CLAIMS

1. A system for oil separation and upgrading, the system comprising:

an inlet stream comprising crude oil;

an atmospheric distillation unit (ADU), the ADU in fluid communication with the inlet stream, and operable to separate the inlet stream into an ADU tops stream and an ADU middle stream, the ADU tops stream comprising naphtha, and the ADU middle stream comprising diesel;

a naphtha hydrotreating unit (NHT), the NHT in fluid communication with the ADU and operable to treat with hydrogen the naphtha in the ADU tops stream;

a naphtha reforming unit (NREF), the NREF in fluid communication with the NHT and operable to reform a hydrotreated naphtha stream produced by the NHT, and the NREF further operable to produce separate hydrogen and reformate streams;

an aromatics complex (ARC), the ARC in fluid communication with the NREF and operable to receive the reformate stream produced by the NREF, and the ARC further operable to separate the reformate stream into a gasoline pool stream, an aromatics stream, and an aromatic bottoms stream, wherein the aromatic bottoms stream is in fluid communication with the inlet stream comprising crude oil; and

a diesel hydrotreating unit (DHT), the DHT in fluid communication with a diesel inlet stream, and the diesel inlet stream comprising fluid flow from the ADU middle stream.

2. The system according to claim 1, wherein the aromatic bottoms stream comprises aromatic compounds with boiling points in a range of 100 °C to 350 °C.

3. The system according to either of claims 1 or 2, wherein benzene content of the gasoline pool stream is less than 3 % by volume.

4. The system according to either of claims 1 or 2, wherein benzene content of the gasoline pool stream is less than 1 % by volume.

5. A system for oil separation and upgrading, the system comprising:

an inlet stream comprising crude oil;

an atmospheric distillation unit (ADU), the ADU in fluid communication with the inlet stream, and operable to separate the inlet stream into an ADU tops stream and an ADU middle stream, the ADU tops stream comprising naphtha, and the ADU middle stream comprising distillate;

a naphtha hydrotreating unit (NHT), the NHT in fluid communication with the ADU and operable to treat with hydrogen the naphtha in the ADU tops stream;

a naphtha reforming unit (NREF), the NREF in fluid communication with the NHT and operable to reform a hydrotreated naphtha stream produced by the NHT, and the NREF further operable to produce separate hydrogen and reformate streams;

an aromatics complex (ARC), the ARC in fluid communication with the NREF and operable to receive the reformate stream produced by the NREF, and the ARC further operable to separate the reformate stream into a gasoline pool stream, an aromatics stream, and an ARC aromatic bottoms stream;

a secondary ADU in fluid communication with the ARC aromatic bottoms stream and the ADU middle stream, wherein the secondary ADU is operable to separate the aromatic bottoms stream into a gasoline stream and a stream comprising heavy aromatics, wherein the stream comprising heavy aromatics is in fluid communication with the ADU middle stream; and

a kerosene hydrofinishing unit (KHT), the KHT in fluid communication with a distillate inlet stream, the distillate inlet stream comprising fluid flow from the ADU middle stream and the stream comprising heavy aromatics, and the KHT operable to treat the distillate inlet stream with hydrogen.

6. The system according to claim 5, wherein the gasoline stream is used as a gasoline blending component without any further treatment.

7. The system according to either of claims 5 or 6, wherein the KHT comprises a first stage sour hydrotreating section, a second stage sweet aromatic saturation and hydrocracking section with intermediate separation, and a fractionation system.

8. The system according to claim 5, wherein kerosene is produced and the kerosene is suitable for dual purpose kerosene use according to heating and jet fuel requirements.

9. The system according to claim 5, wherein the aromatic bottoms stream comprises aromatic compounds with boiling points in the range of 100 °C to 350 °C.

10. A method for oil separation and upgrading, the method comprising the steps of:

supplying an inlet stream comprising crude oil;

separating the inlet stream into a tops stream and a middle stream, the tops stream comprising naphtha, and the middle stream comprising diesel;

treating with hydrogen the naphtha in the tops stream to produce a hydrotreated naphtha stream;

reforming the hydrotreated naphtha stream;

producing separate hydrogen and reformate streams;

separating the reformate stream into a gasoline pool stream, an aromatics stream, and an aromatic bottoms stream; and

recycling the aromatic bottoms stream to the inlet stream.

