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The Plastics Show

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CHEMICAL MARKET ANALYTICS
BY OPIS, A DOW JONES COMPANY

Transitioning from a linear to a circular plastics economy

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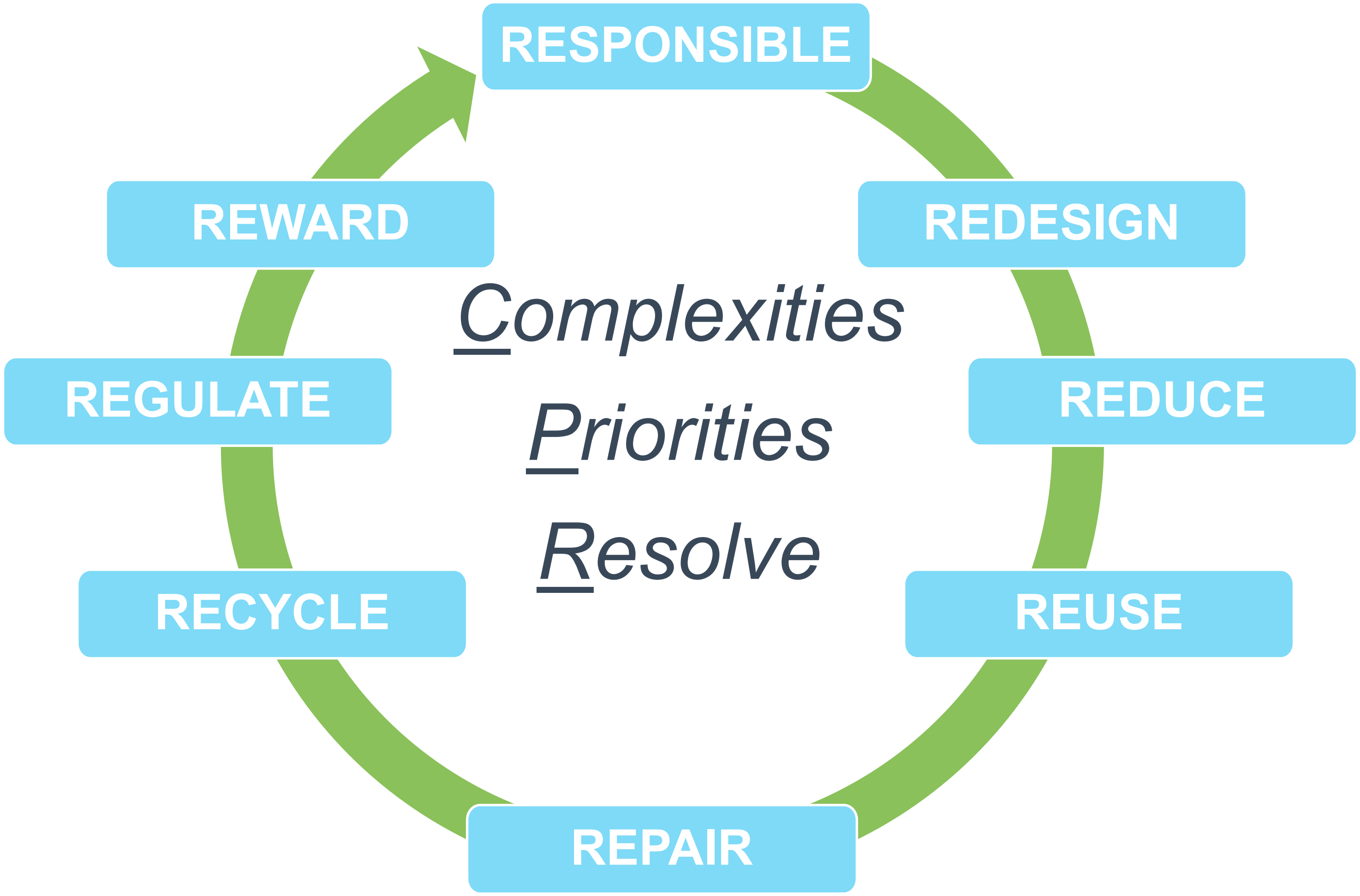
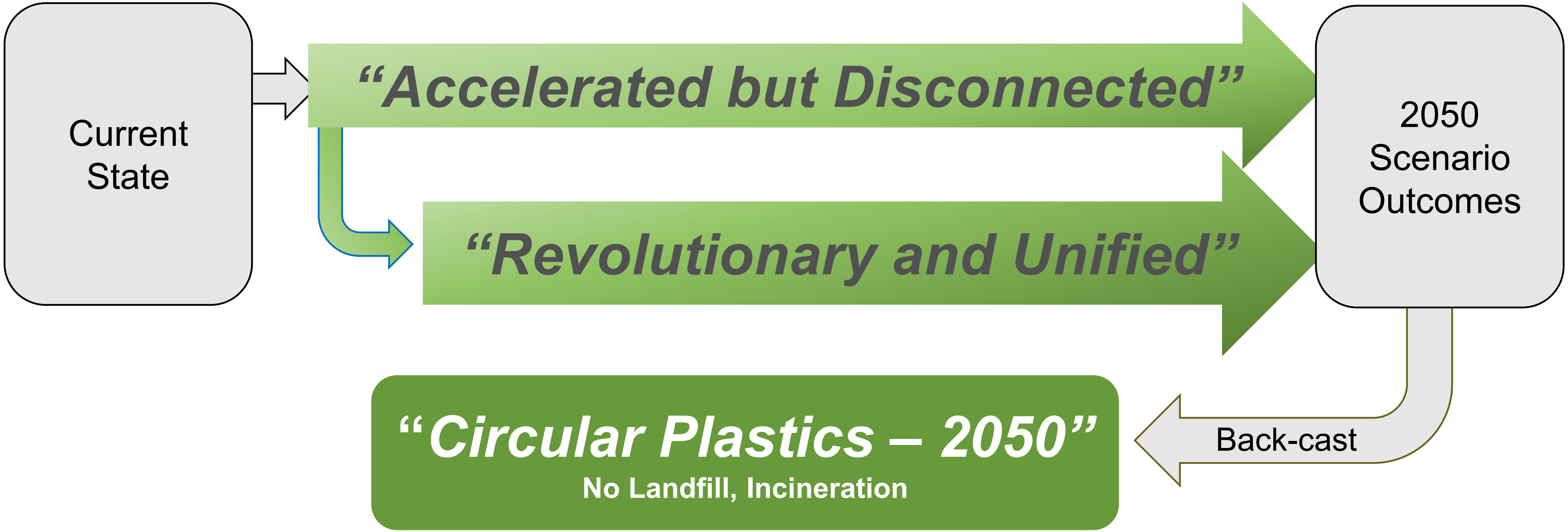
Chemical Market Analytics

