Conversion of consumer waste plastic into new plastics

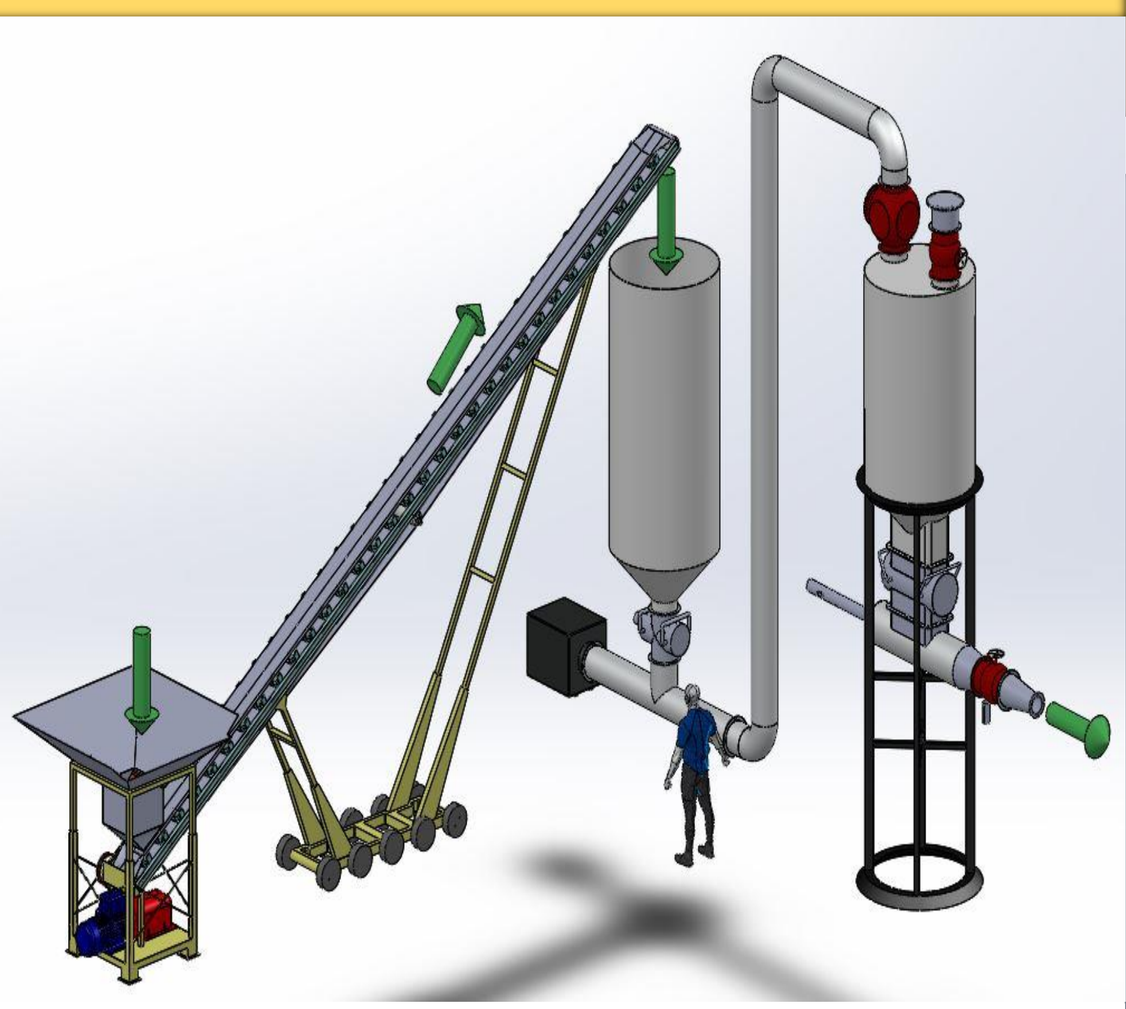
INTRODUCTION

Plastics are an integral part of society with extensive and innumerable applications. However, their low biodegradability has led to an accumulated environmental nuisance large enough to warrant global attention. Using waste plastics as fuel contributes to greenhouse gas emissions and causes destruction of a non-renewable resource. A significantly better option is closed-loop recycling via pyrolysis to produce naphtha, a chemical feedstock for use in plastic production, which achieves a circular economy.