11. The method according to claim 10, further comprising the step of:

treating with hydrogen the middle stream comprising diesel.

12. A method for oil separation and upgrading, the method comprising:

supplying an inlet stream comprising crude oil;

separating the inlet stream into a tops stream and a middle stream, the tops stream comprising naphtha, and the middle stream comprising diesel;

treating with hydrogen the naphtha in the tops stream to produce a hydrotreated naphtha stream;

reforming the hydrotreated naphtha stream;

producing separate hydrogen and reformate streams;

separating the reformate stream into a gasoline pool stream, an aromatics stream, and an aromatic bottoms stream;

separating the aromatic bottoms stream into a gasoline stream and a stream comprising hydrocarbons boiling in a diesel-boiling-point range;

recycling the stream comprising hydrocarbons boiling in a diesel-boiling-point range to the middle stream comprising diesel; and

treating the middle stream comprising diesel and the stream comprising hydrocarbons boiling in a diesel-boiling-point range with hydrogen.

13. A method for oil separation and upgrading, the method comprising the steps of:

supplying an inlet stream comprising crude oil;

separating the inlet stream into a tops stream and a middle stream, the tops stream comprising naphtha, and the middle stream comprising distillate;

treating with hydrogen the naphtha in the tops stream to produce a hydrotreated naphtha stream;

reforming the hydrotreated naphtha stream to produce separate hydrogen and reformate streams;

separating the reformate stream into a gasoline pool stream, an aromatics stream, and an aromatic bottoms stream;

separating the aromatic bottoms stream into a gasoline stream and a stream comprising heavy aromatics;

combining the middle stream comprising distillate and the stream comprising heavy aromatics; and

treating the middle stream comprising distillate and the stream comprising heavy aromatics with hydrogen.

14. A system for oil separation and upgrading, the system comprising:

an inlet stream comprising crude oil;

an atmospheric distillation unit (ADU), the ADU in fluid communication with the inlet stream, and operable to separate the inlet stream into an ADU tops stream and an ADU middle stream, the ADU tops stream comprising naphtha, and the ADU middle stream comprising distillate;

a naphtha hydrotreating unit (NHT), the NHT in fluid communication with the ADU and operable to treat with hydrogen the naphtha in the ADU tops stream;

a naphtha reforming unit (NREF), the NREF in fluid communication with the NHT and operable to reform a hydrotreated naphtha stream produced by the NHT, and the NREF further operable to produce separate hydrogen and reformate streams;

an aromatics complex (ARC), the ARC in fluid communication with the NREF and operable to receive the reformate stream produced by the NREF, and the ARC further operable to separate the reformate stream into a gasoline pool stream, an aromatics stream, and an aromatic bottoms stream, wherein the aromatic bottoms stream is in fluid communication with the inlet stream comprising crude oil; and

a kerosene hydrofinishing unit (KHT), the KHT in fluid communication with a distillate inlet stream, the distillate inlet stream comprising fluid flow from the ADU middle stream and comprising heavy aromatics from the aromatic bottoms stream, and the KHT operable to treat the distillate inlet stream with hydrogen.

15. A method for oil separation and upgrading, the method comprising the steps of:

supplying an inlet stream comprising crude oil;

separating the inlet stream into a tops stream and a middle stream, the tops stream comprising naphtha, and the middle stream comprising distillate;

treating with hydrogen the naphtha in the tops stream to produce a hydrotreated naphtha stream;

reforming the hydrotreated naphtha stream to produce separate hydrogen and reformate streams;

separating the reformate stream into a gasoline pool stream, an aromatics stream, and an aromatic bottoms stream; and

recycling the aromatic bottoms stream to the inlet stream.

16. The method according to claim 15, further comprising the step of:
treating with hydrogen the middle stream comprising distillate.