Linear to circular plastics transition

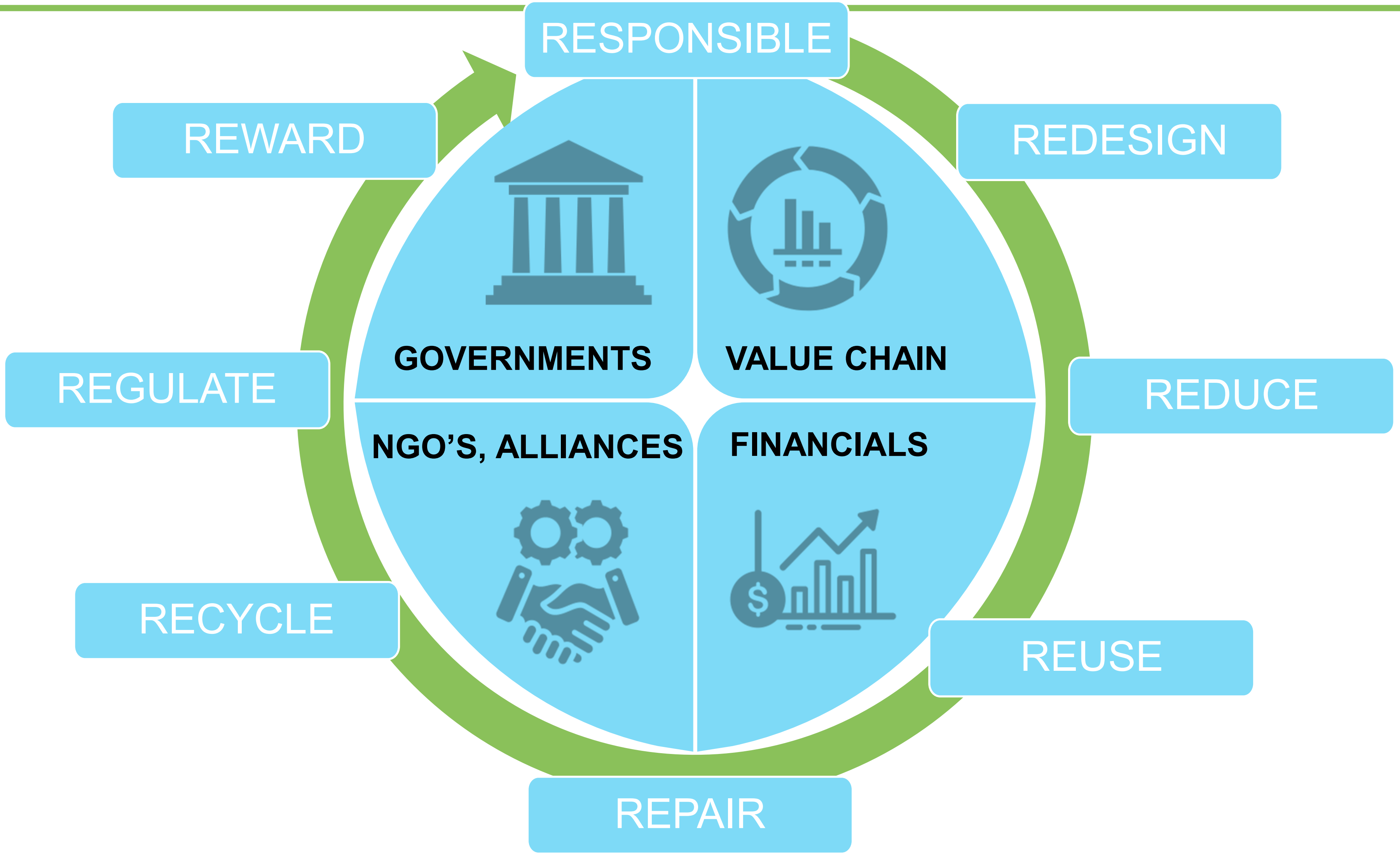


Circular Plastics scenario models



Source: Chemical Market Analytics

Four sets of actors apply the levers



Four sets of actors apply the levers

GOVERNMENTS

PUBLIC EXPOSURE

EXTERNALITIES, JUST TRANSITION

LICENSE TO OPERATE

NGO'S, ALLIANCES

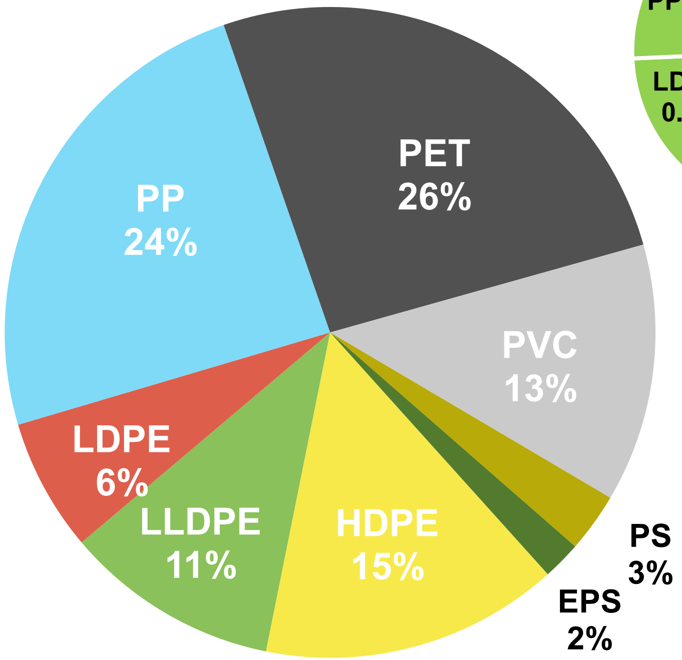
Leveraging power of visualization provided by social media

