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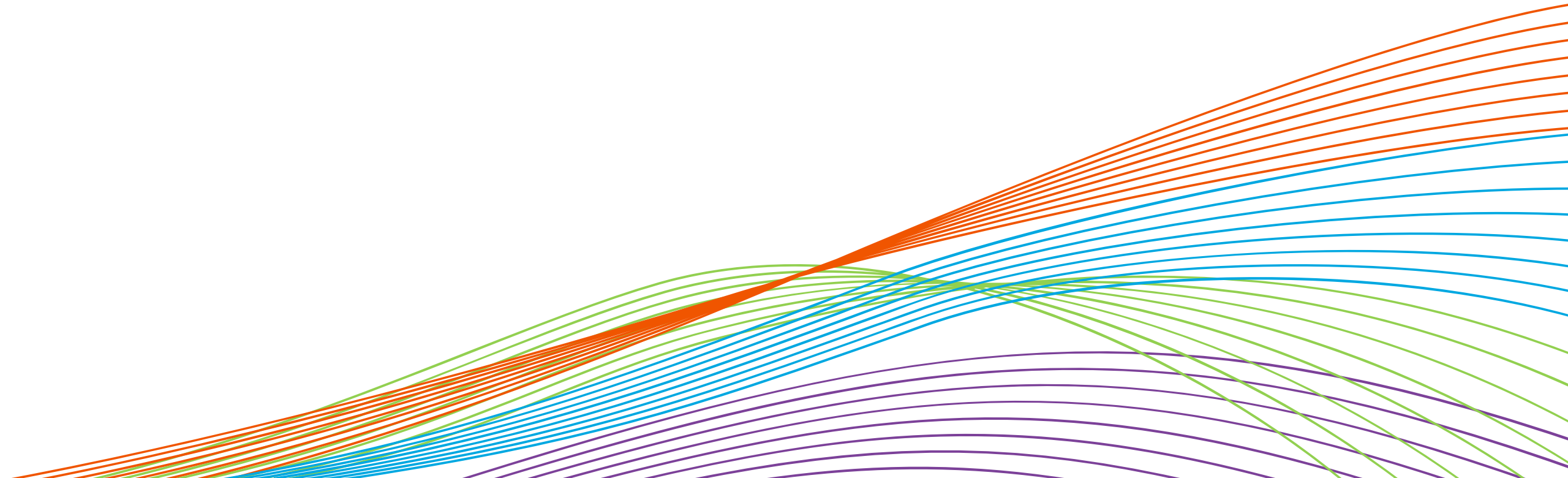
EM Sustainability and Circular Economy

October 2021



Sustainability Drivers: Regulations and Self-Commitments

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AMERICAS

Canada

- Reduce total greenhouse gas emissions reduction by 30% in 2030 vs 2005 emission levels,
- Increase recycled content by at least 50% in plastic products where applicable by 2030

US

- Net zero carbon emissions for the power sector by 2035, and economy-wide by 2050
- Lately rejoined the Paris Climate agreement to foster climate resilience and low greenhouse gas emissions

EMEA

- 55% reduction in CO_2 by 2030 vs 1990 and CO_2 neutral by 2050
- Mandatory recycled content targets in Automotive on the way*
- CO_2 footprint required, appr. starting 2023

Keep global temp. increase well below 2°C compared to pre-industrial level

*Circular Economy Action Plan, **Automotive** : „considering rules on **mandatory recycled content** for certain materials of components, and improving recycling efficency.*

