

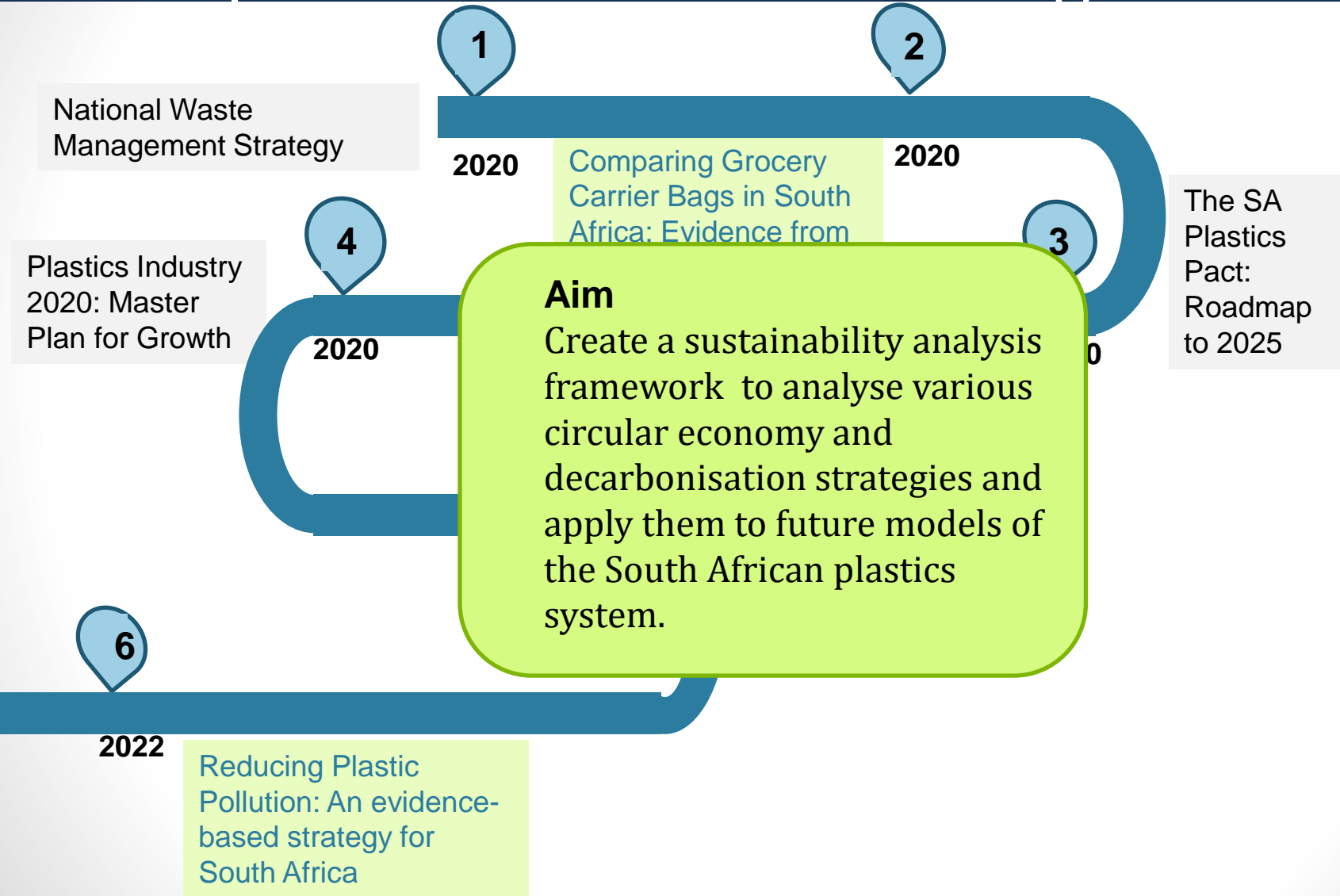
Development of a life cycle-based sustainability analysis framework Application to the South African plastics value chain

