



ReOil® - Recycling Technology for post consumer plastics

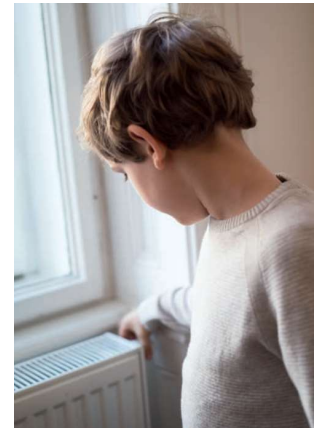
Triple N Talks, December 2nd 2021

Wolfgang Hofer, OMV Chemicals & Materials/P2P

OMV Chemicals & Materials



Hydrocarbons play a key role in our daily lives

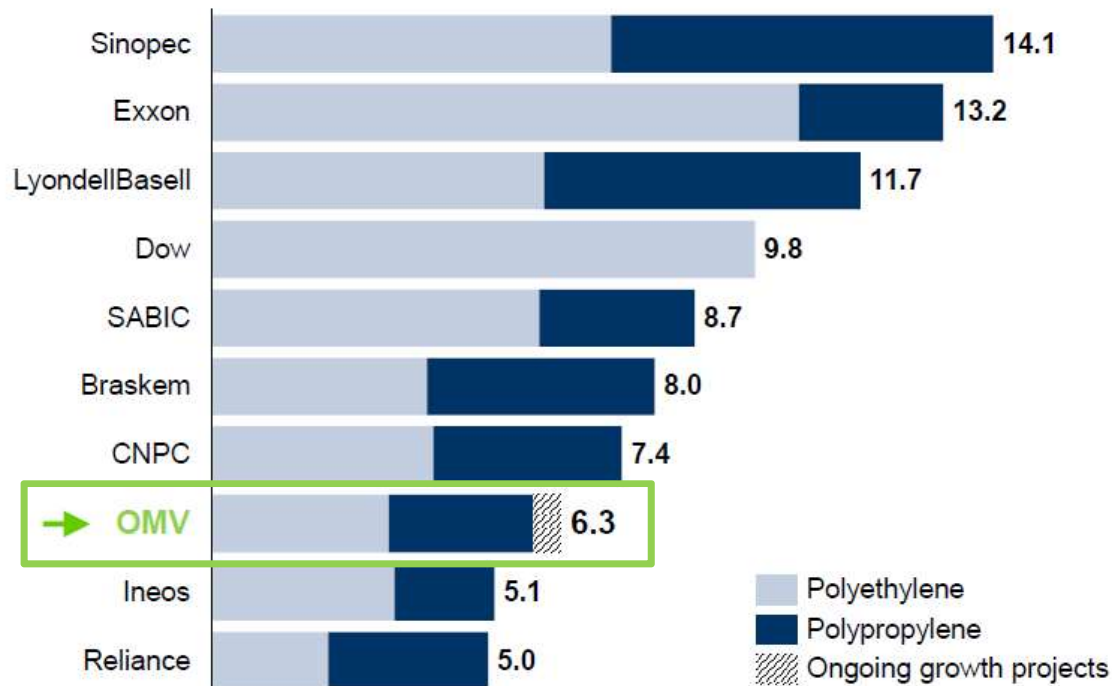


Three strong pillars



OMV extends value chain into polymers, immediately becoming one of the world's leading producers

Top 10 polyolefins capacities Globally, 2020
Mn t



- ▶ Borealis deal extends value chain, providing a **natural hedge against cyclicity**
- ▶ Integrated value chain allows **margin optimization**
- ▶ OMV has **access to high growth segment of polymers**
- ▶ OMV is **#8 globally** and **#2 in Europe**

Repositioning refining for a low carbon future



- ▶ Various **measures to increase efficiency** of OMV refineries
- ▶ e. g. revision program of steam turbines in Schwechat, **saving 60,000 tons of CO₂ per year** by 2021.