ASIA

China

Climate Neutrality by 2060 with peak carbon in 2030

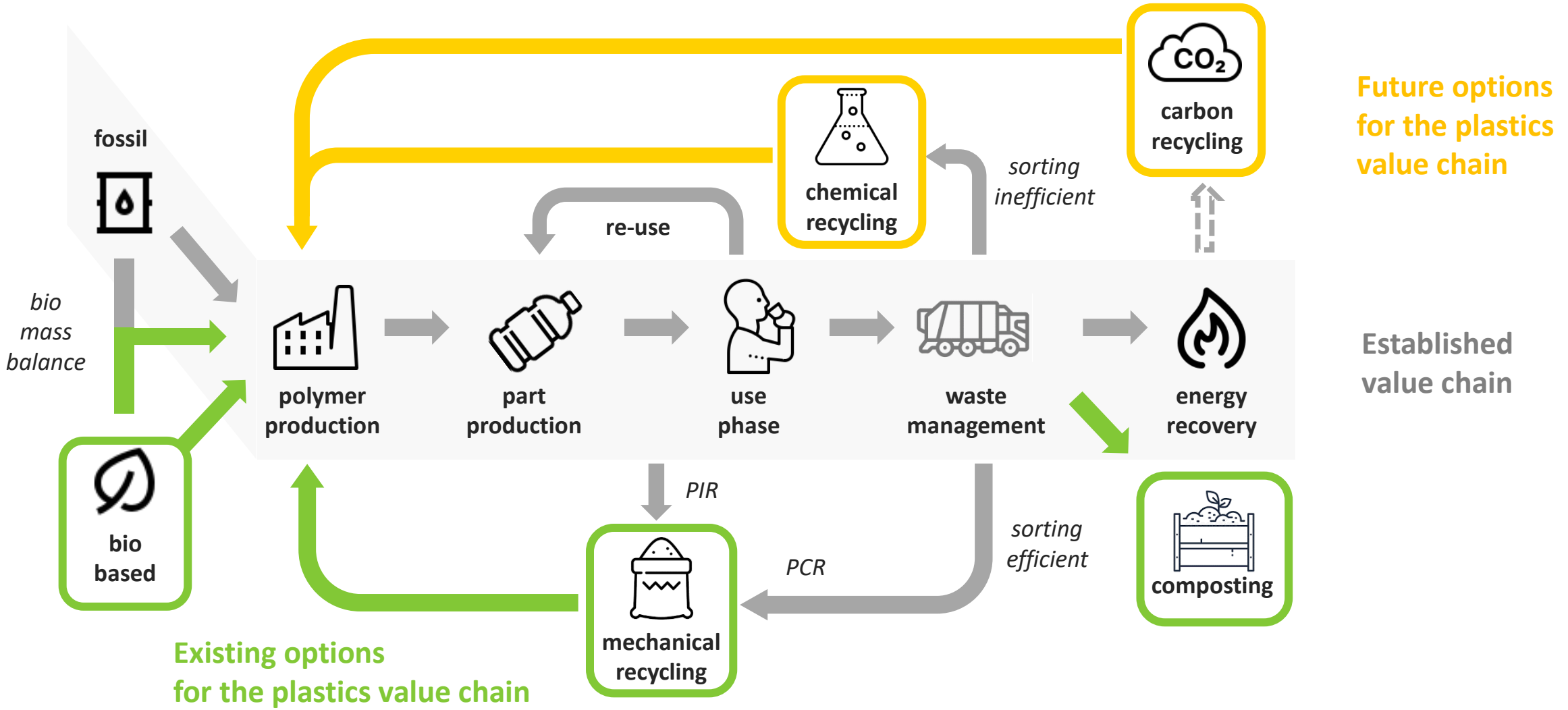
Japan

- Reduce CO_2 emissions by 26% in 2030 (compared to 2013 levels)
- Carbon neutral by 2050

S.Korea

- Green New Deal, carbon neutral by 2050
- Decrease plastic waste by 50% while increasing the rate of recycling from 34 to 70% by 2030

Circular economy in the plastics value chain



EM Sustainable Solutions

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Recycled content

Products that contain post-industrial or post-consumer recycled materials while still maintaining consistency, quality and performance

Bio-based

Products derived from biological feedstock like forestry and agricultural waste materials or renewable domestic waste

Includes ECO-B biomass balanced solutions

End-of-life

Products that are biodegradable and compatible with waste streams that go into composting

Recycled content options

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Recycled content

Products that contain post-industrial or post-consumer recycled materials while still maintaining consistency, quality and performance

Mechanical Recycling - Polymer chain remains untouched

- Source: separated post industrial (PIR) or post consumer (PCR)
- Performance loss with every thermal/mechanical step
- Properties can be tuned to match prime reference by adjusting %
- … but product close but not identical to prime => re-approvals needed
- Limited options for stringent requirements (food contact, drinking water, colors)

Carbon Recycling - Reclaimed fossil CO_2

- Source: CO_2 waste stream converted back into polymer
- Ideally suited for POM due to versatile Methanol precursor
- Product identical to prime

Chemical Recycling - Polymer chain partially split

- Source: pre-separated post consumer (PCR) waste
- Potential routes solvolysis – pyrolysis – gasification
- Most promising solvolysis yields oil as feedstock for steam cracker
- Product identical to prime quality with mass balance approach
- Still in industrial scale up stage

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Bio-Based Solutions

Bio based options

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Bio-based

Products derived from biological feedstock like forestry and agricultural materials or renewable domestic waste

- Source: naturally occurring materials (wood, agricultural waste)
- CE ambition is to use feedstock not in conflict with food chain where possible