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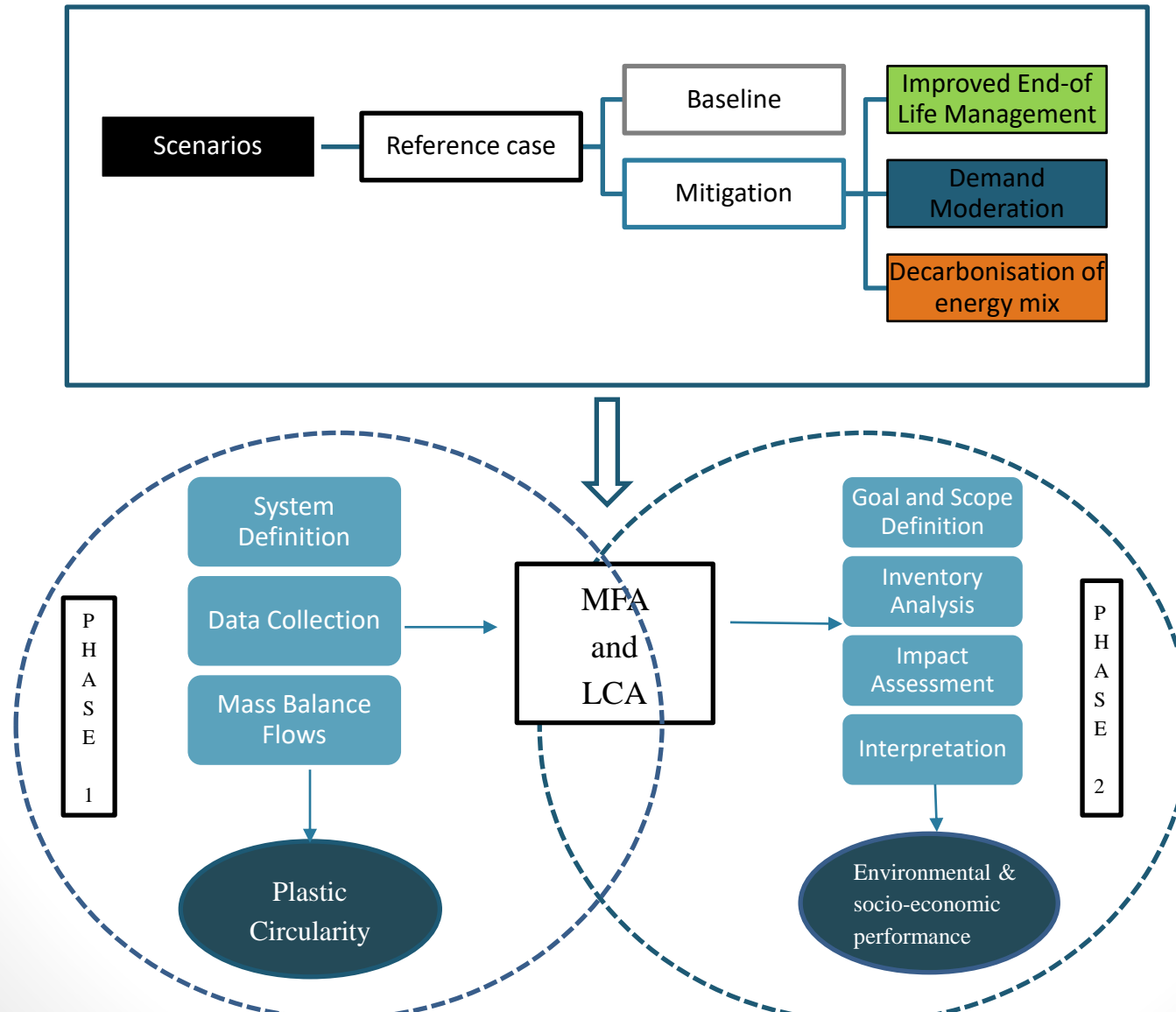
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Sustainability, Economics, and Waste, Council for Scientific and Industrial Research (CSIR)

