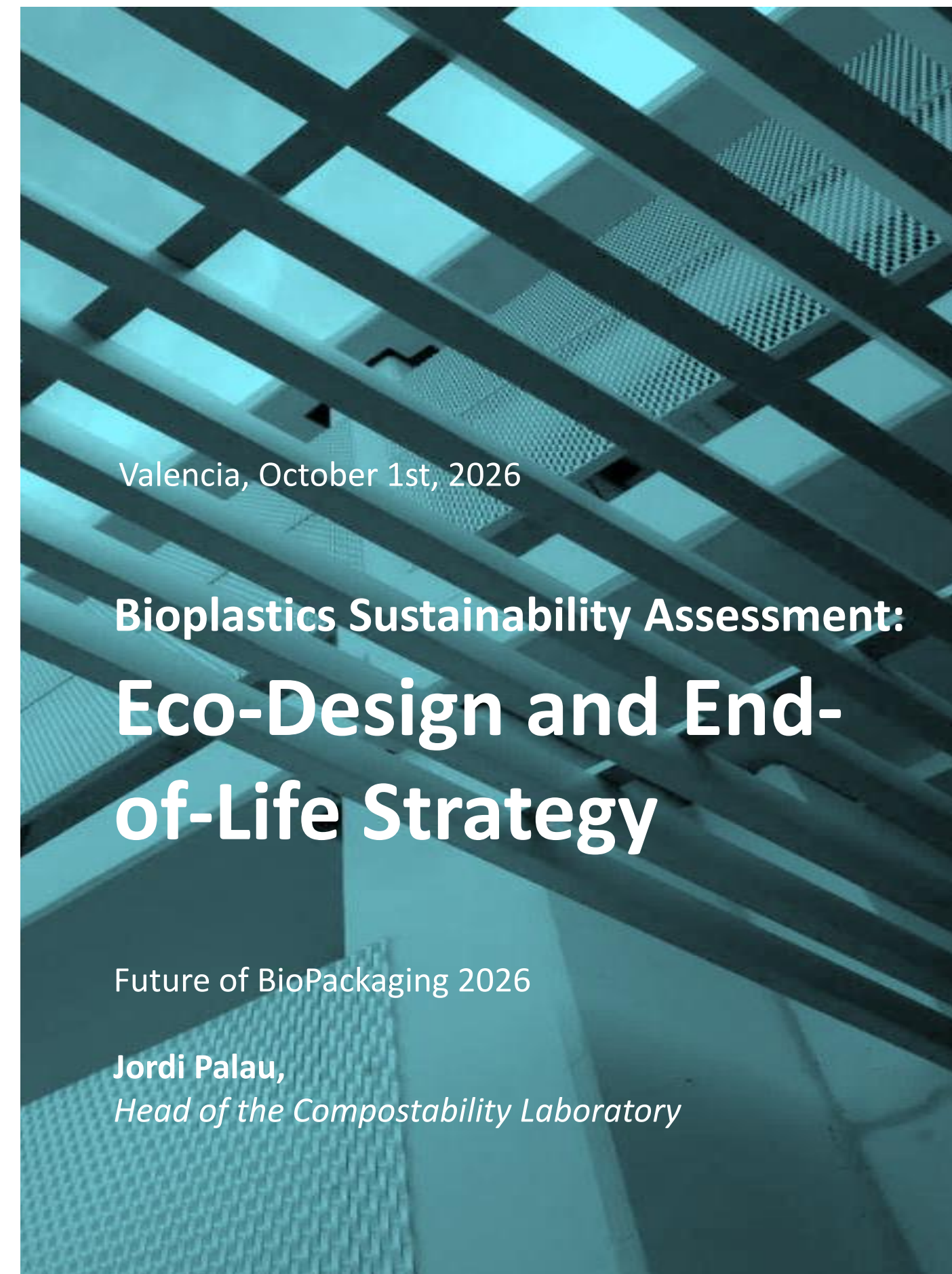
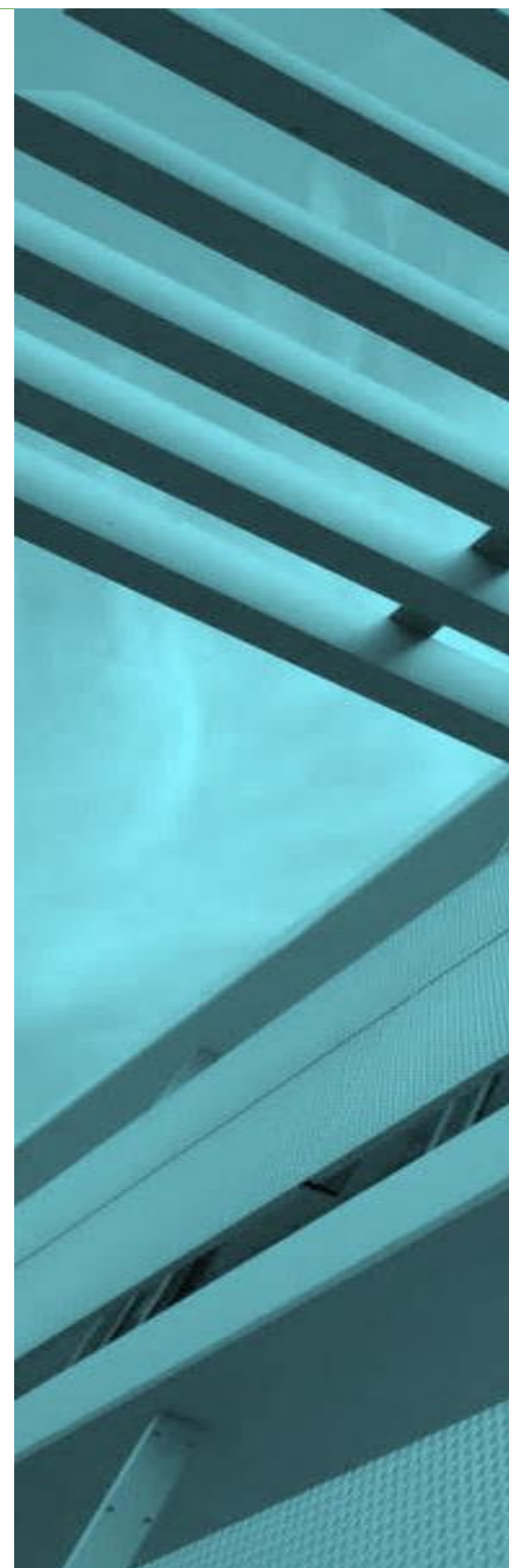