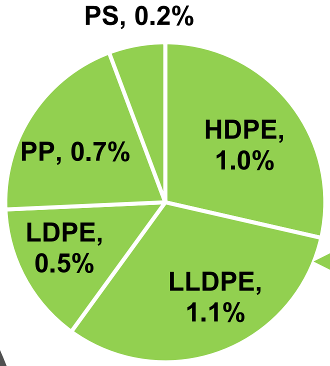
Globalized, prolific & well funded

Increasingly analytic & data rich

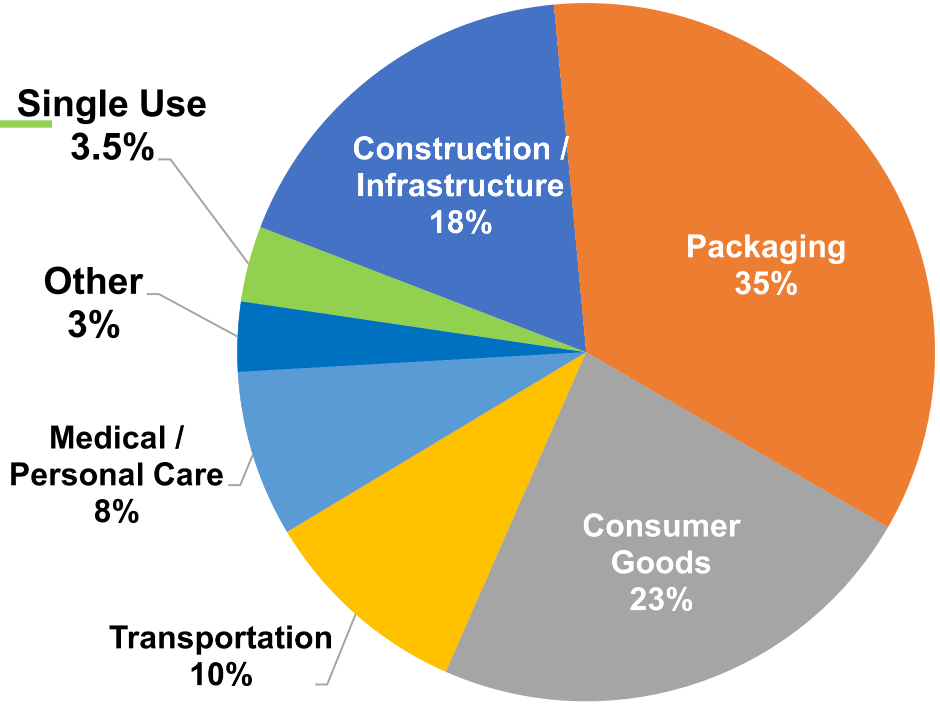
Use restrictions in perspective

Global demand for volume plastics





Global demand for volume plastics

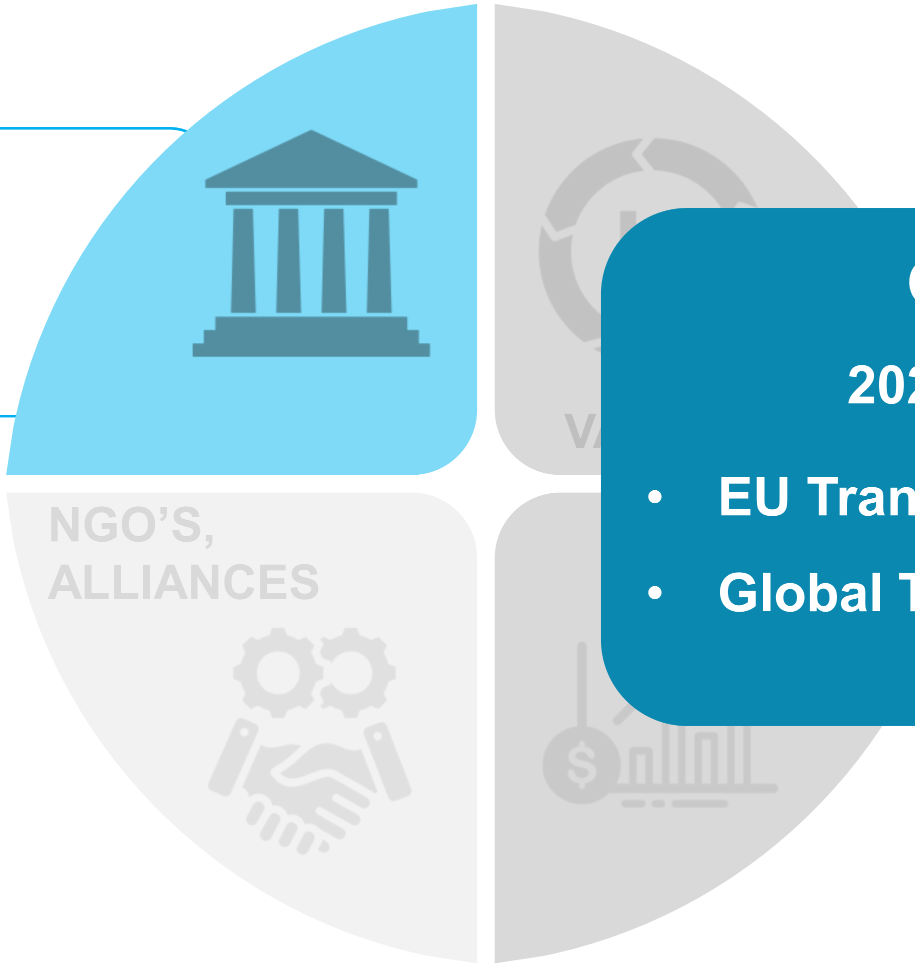


Source: Chemical Market Analytics by OPIS

- Other includes wide range of durable and non-durable industrial applications

Four sets of actors apply the levers

VALUE FOR RECYCLING
SOCIETAL PRIORITIES
INCENTIVES VS PENALTIES

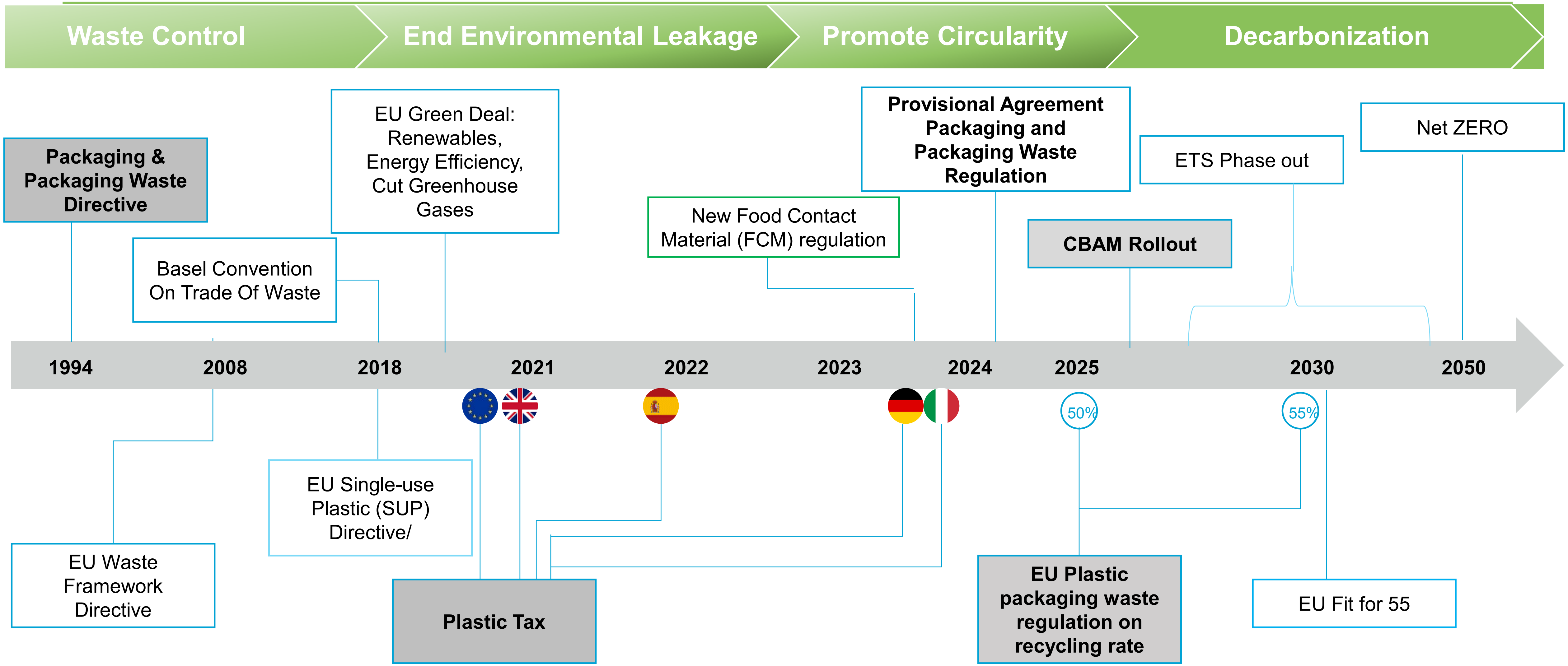


GOVERNMENTS

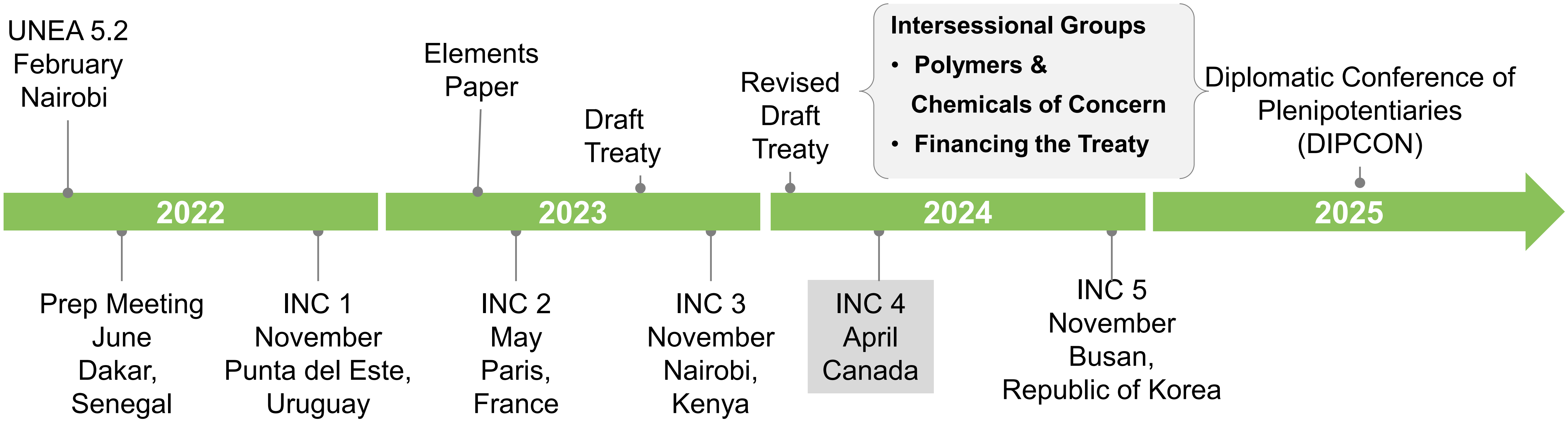
2024 ***"a pivotable year"***

- EU Transition to Circular Economy
- Global Treaty on Plastics Waste

Europe’s sustainability goals increasingly ambitious



UNEP Intergovernmental Negotiating Committee *(INC)*
International Legally Binding Instrument on plastic pollution *(ILBI)*



- Major “Intractable”: Production Caps
- Long way to align: Globally Applied vs Nationally Determined
- More aligned: Extended Producer Responsibility
  Minimum Recycle Content

Four sets of actors apply the levers

VALUE FOR RECYCLING
SOCIETAL PRIORITIES
INCENTIVES VS PENALTIES

GOVERNMENTS

2024 – a pivotal year

Packaging & Packaging Waste Regulation

Global Treaty on Plastics Waste

U.S. progress & complexity

- California SB 54 Influence
- EPR in 3 states, different schemes
