Chemical recycling – a viable path towards sustainable products in Czech Republic?

ERTC 2020

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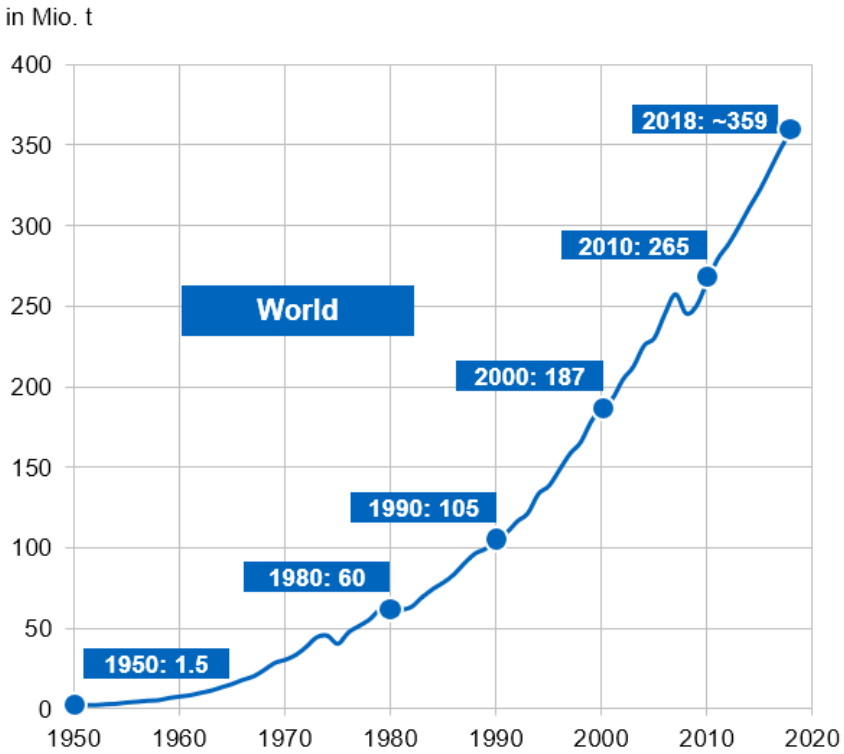
Outline of the presentation

- Production of plastics – a global success story.
- Situation with waste plastics in EU & Czech Republic today and tomorrow
  - Where are we? Where are we going? What do we need to do to get there?
- Chemical recycling
  - What is it? Why should it be implemented? How can it be implemented?
- Project Pyrekol
  - What is the scope? Who is behind this? What is the status? How far from industrialisation are we?
- Summary & wrap-up

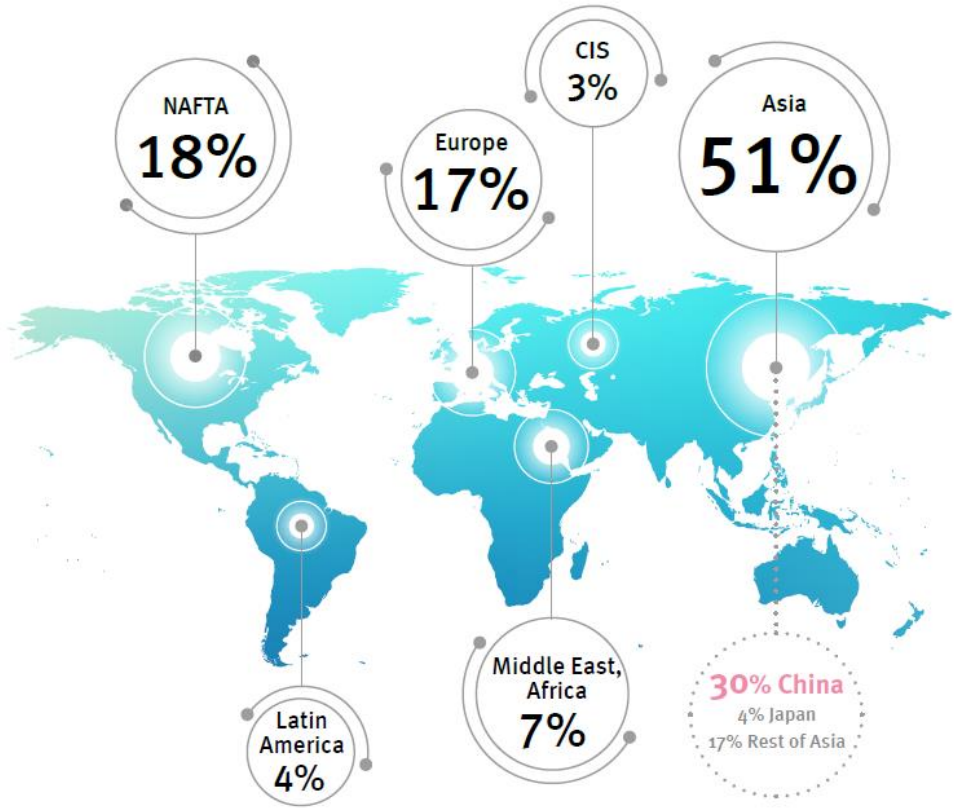
Global plastics production between 1950 – 2018

