

Claims

1. A method, comprising:
- operating an integrated production plant system comprising, at one production site:
 - at least two plants of different kinds selected from:
 - a) a renewable paraffinic fuel plant to produce a renewable paraffinic fuel as a main product in a renewable paraffinic fuel process,
 - b) a renewable fatty acid alkyl ester (FAAE) fuel plant to produce a renewable FAAE fuel as a main product in a renewable FAAE fuel process,
 - c) a renewable base oil plant to produce a renewable base oil as a main product in a renewable base oil process, and
 - d) a renewable chemical plant to produce a renewable chemical as a main product in a renewable chemical process; and
 - a storage unit for a common renewable system feed;
 - providing each of the renewable processes with a respective renewable process feed, wherein at least part of each renewable process feed originates from a common renewable system feed;
 - processing the respective renewable process feed in said renewable process to obtain a respective renewable product flow;
 - altering i) the renewable process feed to at least one of the renewable processes by directing at least part of the renewable process feed of at least one of the processes to another of said processes and/or ii) the renewable product flow of at least one of the renewable processes by directing at least part of the renewable product flow of at least one of the processes to another of said processes for use as the respective renewable process feed.
2. The method of claim 1, wherein the common renewable system feed and/or the renewable process feed comprises one or more of fatty and/or resin acids, fatty acid glycerides, and thermally liquefied renewable and/or recycled organic material.
3. The method of claim 1 or 2, wherein the common renewable system feed and/or the renewable process feed comprises one or more of vegetable oils such as rapeseed oil, canola oil, soybean oil, coconut oil, sunflower oil, palm oil, palm kernel oil, peanut oil, linseed oil, sesame oil, maize oil, poppy seed oil, cottonseed oil, soy oil, tall oil,

- corn oil, castor oil, jatropha oil, jojoba oil, olive oil, flaxseed oil, camelina oil, safflower oil, babassu oil, Brassica species seed oil, especially Brassica carinata seed oil, and rice bran oil, or fractions or residues of said vegetable oils such as palm olein, palm stearin, palm fatty acid distillate (PFAD), purified tall oil, tall oil fatty acids, tall oil resin acids, tall oil unsaponifiables, tall oil pitch (TOP), and used cooking oil of vegetable origin; animal fats such as tallow, lard, yellow grease, brown grease, fish fat, poultry fat, and used cooking oil of animal origin; microbial oils, such as algal lipids, fungal lipids and bacterial lipids; and thermally liquefied renewable organic material, such as pyrolyzed, hydrothermally liquefied, and/or solvothermally liquefied solid or fluid biomass.
4. The method of any preceding claim, wherein the integrated production plant system comprises:
- at least one renewable paraffinic fuel plant and at least one renewable FAAE fuel plant; or
 - at least one renewable paraffinic fuel plant and at least one renewable chemical plant; or
 - at least one renewable paraffinic fuel plant, at least one renewable FAAE fuel plant and at least one renewable chemical plant; or
 - at least one renewable paraffinic fuel plant, and at least one renewable base oil plant; or
 - at least one renewable paraffinic fuel plant, at least one renewable base oil plant, and at least one renewable FAAE fuel plant; or
 - at least one renewable paraffinic fuel plant, at least one renewable base oil plant, and at least one renewable chemical plant; or
 - at least one renewable paraffinic fuel plant, at least one renewable base oil plant, at least one renewable FAAE fuel plant, and at least one renewable chemical plant.
5. The method of any preceding claim, wherein the renewable paraffinic fuel process of the renewable paraffinic fuel plant comprises hydroprocessing the renewable process feed, and fractionating the hydroprocessing effluent to obtain renewable paraffinic fuel as the main product, preferably renewable diesel, kerosene, gasoline and/or naphtha, more preferably diesel range paraffinic hydrocarbons meeting EN 590 requirements for automotive diesel fuel and/or kerosene range paraffinic hydrocarbons meeting ASTM D7566-16b, Annex A2, requirements for aviation turbine fuel.