- ▶ **Investment** of around **EUR 200 mn** in biofuel production at Schwechat Refinery: **Annual savings of up to 360,000** metric tons of CO₂
- ▶ **Supply agreement signed for bio-ethanol** (96% cut in greenhouse gases versus gasoline)



- ▶ **ReOil®** – patented technology, converting of plastic waste into high-quality synthetic crude
- ▶ Successful operation of **pilot plant**
- ▶ **Commercial plant** expected **by 2025** with 200,000 t capacity a year
- ▶ Combining **chemical** and **mechanical recycling** (Borealis & OMV)



- ▶ **Investments in green hydrogen**
- ▶ **Hydrogen partnerships**, e. g. with Daimler, Iveco, Volvo and Austrian Post

OMV Group aims to become a significant player in circular economy

Total investments of up to EUR 1 bn for innovative sustainable solutions planned until 2025

 BOREALIS



Waste collection

- ▶ Borealis is a co-founder of the project STOP
- ▶ Support to create a **sustainable waste management system**
- ▶ Reduce ocean plastic pollution in emerging countries

 BOREALIS



Design for recycling & Mechanical recycling

- ▶ Borealis is a technology leader within the industry
- ▶ Design for recycling – solutions to replace difficult-to-recycle materials with **100% recyclable** ones
- ▶ **2 recycling plants** in Austria and Germany

&

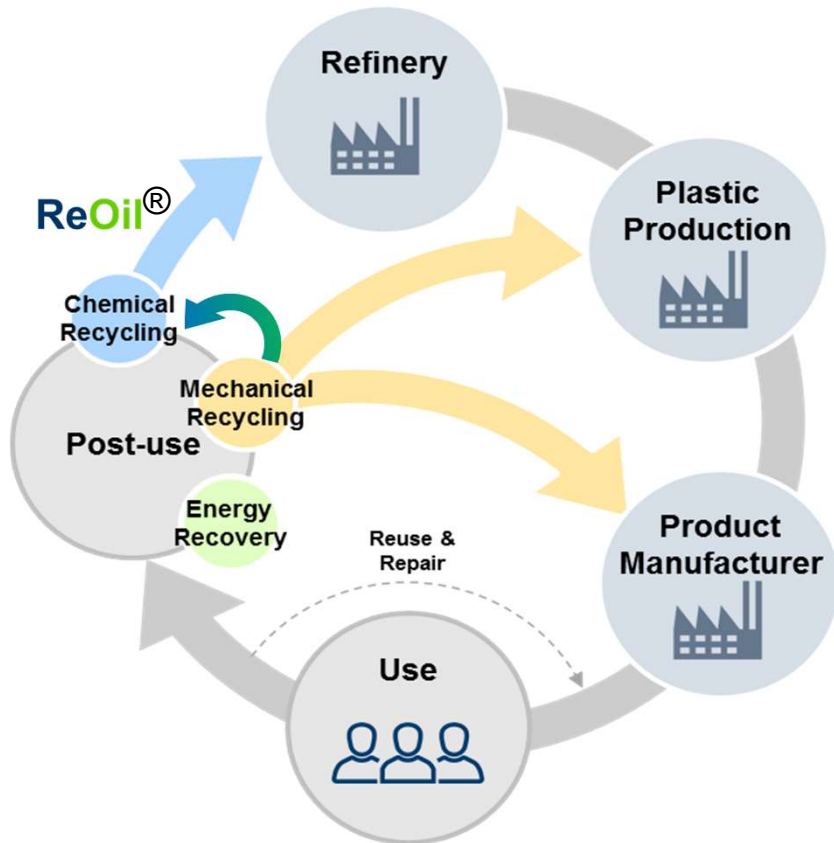

OMV



Chemical recycling

- ▶ **ReOil®** – patented technology, converting of eol PO plastics into **high-quality synthetic crude**
- ▶ Substantially **lower CO₂ emissions**
- ▶ Successful **pilot plant** operation
- ▶ **Target: Upscaling to commercial plant of up to 200 kt/a by 2025**

Circular Economy – the Chemical Recycling closes the loop of post consumer plastic recycling in an energy efficient way



Chemical Recycling

Synthetic crude oil (Short chain → long chain)

Refinery/petchem process (Short chain → long chain)

ReOil® process (Long chain → short chain)

