

# Recycling the Unrecyclable

Using Cat-HTR™ to Recycle All Plastic Waste

NEPIC Meet the Members 2020

Kim West

# 1. Plastic Pollution & Recycling Rates

- Annually, around **350 million tonnes** of global plastic is generated (*Plastics Europe 2018*)
- Of all global packaging material created, **only 14% of it is collected for recycling** (*Ellen McArthur Foundation*)
- By 2040, it is expected that plastic production will double to **600 million tonnes** annually (*McKinsey & Company*)
- Approximately **8 million tonnes of plastic** enters the world's oceans annually (*Ellen McArthur Foundation*)



## 2. Plastic - a Wasted Resource

- The lost resource of combined plastic waste is valued at over **\$80 billion per year** (*Ellen McArthur Foundation*)
- A number of plastics, such as flexible, multi-layer films, are **considered 'unrecyclable'** and are destined for landfill, incineration and leakage into the environment
- By relying solely on mechanical recycling, the opportunity for **capturing value** from all waste plastic is lost and a circular economy can not be achieved



### 3. What is Chemical / Advanced Recycling?

Chemical Recycling, (or Advanced Recycling), is currently not defined in any EU Regulation.

According to Chemical Recycling Europe (CRE), Chemical Recycling is defined as:

- *any reprocessing technology that directly affects either the formulation of the polymeric waste or the polymer itself, and*
- *converts them into chemical substances and/or products whether for the original or other purposes, excluding energy recovery.*

Critically:

- Process changes the polymer formulation or polymer
- Wide potential for use in a range of products
- End-product is 'a recyclate' – **not** used as a fuel.
- **Conversion** to fuel / energy is termed '**recovery**'.