Background and Aim

Developments in SA Plastics Management



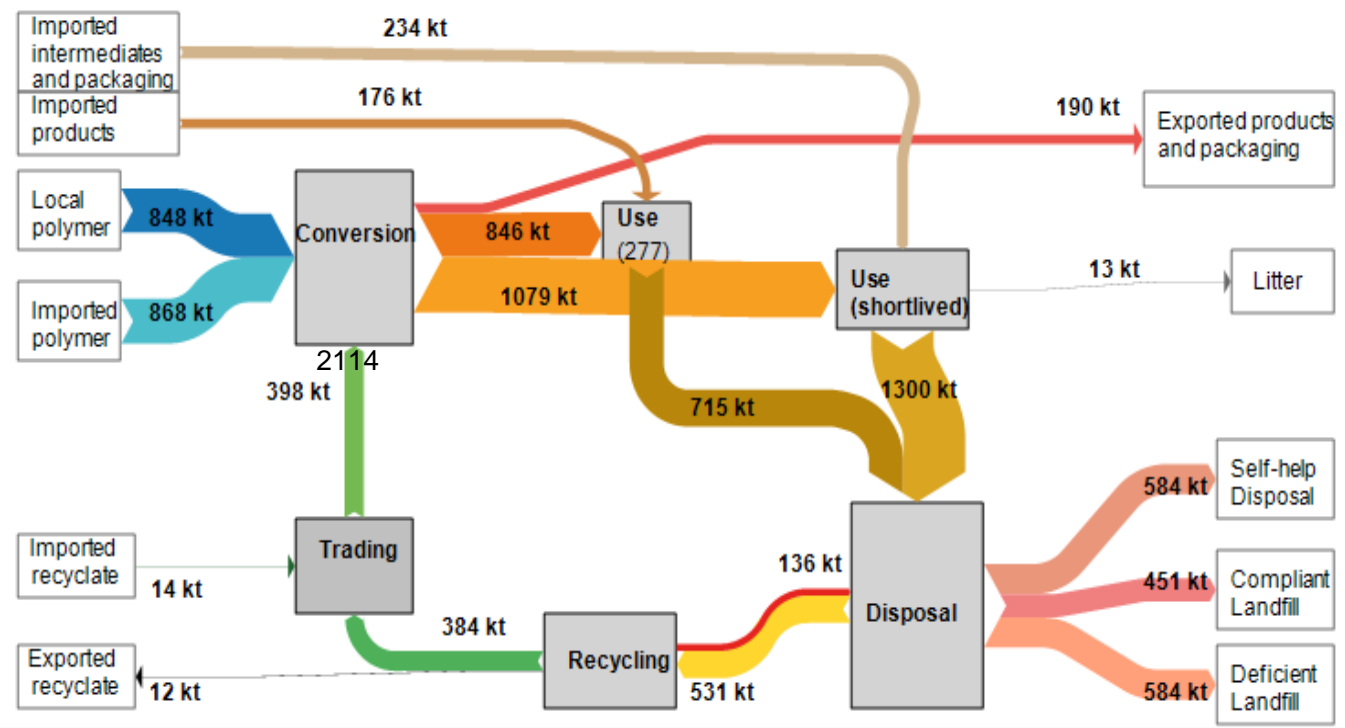
Methodological approach





Key Indicators

MFA SA Plastics Baseline Scenario (2025)



Environmental Indicators

Global Warming Potential (kg CO₂eq)

Water Use (m³)

Plastic Persistence (kg.year)

Socio-Economic Indicators

Employment (FT jobs)