- Production of plastics is a global success story.
- Continuous growth for >60 years.
- Plastics production ramped up from 1,5 Mt (1950) to ~359 Mt (2018).
- In 2018 global plastics production grew by 3,0 % compared to 2017.
- **Compound annual growth rate (CAGR) from 1950 to 2017 is about 8,4 % over 67 years!**



Source: Data - PlasticsEurope Market Research Group (PEMRG) / Conversio Market & Strategy GmbH, Plot – PlasticsEurope Fachpressetag 28.3.2019

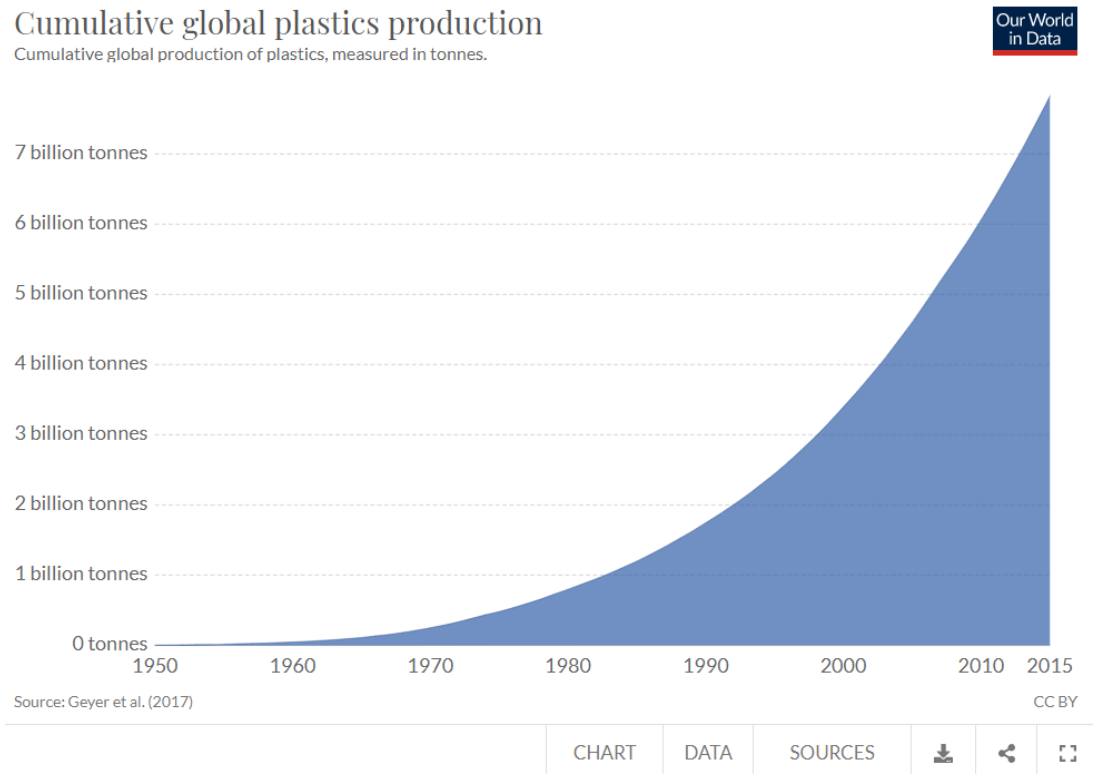
Distribution of global plastics production



- Total global production in 2018:
  - 359 Mt (grew from 348 Mt in 2017)
- Total production in EU28+NO/CH:
  - 62 Mt (dropped from 64 Mt in 2017)
- PRC became a leading producer of plastics*.