Plastics

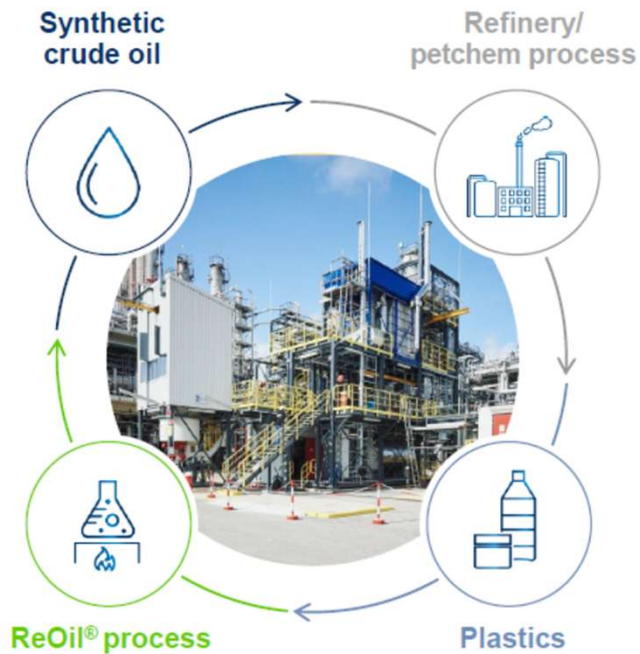
Mechanical Recycling

- ▶ Re-granulation of sorted material
- ▶ High-price segment is limited by product quality requirements
- ▶ High standards of feedstock quality

Energy Recovery

- ▶ Production of high calorific and low calorific substitute fuels
- ▶ Low value-Segment

Plastic to Oil – OMV's proprietary ReOil® Technology



- ▶ Converts used plastics under moderate pressure and normal refinery operating temperatures into synthetic crude oil
- ▶ Synthetic crude oil can be used as refinery feedstock to produce base materials or fuels
- ▶ Advantage of this synthetic crude oil is:
 - ▶ low content of heavy components
 - ▶ short transfer distance to refinery

▶ The substitution of crude oil by post-consumer plastics leads to

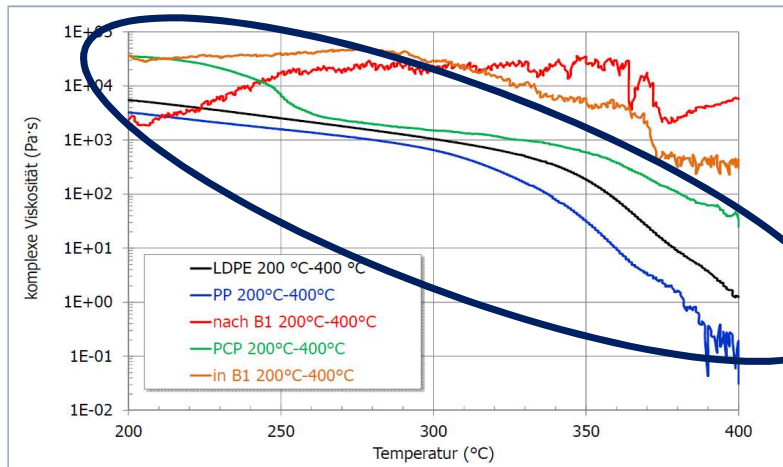
 **~45%** lower CO₂ emissions¹

 **~20%** less energy demand per t¹

¹ Austrian Federal Environmental Agency – LCA Well-to-Refinery fence

What is the challenge of thermal cracking of plastic?

Plastic is an excellent heat isolator with a poor heat transfer, compared with glass or metal.