- Regulating pyrolysis as recycling

Policy with broad acceptance

- Extended Producer Responsibility
- Minimum Recycle Content

Four sets of actors will apply the levers

FINANCIALS

- Structure / Organization via Global Plastics Treaty
- Extended Producer Responsibility Contribution
- Resolve to stay the ESG course

PUBLIC SCRUTINY
RISK ASSESSMENT
JUST TRANSITION

Four sets of actors apply the levers

VALUE FOR RECYCLING
SOCIETAL PRIORITIES
INCENTIVES VS PENALTIES

VALUE CHAIN

TECHNOLOGIES
COSTS
BUSINESS MODELS

PUBLIC EXPOSURE
EXTERNALITIES, JUST TRANSITION
LICENSE TO OPERATE

PUBLIC SCRUTINY
RISK ASSESSMENT
JUST TRANSITION

Turning complexity into actionable strategies

Regulations & Policies	Circular Driven Demand Shifts	Waste Based Supply
Technology Selection	Technology Scaling	Infrastructure Buildout
Capital Costs	Price, Margin, ROI	Emissions

Acceleration of alliances, offtakes, joint ventures & integration

- Waste management, material reclaim with recycling plus compounding, distribution
- Material reclaim, polymer production, municipalities
- Producers and waste industry integration into chemical and mechanical recycling
- Converters replacing disposables with reuse & return

Mega sites that optimize use of multiple solutions

Reverse logistics increasingly bypass MSW

Incremental plastics waste growth disconnected from plastics production infrastructure

