



**PolyUrethane Recycling Towards
a Smart Circular Economy**

**The contribution of chemical
recycling in achieving a sustainable
circular economy**

The case of PUReSmart technology

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CIRCULAR ECONOMY

Circularity aims to **minimize** depletion of raw resources by **reusing** and **reducing** waste, water and energy

Quantification of the impact of PUReSmart solutions in terms of

Environment

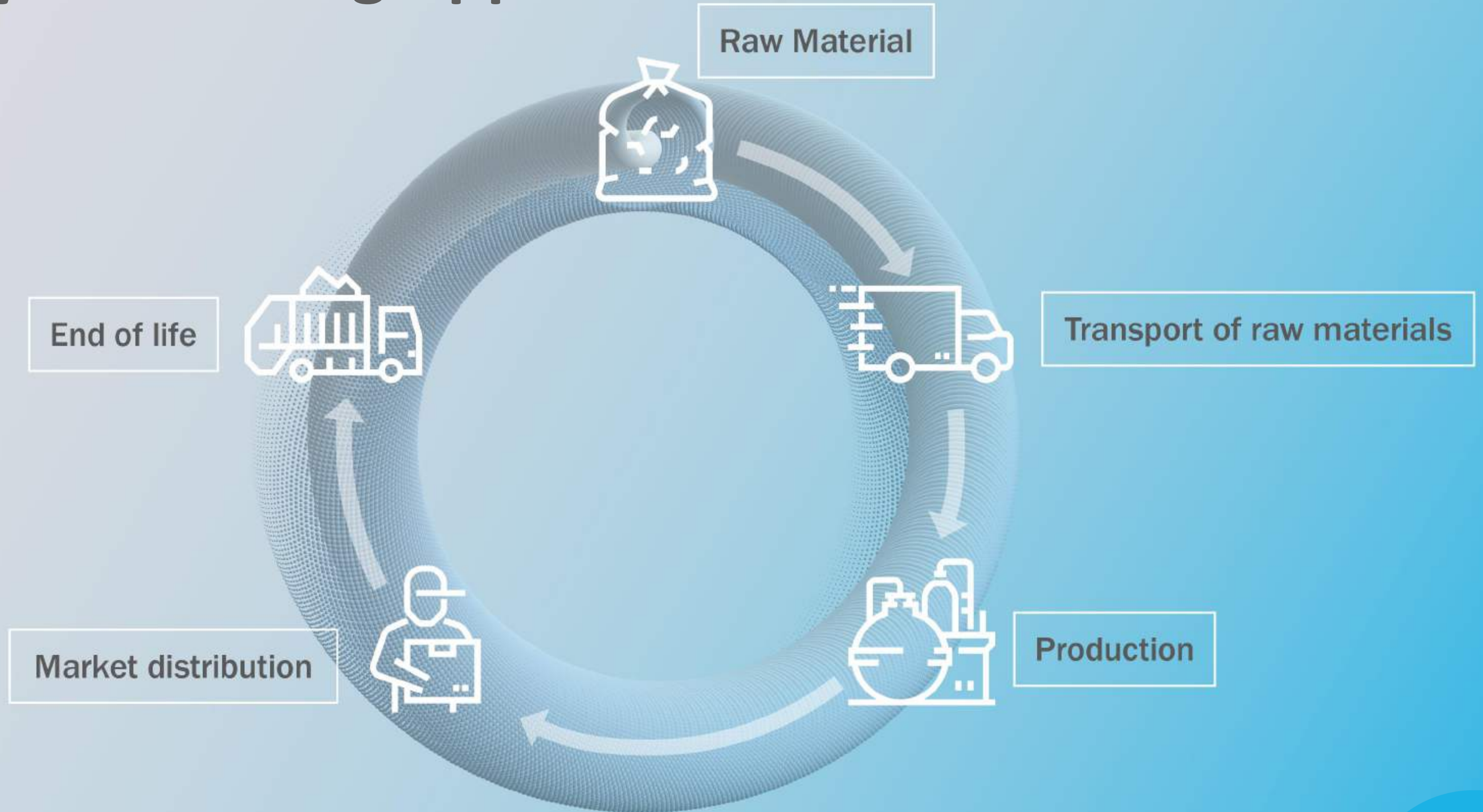
Society

Economy

Provide tools to support decision

"Chance for change"