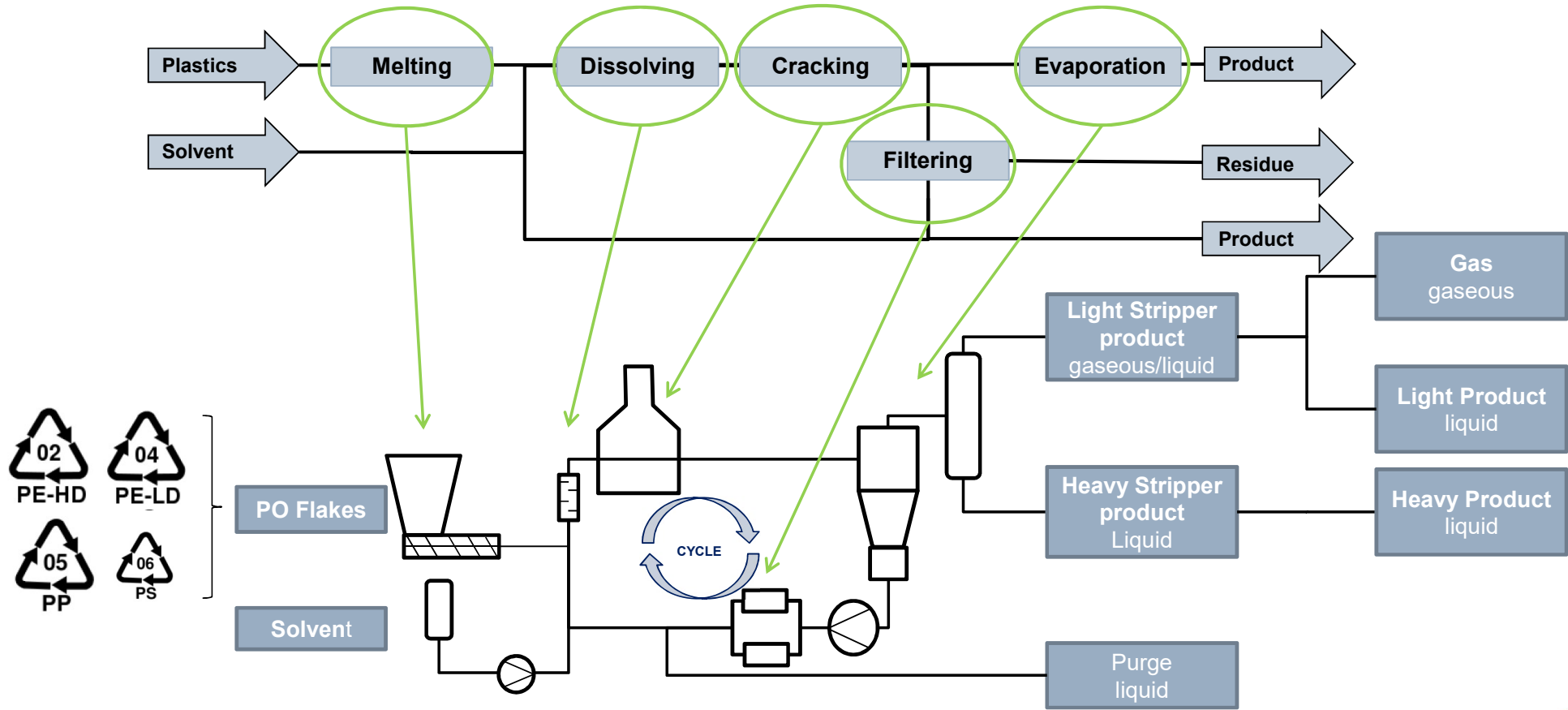
But how to overcome this isolator effect?

- Stirred Reactor
- Rotary kiln
- Reactive Extruder
- Fluidizing bed
- Slurry reactor
- Plasma reactor
- Hydrothermal reactor