Challenging in "build to export" world

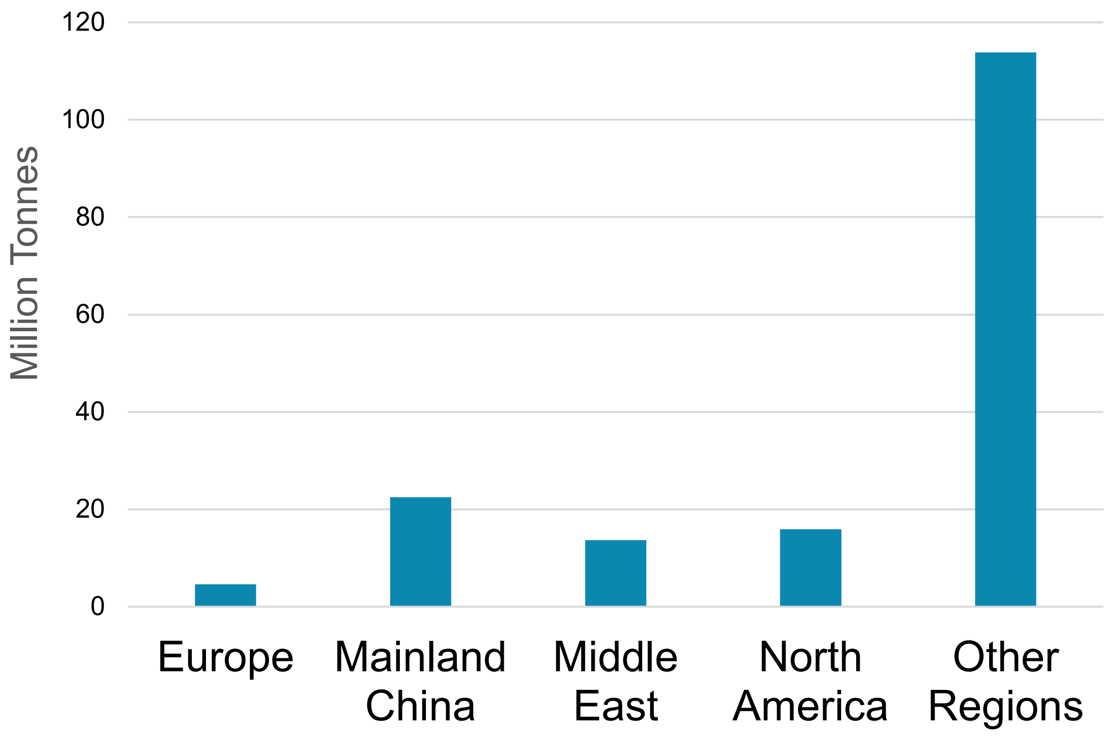
Options based on local circumstances

- **Increase volumes to infrastructure**
- **Export chemical recycled feedstocks**
- **Directing output to fuels**

Repeat of historical, per-capita waste Generation

Pace and extent of recycling technology transfer

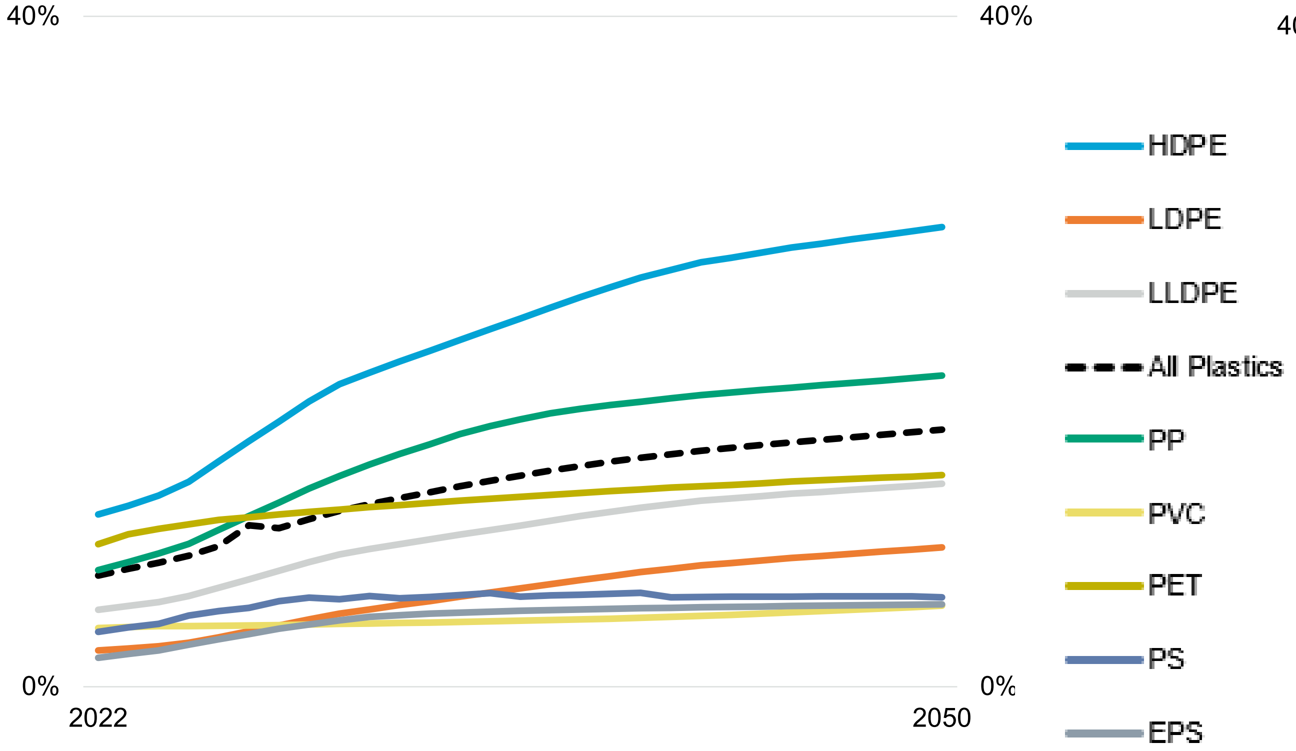
Growth to 2050 of plastics waste in municipal solid waste



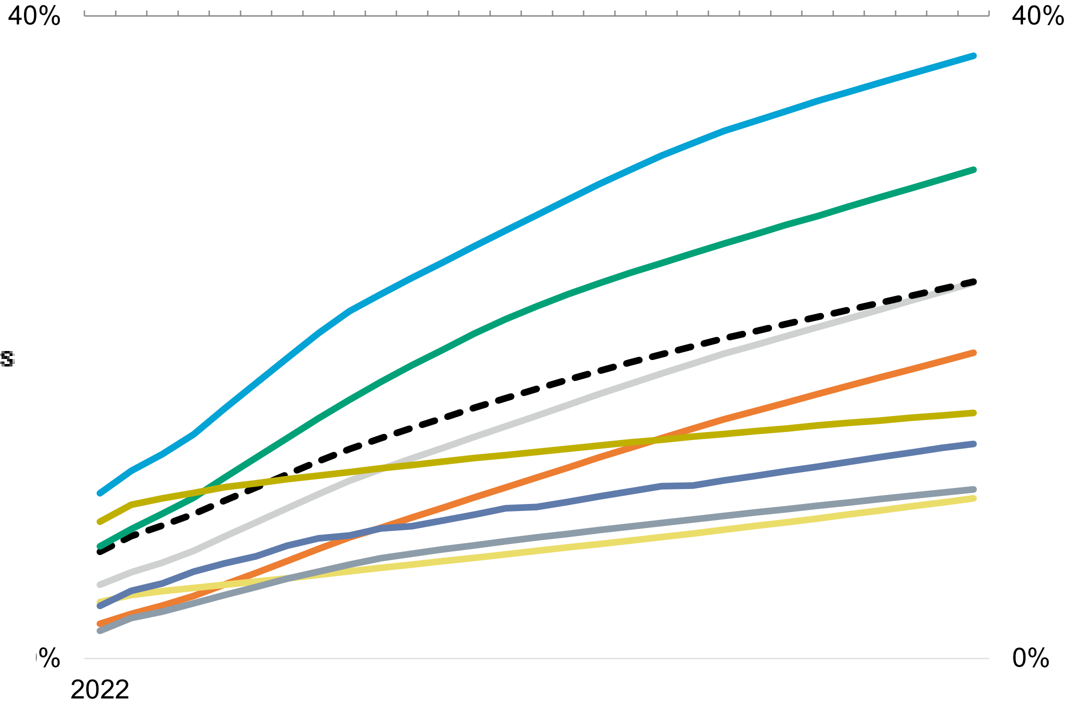
Source: Chemical Market Analytics by OPIS

