

# Waste 2 Gold

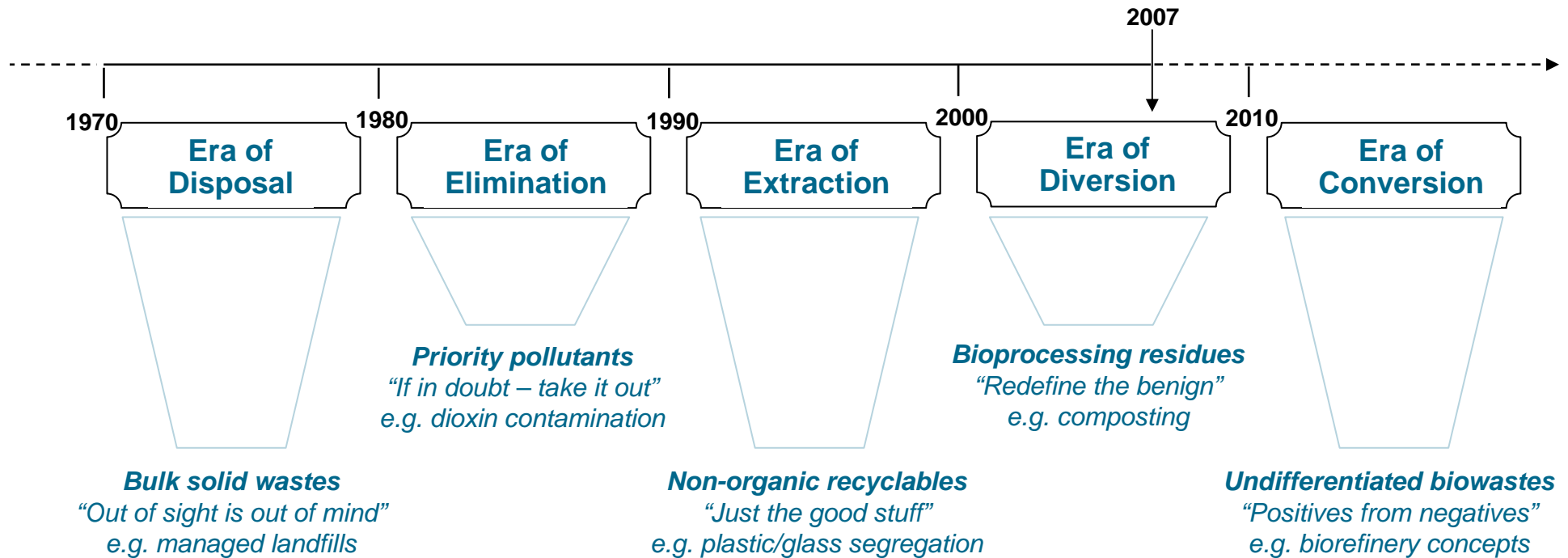
*Turning environmental  
negatives into economic  
positives*

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**Scion**

<http://www.scionresearch.com>

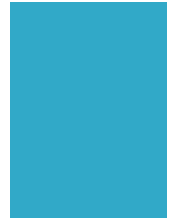
- Primary Industries
  - ▶ Striving for improved sustainability
    - Economic and regulatory drivers
    - Seeking proprietary value propositions
  - ▶ Waste management critical role
    - Distress spending
      - ◆ >\$1 billion per year in NZ alone
      - ◆ >\$ 500 billion per globally
    - NZ Waste Strategy
      - ◆ 95% diversion from landfills by 2010
    - Lost value, lost efficiencies

- Total 2006 industrial waste production: 1.9 MT/yr
- Total 2006 industrial organic waste production: 0.5 MT/yr
- Total landfill costs: \$14 – 69 M/yr
- Greenhouse gas emissions: 0.64 MT CO<sub>2</sub>/yr
- Organic wastes currently diverted from landfill: 24.7%
- 2006 diversion rate required for 2010 goal: 57.2%



- Added value bioproduction from industrial wastes:
  - ▶ improve economic and environmental sustainability
    - Reduce waste treatment costs
    - Negative >>> Positive
    - New market opportunities