Source: Data - PlasticsEurope Market Research Group (PEMRG) / Conversio Market & Strategy GmbH, Picture – PlasticsEurope Plastics – The Facts 2019

Global plastics production – an outlook for 2050



- Annual production:
  - 2018 – 359 Mt
  - 2050 – 1.124 Mt
- Cumulative production:
  - 2018 – 8.700 Mt
  - 2050 – 26.000 Mt

3 fold increase

- Current global oil reserves:
  - >236.000 Mt

Perspective

- Cumulative global oil consumption:
  - ~ 130.000 Mt (estimate)
- Could waste plastics become the „new crude“?

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Source: Plot – ourworldindata.org | Data for 2050 outlook – MacArthurFoundation | Oil consumption & reserves data - Wikipedia

The life cycle of plastic products

- The service life of plastic products spans from less than 1 year to 50 years or more.

Value
Effort
Carbon footprint
Proximity to end user

Production of polymeric materials

Converters demand of plastic materials

Manufacture of plastic products

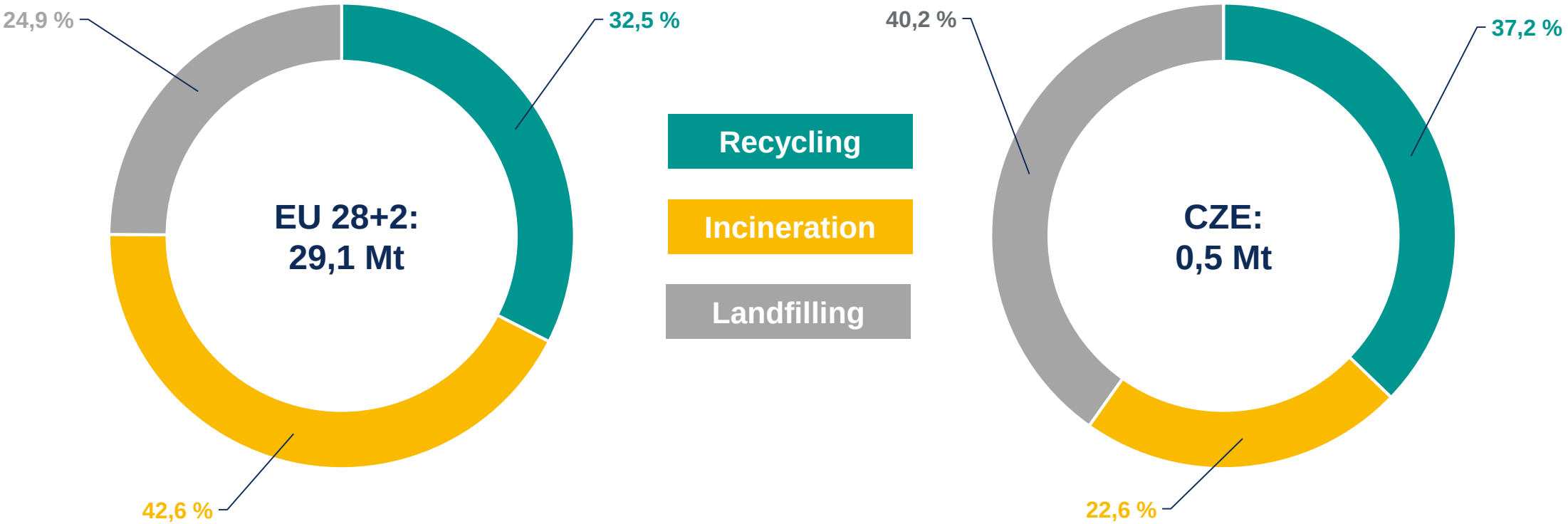
Consumption of plastic products

Plastic post-consumer waste generation

„Second life“ of product = life cycle of waste?