6. The method of any preceding claim, wherein the renewable FAAE fuel process of the renewable FAAE fuel plant comprises (trans)esterifying a renewable process feed comprising fatty acids and/or fatty acid glycerides in the presence of an alkyl alcohol, preferably C1 – C4 alkyl alcohol, and fractionating the (trans)esterification effluent to obtain renewable FAAE fuel as the main product, preferably biodiesel, bunker fuel, heating oil, and/or lubricant component, more preferably a biodiesel fuel blend stock meeting ASTM D6751-19 standard specification for biodiesel fuel blend stock (B100) for middle distillate fuels.
7. The method of any preceding claim, wherein the renewable chemical process of the renewable chemical plant comprises:
- metathesizing a renewable process feed comprising unsaturated fatty acid glycerides and/or unsaturated fatty acid alkyl esters optionally in the presence of an olefin, and fractionating the metathesis effluent to obtain renewable chemicals as the main product, such as terminal olefin products; or
 - subjecting a renewable chemical process feed of crude glycerol to selective hydroprocessing to obtain renewable C3-alcohol, such as 1-propanol, 2-propanol, 1,2-propanediol or 1,3-propanediol.
8. The method of any preceding claim, wherein the renewable base oil process of the renewable base oil plant comprises ketonizing a renewable process feed comprising fatty acids, fatty acid glycerides and/or FAAE, and optionally hydroprocessing, and fractionating the ketonization and/or hydroprocessing effluent to obtain renewable base oil as the main product, preferably meeting API group III specifications for base oils.
9. The method of any preceding claim, comprising: altering both i) the renewable process feed and ii) the renewable product flow.
10. The method of any preceding claim, wherein the altering is performed based on one or more, preferably two or more parameters selected from: inoperability of any of the processes, a target value for the amount of generated carbonaceous waste, a target value for the amount of generated carbon oxide(s), reduced efficiency of a solid catalyst used for processing the renewable process feed in at least one of the processes, increased pressure drop over a fixed catalyst bed used for processing the

renewable process feed in at least one of the processes, predetermined target specification for any of the renewable products, predetermined target specification for any of the renewable process feeds, composition of the common renewable system feed, 14C content of the common renewable system feed and/or any of the renewable process feeds and/or renewable products, market price of the renewable products, and market demand of the renewable products.

11. The method of any preceding claim, wherein the integrated production plant system comprises at least a renewable paraffinic fuel plant, a renewable chemical plant and a renewable FFAE fuel plant, and in case the renewable chemical process of the renewable chemical plant is not running the method comprises:

directing a renewable product flow fraction comprising unsaturated FFAE, preferably a C18-FAAE, of the renewable FFAE fuel process, being used as the renewable process feed for the renewable chemical process, to the renewable paraffinic fuel process for use as renewable process feed therein, and/or collecting said renewable product flow fraction as an unsaturated FFAE fuel, preferably as a winter grade FFAE fuel.

12. The method of any preceding claim, wherein the integrated production plant system comprises at least a renewable paraffinic fuel plant, a renewable base oil plant and a renewable FFAE fuel plant, and in case the renewable base oil process of the renewable base oil plant is not running the method comprises:

directing a renewable product flow fraction comprising C16-FAAE of the renewable FFAE fuel process, being used as the renewable process feed for the renewable base oil process, to the renewable paraffinic fuel process for use as renewable process feed therein, and/or collecting said renewable product flow fraction as a FFAE fuel, preferably as a marine grade FFAE fuel.

13. The method of any preceding claim, wherein the method further comprises blending at least part of the renewable paraffinic fuel, preferably comprising diesel range paraffinic hydrocarbons, and at least part of the renewable FFAE fuel, preferably comprising a biodiesel fuel blend stock, and optionally petroleum-based hydrocarbons preferably of diesel range, to obtain a fuel blend meeting the requirements of ASTM D396-19 specification for fuel oil, or the requirements of ASTM D7467-19 specification for diesel fuel oil.