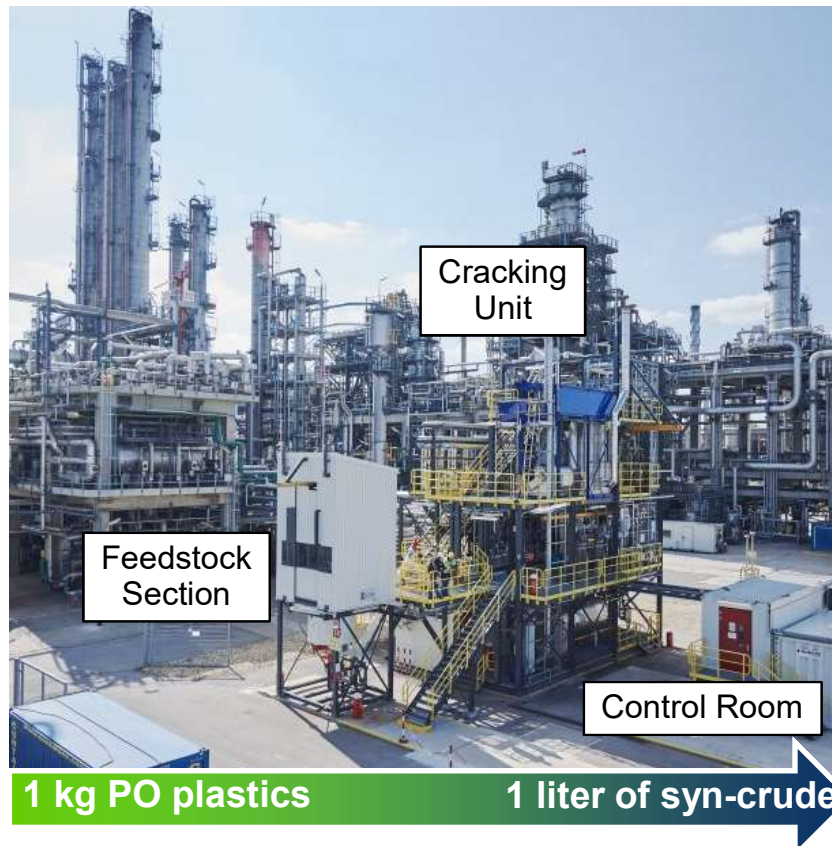


ReOil® approach – reduce the viscosity of the polyolefine plastic melt with an external fluid