Life Cycle Thinking Approach



STAKEHOLDER



Local communities



Society and governance



Consumers



Producers and companies



Other stakeholders of the supply chain

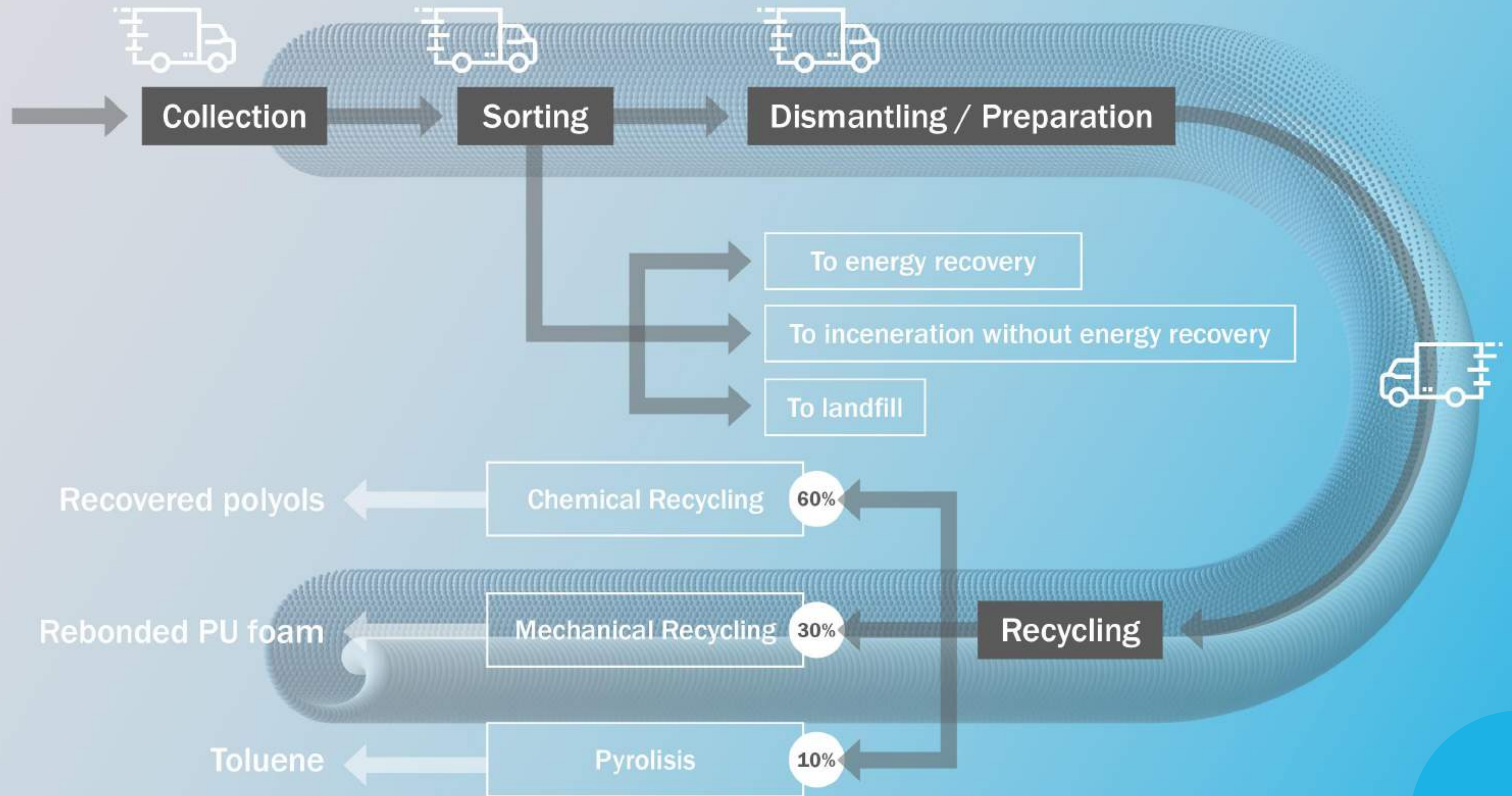


From "linear economy" to "circular economy"