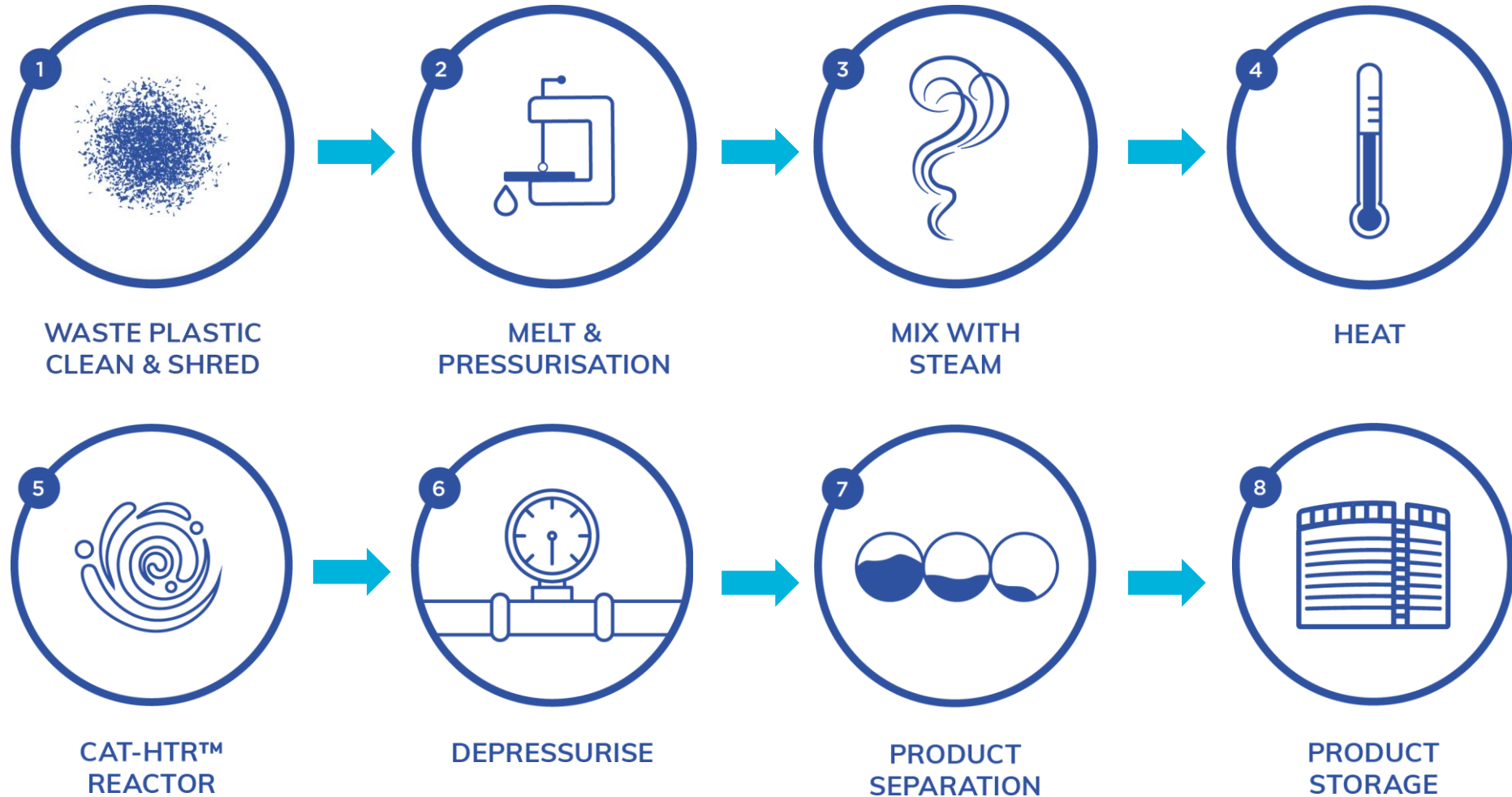
## 4. Chemical Recycling with Cat-HTR™

- Cat-HTR™ is a HydroThermal Liquefaction (or Upgrading) technology, using supercritical water to convert plastics into shorter-chain, stable hydrocarbons, for re-use in feedstocks for the manufacture of new plastic and other materials.
- *The use of supercritical water provides:*
  - An organic solvent
  - A source of hydrogen to complete the broken chemical chains – no external hydrogen is required
  - A means of rapid heating that avoids excessive temperatures that would lead to excessive cracking
  - The ability to scale the process

**Typically, up to 85% of the mass of plastic is converted to liquid hydrocarbons that could be used to make new plastics or other products.**



## 5. The Cat-HTR™ Process





# 6. Feedstock Materials

- PE (HE/LD), PP, (polyolefins)
- PET, PS, ABS, polyamides (nylon) and other plastics types 1-7
- PVC is limited, rejected if possible (type 3)
- End of life post-consumer plastics (films and rigids)
- Agricultural, MRF and AD residual material
- Material which cannot be mechanically recycled
- Able to process mixed plastic streams (films and rigids) without the need for segregation
- Able to process contaminated materials (organics & paper etc)
- No need to pre-dry feedstock
- Able to process multi-layered, complex plastic materials