ReOil[®] process at a glance



ReOil® – From pilot plant to demonstration and industrial-scale




PO... polyolefin

International patent

Pilot plant in the field

Next

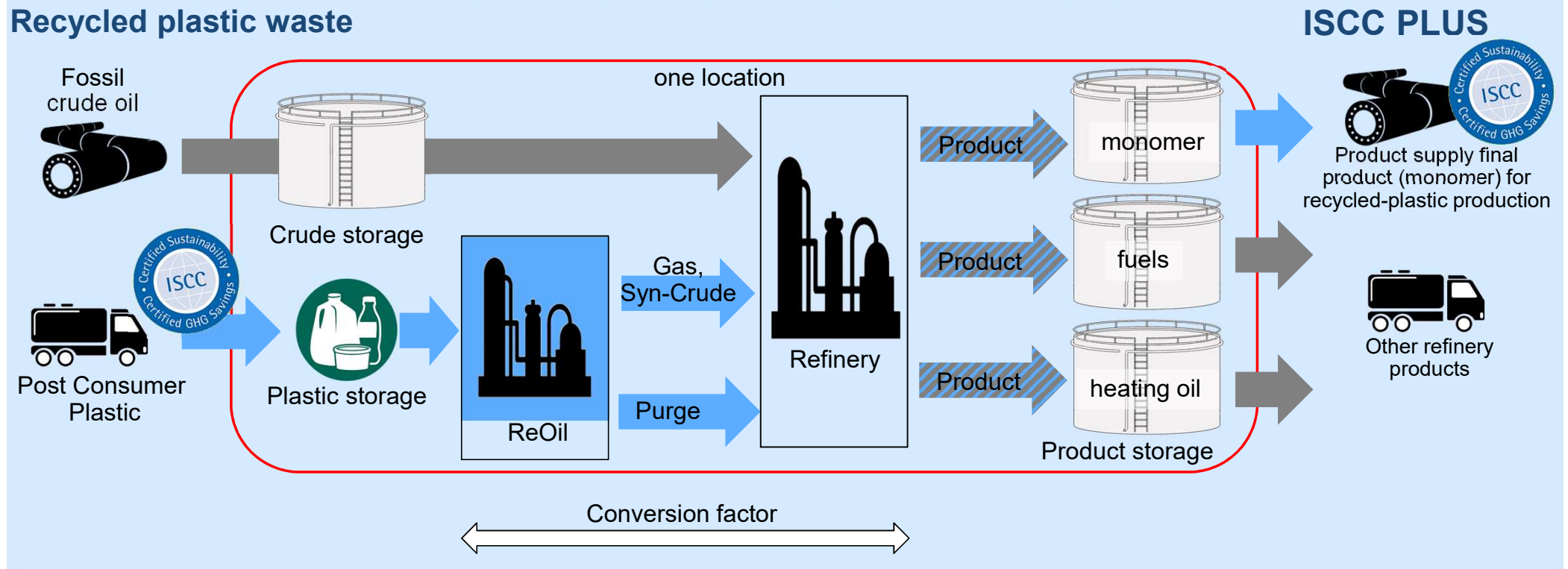
Target

- Patented internationally
- Commissioned in 2018
- Fully integrated in the refinery – **24/7** operation
- The technology readiness level is 8 to 9 (out of 9)
- Focus on process optimization
- Fulfill the 12.000 h cracking hours (since 1.1.2019)
- Current availability > 60-65% (based on 365 days)
- ISCC plus certified 
- Demonstration plant with a feedstock capacity of up to **20,000** t per year – front end engineering ongoing, operative beginning of **2023**

Up to **200,000** t/a (in one train/module)

Aim to develop and roll out **Re Oil®** into a profitable, industrial-scale process

Mass balance approach– ISCC PLUS



- Fossil crude oil
- Sustainable plastic waste acc. ISCC PLUS
- Mixing components from sustainable & non-sustainable feedstock / sustainable declarations for sustainable monomers



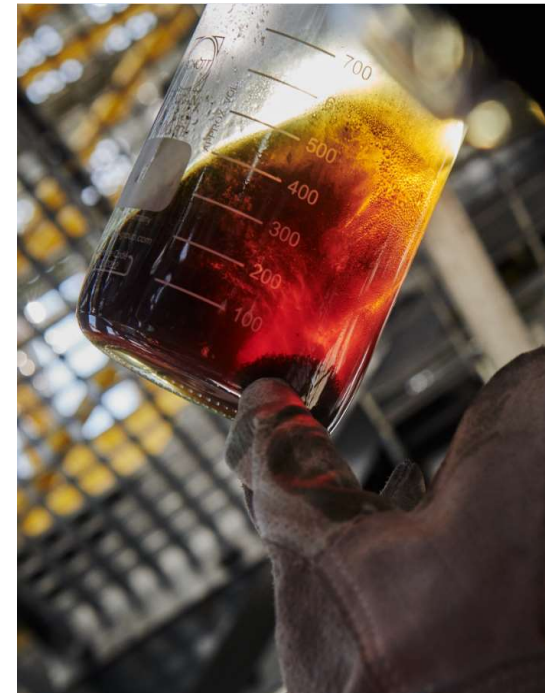
Why chemical recycling in a refinery?

- ▶ **Chemical recycling is safe in the hands of the refinery/petrochemicals industry**
 - ▶ It is able to remove organic/inorganic additives, which otherwise compromise the quality of the recycled material.
 - ▶ The petrochemicals industry has the proven capability to operate chemical processes and deal with hazardous materials, in line with the highest health and safety standards.
 - ▶ Centralized/decentralized CR → less liquid hydrocarbon transports/less potential of accidents
- ▶ **Chemical recycling is energy efficient**
 - ▶ It processes plastic waste streams – which are incinerated today - into synthetic crude oil – which replace fossil crude oil in the production of virgin plastic
 - ▶ The „light“ quality of the synthetic crude oil results in substantially lower overall treatment requirements and therefore less energy consumption and less CO₂ emissions if integrated with a refinery/petrochemical industry.
- ▶ **Chemical recycling complements the plastics recycling options**
 - ▶ Technologies like Re Oil® are capable of processing plastic waste not suitable for mechanical recycling and to convert their rejects via the refinery and Petrochemical to virgin-quality polymers
 - ▶ It helps to fulfill the targets for the plastic packaging recycling quota if recognized as such.
 - ▶ Mass-balancing as an output-oriented approach in existing refinery infrastructure.

safety

efficiency

complementary



Thank you !

The energy for a better life.



Wolfgang Hofer

wolfgang.hofer@omv.com

www.omv.com

www.omv.com/socialmedia

You also find a ReOil video at YouTube



Legal Disclaimer

This presentation is prepared in order to outline our expression of interest. Nothing in this presentation shall be construed to create any legally binding obligations on any of the parties. Neither party shall be obligated to execute any agreement or otherwise enter into, complete or affect any transaction in relation to this presentation.

All figures and information in this presentation are strictly confidential, they are by no means binding and thus indicative only.

© 2021 OMV Downstream GmbH, all rights reserved, no reproduction without our explicit consent.