„Distance“ from raw material stage

Post consumer plastic waste (PCPW) recovered and share of **recycling**, **energy recovery** & **landfilling** of PCPW in EU & CZE



Source: PlasticsEurope Plastics – The Facts 2019

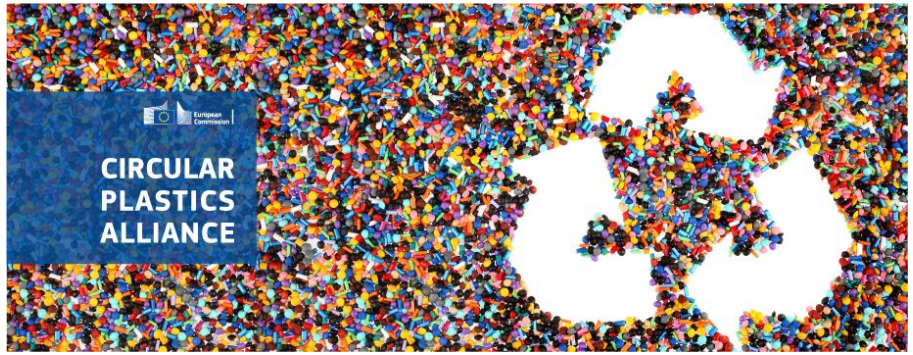
Post consumer plastic waste – policy context

14.6.2018 EN Official Journal of the European Union L 150/109

DIRECTIVE (EU) 2018/851 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 30 May 2018
amending Directive 2008/98/EC on waste
(Text with EEA relevance)

14.6.2018 EN Official Journal of the European Union L 150/141

DIRECTIVE (EU) 2018/852 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 30 May 2018
amending Directive 94/62/EC on packaging and packaging waste
(Text with EEA relevance)



- Reuse and recycling targets:
  - 55 % in 2025
  - 60 % in 2030
  - 65 % in 2035
- Recycling target:
  - 55 % in 2030
- Pledge:
  - 10 Mt of recycled plastics by 2025

