FEDERCHEMICA

Decarbonisation pathways for the Chemical Industry

William Garcia- 9 November 2017

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Agenda

- Chemicals CO2 neutrality : DECHEMA
- Circularity and chemicals: ACCENTURE
- Learnings from many former reports and trends
- Our way forward : towards a mid-century industry strategy

Overview of Dechema study

Low carbon energy and feedstock for the European chemical industry

An inward looking at technology options
[Tabled]

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We asked DECHEMA what it entails for the chemical industry to be carbon-neutral by 2050?

Low-carbon chemical production

- Methanol
- Ethylene
- Propylene
- BTX
- Ammonia (urea)
- Chlorine

accounting for ⅔ of the sector's GHG emissions

Renewable electricity

Alternative carbon feedstock
CO_2 (CO) ***Biomass***

Power to heat

Energy efficiency

Industrial symbiosis

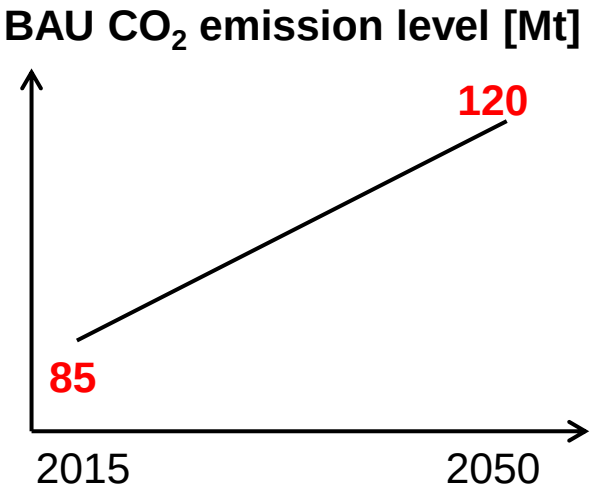
Recycling

Scope 3 emissions not included

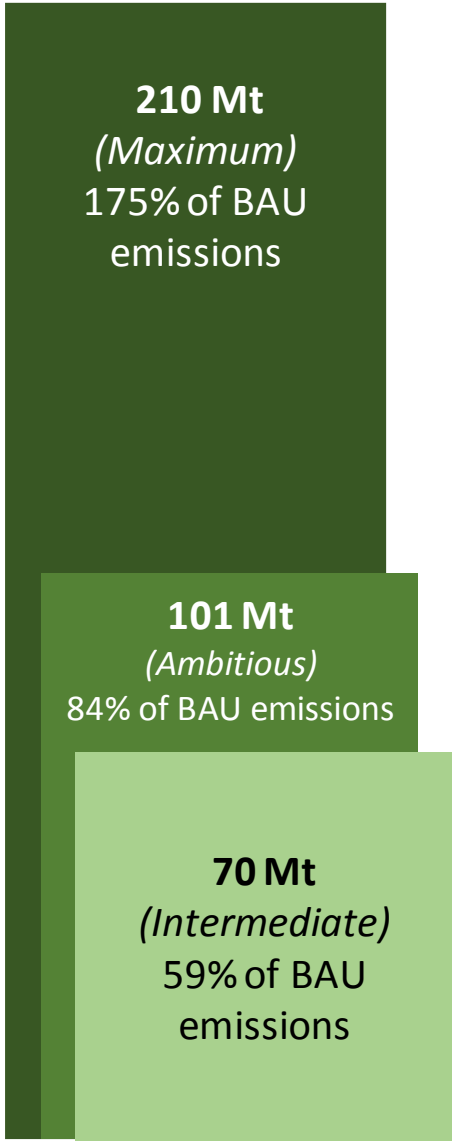
Boundaries

- 4 Scenarios
- IEA 450 ppm and ETP 2°C scenario as basis
- Current production volumes in Europe
- Growth (in value terms) per annum assumed for the EU chemical industry
- No shift of production or carbon leakage effects considered

GHG (CO_2) abatement potential



- High level of ambition as prerequisite for reaching GHG neutrality
- If fuels are included higher impact is leveraged