- Carbohydrate-based industrial sectors
  - ▶ Nitrogen deficient waste streams
    - low cost source of carbon
    - low cost source of biomaterial residues
- Protein-based industrial sectors
  - ▶ Nitrogen rich waste streams
    - low cost source of nutrients and carbon
- Municipal waste sector
  - ▶ Organic rich waste streams
    - low cost source of feedstocks





## Pulp and Paper

100 billion L/yr wastewater  
150,000 t/yr solid wastes  
30% total NZ IOW  
Focus on:  
*Compliance/Value recovery*



## Horticultural Processing

Low volume wastewater  
59,000 t/yr solid wastes  
19% production discards  
Focus on:  
*Value recovery*

These types of conversion wastes typically:

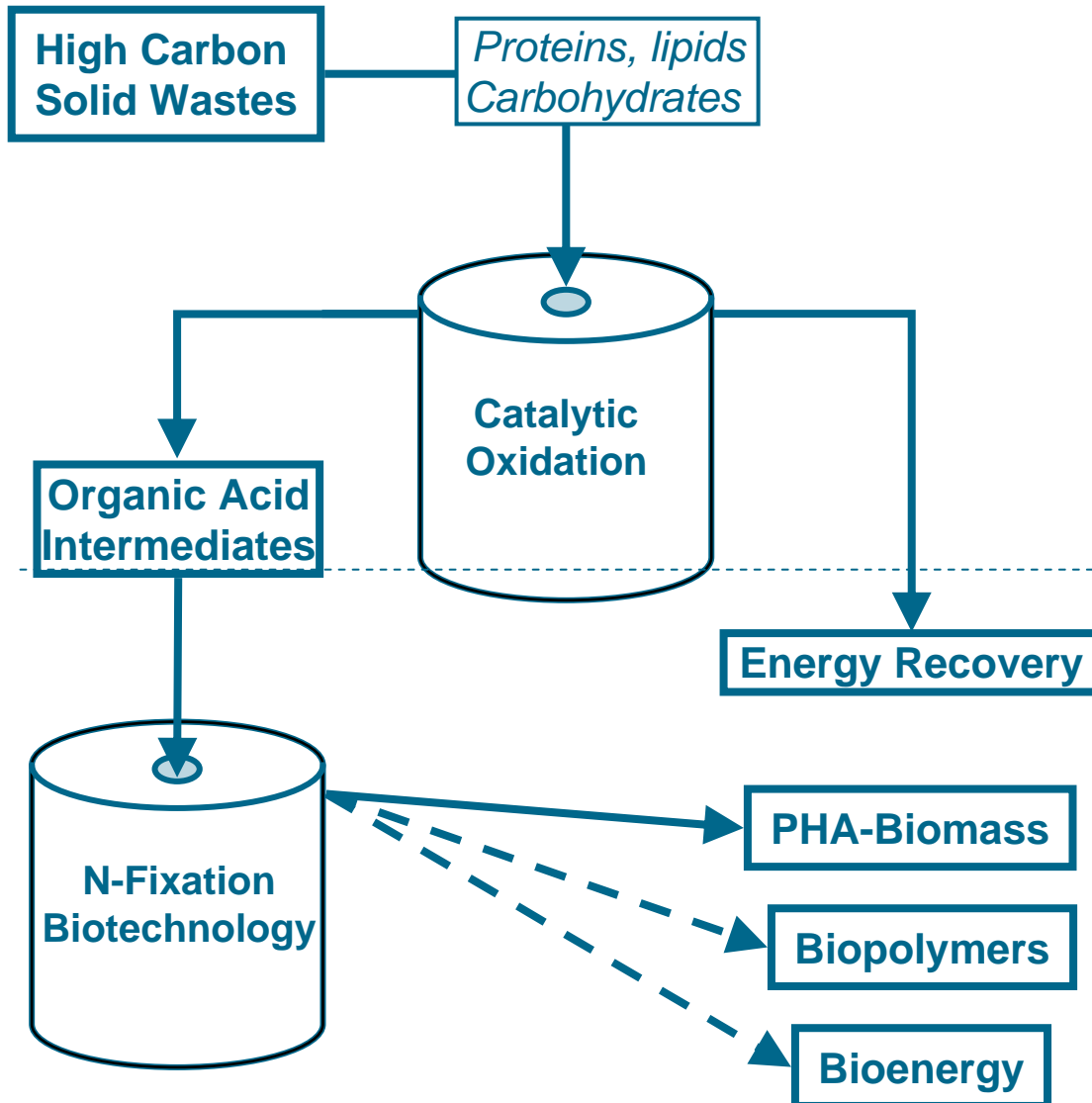
- ▶ Non-homogenous
- ▶ High water content
- ▶ May contain toxicants