**The current option for these streams is incineration or landfill**

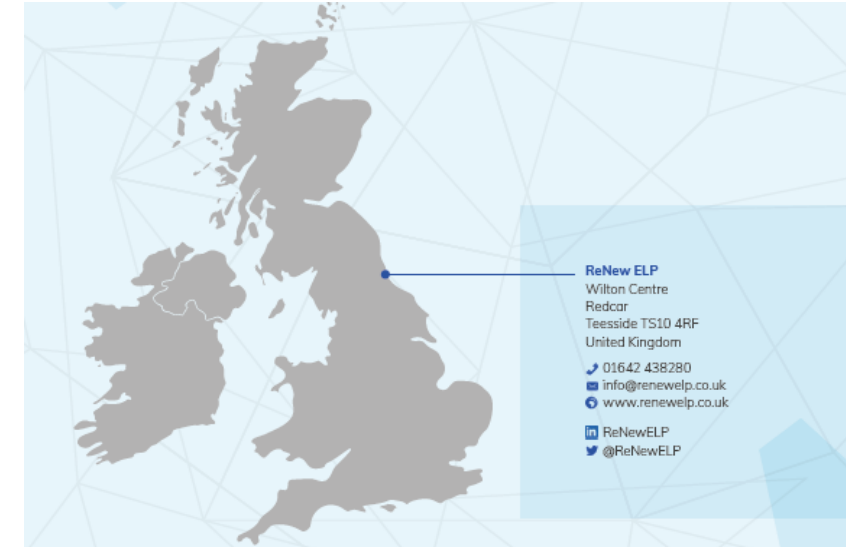


# 7. ReNew ELP

The first commercial-scale Cat-HTR™ to be developed in the world is ReNew ELP, based at Wilton, North East England. The site comprises 4 x 20,000 lines; 80,000tpa waste plastic capacity on completion. In October 2020, we announced a £4.42million grant award from Innovate UK, the UK's innovation agency.