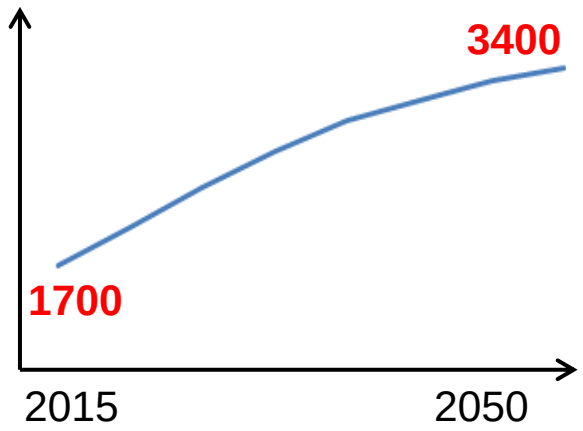


CO_2 emission reductions (Mt)

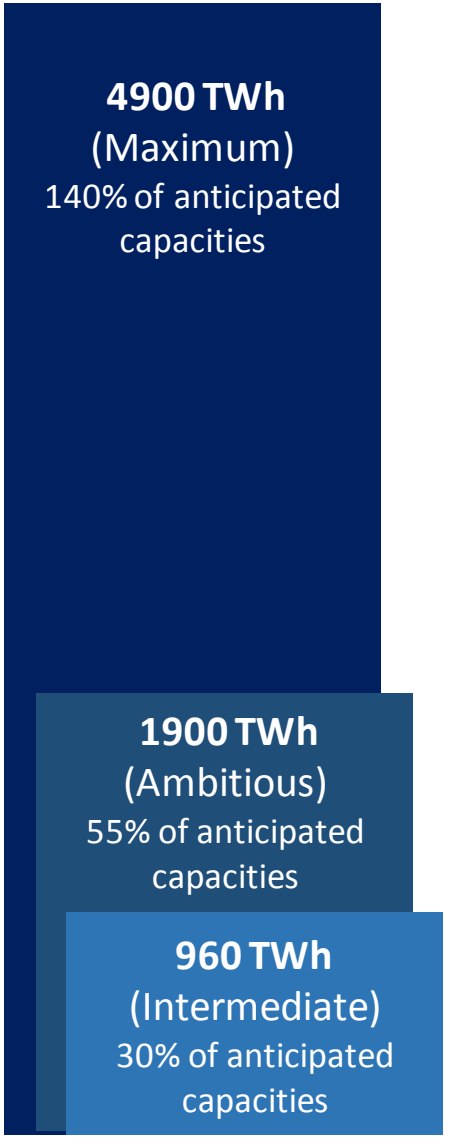
DECHEMA

Electrification potential

Projected low carbon power capacities[TWh], IEA



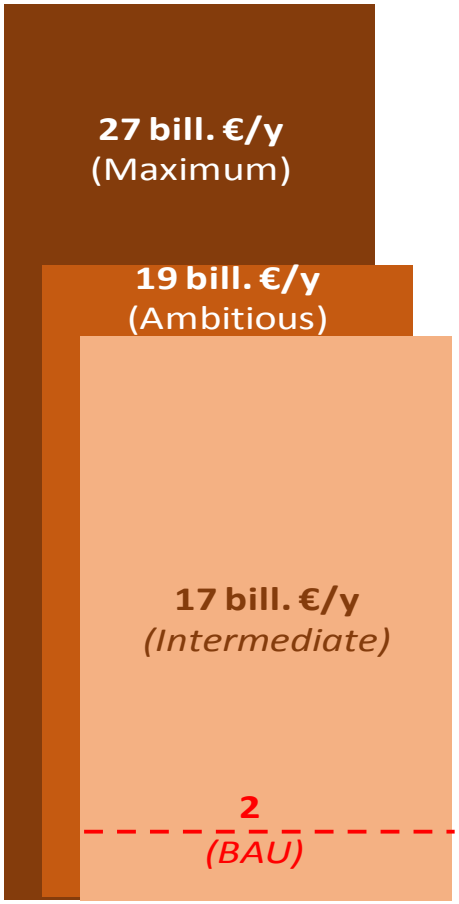
- Much more ambitious extension of low-carbon power capacities required, at least a factor 2 of the level currently anticipated by the IEA
- Critical factor outside the control of the chemical industry