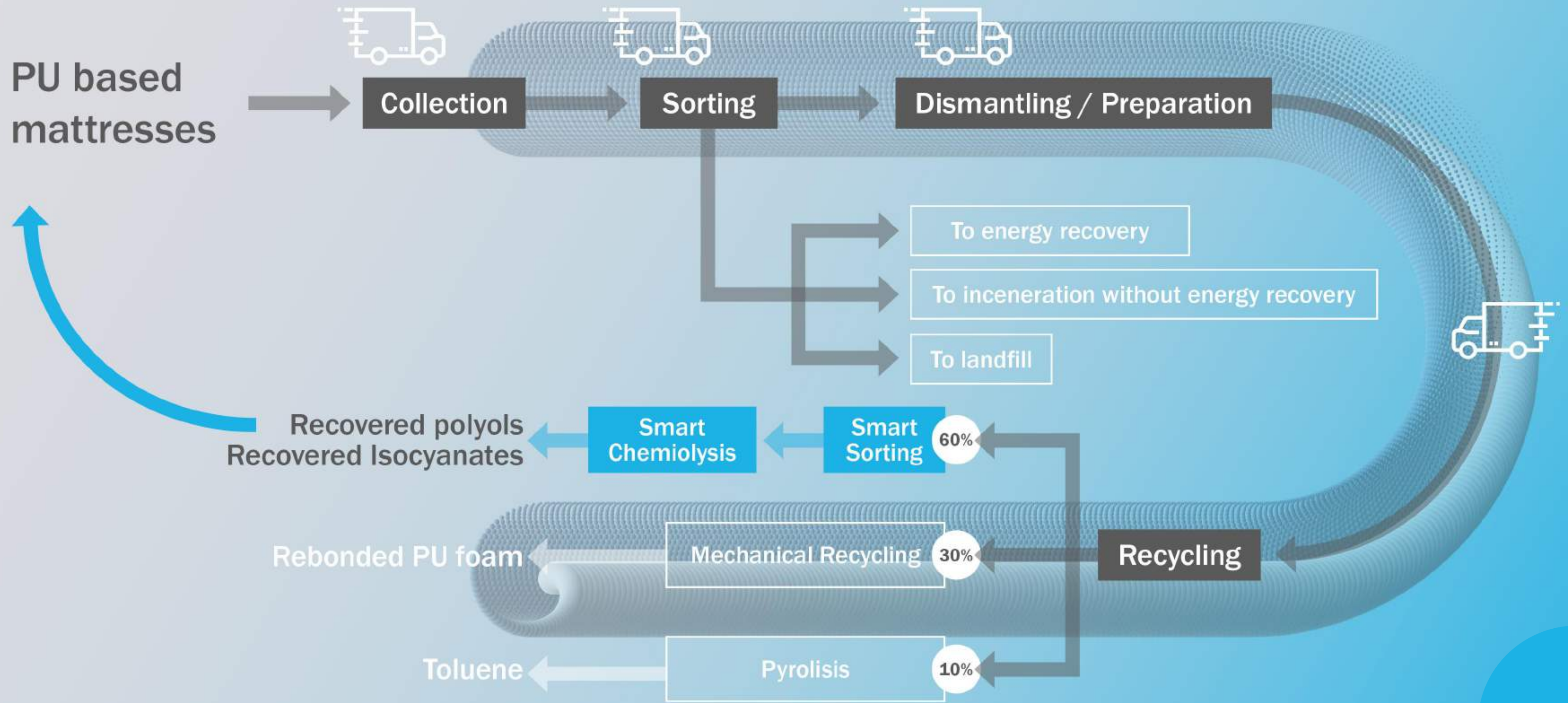
End-of-life PU management

THE CURRENT SYSTEM

PU based mattresses



THE PURESMTART SYSTEM



SOCIAL ASSESSMENT

Materiality assessment

It identifies what is important to monitor and measure to reduce or prevent social impacts.

Integration of literature review and stakeholders' engagement

Evaluation of potential social risks and effects

Identification of social hotspots of reference sectors and countries

Identification of social indicators

for monitoring potential social issues when the PUReSmart technology will be up and running

The analysis has been carried out at qualitative level, considering the two main functions of PReSmart technology system:

Waste management

collection / selection / sorting / recycling

Production of secondary raw materials

Recycled polyols and isocyanates



Materiality assessment

What is relevant

A topic is material if a product and its life-cycle is likely to have a high positive or negative impact on the stakeholders and the business

What is of interest

A topic is material if the intended audience finds a topic very relevant and desires to have information on it



 **Materiality assessment**

Social LCA reference literature identifies

List of potential social topics

Technical and scientific literature identifies

Social topics relevant in the reference sector

Stakeholders' engagement

Check relevance of the selected social topics, complement them and

Define the level of relevance





Materiality assessment

Social topic	Stakeholder	Score	Level of relevance
10. Product quality	User/consumer	9,56	important
9. Health and Safety	User/consumer	9,30	important
6. End-of-Life responsibility	User/consumer	9,11	important
17. Transparency	User/consumer	8,89	important
16. Technology Development	Society	8,82	important
12. Public Commitment to Sustainability Issues	Society	8,75	important
7. Fair competition	Value chain actors	8,36	important
5. Eco-industrial partnership	Value chain actors	8,33	important
15. Supplier relationships and fair trading	Value chain actors and small scale entrepreneurs	8,22	important
14. Safe and Healthy Living Conditions	Local community	8,10	important
11. Promoting social responsibility	Value chain actors	8,00	important
3. Contribution to economic development	Local community	7,00	moderately important
2. Community engagement	Local community	6,82	moderately important
8. Feedback mechanism	User/consumer	6,63	moderately important
13. Respect of intellectual properties rights	Value chain actors	6,60	moderately important
1. Access to immaterial and material resources	Local community	6,40	moderately important
18. Wealth distribution	Value chain actors	5,60	moderately important
19. Women's empowerment	Value chain actors and Small scale entrepreneurs	4,60	slightly important
4. Corruption	Society	3,58	slightly important



Evaluation of potential social risks and effects

Social hotspot analysis

by means of PSILCA database on reference sectors and countries
**It identifies social risks which currently characterized the sectors
where PReSmart will be implemented**

