CLAIMS

What is claimed is:

1. A continuous process for converting waste plastic into recycle for polyethylene polymerization comprising:

(a) selecting waste plastics containing polyethylene and/or polypropylene;

(b) passing the waste plastics from (a) through a pyrolysis reactor to thermally crack at least a portion of the waste plastics and produce a pyrolyzed effluent;

(c) separating the pyrolyzed effluent into offgas, char and a pyrolysis oil comprising a naphtha/diesel fraction and a heavy fraction, and wax;

(d) passing the pyrolysis oil and wax from (c) to a refinery FCC unit;

(e) recovering a liquid petroleum gas C_3-C_5 olefin/paraffin mixture fraction from the FCC unit;

(f) passing the liquid petroleum gas C_3-C_5 olefin/paraffin mixture fraction to a refinery alkylation unit;

(g) recovering a propane fraction and a butane fraction from the alkylation unit; and

(h) passing the propane fraction, or butane fraction or combination of propane and butane fraction to a steam cracker for ethylene production.

2. The process of claim 1, wherein a gasoline and heavy fraction is recovered from the refinery FCC unit.

3. The process of claim 1, wherein an alkylate gasoline fraction is recovered from the refinery alkylation unit.

4. The process of claim 1, wherein ethylene produced in (h) is subsequently polymerized.

5. The process of claim 4, wherein polyethylene products are prepared from the polymerized ethylene.

6. The process of claim 2, wherein the gasoline fraction recovered from the refinery FCC unit is combined with an alkylate gasoline fraction recovered from the alkylation unit.

7. The process of claim 1, wherein the gasoline produced by the FCC and alkylation units is increased with recycled pyrolysis oil and wax.

8. The process of claim 1, wherein at least some contaminants are removed from the recovered pyrolysis oil of step (c) before the oil is passed to the FCC unit in (d).

9. The process of claim 1, wherein the waste plastics selected in (a) are from plastics classification group 2, 4, and/or 5.

10. The process of claim 1, wherein the volume flow of pyrolysis oil and wax to the refinery FCC unit comprises up to 50 volume % of the total hydrocarbon feed to the FCC unit.

11. The process of claim 10, wherein the volume flow of pyrolysis flow to the refinery FCC unit is up to 20 volume % of the total feed to the FCC unit.

12. A continuous process for converting waste plastic into recycle for polyethylene polymerization comprising:

(a) selecting waste plastics containing polyethylene and/or polypropylene;

(b) passing the waste plastics from (a) through a pyrolysis reactor to thermally crack at least a portion of the waste plastics and produce a pyrolyzed effluent;

(c) separating the pyrolyzed effluent into offgas, char and a pyrolysis oil comprising a naphtha/diesel fraction and a heavy fraction;

(d) passing the pyrolysis oil and wax from (c) to a refinery FCC unit;

(e) recovering a liquid petroleum gas C_3-C_5 olefin/paraffin mixture fraction from the FCC unit;

(f) passing the liquid petroleum gas C_3-C_5 olefin/paraffin mixture fraction to a refinery alkylation unit;

(g) recovering a naphtha fraction from the alkylation unit; and

(h) passing the naphtha fraction to a steam cracker for ethylene production.

13. The process of claim 12, wherein a gasoline and heavy fraction is recovered from the refinery FCC unit.

14. The process of claim 12, wherein an alkylate gasoline fraction is recovered from the refinery alkylation unit.

15. The process of claim 13, wherein the gasoline fraction recovered from the refinery FCC unit is combined with an alkylate gasoline fraction recovered from the alkylation unit.

16. The process of claim 12, wherein at least some contaminants are removed from the recovered pyrolysis oil of step (c) before the oil is passed to the FCC unit in (d).

17. The process of claim 12, wherein the waste plastics selected in (a) are from plastics classification group 2, 4, and/or 5.

18. The process of claim 15, wherein the amount of gasoline produced by the FCC and Alkylation units is increased with recycled pyrolysis oil.

19. The process of claim 12, wherein ethylene produced in (h) is subsequently polymerized.

20. The process of claim 19, wherein polyethylene products are prepared from the polymerized ethylene.

21. The process of claim 12, wherein the volume flow of pyrolysis oil and wax to the refinery FCC unit comprises up to 50 volume % of the total hydrocarbon feed to the FCC unit.

22. The process of claim 21, wherein the volume flow of pyrolysis flow to the refinery FCC unit is up to 20 volume % of the total feed to the FCC unit.

23. A continuous process for converting waste plastic into recycle for polyethylene polymerization comprising:

(a) selecting waste plastics containing polyethylene and/or polypropylene;

(b) passing the waste plastics from (a) through a pyrolysis reactor to thermally crack at least a portion of the waste plastics and produce a pyrolyzed effluent;

(c) separating the pyrolyzed effluent into offgas, char and a pyrolysis oil comprising a naphtha/diesel fraction and a heavy fraction;

(d) passing the pyrolysis oil from to a refinery FCC unit;

(e) recovering a liquid petroleum gas C_3 olefin/paraffin mixture fraction from the FCC unit;

(f) passing the C_3 olefin/paraffin fraction to a steam cracker for ethylene production.

24. A process for converting waste plastic into chemicals useful in preparing polyethylene comprising:

(a) selecting waste plastics containing polyethylene and/or polypropylene;

(b) pyrolyzing the waste plastics and recovering a pyrolysis oil comprising a naphtha/diesel fraction and a heavy fraction, and wax;

(c) passing the pyrolysis oil and wax to a refinery FCC unit wherein the volume flow of pyrolysis oil and wax to the refinery FCC unit comprises up to 50 volume % of the total hydrocarbon feed to the FCC unit;

(d) recovering a C_3-C_5 olefin/paraffin mixture from the FCC unit; and

(e) passing the C_3-C_5 olefin/paraffin mixture to an alkylation unit.