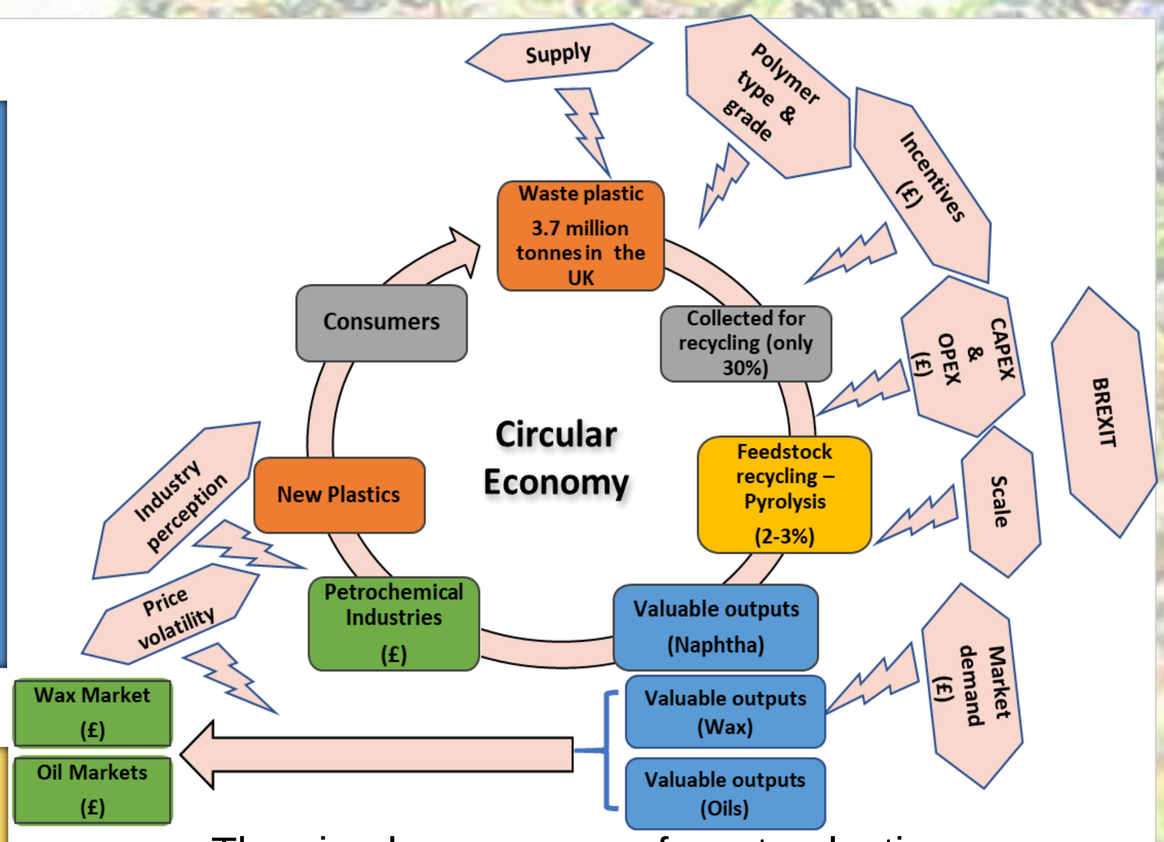
AIMS AND OBJECTIVES

In partnership with Recycling Technologies Ltd. this study evaluates three key aspects of commercialising closed-loop recycling via pyrolysis:

- Best available reactor technology for large scale naphtha production from consumer plastic waste.
- Safe and continuous delivery of large volumes of low density mixed plastic feedstock into the reactor.
- Economic assessment of the potential profitability and opportunity cost of naphtha production.



Proposed feeding system



The circular economy of waste plastic

APPROACH

- Literature review of plastic pyrolysis, evaluation of plastic feedstocks and comparison of reactor technologies.
- Literature review of biomass industry feeding systems and design of a novel system for mixed plastic waste.
- Identification of underlying factors in closed-loop recycling economics, comparison of output product profitability and scale of production.

FINDINGS AND FUTURE CONSIDERATIONS

- Polypropylene and polystyrene are the best feedstocks for naphtha production. Conical spouted bed reactors are currently the most suitable technology due to avoidance of defluidisation. Microwave assisted pyrolysis is extremely promising but requires significant future research.
- Existing feeding systems must be designed to the special material properties of waste plastics. Potential solutions are screw feeders with variable pitch and tapered shaft diameter or piston feeders in combination with a rotary valve.
- The economics of feedstock recycling is yet to be fully structured and the profitability of naphtha production is susceptible to scale, quality, demand, price volatility etc. Though closed-loop recycling of waste plastics is desirable, output flexibility spreads risks for businesses.

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