Low-carbon power Demand (TWh)

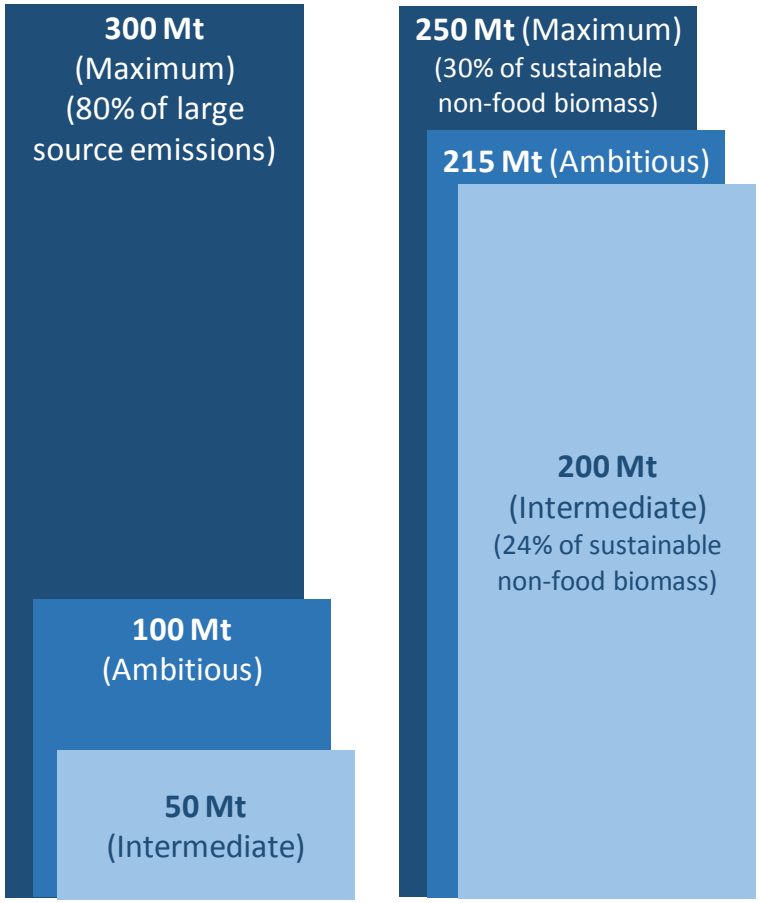
DECHEMA

Economics



Investment Requirements
(bill. €/y)

Feedstock demand



Alternative Feedstock Demand

CO_2 (Mt) Biomass (Mt)

DECHEMA

High performance. Delivered.

We asked ACCENTURE to stimulate a thought process about the role for the chemical industry in enabling a circular economy

[Tabled]

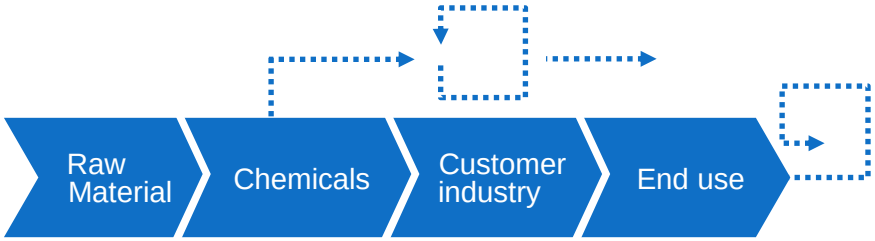
accenturestrategy

Strategy | Digital | Technology | Operations

Circularity has two aspects: enabling circularity in downstream end uses; and circulating molecules