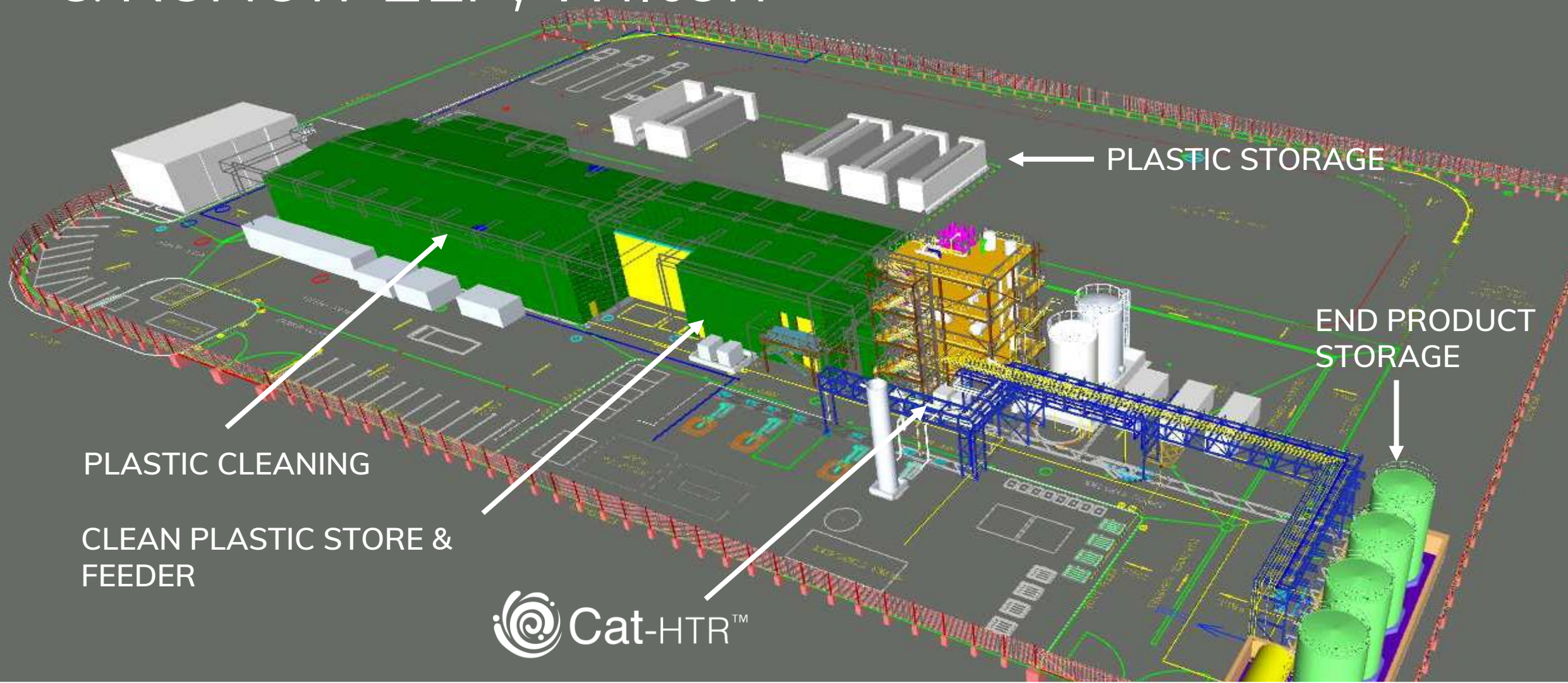


- The grant comes through the Government's Industrial Strategy Challenge Fund's Smart Sustainable Plastic Packaging programme, aiming to drive economic growth through new technology.
- It recognises the commercial-scale feasibility of the technology and potential of the chemical recycling sector to help meet ambitious plastic recycling targets.
- The project has commenced, with initial construction scheduled for Q1, 2021.





## 8. ReNew ELP, Wilton



# 9. Hydrocarbon Products

- As the high-pressure system is depressurised and exits the Cat-HTR™ reactors, the majority of liquids flash off as vapour.
  - This vapour is then cooled in a distillation column and the condensed liquids are separated on boiling range to produce valuable hydrocarbon liquids and oils;
1. **Naphtha oil** - petrochemical feedstock for new plastic production
  2. **Distillate gas oil** - petrochemical feedstock, industrial solvent, steam cracker feedstock for new plastic production
  3. **Heavy gas oil** - petrochemical feedstock, base oil and wax production, hydrocracker feedstock
  4. **Heavy wax residue** - asphalt production, wax and base oils and coker feedstock

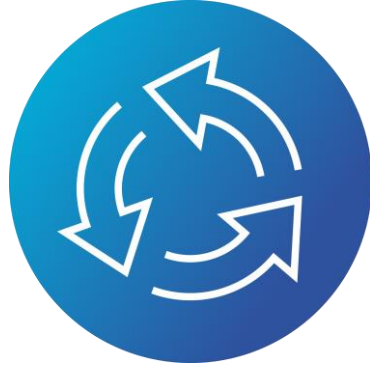


All of the products are being currently being registered under REACH to allow export into the EU.

# 10. Benefits



A key benefit of the Cat-HTR™ technology is its ability to recycle multi-layer, flexible plastic materials such as films, and pots, tubs and trays (PTT) without need for segregation.



There are no limits to the number of times that plastic can be recycled using Cat-HTR™.



New materials made from ReNew ELP's recycled feedstock are suitable for food-contact packaging materials.



Cat-HTR™ is a complementary solution to traditional mechanical recycling – not a replacement

# 11. Environmental Impact



As Cat-HTR™ can process all plastic types, this increases the scope of plastics recycling.



Cat-HTR™ diverts plastic away from landfill, incineration and environmental pollution



The products from Cat-HTR™ are sustainable and help reduce the dependency on fossil feedstock



Approx. 120,000 tonne annual CO<sub>2</sub> emissions saving once site is fully developed



## 12. Summary

- ReNew ELP are developing the world's first Cat-HTR™ recycling facility, based at Wilton, in Teesside.
- Cat-HTR™ is a technology that uses water and heat to convert the plastics considered 'unrecyclable' back into the chemicals and oils from which they were made, for re-use in new plastics products – there is no limit to the number of times plastic can be recycled with this technology. It can recycle all plastic types, including flexible packaging materials.
- ReNew ELP is developing an 80,000tpa site, comprising four lines.
- Build commences early Q1 2021 with first 20,000 line, for operation mid 2022. Remaining three lines will follow, to total 80,000tpa
- This will place Teesside on the map as global frontrunners in plastic recycling, bringing industry and jobs to the area.





Many Thanks