Conventional polymer – bio-mass balance feedstock

- Polymer chain identical to fossil based equivalent
- Precursor for key feedstock bio-based instead of fossil
- Example POM ECO-B: same POM polymer made of bio-origin Methanol

Distinct class of polymer – bio-based feedstock

- Polymer backbone of natural origin => often compostable
- Feedstock directly bio-based without mass balance + chemical modification
- Example BlueRidge™ Cellulosic Pellets & Clarifoil® Cellulose Acetate: cellulose from wood pulp modified with acetic acid

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Bio-Based Solutions

Conventional polymer – bio-mass balance feedstock

Bio-mass balance derived feedstocks for conventional polymers

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POM ECO-B

- POM ECO-B grades use bio-based methanol as feedstock with a bio-mass balance approach
- POM ECO-B follows the ISCC+ mass balance certification, independently audited by external 3rd parties
- Bio-mass balance provides end products in identical quality and properties vs prime avoiding requalification in specified applications

PBT ECO-B

- PBT polymer contains min. 40% bio-mass balance coming from the aliphatic portion can be used to produce Celanese PBT compounds
- Products will be available in 1Q22 with RedCert^2 certification
- Will be meeting requirements of upcoming EU supply chain act

UHMW-PE ECO-B

- We are evaluating bio-based ethylene sources to produce Celanese UHMW-PE products on a bio-mass balance approach

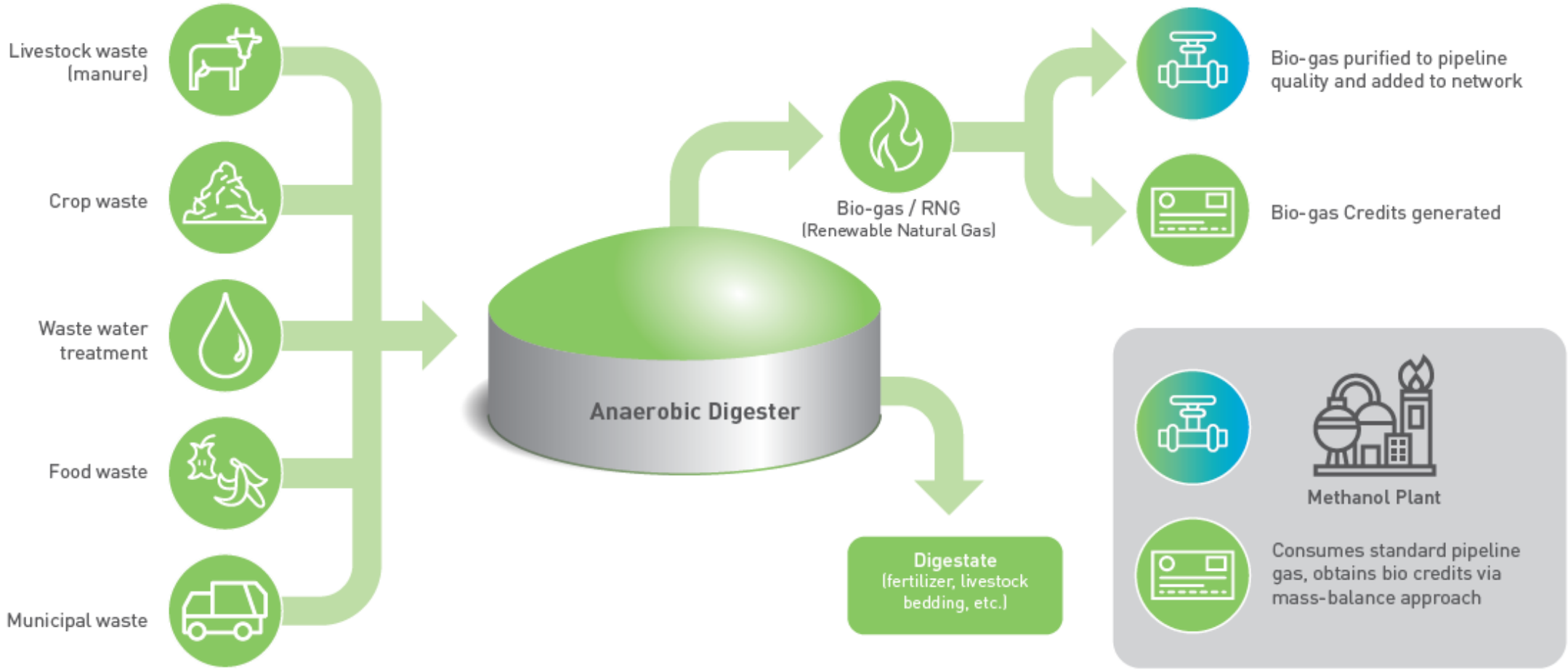
POM ECO-B

POM ECO-B	
Product	Mass-balance Bio-POM
Availability	EMEA January 2021 Any EU-manufactured grade Q1 2021 Any US-manufactured grades TBD
Renewable Content	Up to 97% certified Bio-content via ISCC Plus mass-balance
CO_2 Benefit	Reduction in CO_2 footprint (GWP – Global Warming Potential) of ˜50% of CO_2 per KG of POM polymer*

