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# INTRODUCTION TO CHEMICAL RECYCLING



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# Who is Valorplast ?

## A strong and visionary shareholding since 1993

- Non Profit policy
- Historical partner of EPR
- Guarantee of recovery

### Plastics Europe

- European professional association representing producers of plastics

### ELIPSO

- Professional union representing plastic and flexible packaging industry

### Fédération de la Plasturgie

- Organization representing French plastics industry



Created to meet a major goal :  
**increase the recycling rate of household plastic packaging in France**



**2018**

**57 %** OF FRENCH MUNICIPALITIES  
UNDER CONTRACT

**133** SORTING CENTERS

**710** MONTHLY TRANSPORTS

**30** INDUSTRIAL RECYCLERS WITH  
LONG TERM RELATIONSHIP

**151 400** TONS OF HOUSEHOLD PLASTIC  
PACKAGING RECYCLED (50%)

**75 %** RECYCLED IN FRANCE  
25 % IN EUROPE  
NO EXPORT



# Why chemical recycling ?

## AMBITIOUS TARGETS :

- current european plastic recycling rate : 28%
- target : 55 % of recycling by 2030

→ Need to work with feedstock more difficult to recycle

## LIMITS OF MECHANICAL RECYCLING :

- difficulties to handle multilayers products
- deinking / discoloration of plastics
- food contact for most polymers (PP, PE, PS)
- desodorisation of recycled plastics
- removal of forbidden substances (REACH, POP, RoHS)

→ Need to find new processes to solve these issues

→ **CHEMICAL RECYCLING MAY BE ONE SOLUTION**



## Definition – ISO 15270

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### **MECHANICAL RECYCLING :**

**refers to processes which involve the reprocessing of plastic by melting, shredding or granulation**

**without significantly changing the chemical structure**

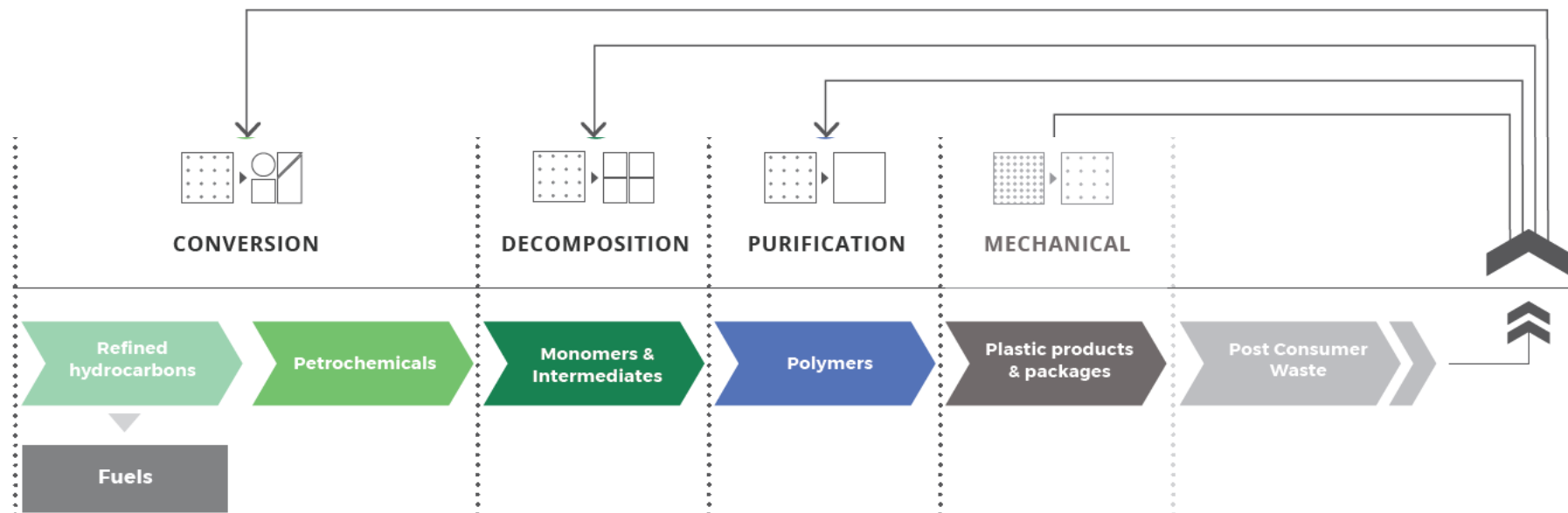
### **CHEMICAL RECYCLING :**

**Conversion to monomer or production of new raw materials by changing the chemical structure of plastics waste through cracking, gasification or depolymerization**