Valencia, October 1st, 2026

Bioplastics Sustainability Assessment: Eco-Design and End- of-Life Strategy

Future of BioPackaging 2026

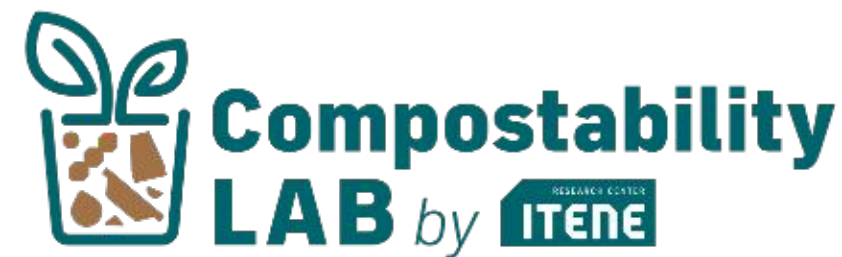
Jordi Palau,
Head of the Compostability Laboratory

Expertise, technology & worldwide recognition

Expertise behind the Lab

Integrated within ITENE, a Research Center with **+30 years of experience** developing technological solutions through **R+D+I**

+200 professionals
10,000 m² facilities



Approved for the main global standards



ASTM D6400 D6868



EN 13432 EN 14995 EN 17427 NF T 51-800



ISO17088 ISO18606



AS5810 AS4736

Our laboratories meet the highest standards

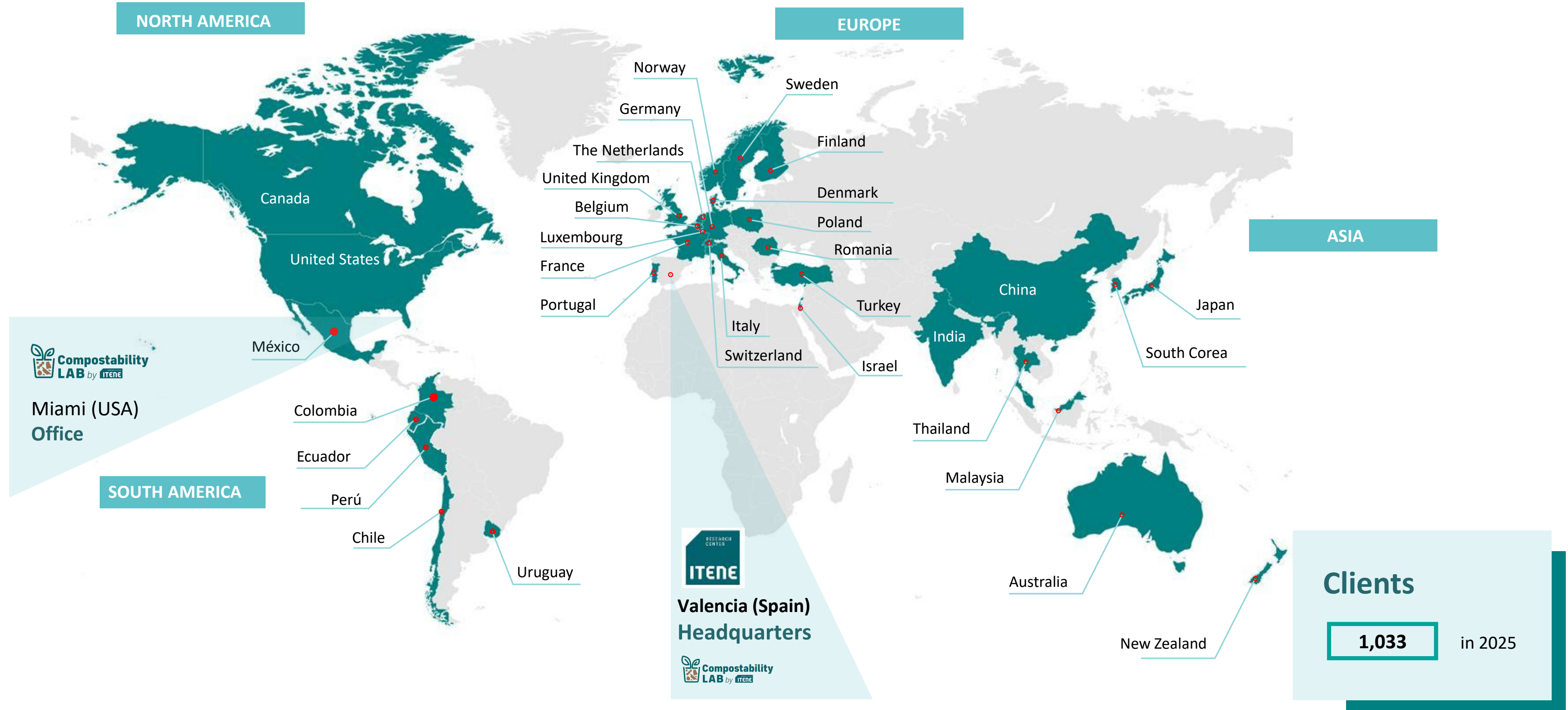
Laboratories accredited according to the international quality UNE-EN/IEC **17025**: 2012 standard



Recognised by



Worldwide customer portfolio



The sustainability claims landscape

Markets rely heavily on specific property certificates to market eco-friendly design.

Four common claims



Bio-based



Biodegradable



Compostable



Recyclable

Which is more sustainable?

The sustainability claims landscape

 Markets rely heavily on specific property certificates to market eco-friendly design.

None of them.



MARKET CONTEXT

Rapid Growth vs. Global Share

ANNUAL GROWTH RATE

+15%

Industrial Compound Annual Growth

High demand concentrated in short-life packaging & agriculture.



STANDARDS & REGULATION

Regulatory Rigor: EN 13432 & PPWR



EN 13432 Benchmark

90% Disintegration: Must break down under 2mm within 12 weeks in industrial composting.

Zero heavy metal accumulation or eco-toxicity in final compost soil.



EU PPWR Integration

Targeted Mandates: Restricts compostability to organic-contaminated packaging.

Tea bags, coffee pods, sticky fruit labels, and bio-waste bags.



The Single-Metric Illusion

The Fallacy

"100% Bio-Based" Does Not Equal Zero Impact

Focusing exclusively on renewable feedstock ignores agricultural land burden, chemical processing energy, and end-of-life leakage into natural ecosystems.

Core Principle

Material properties alone do not guarantee environmental benefits without matching recovery systems



Feedstock Impact

Agricultural land use, fertilizers, and water footprints.



Processing Energy

Conversion efficiency and grid carbon intensity.