14. The method of any preceding claim, wherein the method further comprises a waste processing system in the integrated production plant system, and passing a carbonaceous waste stream of the integrated production plant system not useful in any of said renewable processes to the waste processing system, and converting it to a conversion effluent comprising carbon oxide(s).
15. The method of claim 14, wherein said converting comprises one or more of burning in a flaring unit, burning in a power generation unit, gasifying in a gasification unit, and reforming in a reforming unit, preferably at least reforming in a reforming unit, to obtain a conversion effluent comprising carbon oxide(s), preferably carbon oxide(s) and hydrogen.
16. The method of any preceding claim, wherein the method further comprises one or more pretreatment units in the integrated production plant system, and pretreating at least part of the renewable common system feed and/or of any of the renewable process feeds by one or more of blending, bleaching, degumming, deodorizing, filtering, sedimentation, decanting, centrifuging, evaporating, distillation, heat treating, flocculating, catalytic hydrogenation of unsaturated bonds, treating with an absorbent, and treating with an adsorbent.
17. An integrated production plant system comprising, at one production site:
- at least two plants of different kinds selected from:
 - a) a renewable paraffinic fuel plant configured to produce a renewable paraffinic fuel as a main product in a renewable paraffinic fuel process,
 - b) a renewable FAAE fuel plant configured to produce a renewable FAAE fuel as a main product in a renewable FAAE fuel process,
 - c) a renewable base oil plant configured to produce a renewable base oil as a main product in a renewable base oil process, and
 - d) a renewable chemical plant configured to produce a renewable chemical as a main product in a renewable chemical process; and
 - a storage unit configured to receive a common renewable system feed;
- wherein the integrated production plant system is configured to:
- provide each of the processes with a respective renewable process feed, wherein at least part of each renewable process feed originates from a common renewable system feed;
 - process the respective renewable process feed in said renewable process to

- obtain respective renewable product flows;
- alter i) the renewable process feed to at least one of the processes by directing at least part of the renewable process feed of at least one of the processes to another of said processes and/or ii) the renewable product flow of at least one of the processes by directing at least part of the renewable product flow of at least one of the processes to another of said processes for use as the respective renewable process feed.
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- 10 18. The integrated production plant system of claim 17, further comprising a waste processing system configured to convert a carbonaceous waste stream to a conversion effluent comprising carbon oxide(s), wherein the integrated production plant system is further configured to pass a carbonaceous waste stream of the integrated production plant system not useful in any of said renewable processes to the waste processing system, and to convert it to a conversion effluent comprising
- 15 carbon oxide(s).
19. The integrated production plant system of claim 18, wherein the waste processing system comprises one or more of a flaring unit, a power generation unit, a gasification unit, and a reforming unit, preferably a reforming unit, such as steam reforming unit
- 20 and/or a catalytic reforming unit.
20. The integrated production plant system of any of claims 17-19, further comprising one or more pretreatment units configured to pretreat at least part of the renewable common system feed and/or of any of the renewable process feeds by one or more of
- 25 blending, bleaching, degumming, deodorizing, filtering, sedimentation, decanting, centrifuging, evaporating, distillation, heat treating, flocculating, catalytic hydrogenation of unsaturated bonds, treating with an absorbent, and treating with an adsorbent.
- 30 21. The integrated production plant system of any of claims 17-20, further comprising material flow connections, preferably comprising pipelines, providing fluid communication between the plants, the storage unit, and the optional waste processing system and pretreatment unit(s).
- 35 22. A control system for an integrated production plant system of any of claims 17-21, comprising:

- at least one processor;
 - at least one memory comprising program code executable by the at least one processor; and
 - at least one communication unit configured to communicate with process flow or product flow adjustment unit(s) of the integrated production plant system to control at least one of the alterations claimed in claim 17.
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