**excluding energy recovery and incineration !**



# Process categories



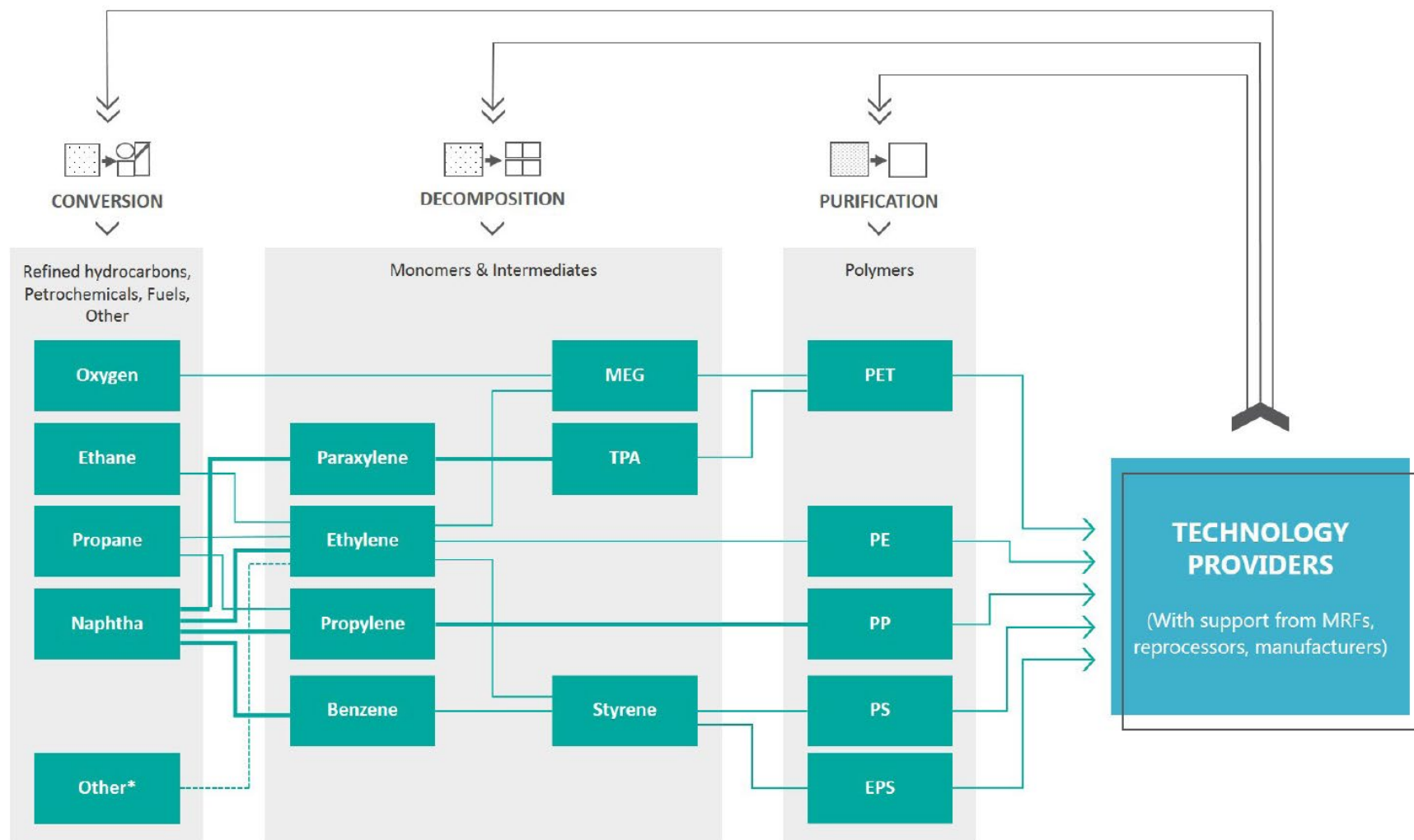
**PURIFICATION :** → involves dissolving plastic in a solvent  
→ applicable for PVC, PS, PE, PP

**DECOMPOSITION (or depolymerisation) :**  
→ breaking molecular bonds to recover monomers  
→ PET, PU, PA, PC, PEF

**CONVERSION :** → thermal depolymerisation and cracking (pyrolysis and gasification)  
→ breaking further molecular bonds (liquids or gaseous hydrocarbons)