>>> Destruction best option, but:

- ▶ Energy intensive
- ▶ High Capex
- ▶ Generate high CO<sub>2</sub> emissions
- ▶ Secondary waste streams







## Disassembly:

- Reduce volume
- Eliminate risk
- Recover embodied energy
- Capture carbon
- Simplify feedstock

## Reassembly:

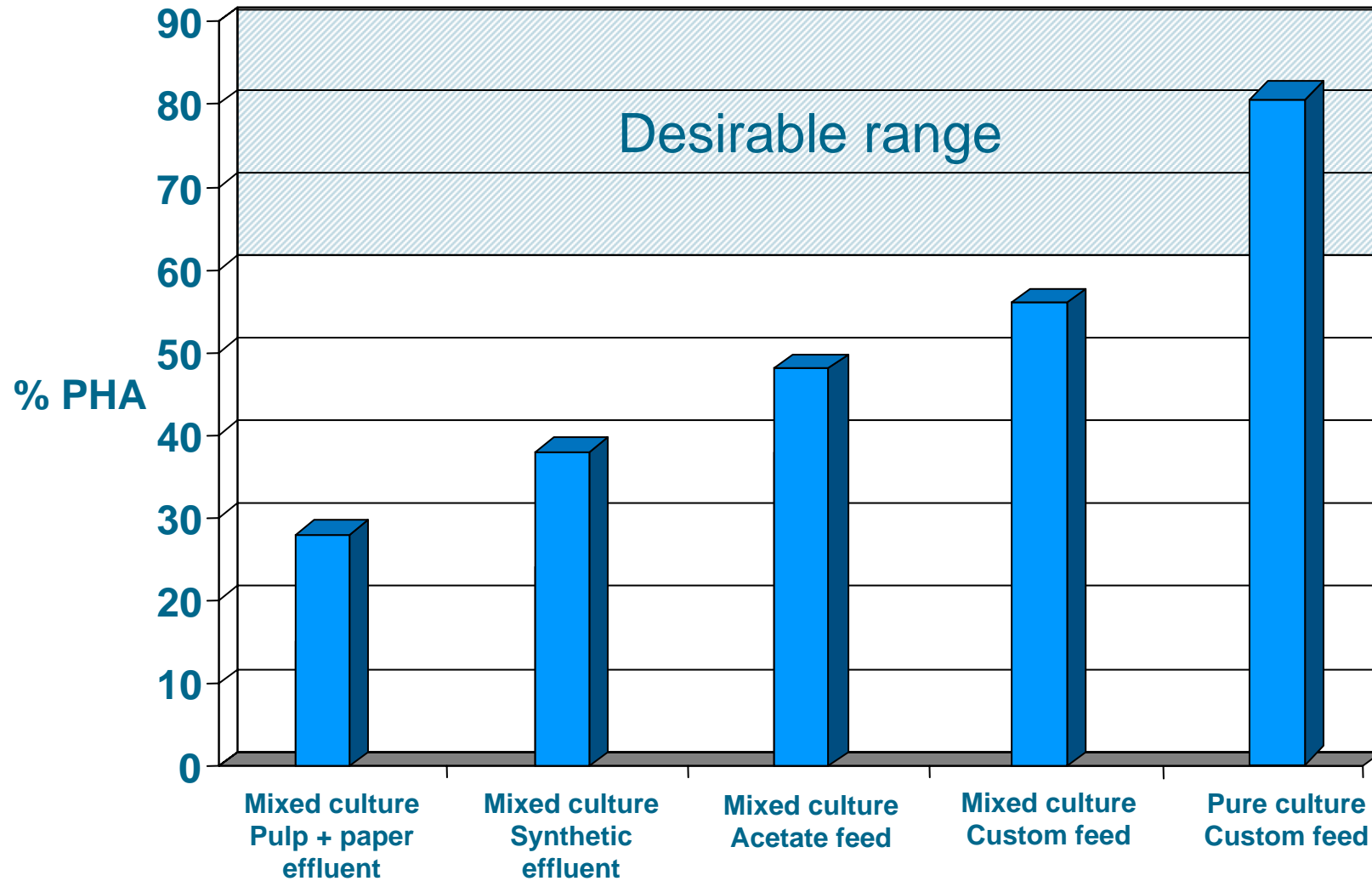
- Create value
- Exploit embodied carbon
- Minimise energy input
- Maximise selective output
- Link to broader Scion IP