Fate at End-of-Life

Real-world disposal pathways and waste infrastructure.

FOUNDATIONAL PRINCIPLE

The Sustainability Master Equation

A single element cannot guarantee environmental success. All four pillars are mandatory.

**Material**

Renewable Feedstock

+

**Application**

Functional Fit

+

**Infrastructure**

Collection Logistics

+

**End-of-Life**

Effective Recovery

= True Environmental Sustainability

ASSESSMENT FRAMEWORK

Four Tools. Four Fundamental Questions.

 1. Biodegradation 2. Compostability 3. Recyclability 4. Life Cycle Assessment

Useful information, incomplete answer.

Biodegradation tests reveal potential — not real-world behavior.

ASSESSMENT FRAMEWORK

Four Tools. Four Fundamental Questions.

 1. Biodegradation 2. Compostability 3. Recyclability 4. Life Cycle Assessment

**Important in some
applications,
irrelevant in others.**



Value depends entirely on waste infrastructure and end-of-life context.

ASSESSMENT FRAMEWORK

Four Tools. Four Fundamental Questions.

 1. Biodegradation 2. Compostability 3. Recyclability 4. Life Cycle Assessment

Recycling should be preferred whenever it makes environmental sense.

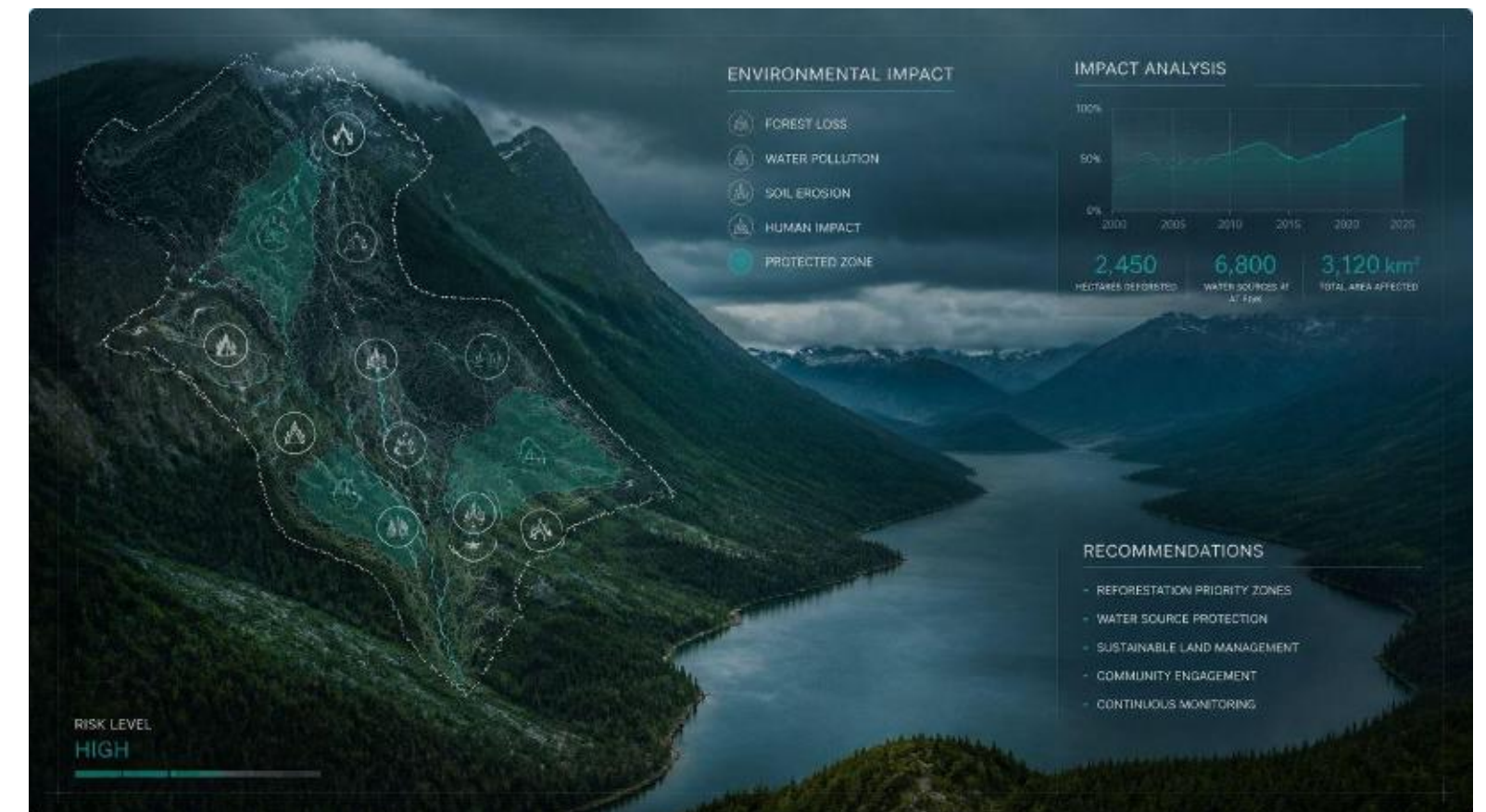
Not all recycling is equal — system context matters.