$$RC = \frac{\text{Used recycle}}{\text{Tot converted}}$$

$$IRR = \frac{\text{Collections}}{\text{S/L waste}}$$

$$ORR = \frac{\text{Recycle}}{\text{S/L waste}}$$

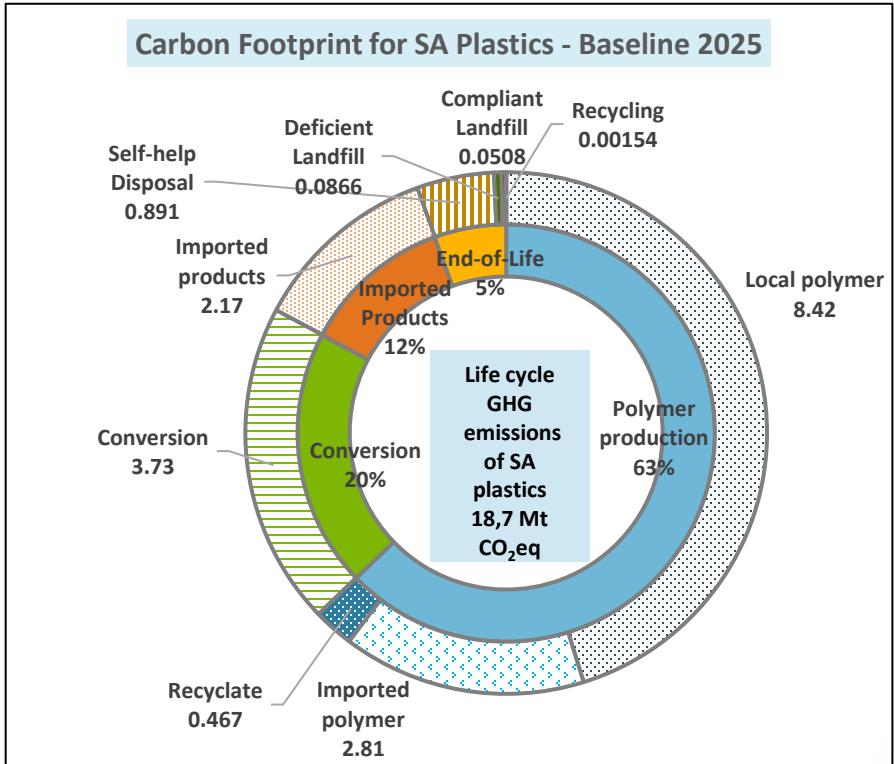
$$CR = \frac{\text{Collections}}{\text{Tot waste}}$$

Results Dashboard



Results for indicators based on SA plastics MFA and LCA for 2025

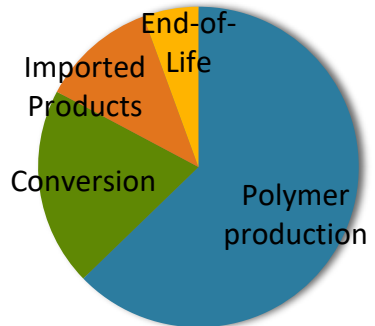
	Unit	Value
Circularity Indicators		
Collection rate	%	26,4
Input Recycling rate	%	40,9
Output Recycling rate	%	30,4
Recycled content	%	18,8
Mass-based Indicators		
Virgin Polymer	kt	1 716
Recyclate	kt	398
Domestic Production	kt	2 114
Environmental and Socio-Economic Indicators		
Water Use	m ³	6,11 x 10 ⁹
Plastic Persistence	Mt.year	537
Employment	FT jobs	85 833





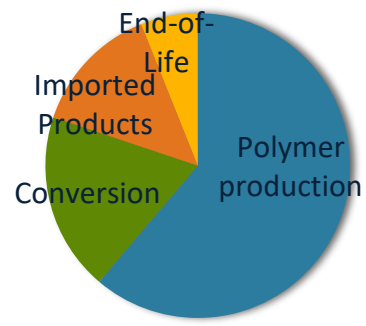
Forecast of Selected Indicator (GHG)

