GEMEINSAM KREISLAUF-WIRTSCHAFTEN
Abfall der Zukunft – Rohstoff der Zukunft

25. September 2019
Liquid Hydrocarbons – the energy carrier

Necessary volume and weight of the energy source for a distance of 500km

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Energy density [Wh/kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con. lead Battery</td>
<td>35</td>
</tr>
<tr>
<td>Lithium-Ion Accu.</td>
<td>200</td>
</tr>
<tr>
<td>Lithium-Sulphur Accu.</td>
<td>400-600</td>
</tr>
<tr>
<td>Methanol</td>
<td>6,000</td>
</tr>
<tr>
<td>Ethanol</td>
<td>7,500</td>
</tr>
<tr>
<td>ETBE</td>
<td>10,000</td>
</tr>
<tr>
<td>RME (FAME)</td>
<td>10,200</td>
</tr>
<tr>
<td>Gasoline, Diesel, HVO</td>
<td>12,500</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>33,000</td>
</tr>
</tbody>
</table>

„ … the fascination of a combustion engine is not it´s efficiency, but the fuel tank …“
Plastics in use – the energy/CO₂ saver

- Weight reduction in transport saves fuels consumption
- Isolation on buildings saves heating energy
- And much more e.g. medical, food, pipes, transport, living ….
The challenge of thermal recycle of plastic

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

But how you will bring in heat for a thermal processing??
- Stirred Reactor
- Rotary kiln
- Reactive Extruder
- Fluidizing bed
- Slurry reactor
ReOil® is a process for chemical recycling of Post Consumer Plastic (PCP)

ReOil®

- is an OMV in-house developed & patented process
  Patent granted in: EU, US, Japan, China, Russia, Kanada, Australia
- enables chemical recycling of PCP to Fuels & Petrochemicals via breaking longer molecule chains into shorter ones
- is a continuous process supported by an innovative heat transfer technology

ReOil® Feedstock

- PE - Polyethylene
  e.g. toys, plastic bottles, films
- PP - Polypropylene
  e.g. food packaging, automotive parts
- PS - Polystyrol
  e.g. plastic cups, packaging, insulation
Typical sources of „Post Consumer Plastics”
PCP and recycling options

Typical PCP sources

- Packaging
- Municipal Waste
- Commercial & Industrial
- Production

Refinery

Chemical Recycling

ReOil

Mechanical Recycling

Product Manufacturer

Energy Recovery

Reuse & Repair

Use

Plastic Production
The development of the ReOil® technology was started already some time ago

### ReOil® Development

- Start of research activities
- Pilot Plant - ReOil 5
- Patent applied
- Pilot Plant - ReOil 100

#### Timeline:
- 2009
- 2013
- 2015
- 2017

### ReOil® Technology

- Continuous process in a tubular reactor
- 2-step process
  - PCP Melting at 200°C
  - Depolymerisation at >390°C
- A solvent reduces the viscosity & improves the heat transfer

---

Pilot Plant ReOil 5 in the refinery Schwechat

ReOil® products
Thermal Cracking (3)

Plastics → Melting → Dissolving → Cracking → Evaporation → Product

Solvent → Melting → Dissolving → Cracking → Evaporation → Product

POS Flake → Melting → Dissolving → Cracking → Evaporation → Product

Solvent → Melting → Dissolving → Cracking → Evaporation → Product

Light Stripper product gaseous/liquid

Heavy Stripper product Liquid

Flash product liquid
Process implementation

Our ReOil-process converts used plastics under moderate pressure and under normal refinery operating temperatures into so-called R-crude

Plastics → Melting
Solvent → Dissolving → Cracking → Separation

Intermediate fractions:
- gaseous
- light
- medium
- heavy

Approx. yield structure

1) R-crude = recycled crude

R-crude → Refinery
Process implementation

The conversion factor is around

1kg = 1l
Kontakt
OMV Downstream
Mannswörtherstr. 23
2320 Schwechat
wolfgang.hofer@omv.com
www.omv.com
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.

© 2017 OMV Aktiengesellschaft, all rights reserved, no reproduction without our explicit consent.