** Polymer-only basis, compounded products may differ*

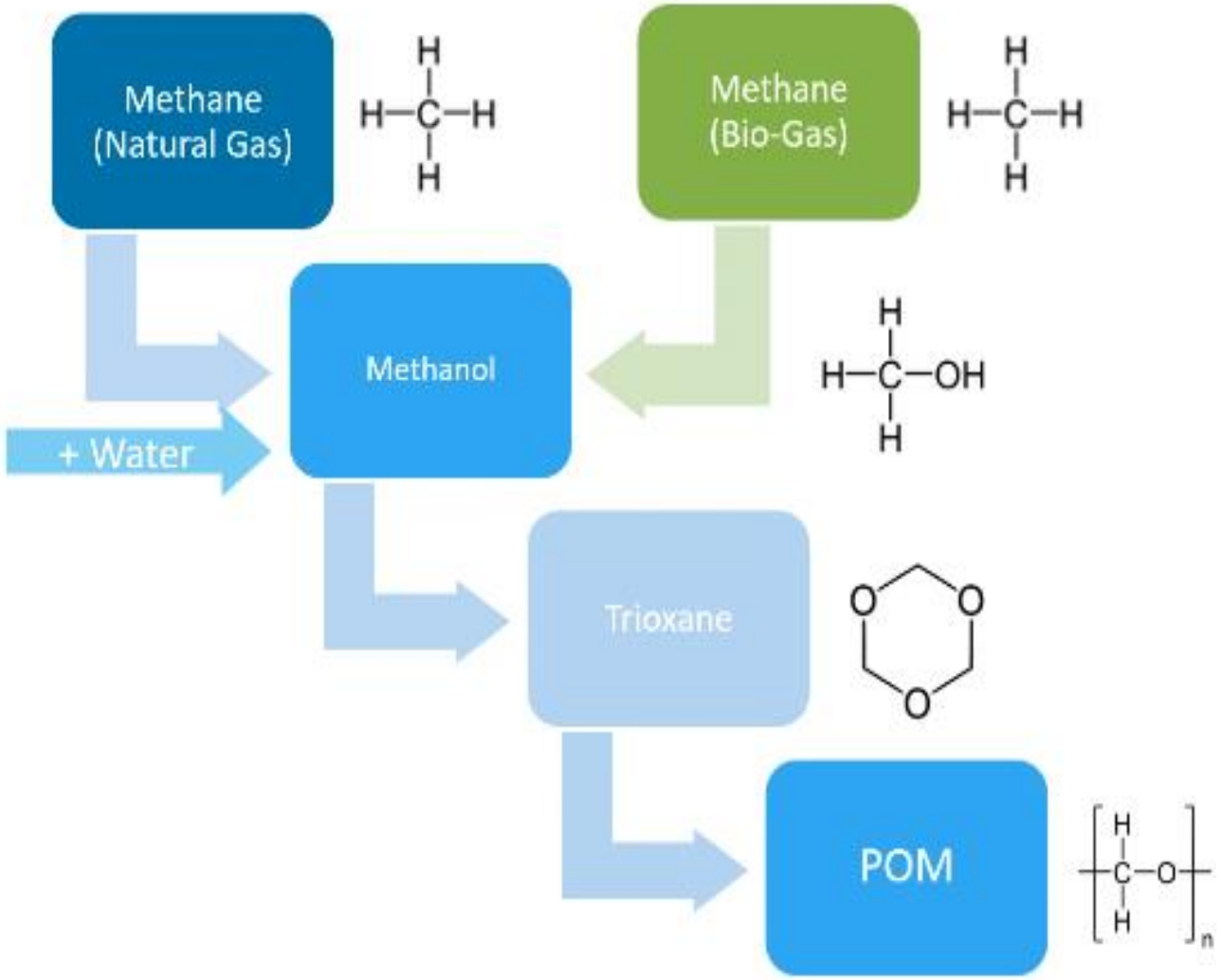
- Mass-balance bio-based POM using renewable feedstocks
- Chemically identical alternative to traditional POM, ***no product requalification required***
- Option on any grade in portfolio
- Does not use or contain food or feed crops
- Celanese uniquely positioned to offer ECO-B solution given fully integrated chain