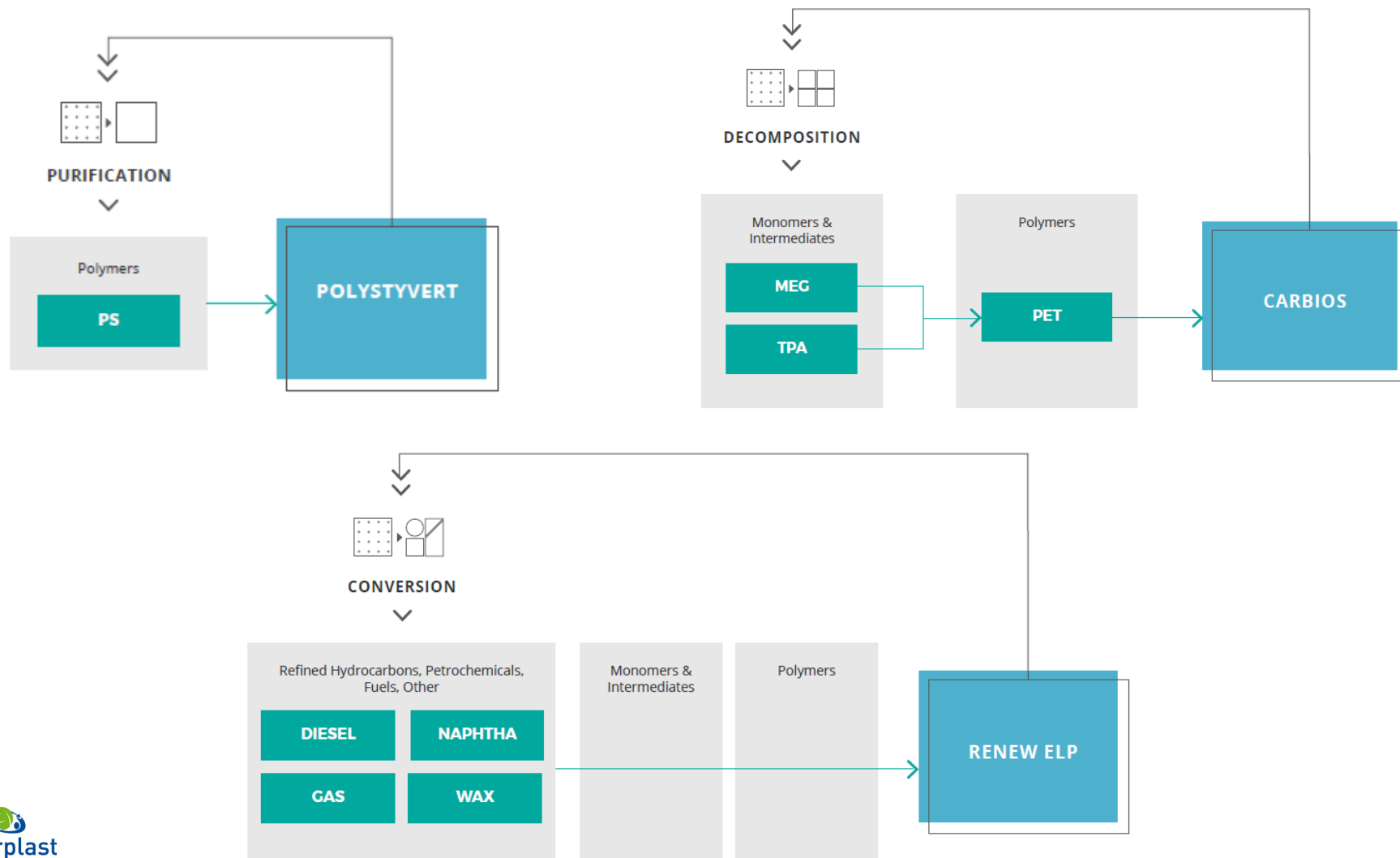


# What we can get ?





# Few examples







## CONVERSION



## DECOMPOSITION



## PURIFICATION

Refined hydrocarbons

Petrochemicals

Monomers & intermediates

Polymers

Fuels

30

14

21

REFINED HYDROCARBONS,  
PETROCHEMICALS, FUELS, OTHERS

+ Agile Process Chemicals LLP  
+ Agilyx  
+ Anhui Oursun  
+ Polycycl  
+ Pyrowave  
+ Reclaimed EcoEnergy

MONOMERS &  
INTERMEDIATES

+ Agilyx  
+ Axens  
+ Biocollection

POLYMERS

+ APK  
+ Aquafil  
+ Cadel Deinking

**Pilot :**

**13**

**Upscaling to industrial level :**

**28**

**Being implemented in various parts of the world :**

**8**

+ Fulcrum BioEnergy  
+ Global Electric Electronic Processing  
+ Golden Renewable Energy  
+ GreenMantra Technologies  
+ Illinois Sustainable Technology Center  
+ JBI Plastic2Oil  
+ Jeplan  
+ Klean Industries  
+ New Hope Energy  
+ Nexus Fuels  
+ Plastic Energy

+ The Pennsylvania State University  
+ Vadxx

+ Loop Industries  
+ perPETual  
+ Pyrowave  
+ Tyton BioSciences  
+ University of Massachusetts-Lowell  
+ University of Portsmouth & U.S. Department of Energy's National Renewable Energy Laboratory

+ Illinois Sustainable Technology Center  
+ Natureworks  
+ Next Generation  
+ Polystyvert  
+ PureCycle Technologies  
+ Resinate Materials Group  
+ RESYNTEX  
+ SABIC Innovative Plastics  
+ TRASH2CASH  
+ University of Massachusetts-Lowell  
+ University of Ulsan  
+ Worn Again Technologies



## Points to clarify

- **What type of waste can be accepted ?**
  - required level of quality and preparation
  - No miracle : “garbage in, garbage out”
- **Will quality be equivalent to virgin material ?**
  - Importance of purification step
- **Are these processes sustainable ?**
  - Energy consumption and environmental impacts
  - output cost in line with market level ?
- **Time to market ?      From lab to plant..... from kilo to tons of material**
- **Plant size ?                      minimum / optimum capacity**  
**Local / national / international sourcing**
- **Regulatory situation ?**
  - will chemical recycling count for recycling rate ? traceability ?

# Thank you

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