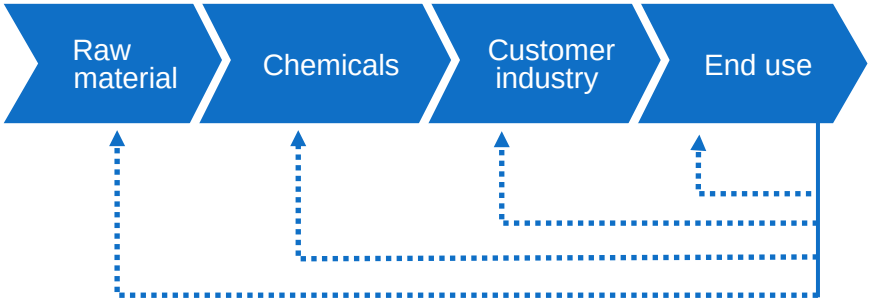
Approaches towards a more circular economy for the chemical industry

1 Enabling circularity



Enabling maximum utility in end usage
e.g. higher durability of goods, sharing cars, decreasing energy need by passive houses

2 Circulating molecules



Maximizing utility of existing molecules
e.g. reusing/recycling molecules such as PET bottles

Source: Accenture

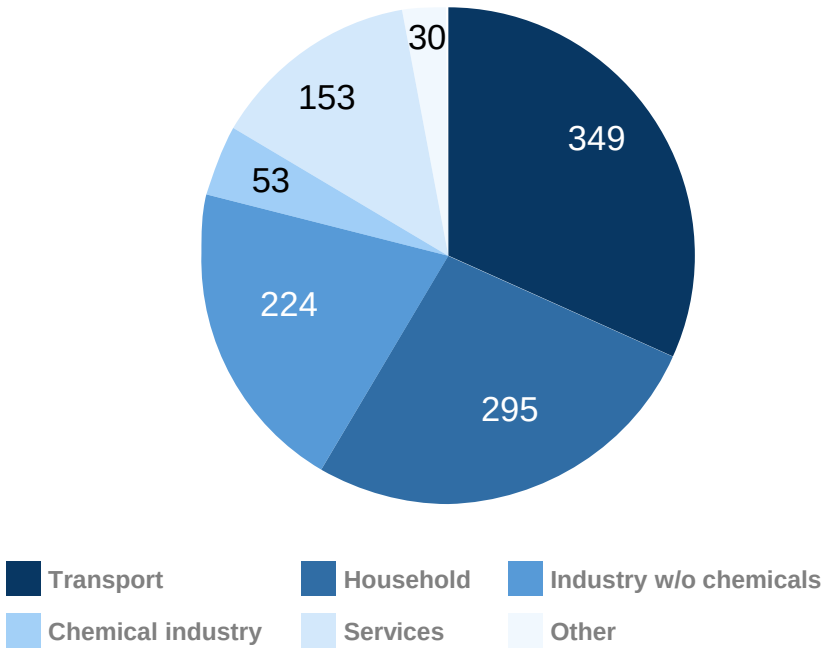
Approximately 425 Mtoe of EU energy consumption can be reduced in a full circular scenario

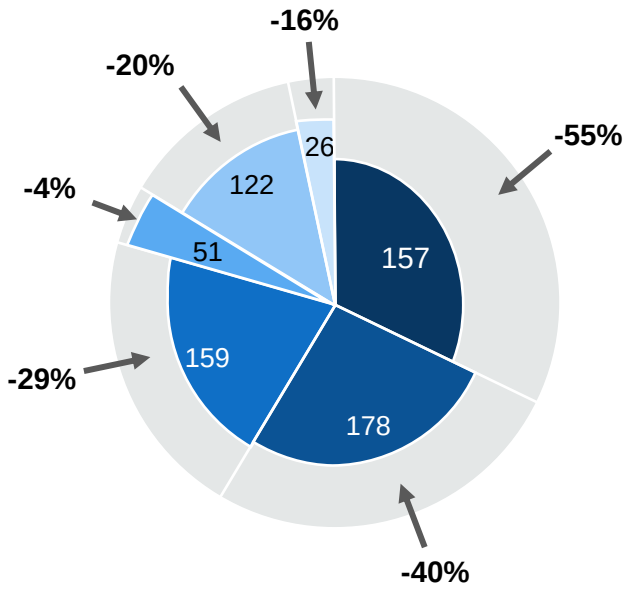
Impact of 2030 circularity scenario on energy consumption (in Mtoe)