Baseline 2025



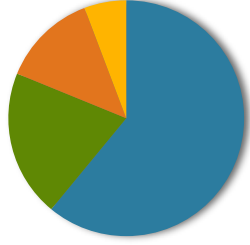
Total: 18,7 Mt CO₂eq

Combination 2025



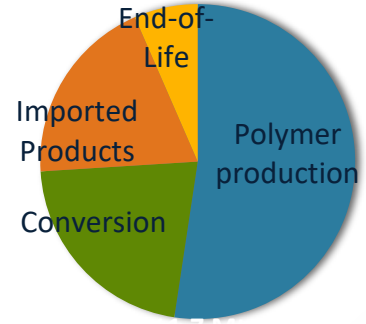
Total: 15,2 Mt CO₂eq

Ref Case 2018



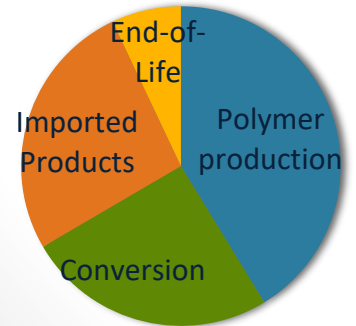
Total: 16,5 Mt CO₂eq

Combination 2030



Total: 11,7 Mt CO₂eq

Combination 2035



Total: 9,5 Mt CO₂eq

- 19% →

- 23% ↓

← - 19%

Additional Indicators

Plastic Leakage and Persistence

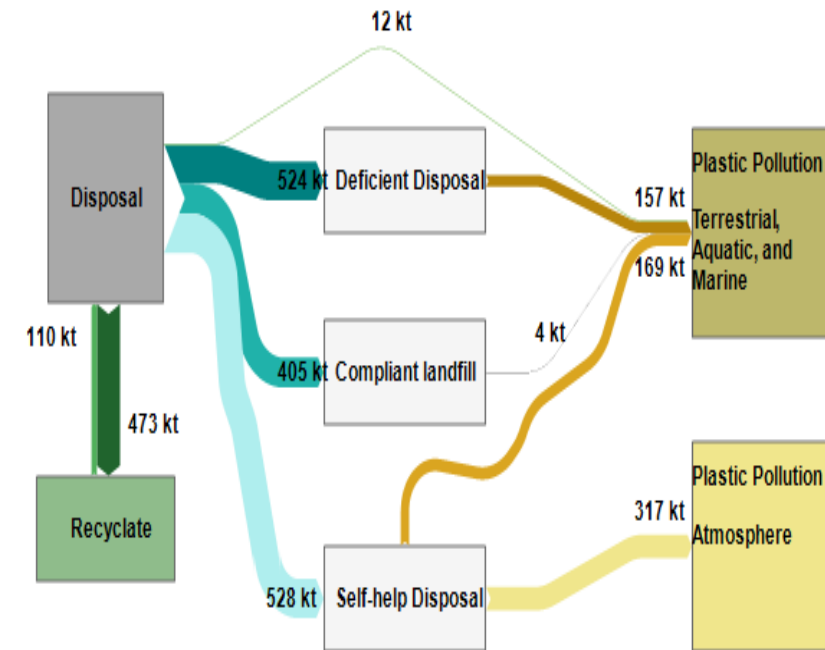
Inventory Flows



Environmental Impact

Persistence = Material Disposed x Mean Lifetime

Plastic Pollution at End-Of-Life Stage



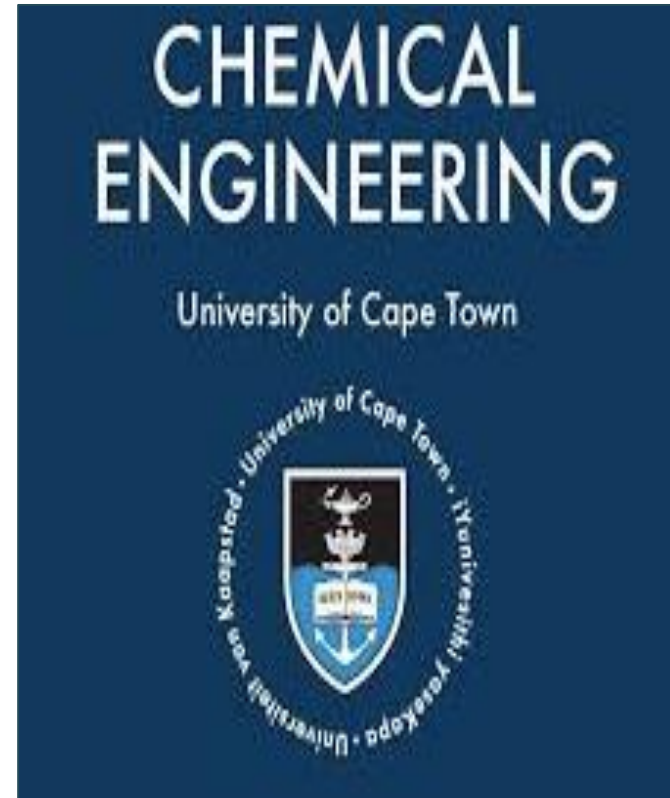
Year	Scenarios	Persistence Mt.year
2018	Reference	471
2025	Baseline	537
2025	Combination	442
2030	Combination	390
2035	Combination	405



Conclusions

- Methodological framework displays the capability to:
 - Analyse key indicators (MFA and LCA indicators)
 - Model interventions in separate scenarios and in combination
 - Track system performance over time relative to forecasts
- Results indicate that combining circularity and decarbonisation strategies can substantially reduce environmental impacts such as climate change and persistence to below historic values.
- This is showcased by the fact that some improvements can be seen in as early as 2025 for the combination of interventions.
- These findings align with both global and local studies (The Pew Charitable Trusts and SYSTEMIQ, 2020; Stafford et al., 2022).

Acknowledgements



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