Evaluation of potential effects (positive and negative)

generated by the implementation of PReSmart technology
by means of experts' inputs and insights from the technical literature

Evaluation of potential social risks

CHEMICAL PRODUCTS

SOCIAL TOPICS

Access to material resources
fair salary
contribution to economic development
workers' rights

STAKEHOLDER

Highest risks on
Workers and local communities

CORE/SUPPLY CHAIN

The contribution of the supply chain to the social risks of the sector is larger than the one of the direct activities

WASTE RECYCLING

SOCIAL TOPICS

Access to material resources
fair salary
workers' rights
migration
health and safety

STAKEHOLDER

Highest risks on
Workers and local communities
Non negligible risks also on
corruption

Contribution to economic development
Promoting social responsibility

CORE/SUPPLY CHAIN

The relevance of supply chain and core activities is context dependent

FURNITURE

SOCIAL TOPICS

Access to material resources
fair salary
workers' rights
contribution to economic development
migration

STAKEHOLDER

Highest risks on
Workers and local communities
Non negligible risks also on
Promoting social responsibility
Safe & healthy living conditions
Corruption

CORE/SUPPLY CHAIN

The contribution of the supply chain to the social risks of the sector is larger than the core's one



Evaluation of potential effects

POSITIVE	NEUTRAL	NEGATIVE	UNKNOWN
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Access to material and immaterial resources
 Contribution to economic development
 Fair competition
 Product quality
 Promoting social responsibility
 Public commitment to sustainability issues
 Technology development

EoL responsibility
 Transparency
 Corruption
 Respect of intellectual properties rights
 Safe & healthy living conditions
 Supplier relationships and fair trading
 Wealth distribution
 Women's empowerment

NONE

Community engagement
 Feedback mechanism

PU RECYCLING

EoL responsibility
 possibility of supporting the EPR system on mattress and of sustainability issues increasing among value chain actors

Contribution to economic development
 it could trigger technology transfer to new EPR's schedules and potential for sorting other types of materials with consequences in terms of job creation

Transparency
 clear communication is needed to guide customer to mattresses recycling

POLYOLS PRODUCTION (SECONDARY RAW MATERIALS)

Access to material and immaterial resources
 due to the materials recycling which counters raw material extraction

Product quality
 thanks to the creation of higher quality secondary raw material.

Promoting the social responsibility

Public commitment to sustainability issues
 new opportunity for customers and other value chain actors that could make a choice for lower 'environmental impact materials'

Transparency
 to guarantee traceability and safety on the recycled material, thus enhancing interest and trust across actors and on the final consumer



SOCIAL ASSESSMENT/ HIGHLIGHTS

Important social topics	Moderately important social topics	Slightly important social topics
<p style="text-align: center; font-size: 2em;">11</p>	<p style="text-align: center; font-size: 2em;">6</p>	<p style="text-align: center; font-size: 2em;">2</p>
<ul style="list-style-type: none"> Product quality Health and safety EoL responsibility Transparency Technology development Public commitment to sustainability issues Fair competition Eco-industrial partnership Supplier relationship and fair trading Health&safety living conditions Promoting social responsibility 	<ul style="list-style-type: none"> Contribution to economic development Community engagement Feedback mechanisms Respect of intellectual property rights Access to material and immaterial resources Wealth distribution 	<ul style="list-style-type: none"> Women's empowerment Corruption