Potential reactor-produced polymer displacement

PCR as % of total demand - Incremental Case



PCR as % of total demand - Global - Green



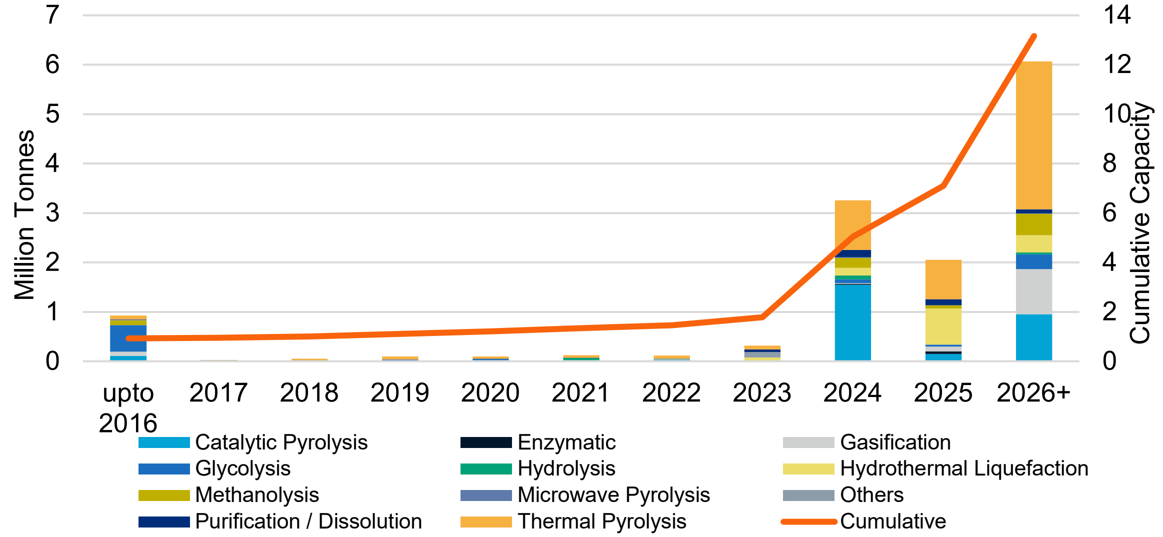
Source: Chemical Market Analytics by OPIS

Chemical recycling capacity doubling from small base

1.8 mtpa Operational
2.6 " Under construction
8.4 " Under some form of planning

164 Technology companies
437 Facilities
552 Unique companies in collaborations

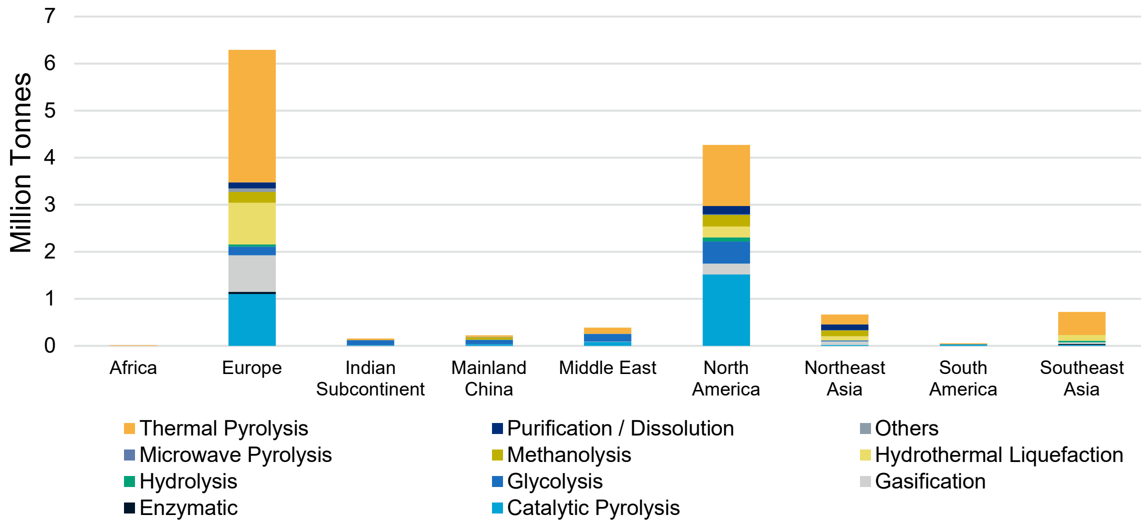
Cumulative capacity by date of commissioning



Note: Unknown timeline projects included in 2026+ section

Source: Chemical Market Analytics by OPIS

Capacity by Region and Technology



Note: Includes all years, i.e. Operational, Under construction, and Under feasibility

Multiple options, no single solution

- **Plastics Recycling**
  - **Physical**
    - Mechanical recycling
    - Solvent-based purification (dissolution)
  - **Other**
    - Photo Degradation
    - Ultrasonic Degradation
    - Catalytic oxidation
  - **Chemical**
    - Depolymerization
      - Solvolysis → Hydrolysis, Glycolysis, Methanolysis, Ammonolysis, Aminolysis — PET
      - Pyrolysis (mild) → Polystyrene to styrene
    - Cracking Feedstock recycling
      - Pyrolysis → Mixed polymer waste to waxes, liquid oil or gases
      - Gasification → Mixed polymer waste to synthesis gas

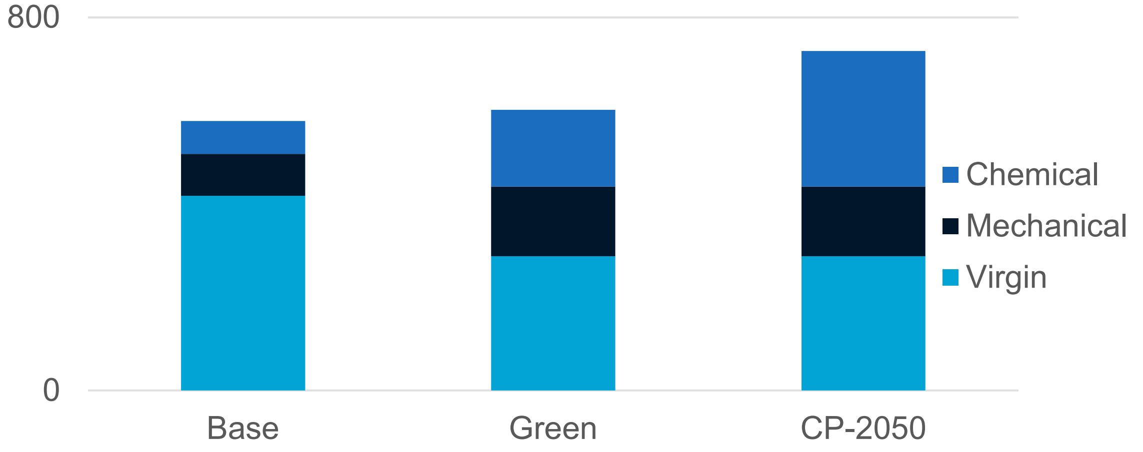
Business-as-usual risk increases with transformation

