CLAIMS:

1. A process for upgrading heavy oil or bitumen to formulate hydrocarbon byproducts, comprising:
   (a) providing a source of heavy oil or bitumen feedstock;
   (b) treating said feedstock to form a non-distilled bottoms fraction;
   (c) feeding said bottoms fraction to a syngas generating circuit for formulating a hydrogen lean syngas stream via a non-catalytic partial oxidation reaction, and reacting said syngas in a Fischer-Tropsch reactor to synthesize hydrocarbon byproducts;
   (d) adding a source of hydrogen to said hydrogen lean syngas to optimize the synthesis of hydrocarbons at least one of which is synthetic crude oil.

2. The process as set forth in claim 1, wherein said source of hydrogen comprises a hydrogen rich syngas stream produced from a hydrogen rich syngas generator.

3. The process as set forth in claim 2, wherein said hydrogen rich syngas generator is selected from the group consisting of a steam methane reformer (SMR), autothermal reformer (ATR) and combinations thereof.

4. The process as set forth in claim 2, wherein said hydrogen rich syngas generator uses hydrogen rich feed to generate said hydrogen rich syngas stream.

5. The process as set forth in claim 4, wherein said hydrogen rich feed is selected from the group consisting of natural gas, FT vapours, FT naphtha, hydroprocessor vapours and combinations thereof.

6. The process as set forth in any one of claims 2 through 5, further including purifying at least a portion of said hydrogen rich syngas.

7. The process as set forth in claim 6, wherein purification of said hydrogen rich syngas is performed by pressure swing adsorption, membrane or liquid absorption.

8. The process as set forth in any one of claims 1 through 7, wherein treating said bitumen includes providing said bitumen as a froth or diluted bitumen (dilbit) as a feed to an atmospheric distillation unit.

9. The process as set forth in any one of claims 1 through 8, wherein said bottom fraction is fed to a gasifier within said syngas generating circuit.

10. The process as set forth in claim 9, wherein said bottom fraction is converted to a sour hydrogen lean syngas stream.

11. The process as set forth in claim 10, further including the step of treating said stream to a sour syngas treatment operation.

12. The process as set forth in claim 11, further including the step treating said stream to a series of unit operations prior to reaction in said Fischer-Tropsch unit.

13. The process as set forth in any one of claims 1 through 12, wherein said hydrocarbon byproducts include at least one of Fischer-Tropsch vapours, paraffinic naphtha, light Fischer-Tropsch liquid and heavy Fischer-Tropsch liquid.

14. The process as set forth in any one of claims 1 through 13, further including the step of processing said byproducts in a hydroprocessing unit.

15. The process as set forth in any one of claims 1 through 14, further including the step of processing said straight run distillate, vacuum gas oil (VGO) fraction and deasphalted oil (DAO) in a hydroprocessing unit.

16. The process as set forth in claim 15, wherein said hydroprocessing unit includes at least one operation selected from the group consisting of hydrocracking, thermocracking, hydrotreating, isomerization, fractionation and combinations thereof.

17. The process as set forth in any one of claims 1 through 16, further including the step of augmenting the process with an auxiliary source of gas.

18. The process as set forth in claim 17, wherein said auxiliary source of hydrogen comprises hydroprocessing unit gas.

19. The process as set forth in claim 18, wherein said auxiliary source of hydrogen comprises hydrogen rich gas from hydrocracker, thermal cracker, hydrotreater, isomerization unit, fractionator and combinations thereof.

20. The process as set forth in claim 17, wherein said auxiliary source of hydrogen comprises natural gas.

21. The process as set forth in any one of claims 1 through 20, wherein said hydrogen generator includes at least one of an autothermal reformer, a steam methane reformer and a combination thereof for receiving as feedstock at least one of natural gas, Fischer-Tropsch vapours, Fischer Tropsch naphtha, refinery fuel gas and combinations thereof, to generate hydrogen rich syngas.

22. The process as set forth in any one of claims 1 through 21, wherein said bitumen is an *in situ* source.

23. The process as set forth in any one of claims 1 through 22, wherein said bitumen is a mineable source.

24. A process for upgrading heavy oil or bitumen to formulate hydrocarbon byproducts, comprising:

i) providing a source of bitumen or heavy oil feedstock treating said feed with distillation to form a non-distilled bottoms fraction;

ii) feeding the bottoms fraction to a syngas generating circuit for formulating a hydrogen lean syngas stream via a non-catalytic partial oxidation reaction;

iii) treating the said hydrogen lean syngas stream to a water gas shift (WGS) reaction to generate an optimum Fischer-Tropsch syngas; and

iv) treating said optimum Fischer-Tropsch syngas stream in a Fischer-Tropsch unit to synthesize hydrocarbons byproducts, where at least one of which is synthetic crude.

25. The process as set forth in claim 24, further including purifying at least a portion of said hydrogen rich syngas.

26. The process as set forth in claim 25, wherein purification of said hydrogen rich syngas is performed by pressure swing adsorption, membrane or liquid absorption.