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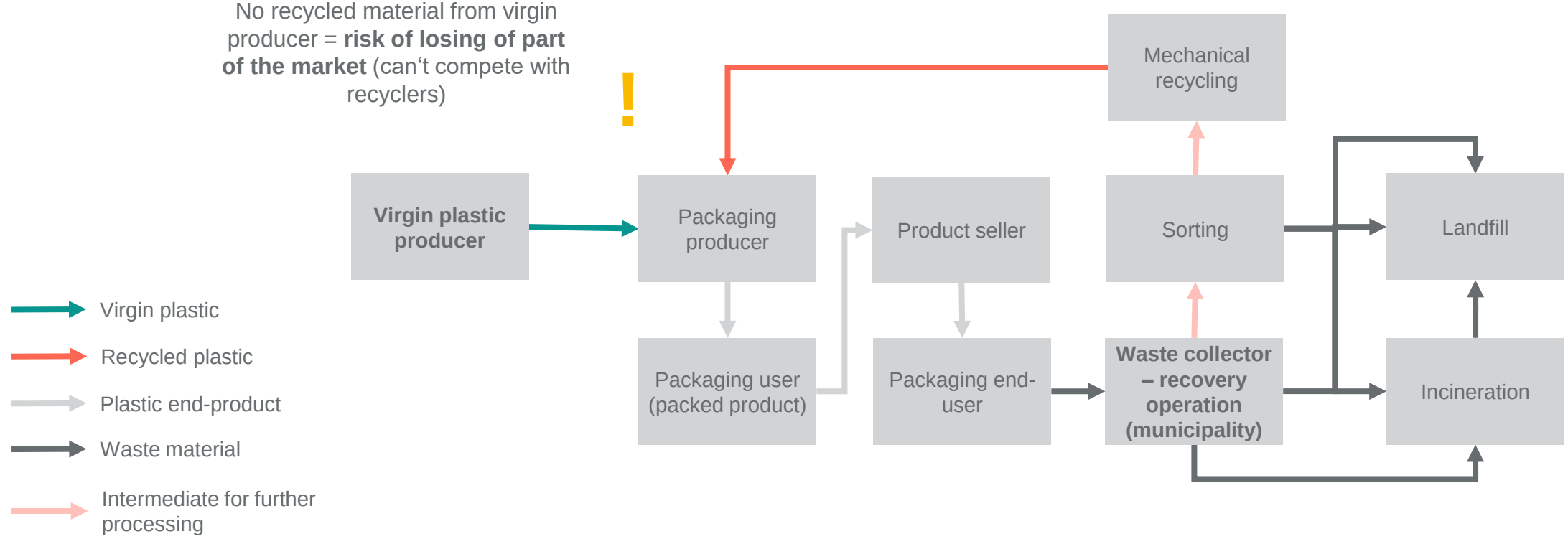
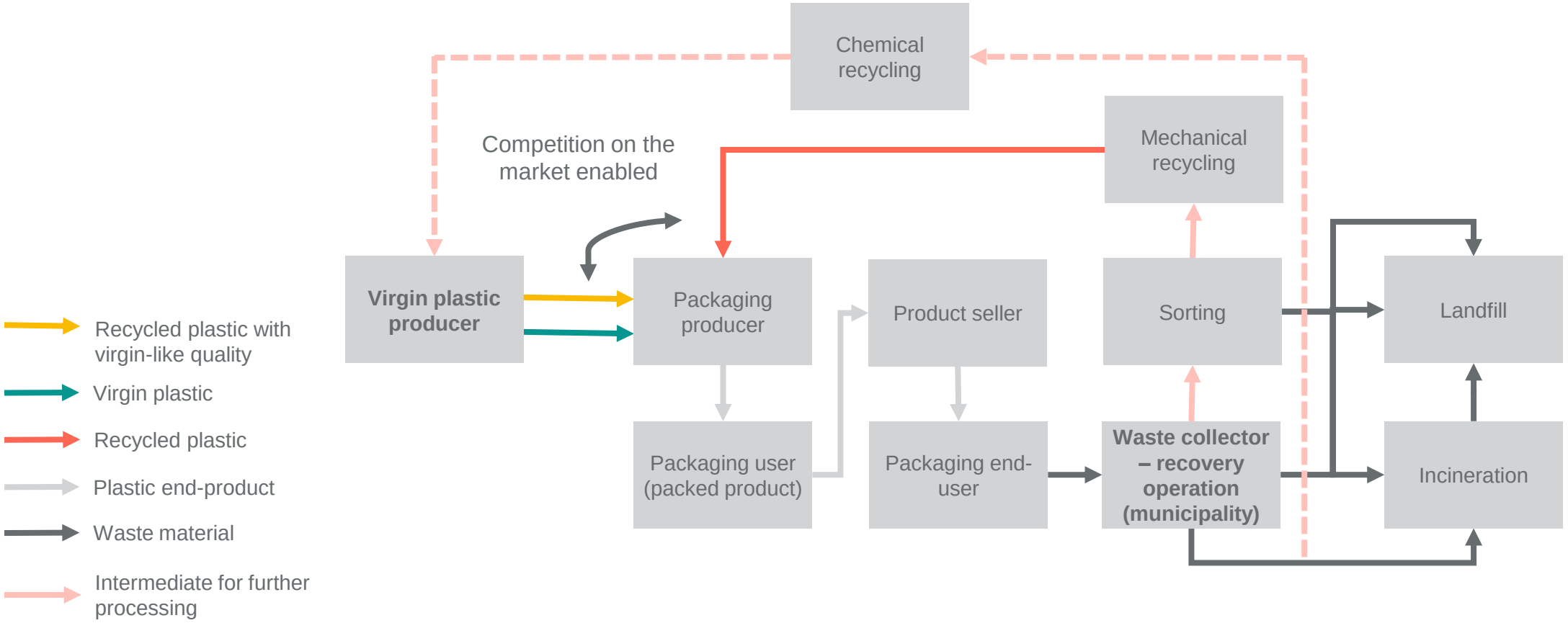
Lifecycle of plastic packaging in EU and role of mechanical recycling

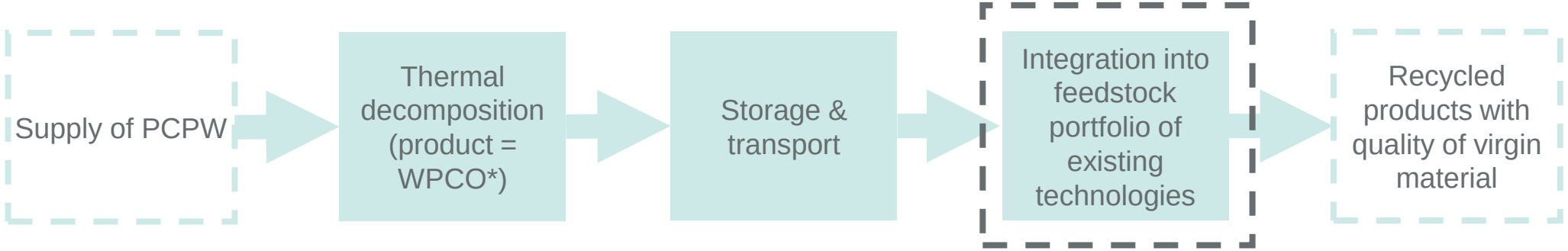
No recycled material from virgin producer = **risk of losing of part of the market** (can't compete with recyclers)