As-is:
1,104 Mtoe energy consumption

-37%

Circular scenario 2030:
679 Mtoe energy consumption

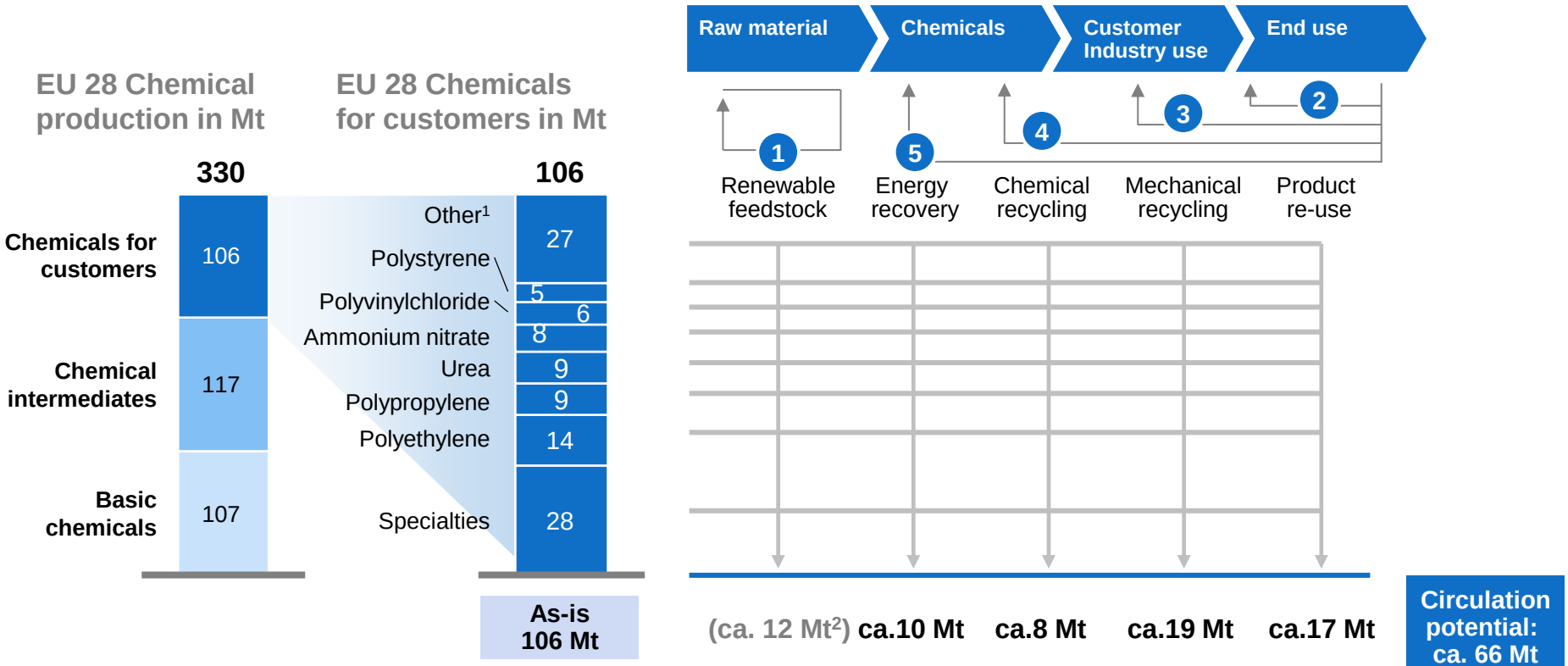




Source: Consumption of Energy, Eurostat – Energy Balance, 2013; Accenture analysis