ASSESSMENT FRAMEWORK

Four Tools. Four Fundamental Questions.

 1. Biodegradation 2. Compostability 3. Recyclability 4. Life Cycle Assessment

LCA reveals trade-off invisible to individual tests.



Carbon, water, land use — the full picture.

TERMINOLOGY PRECISION

Biodegradability ≠ Compostability

Biodegradability

Chemical Process: Natural breakdown by microbes.

No mandatory timeframe or specific temperature constraints defined.

Compostability

Waste Management Strategy: Controlled industrial processing.

Strict timeline, specific temperatures, and toxicologically safe compost output.



SYSTEMIC VALUE

Compostability Creates Systemic Value

+50%

Organic Waste Capture

Diverts food scraps from grey bins

0%

Methane from Landfills

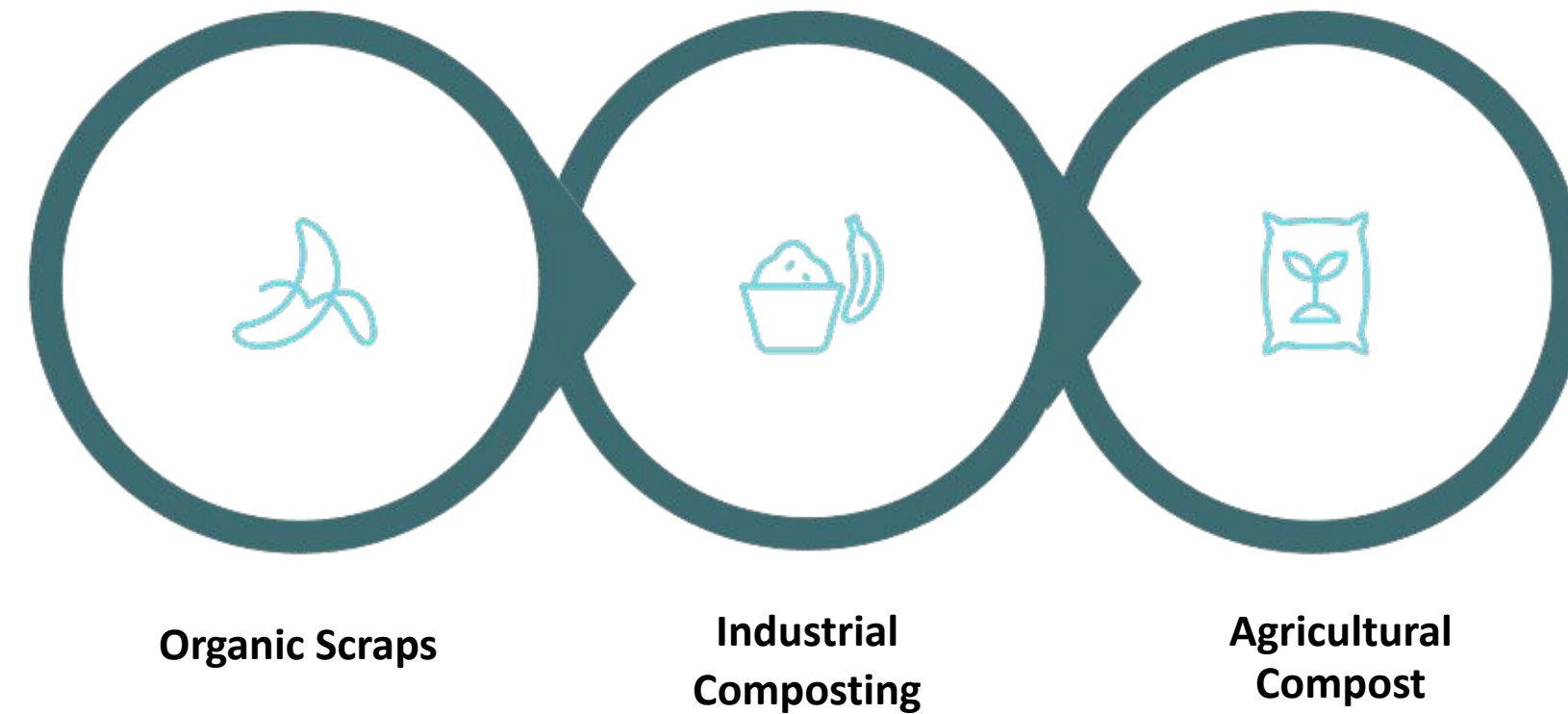
Prevents anaerobic degradation

100%

Soil Carbon Return

Yields nutrient-rich humus

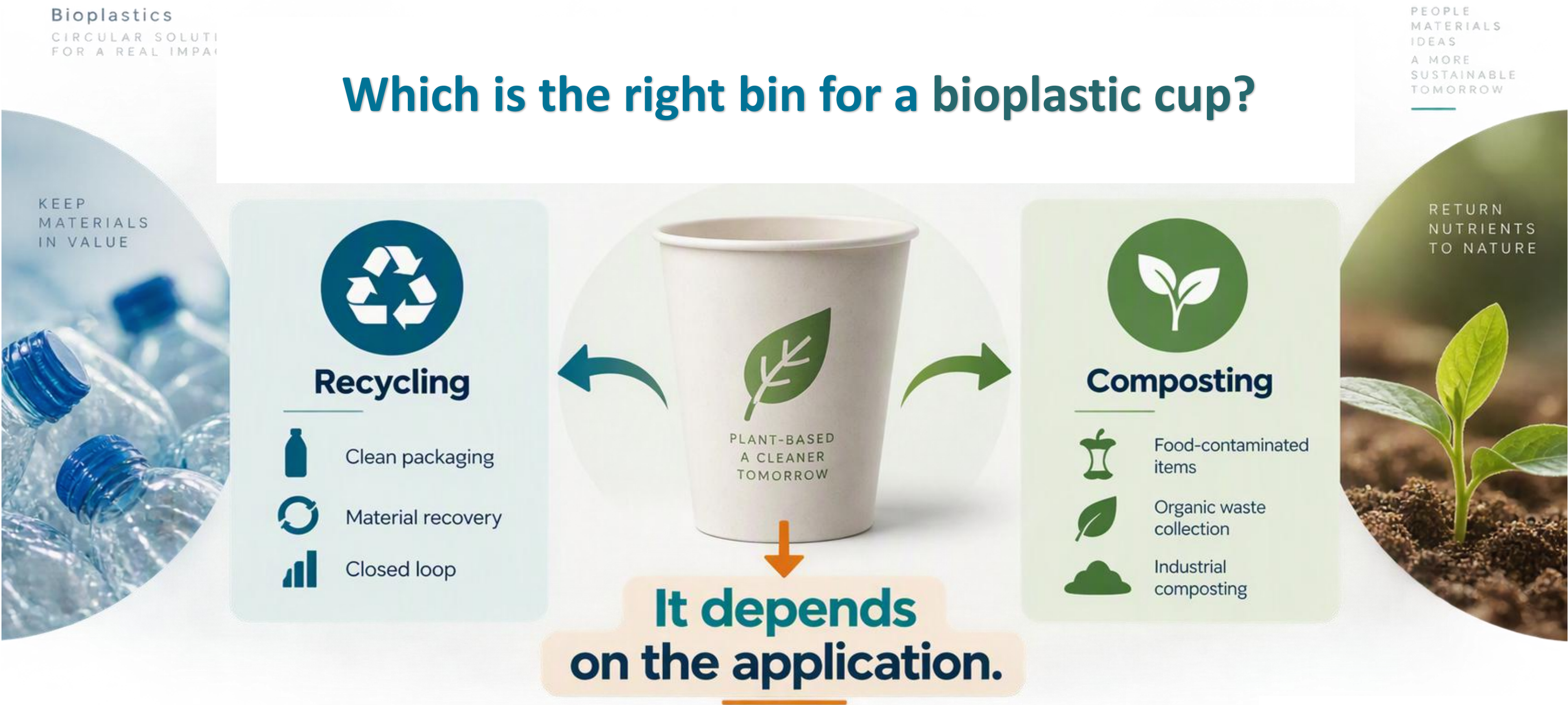
Compostability as an Operational Vehicle



Compostable packaging is not a littering license. It is a functional vehicle to capture and divert organic waste away from landfills and incinerators toward biological recovery.