SOCIAL ASSESSMENT/ CONCLUSIONS

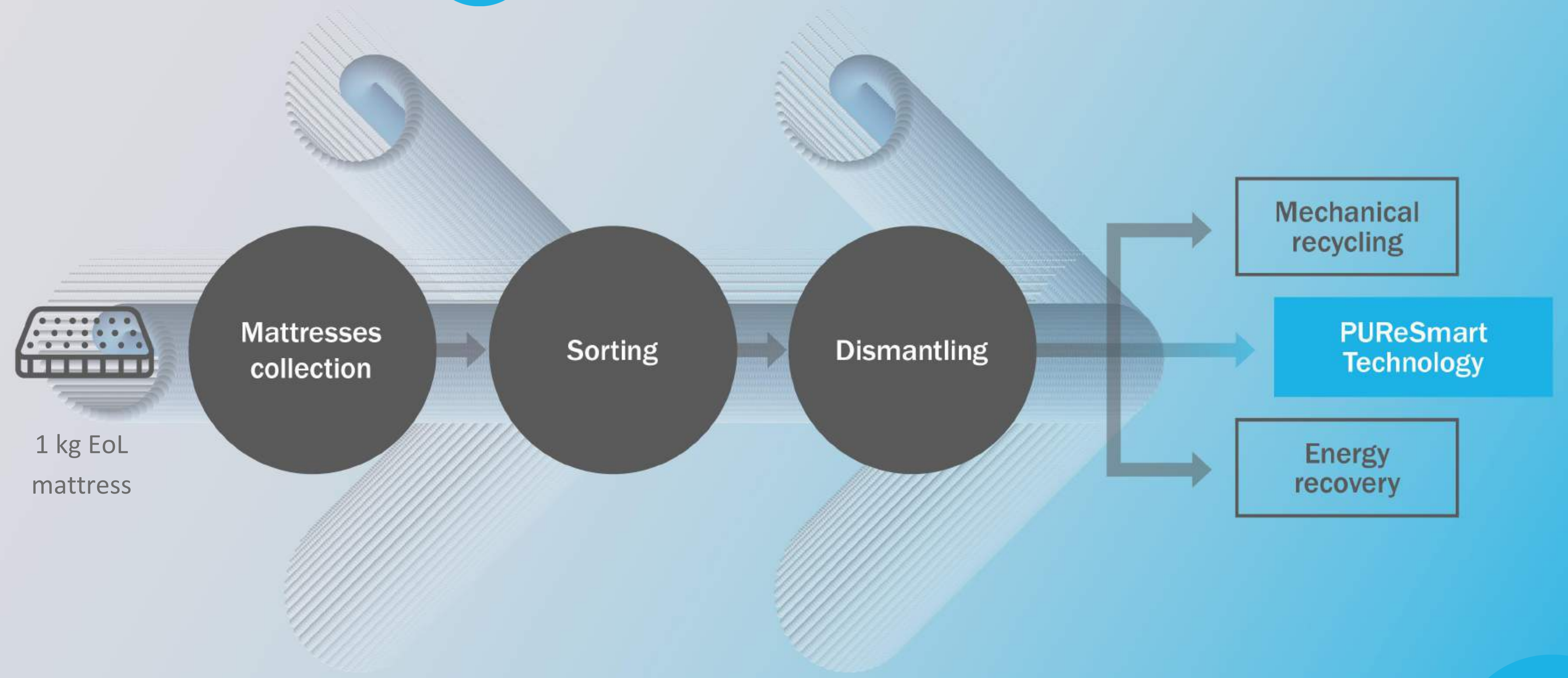
POSITIVE EFFECTS	NEUTRAL EFFECTS	NEGATIVE EFFECTS
<p>Access to material and immaterial resources</p> <p>Contribution to economic development</p> <p>Fair competition</p> <p>Product quality</p> <p>Promoting social responsibility</p> <p>Public commitment to sustainable development</p> <p>Technology development</p>	<p>Community engagement</p> <p>Feedback mechanisms</p>	<p>No negative effects raised from the analysis</p> <p>EoL responsibility& transparency</p> <p>Depend on the communication about the new recycling technologies along the value chain actors</p>