Each circulating loop can contribute to reducing the demand for new molecules

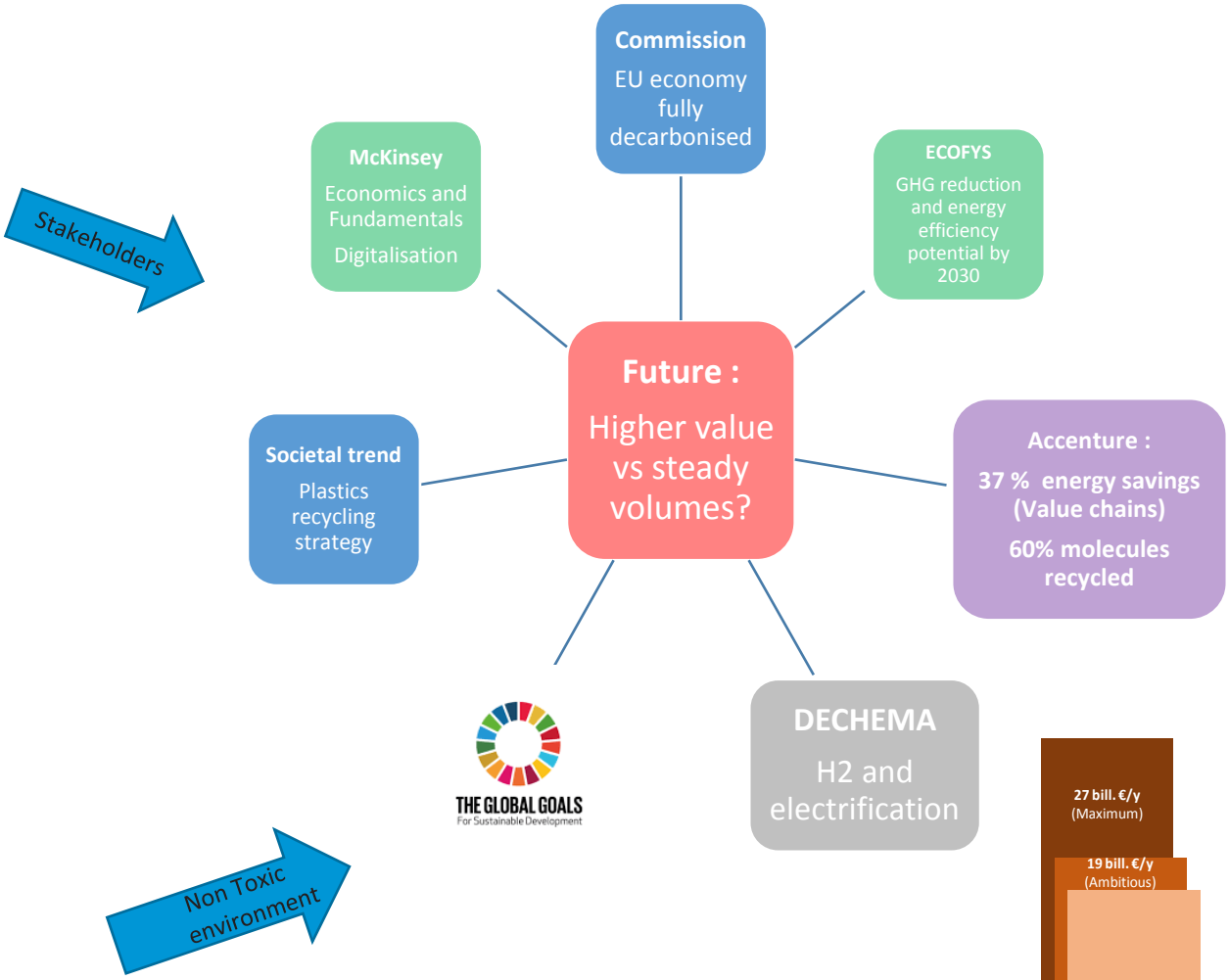
Out of 106 Mt chemicals delivered to customers, up to 60% can be circulated