99% pure polyester granule

## Bacterial polyesters

- Readily degradable
- Behave like polyethylene
- Sustainable replacement for petrochemical plastics



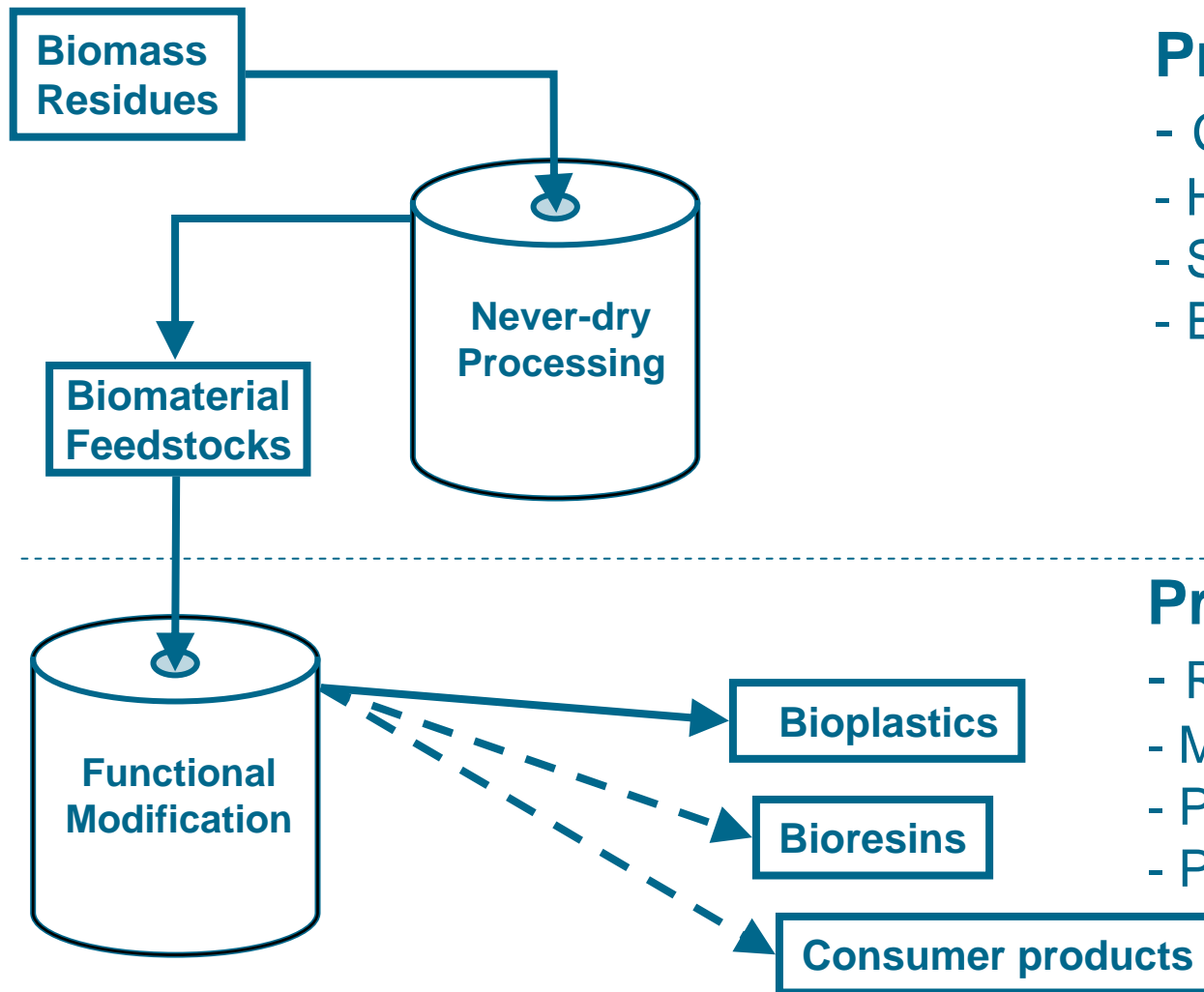
These types of conversion wastes typically:

- ▶ Homogenous
- ▶ High water content
- ▶ Benign

>>> Re-direction best option, but:

- ▶ Processing demands
- ▶ Value proposition
- ▶ Seasonality
- ▶ Fit with business strategy





## Preparation:

- Control moisture content
- Homogeneity
- Storage
- EIB database

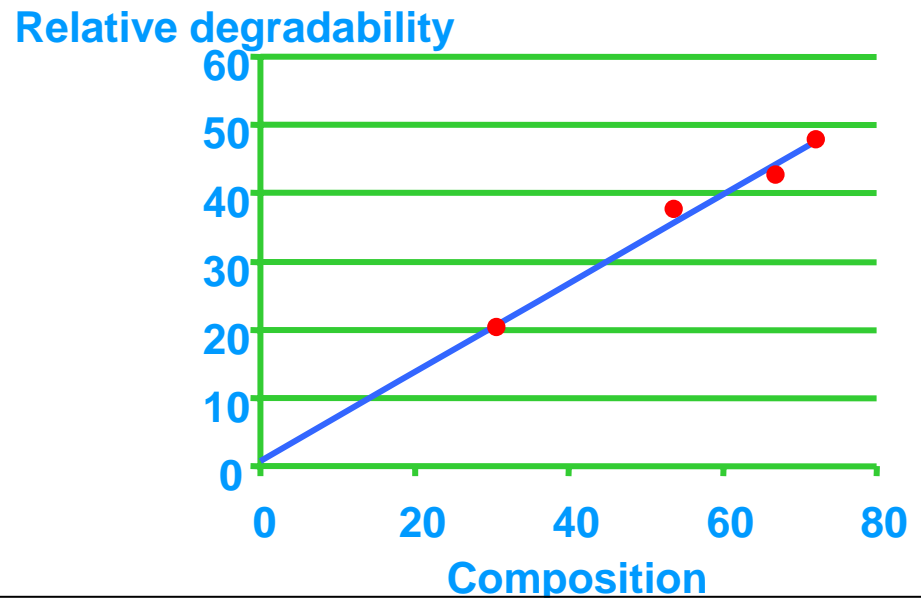
## Production:

- Reactive extrusion
- Masterbatch formulation
- Prototyping
- Performance testing

- A ‘dialer’ is the substrate used to adjust biocomposite performance and improve cost envelope
- Broad range tested:
  - ▶ Lignocellulosics
  - ▶ Horticultural
  - ▶ Agricultural
  - ▶ Industrial







- Environmentally-intelligent biocomposites
  - Programmable degradation using waste-derived dialers
    - Eco-Pots - biodegradable planting system
    - EcoFert - controlled-release nutrients
    - BioFoam - post-consumer-compostable packaging
    - Low-grade panels and molded sheets

- Pulp and Paper Waste Minimisation Project Committee
- Bay of Plenty Waste 2 Gold Initiative
- EIB Industry Partnership
  - ▶ strategic input, leveraged investment
  - ▶ technology transfer via directed R&D programmes
  - ▶ conduit for identifying issues and implementing solutions
  - ▶ secure websites, newsletters and workshops
  - ▶ established model for other sectors