ENVIRONMENTAL FOOTPRINT

● STATIONARY



EVOLUTIONARY



1 kg EoL
mattress

**Mattresses
collection**

Sorting

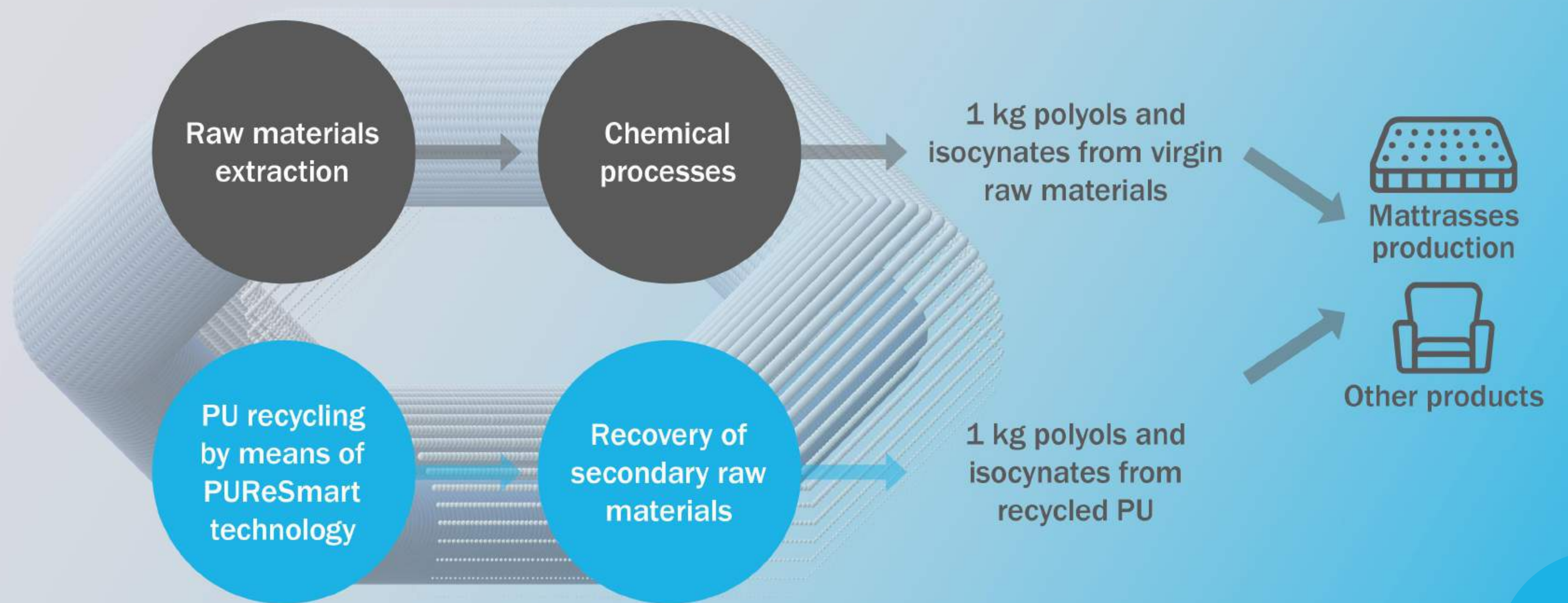
Dismantling

Mechanical
recycling

**PUReSmart
Technology**

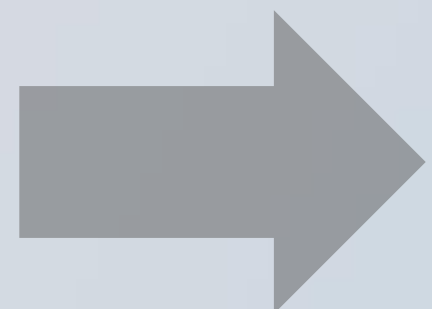
Energy
recovery

ADDED VALUE