Chemical recycling can be complementary to mechanical recycling



Chemical recycling – how could it be executed for PCPW as feedstock via cooperation with SMEs?



Raw material - PCPW

WPDOs from different raw materials

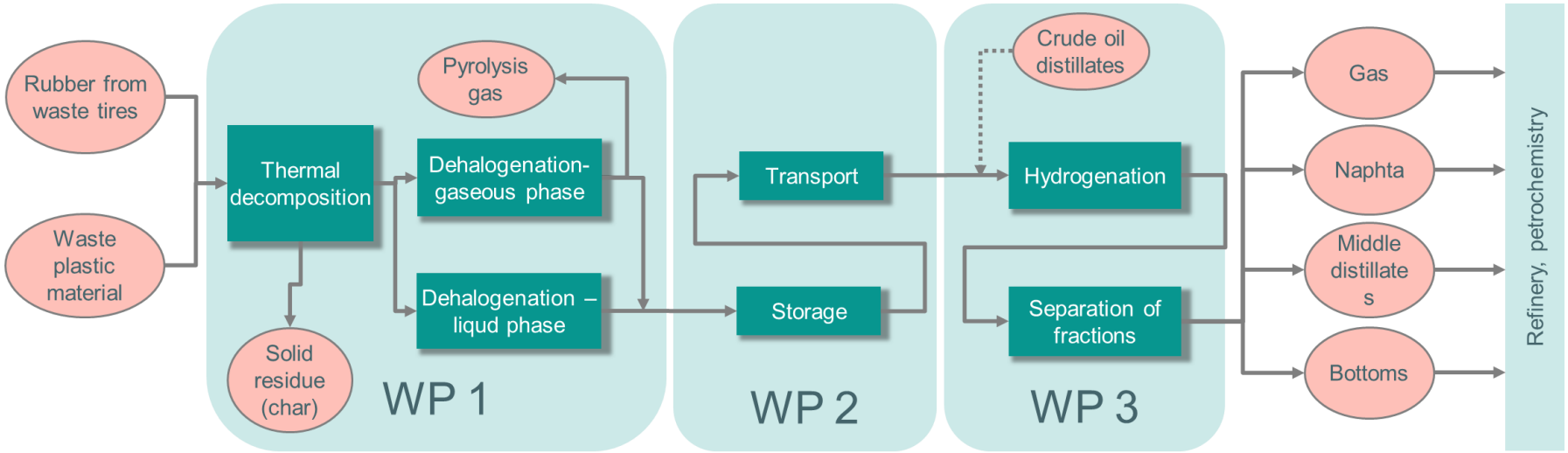
WPDOs light naphta fractions

The most severe bottleneck faced while working with existing SMEs → Lessons learned: **Project Pyrekol**

