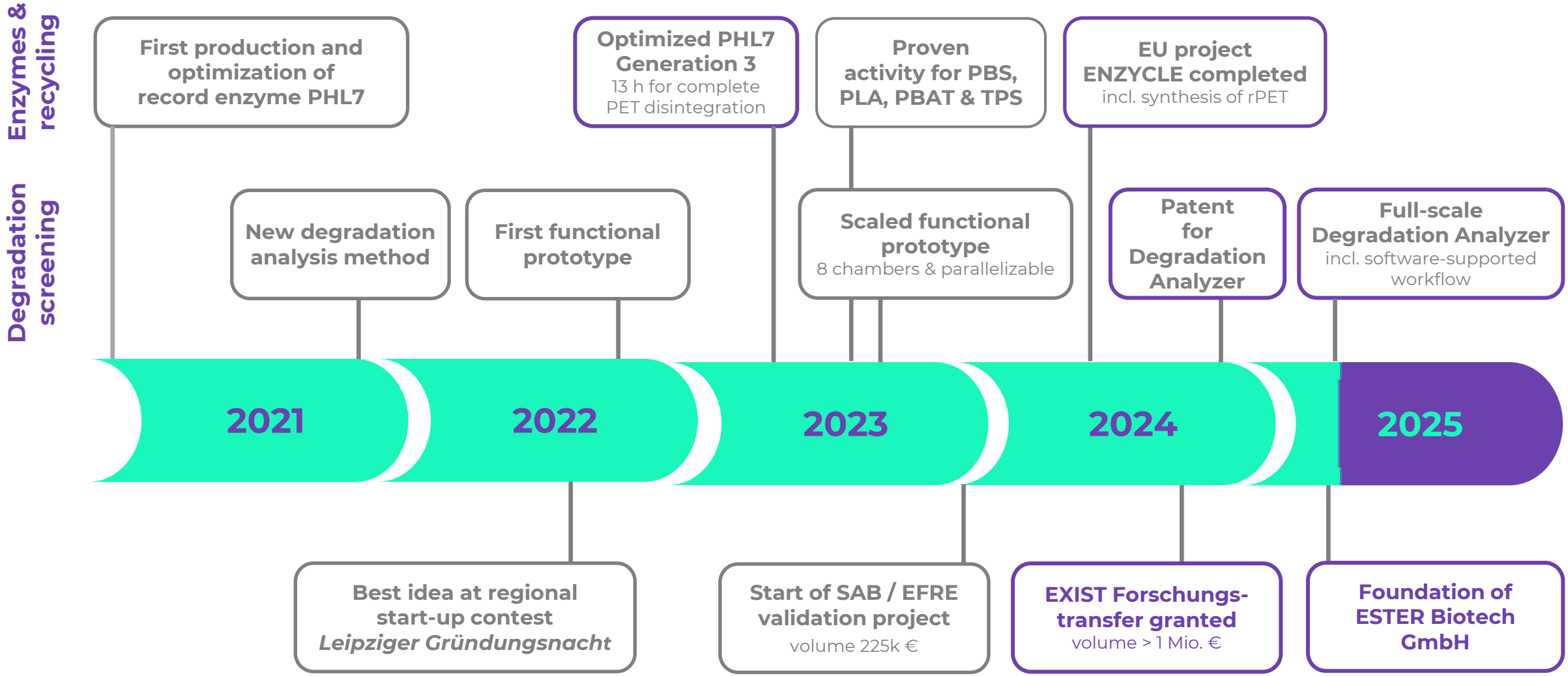
| Product / Service | Potential Customer groups | Global market size | Revenue potential & conceivable market entry |
|---|---|---|---|
|  **Test services for plastics development** | (Bio-)Plastics industry & Test service providers |  500+ mil. $ 7+ % CAGR |  2025 |
|  **Enzyme licensing & Test services for enzyme development** | Enzyme developers & manufacturers |  Industrial enzymes 7+ bn. $ 6+ % CAGR | Testing  2025 Licensing  2026 |
|  **Technology licensing of recycling process** | Recycling, plastics & chemical industry |  Plastics packaging 400+ bn. $ 4+ % CAGR |  2030+ |

# Recycling process: Lifecycle cost comparison




[1] Follow-up cost due to negative effects on the environment and health

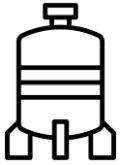
# ACHIEVEMENTS



# NEXT STEPS

Continuous building up & improving of enzyme portfolio aligned to customer needs

| Pilot scale | | Demonstrator scale | Full industrial scale |
|---|---|---|---|
| 100 L reactor | 1 m³ reactor | ~ 2 kt/a plastics waste | ~ 45 kt/a plastics waste |



2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031

# TEAM

**Ronny Frank**

**Managing director/ Co-Founder**

PhD Biochemistry

**Martin Hirschfeld**

**Managing director/ Co-Founder**

MSc Industrial engr.

**Christian Sonnendecker**

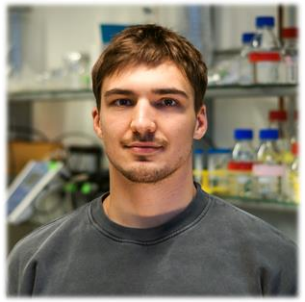
**Head of Research/ Co-Founder**

PhD Biochemistry

**Madalin Ceausescu**

**Head of Engineering/ Co-Founder**

EngD Chem. process engr.



**Alexander Hergett**

**Head of Data Science**

MSc Bioinformatics

**BioCity Campus Leipzig, Germany**

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

Get more information @LinkedIn