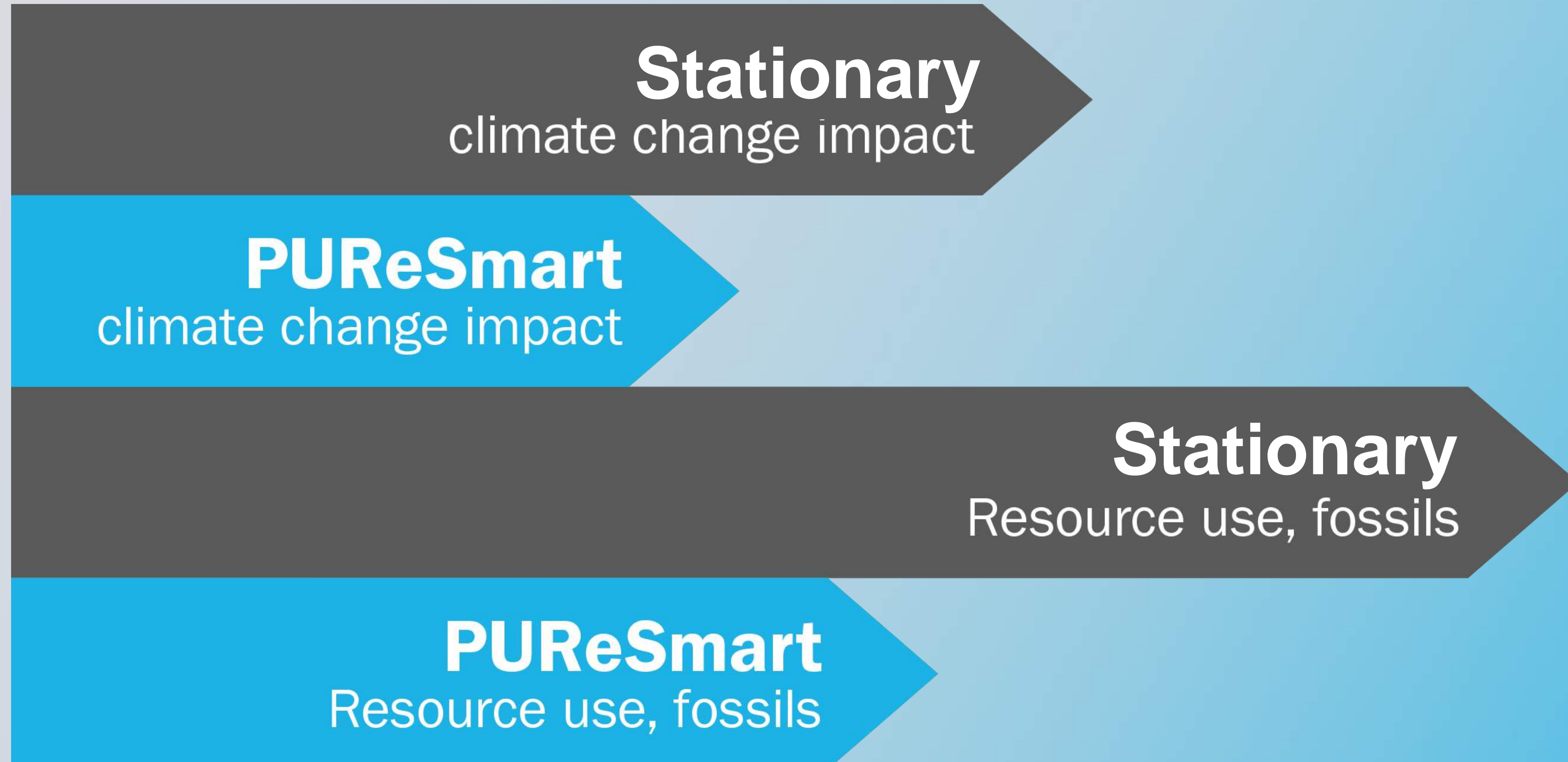
With and without PUReSmart

● EVOLUTIONARY



- Comparison between technology systems for EoL mattresses, with and without PUReSmart

LCA 2 / Evolutionary scenario





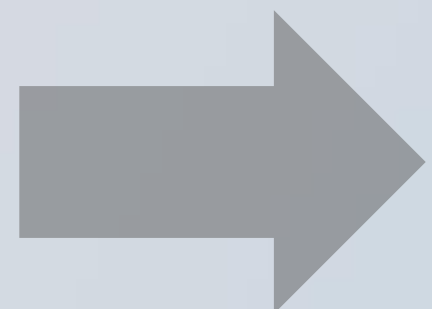
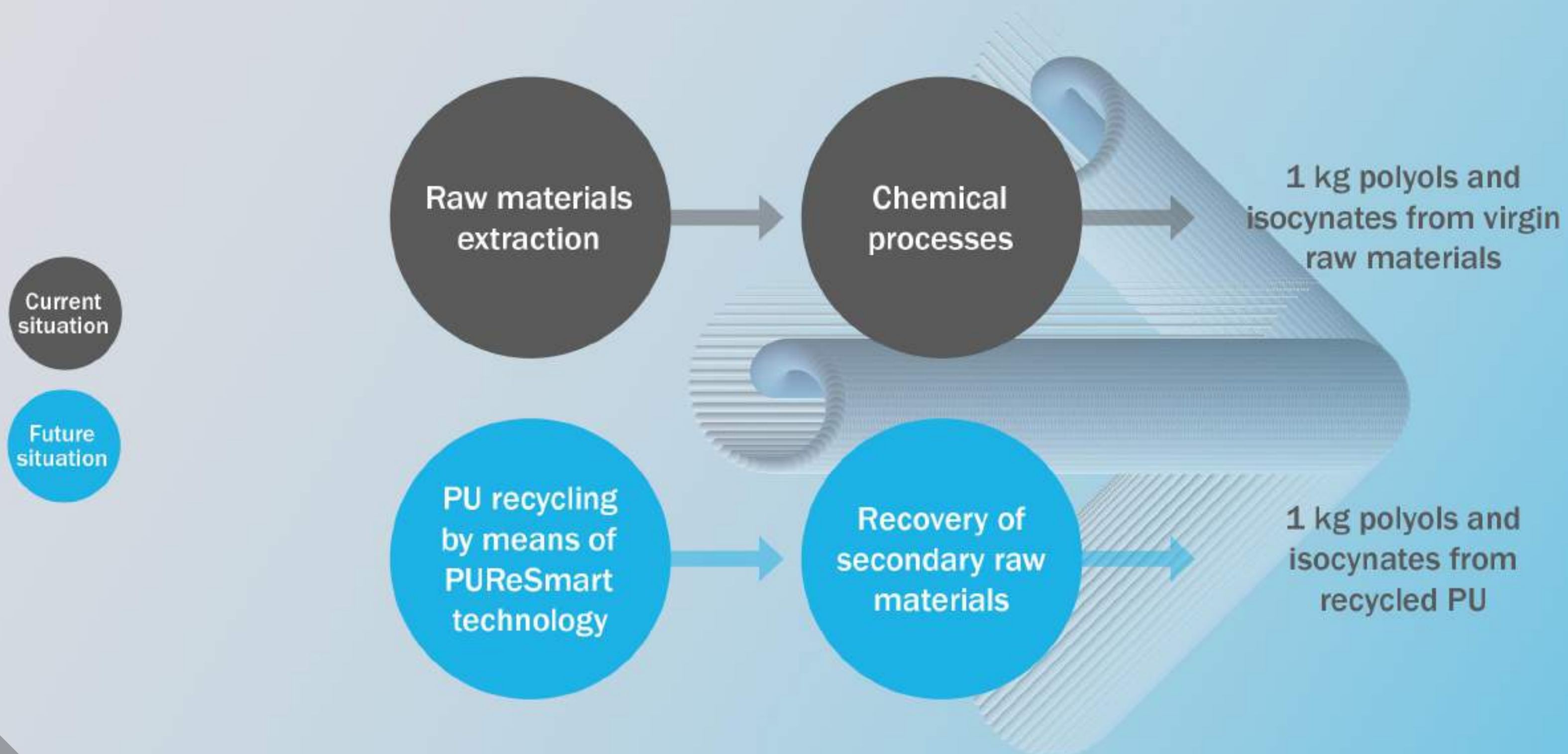
LCA 2 / Evolutionary scenario