$1.3 trillion: total processing investment required for “”Circular Plastics 2050”

Incremental spend $0.3 trillion

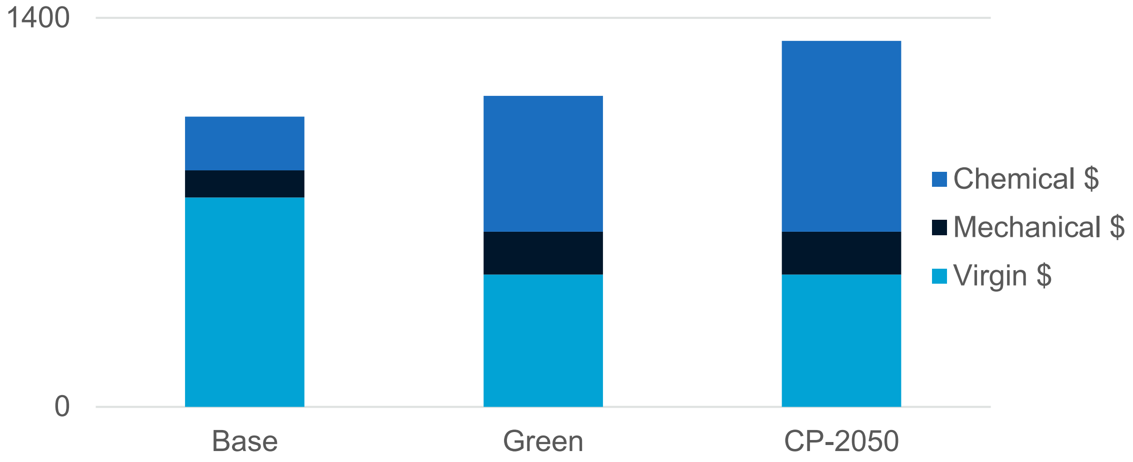
Increasing risk /opportunities from potential economic impact of carbon valuation and ecosystem costs

Capacity Additions (MMT)



Source: Chemical Market Analytics by OPIS

Capital Spending (USD Billion)



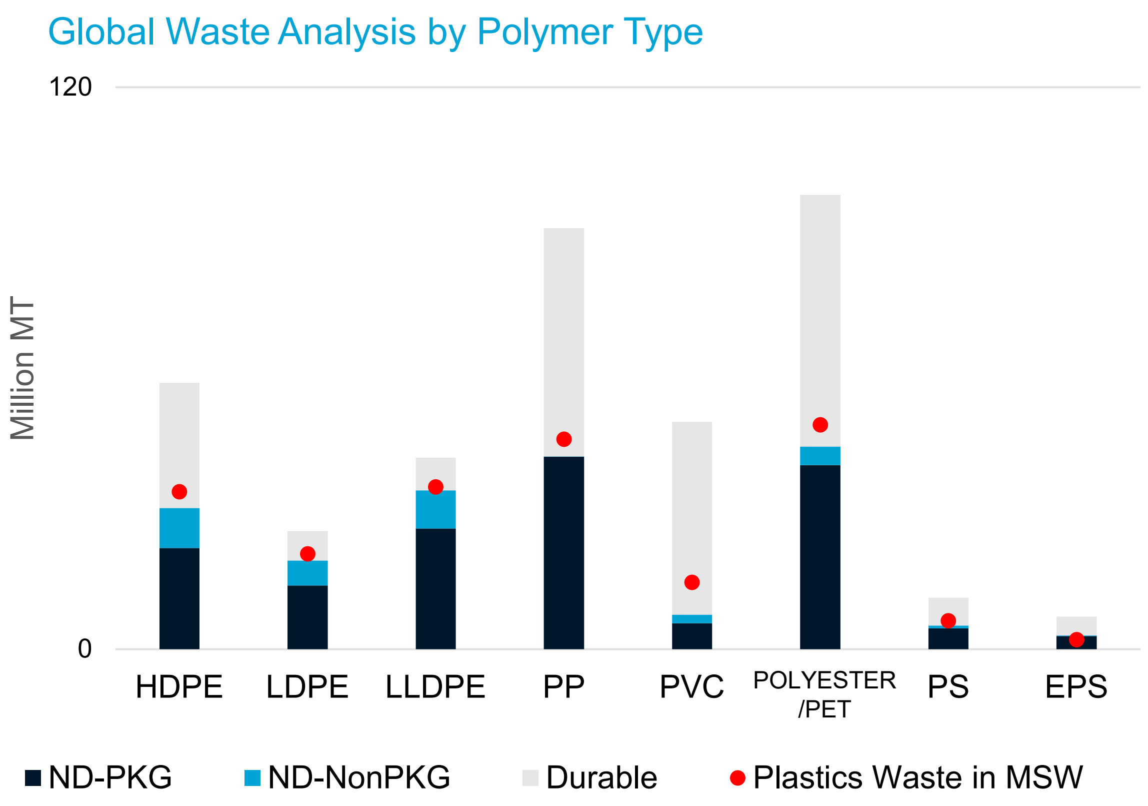
Source: Chemical Market Analytics by OPIS

Comparison of post-consumer plastics waste generation and polymer demand reveals challenges and opportunities