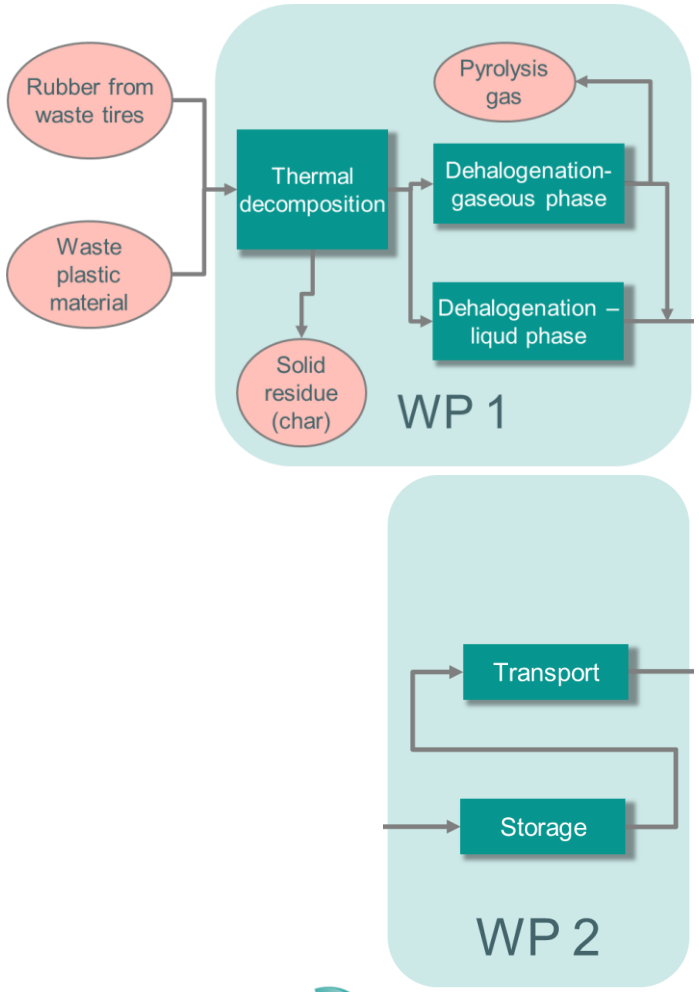
*WPCO – Waste Plastics Cracking Oil

Chemical recycling – project Pyrekol as potential „refiner‘s answer“?

- Refiner (Unipetrol), research centre (UniCRE) & university (UCT Prague) joined forces and came together with a project **Pyrekol.**
- Project of industrial applied research and development was launched at 01/2020 and come up with deliverables until E12/2024.



Project Pyrekol – status so far? (1/2)



- Thermal decomposition:
  - experimental unit before installation, in 2021 capacity of up 15 kgph will be available.
- Dehalogenation in gaseous phase:
  - First experiments to be completed before E2020.
- Dehalogenation in liquid phase:
  - PoC stage reached with catalysts under mild conditions, dehalogenation from 550 ppmw to <1 ppmw was reached.
- Storage & transport:
  - Accelerated lifetime testing methodology developed for wpcos.