The reduction on Climate Change is almost totally due to the replacement of old chemolysis with Smart Chemolysis

The Smart Chemolysis remarkably contributes to reducing the burdens also on the 'Resource use, fossils' environmental impacts

With and without PUReSmart

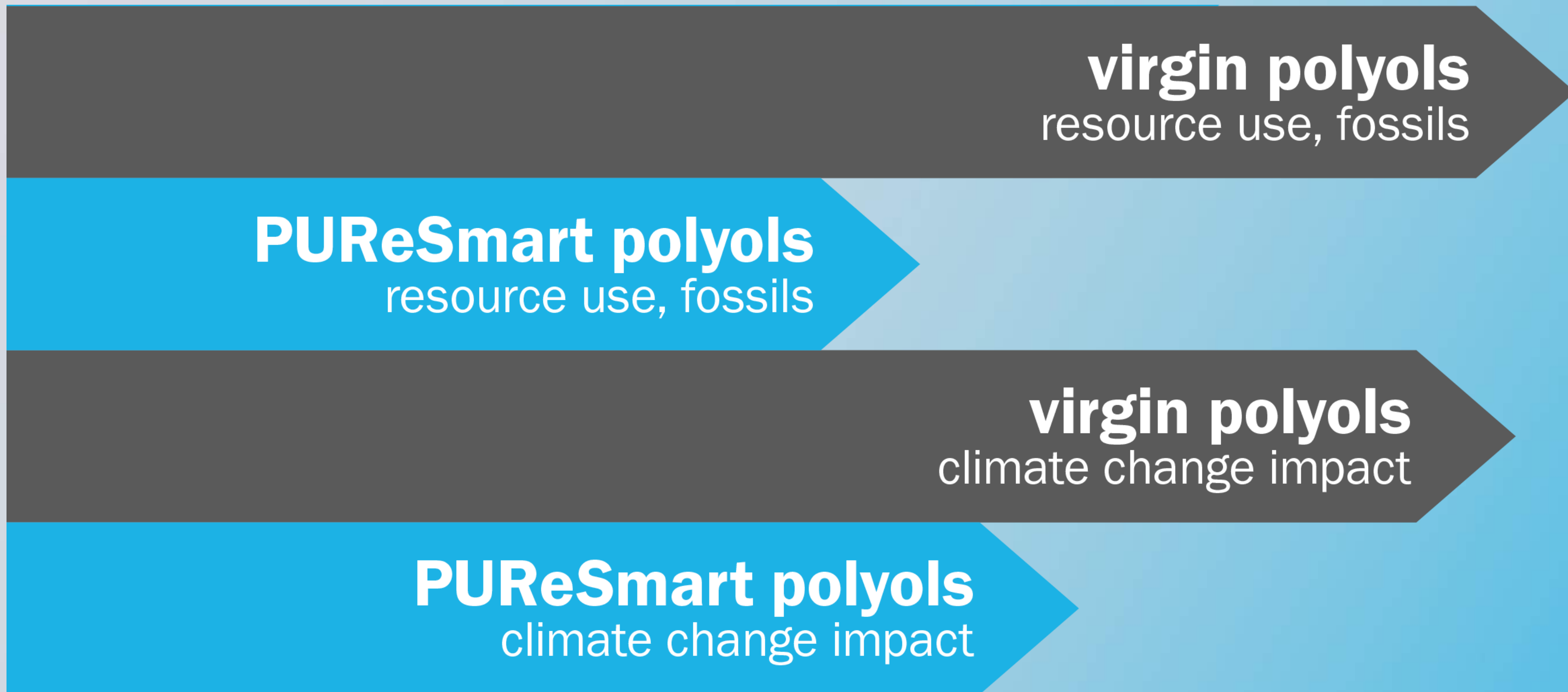
+ ADDED VALUE



- Focus on the production of polyols and isocyanates



LCA 3 / Added value scenario





LCA 3 / Added value scenario

PReSmart show a decrease in the environmental impact due to the recovery of a **high-quality polyols and isocyanates**

The different **energy consumption** gives a contribute to reduce the impact



ENVIRONMENTAL FOOTPRINT / FINAL OUTCOMES

Future EoL PU waste management solutions cannot be implemented without innovative chemical recycling solutions

The environmental impact can be remarkably reduced by replacing current chemical recycling with the PReSmart developed system with Smart Sorting and Smart Chemolysis

Competitiveness of the PReSmart recovered polyols compared with the current production of the virgin ones

Future industrial improvements, especially in the consumption of energy and materials, could improve the overall environmental sustainability of PReSmart polyols

Thank you

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