Zero Value



Waste Disposal

Current costs

-\$38M per year

Transformation



Waste 2 Gold

93% volume reduction  
New products

Value creation

Direct value gain  
+ \$24M per year

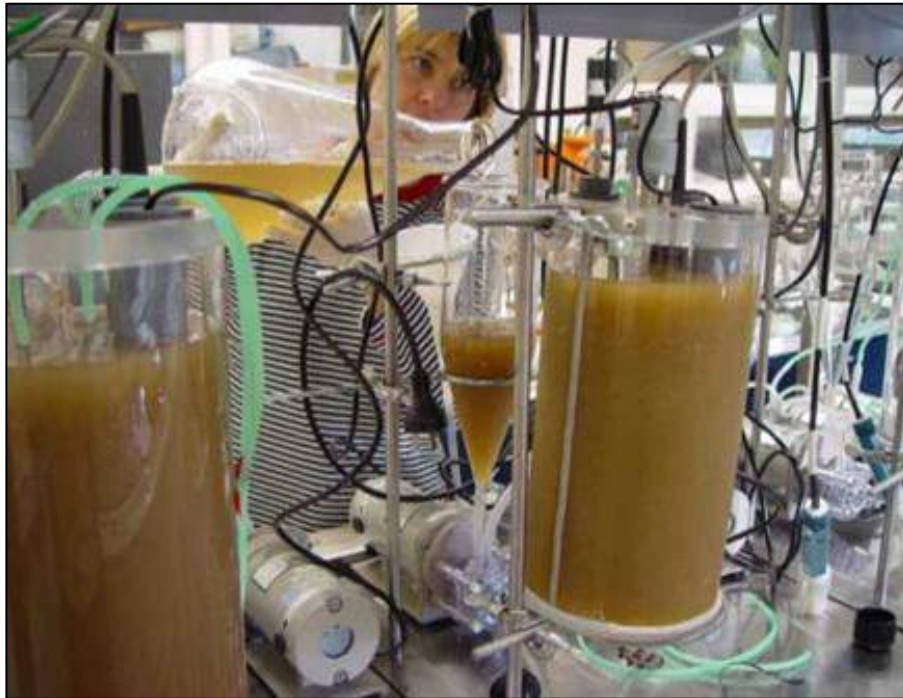
Remediation



Waste levies  
Greenhouse credits

Mitigation

Indirect value gain  
+ \$58M per year



## Waste Bioconversion

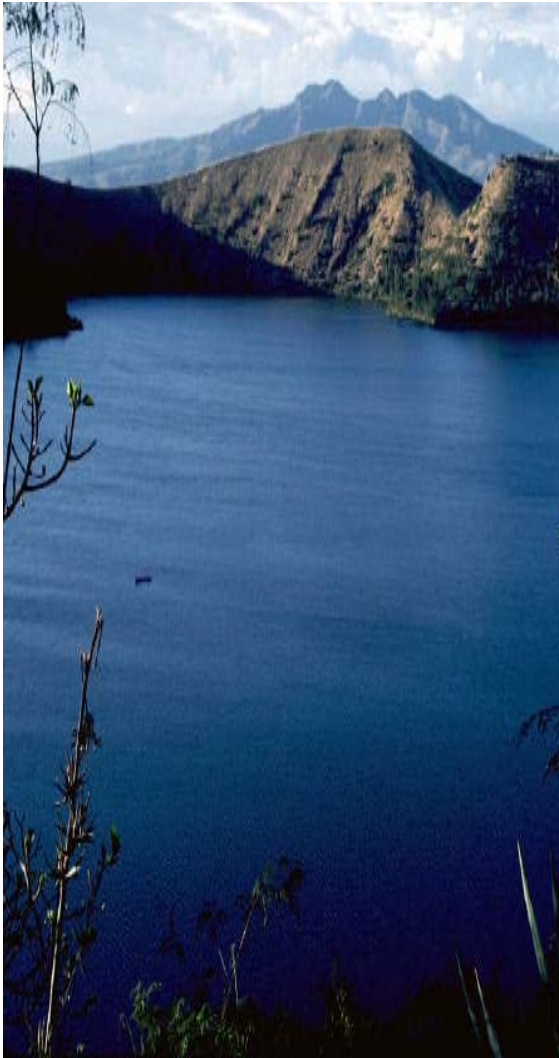
- Remediation
- Bioplastics
- Bioenergy
- Biofuels



## Residue Modification

- Biocomposites
- Chemical extracts
- Enzymes
- Animal feedstocks





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