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 polyolefin waste and produce a pyrolyzed effluent;

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

(d) passing the pyrolysis oil and wax from (c) to a refinery FCC unit, with the volume flow of the pyrolysis oil and wax to the FCC unit comprising up to but no more than 50 volume % of total hydrocarbon flow to the refinery FCC unit;

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

(f) passing the liquid petroleum gas C_3 olefin/paraffin mixture fraction to a steam cracker for ethylene production; and

(g) recovering a C_4 stream from the FCC unit and passing same to a gasoline blending pool or for further upgrading into gasoline.

2. The process of claim 1, wherein the pyrolysis oil and wax are first passed to a FCC feed pretreater unit before the refinery FCC unit, wherein the FCC feed pretreater comprises bimetallic NiMo or CoMo catalyst.

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

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

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

6 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).

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

8. A continuous process for converting waste plastic 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 polyolefin waste 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 to a refinery FCC unit, with the volume flow of the pyrolysis oil to the FCC unit comprising up to but no more than 50 volume % of total hydrocarbon flow to the refinery FCC unit;

(e) recovering a liquid petroleum gas C_4 olefin/paraffin mixture fraction comprising butanes and butenes from the FCC unit and;

(f) passing the liquid petroleum gas C_4 olefin/paraffin mixture fraction to an alkylation unit;

9. The process of claim 8, wherein a gasoline and heavy fraction is recovered from the refinery FCC unit.

10. The process of claim 8, wherein an alkylate gasoline fraction is recovered from the refinery alkylation unit.

11. The process of claim 9, wherein the gasoline recovered from the refinery FCC unit is combined with an alkylate gasoline fraction recovered from the alkylation unit.

12. The process of claim 8, 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).

13. The process of claim 18 wherein the waste plastics selected in (a) are from plastics classification group 2, 4, and/or 5.

14. The process of claim 11, wherein the amount of gasoline produced by the FCC and alkylation units is increased with recycled pyrolysis oil.

15. The process of claim 8, further comprising collecting a C_3 olefin/paraffin mixture fraction from the FCC unit and passing the fraction to a steam cracker for ethylene production.

16. 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 polyolefin waste and produce a pyrolyzed effluent;

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

(d) passing the pyrolysis oil and wax from (c) to a refinery FCC feed pretreater unit, wherein the FCC feed pretreater comprises a bimetallic NiMo or CoMo catalyst;

(e) recovering a heavy fraction from the FCC feed pretreater unit and passing it to a refinery FCC unit, with the volume flow of the pyrolysis oil and wax to the FCC unit comprising up to but no more than 50 volume % of total hydrocarbon flow to the refinery FCC unit;

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

(g) passing the C_3 mixture to a steam cracker for ethylene production.

17. The process of claim 16, wherein a gasoline, C_4 stream, and a heavy fraction is recovered from the refinery FCC unit.

18. The process of claim 17, wherein the gasoline recovered from the refinery FCC unit is sent to a gasoline blending pool.

19. The process of claim 17, wherein the heavy fraction and C_4 stream recovered from the refinery FCC unit are sent to refinery units for upgrading into clean gasoline and diesel.

20. The process of claim 16, wherein sulfur, nitrogen, phosphorus silica, dienes, and metal contaminants are removed from the recovered pyrolysis oil of step (c) by the FCC feed pretreater unit before the oil and wax is passed to the FCC unit in (e).

21. The process of claim 16, wherein the waste plastics selected in (a) are from plastics classification group 2, 4, and/or 5.

22. The process of claim 16, wherein the ethylene produced in (g) is subsequently polymerized.

23. The process of claim 17, wherein the amount of gasoline produced by the FCC unit is increased with recycled pyrolysis oil.