Packaging mandates compete with voluntary targets

Value proposition directing non-durables to durables

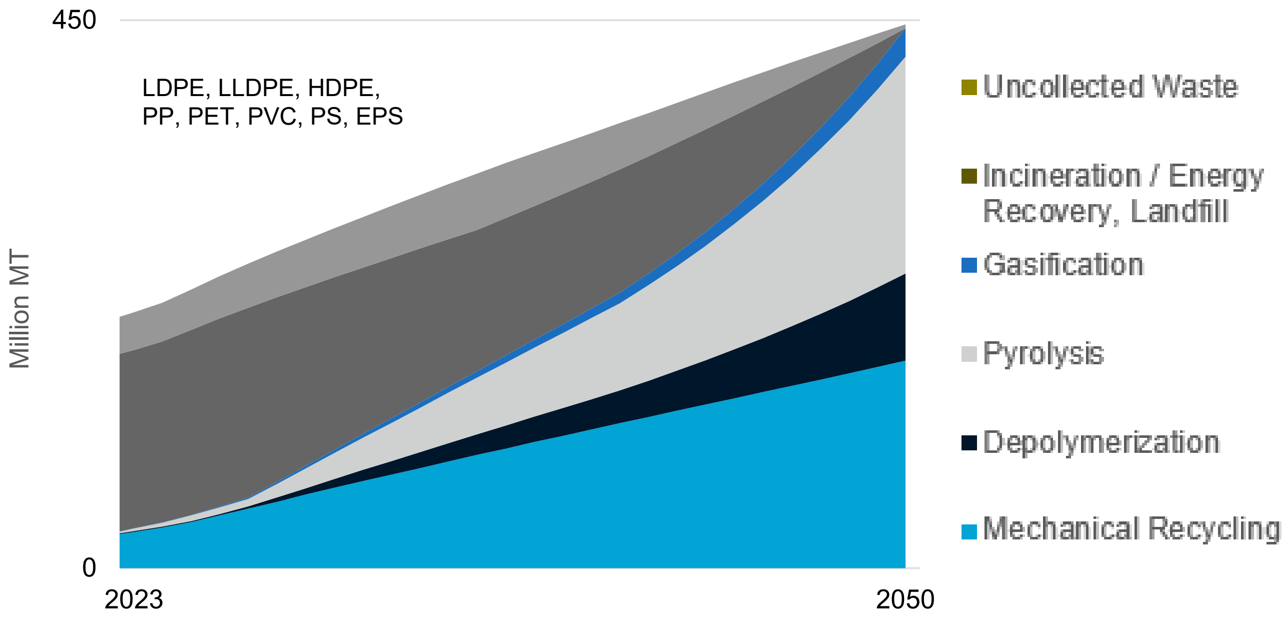
- Cost and risk avoidance benefits
- Benefits from forced alignment
- Addressable market to displace other materials with lower net emissions
- Reduce demand risk during transition



Source: Chemical Market Analytics by OPIS

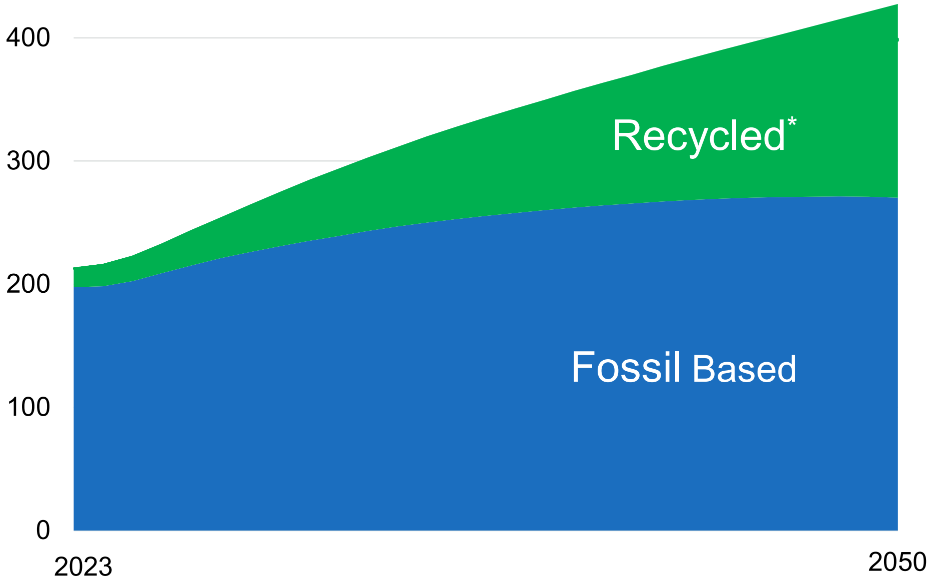
Addressable volumes of post-consumer/commercial plastics waste fails to eliminate fossil-based plastics

Global Disposition of All Plastics - Circular Plastics



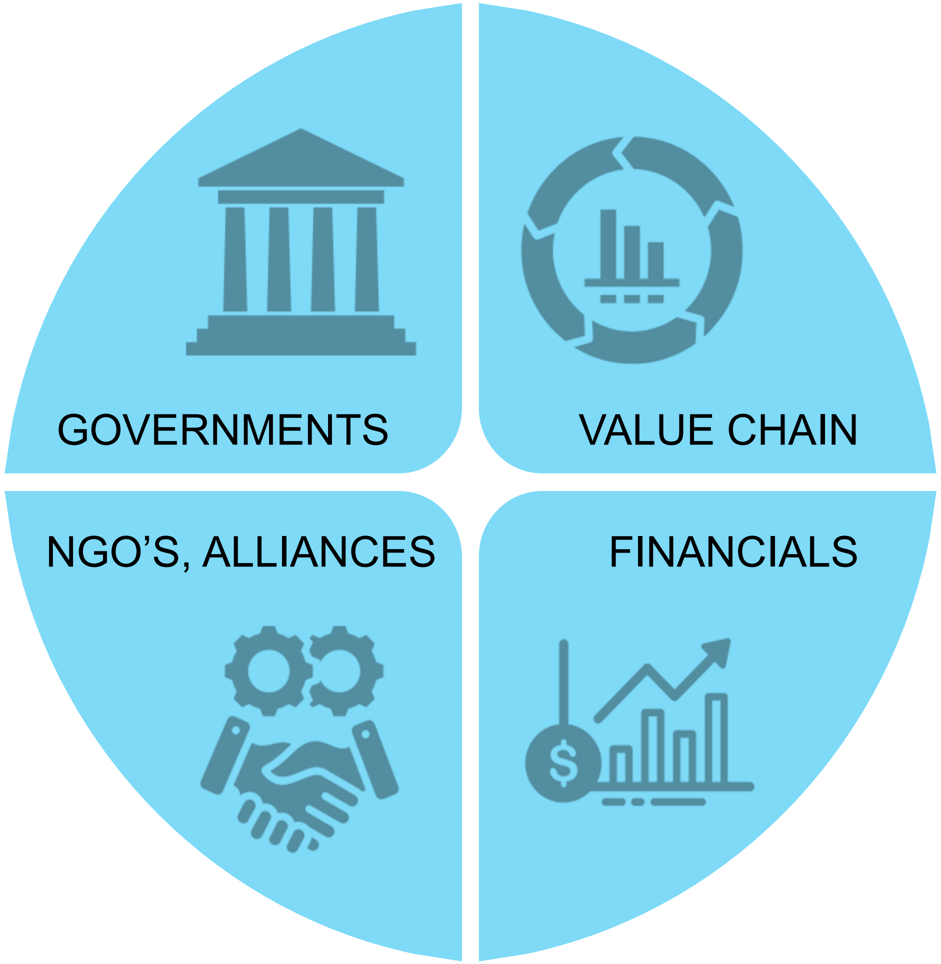
Source: Chemical Market Analytics by OPIS

Global Polyolefins Demand - Circular Plastics 2050



* Proportional Basis

A disruptive journey ahead



- Annual generation of plastic waste will increase
- Current pace inadequate
- Waste generation & "build to export" disconnected
- Critical bottleneck is supply, not demand
- Reverse supply chain increasingly bypass MSW
- Fixing the plastics waste problem does not equate to elimination of fossil fuels
- Risk assessment takes on new meanings

Reach out to us for questions or slides

info@chemicalmarketanalytics.com

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