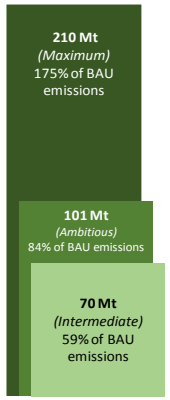


1. 44 further products assessed, some with limited loop potential, e.g., non-recoverable materials such as nano particles, coatings, solvents 2. Loop 1 is fed with biomass rather than from chemicals for customers. Assuming that, after consideration of loops 2-5, ca. 50% of remaining feedstock need can be substituted from biomass

Source: Accenture research

Cefic knowledge base…





CO_2 emission reductions (Mt)

Investment Requirements (bill. €/y)

Low-carbon power Demand (TWh)

…from learning to strategy…

Industry mid-century strategy project outlines

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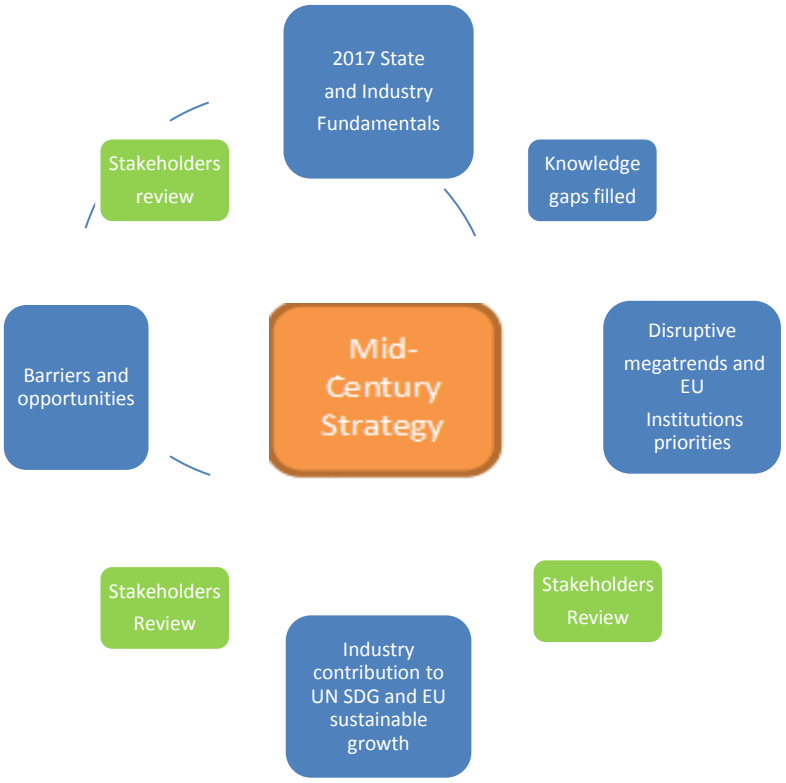
Scope

An advocacy-driven story line targeting the next generation of EU Policy Makers (2019 agenda) aiming to:

- highlight sustainable growth potential in Europe
- foster leadership in innovation
- address UN SDGs and EU Commission legal priorities
- be perceived by Stakeholders as the “ industry of industries ”

Stakeholders engagement

- CEOs to Media, NGOs, Policy Makers, investors community and Citizens
- At least three moments of engagement throughout completion
- Governance in place – the goal is the discussion, not the position.



Wrapping up

- A mid-century industry outlook is a must-have to show potential
- The industry is keystone in enabling efficient buildings, mobility, food , packaging
- In all options , access to abundant and competitive low C energy is required to benefit from full chemicals potential
- Large investments required until 2050 with production costs not yet competitive

Enabling conditions

- Enhance cross-sectorial collaboration models (Steel-Cement, PPA)
- **Foster a competitive circular value-chain** to enable recycling of polymers and the use of polymer waste as feedstock
- Ambitious R&I programs e.g. efficient H2 generation and valorization of biomass
- Support for PPP to enable swifter deployment and risk sharing