TWO SOLUTIONS

Competition or Coexistence?



TECHNOLOGICAL ENABLERS

Advanced Sorting Technologies

Automated high-speed purification technologies separating biopolymers from conventional waste streams.



NIR Spectroscopy

Near-infrared identification segregates PLA from PET at high conveyor speeds.



Digital Watermarking

Invisible codes distinguish food-grade biopolymers automatically.



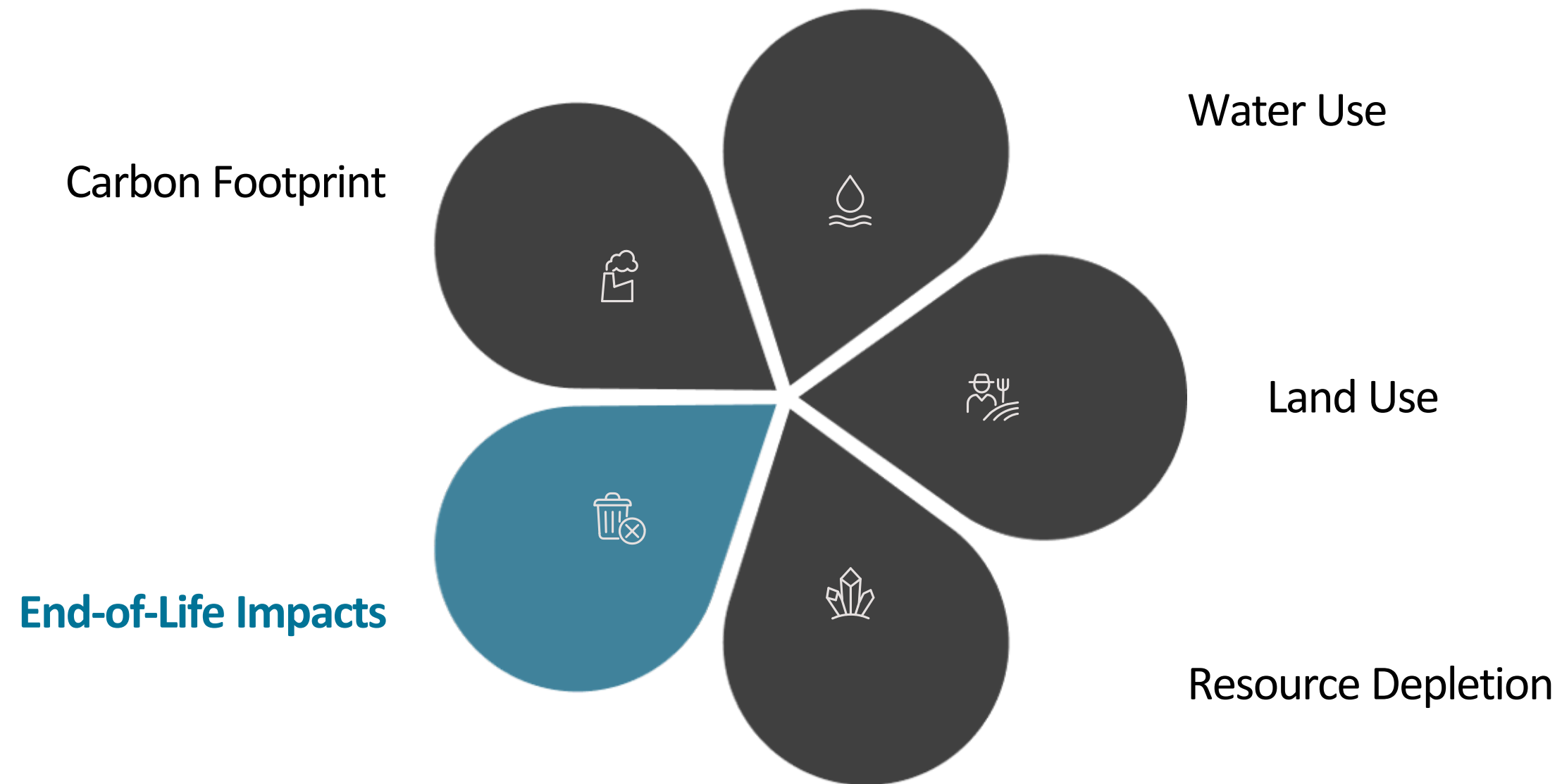
AI & Hyperspectral Imaging

Machine-learning classification systems for complex, mixed-material sorting streams.