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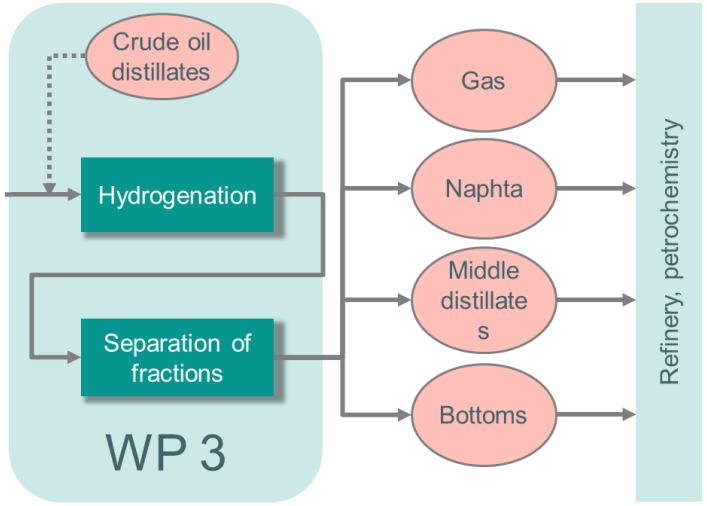
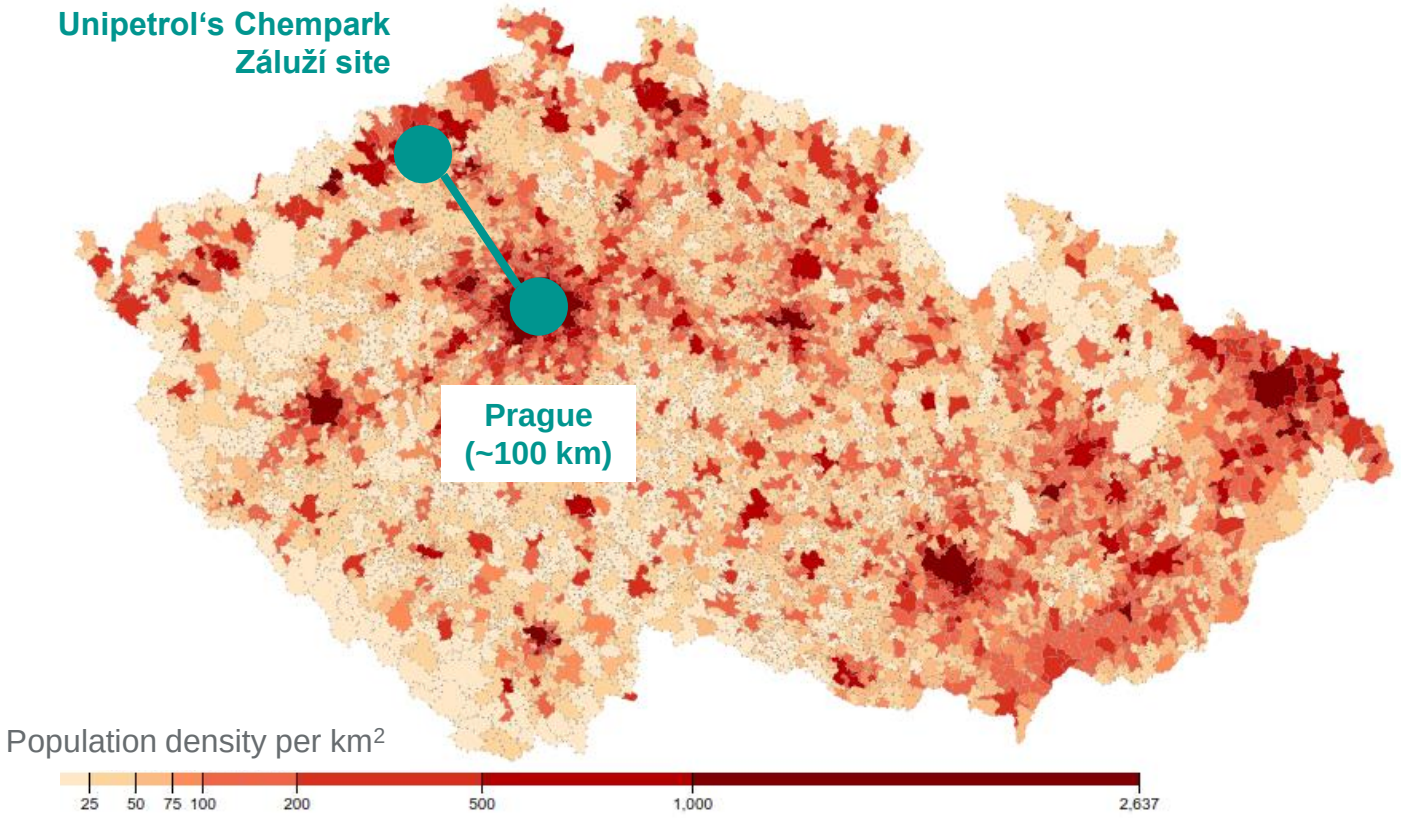
Project Pyrekol – status so far? (2/2)



- Hydrotreatment:
  - Feasibility of hydrotreating using „classic“ catalytic systems verified in bench scale.

- **Goal:**
- To develop complex technological chain for chemical recycling to be implemented in decentralised model throughout Czech Republic by end of decade.
- **Trajectory:**
- So far within expectations.

Why to decentralise in Czech Republic?



- Position of Unipetrol refinery:
  - Population „hotspots“ are too far away from the site = Unreasonable transportation costs → 1 compactor truck has a capacity of approx. 1 tonne of PCPW („yellow bins“).
- Implications for the technology
  - Simplicity of operation, reliability, „no chemical plants in my backyard, please“ public effect, conversion efficiency.
  - Can‘t be done w/o partner from waste handling business.

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Summary & wrap-up

- Plastic waste represents a global issue, that is one of the greatest challenges of current generation.
- Not only broader recycling concepts, but wider recovery schemes has to be implemented to prevent leakages into environment.
- EU is setting ambitious targets implying disruptive development in plastics recycling industry in terms of further transfer from linear to circular value chains.
- Chemical recycling fits in the framework of goals set by EU, although further work needs to be done before widely implemented.
- Chemical industry is up for the challenge, the toolbox is known, only should be implemented.

THANK YOU!

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