POM ECO-B Feedstocks



Biogas is produced from the anaerobic decaying of organic waste material

Chemistry of POM and POM ECO-B



Celanese is fully integrated through entire chain

ECO-B is done via mass-balance approach

Raw materials, specifications, production process, equipment, **all unchanged**

Celanese Portfolio

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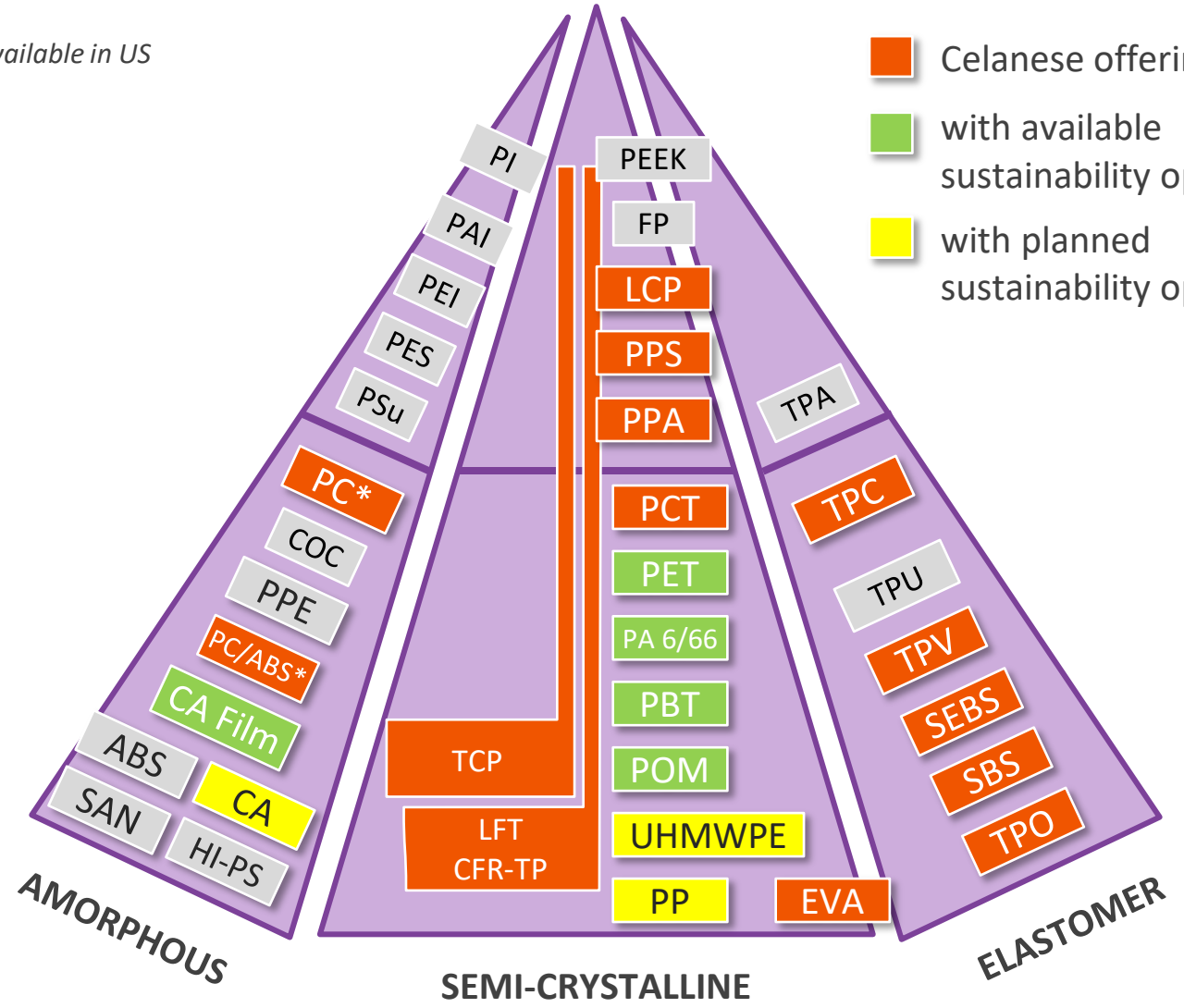
** available in US*



- Celanese EM offers the broadest range of Engineered Thermoplastics in the market
- Key strength overall and for sustainable solutions is within the semi-crystalline part of the plastics pyramide
- A range of sustainability options are available across the portfolio

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The products mentioned herein are not intended for use in medical or dental implants.

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