TRADE-OFF ANALYSIS

Carbon is Not the Whole Story

Carbon is important — but it's only one part of the picture.



TRADE-OFF ANALYSIS

Perfect solutions rarely exist.

Reduce one impact

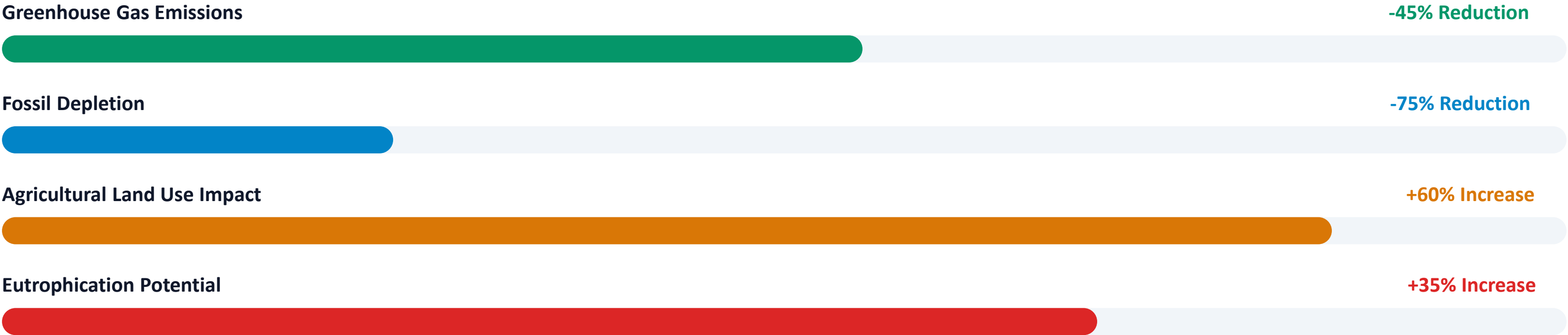
Carbon, water, land use

Another may increase

This is not failure — it's reality

Find the balance

Not the perfect answer



HOLISTIC MEASUREMENT

Life Cycle Assessment (LCA)

LCA reveals what single tests cannot.



1. Raw Material Extraction

Crop cultivation, fertilizer inputs, land transformation.



2. Polymer Synthesis

Fermentation, refining, and compounding energy intensity.



3. End-of-Life Processing

Composting efficiency, incineration recovery, or recycling.

MORE THAN A TOOL

Strategic LCA Deployment

INCORRECT USAGE

LCA ≠ Justification Tool

Conducting an LCA post-design merely to validate pre-existing marketing claims.

CORRECT USAGE

LCA = Optimization Tool

Utilizing iterative LCA data to refine material selection and logistics during development.

**"A bad product made
from bio-based
feedstock remains a
bad product."**

DESIGN PARADIGM

Ecodesign: The Core Solution

01

Simplify Formulations

Minimize non-compostable additives and multilayer barriers.

02

Design for Collection

Intuitive shapes and clear labeling for consumer sorting ease.

03

Align with Infrastructure

Match local composting or recycling facility specifications.

Ecodesign determines the best end-of-life strategy.

ACTION FRAMEWORK

Integrated Material Matrix

Application	Ideal Material	Primary EOL Route	Sustainability Driver
Agri Mulch Film	PBAT / Starch Blend	Soil Biodegradation	Eliminates microplastic soil buildup
Coffee Capsules	Bio-PLA / PHA	Industrial Composting	Captures organic coffee grounds
Beverage Bottles	Bio-PET / Bio-PE	Mechanical Recycling	Seamless drop-in infrastructure fit
Bio-Waste Caddy Bags	EN 13432 Compostable	Organics Collection	Maximizes municipal waste diversion

KEY INSIGHT

Sustainability emerges from combining evidence.

No single metric — biodegradation rate, compostability certificate, recyclability percentage, or carbon footprint — tells the whole story.

Biodegradation

Compostability

Recyclability

LCA



Thank you for your attention!

Jordi Palau, Head of Compostability Laboratory

info@itenecompostability.com