27. The process as set forth in any one of claims 24 through 26, wherein treating said bitumen includes providing said bitumen as a froth or diluted bitumen (dilbit) as a feed to an atmospheric distillation unit.

28. The process as set forth in any one of claims 24 through 27, wherein said bottoms fraction is optionally fed to a deasphalting unit.

29. The process as set forth in any one of claims 24 through 28, wherein said bottom fraction is fed to a gasifier within said syngas generating circuit.

30. The process as set forth in claim 29, wherein said bottom fraction is converted to a sour hydrogen lean syngas stream.

31. The process as set forth in claim 30, further including the step of treating said stream to a sour syngas treatment operation.

32. The process as set forth in any one of claims 24 through 31, wherein said hydrocarbon byproducts include at least one of FT vapours, paraffinic naphtha, light Fischer-Tropsch liquid and heavy Fischer-Tropsch liquid.

33. The process as set forth in claim 32, further including the step of processing said byproducts in a hydroprocessing unit.

34. The process as set forth in claim 33, wherein said hydroprocessing unit includes at least one operation selected from the group consisting of fractionation,

hydrocracking, thermal cracking, hydrotreating, isomerization and combinations thereof.

35. The process as set forth in any one of claims 24 through 34, further including the step of augmenting the process with an auxiliary source of gas.

36. The process as set forth in claim 35, wherein said auxiliary source of gas comprises hydrogen.

37. The process as set forth in any one of claims 24 through 36, wherein said bitumen is an *in situ* source.

38. The process as set forth in any one of claims 24 through 37, wherein said bitumen is a minable source.

39. A system for upgrading bitumen to formulate hydrocarbon byproducts, comprising:
(a) a first bitumen processing stage for processing said bitumen into liquid and residuum materials by distillation;
(b) a second stage for gasifying said residuum materials and formulating Fischer-Tropsch products;
(c) a third stage for hydroprocessing said Fischer-Tropsch products to generate synthetic crude; and
(d) a fourth stage for hydrogen synthesis for combination with hydrogen from said second stage, said combination for optimizing a hydrogen to carbon ratio as a feed to a Fischer-Tropsch reactor whereby synthetic crude oil can be synthesized.

40. The system as set forth in claim 39, wherein said first stage employs atmospheric distillation to remove added diluent and straight run distillate.

41. The system as set forth in claim 40, wherein said residuum from said first stage is distilled in a vacuum distillation unit to form a light vacuum gas oil and a vacuum residuum, said vacuum residuum comprising asphaltenes.

42. The system as set forth in claim 41, wherein said vacuum residuum from said first stage is treated in a solvent deasphalting unit to form a deasphalted oil and asphaltene.

43. The system as set forth in claim 41, wherein said vacuum residuum comprise the feedstock for said second stage, said second stage including a gasifier for forming syngas and Fischer-Tropsch products from said syngas.

44. The system as set forth in claim 42, wherein said asphaltene comprise the feedstock for said second stage, said second stage including a gasifier for forming syngas and Fischer-Tropsch products from said syngas.

45. The system as set forth in any one of claims 39 through 44, wherein said third stage includes hydroprocessing said Fischer-Tropsch products to formulate synthetic crude and hydrogen rich gas.

46. The system as set forth in claim 45, wherein said hydrogen from said fourth stage, when combined with said hydrogen from said second and third stage results in a hydrogen to carbon ratio of 2:1 for introduction into said Fischer-Tropsh reactor to optimize synthetic crude formation.

47. The system as set forth in any one of claims 39 through 46, wherein said formation of said synthetic crude is in a yield of at least 100% and is formulated in the absence of waste petcoke and residuum.

48. A process for upgrading bitumen to formulate hydrocarbon byproducts, comprising:

(a) providing a source of processed bitumen or heavy oil feedstock in the form of a non-distilled bottoms fraction;

(b) forming Fischer-Tropsch hydrocarbons from reaction of hydrogen lean syngas generated from non-catalytic partial oxidation reaction of said non-distilled bottoms fraction; and

(c) adding a source of hydrogen to said hydrogen lean syngas to optimize the synthesis of hydrocarbons at least one of which is synthetic crude oil.

49. The process as set forth in claim 48, wherein said source of hydrogen comprises a hydrogen rich syngas stream produced from a hydrogen rich syngas generator.

50. The process as set forth in claim 49, wherein said hydrogen rich syngas generator is selected from the group consisting of a steam methane reformer (SMR), autothermal reformer (ATR) and combinations thereof.

51. The process as set forth in claim 50, wherein said hydrogen rich syngas generator uses hydrogen rich feed to generate said hydrogen rich syngas stream.

52. The process as set forth in claim 51, wherein said hydrogen rich feed is selected from the group consisting of natural gas, FT vapours, FT naphtha, hydroprocessor vapours and combinations thereof.

53. The process as set forth in claim 51, further including purifying at least a portion of said hydrogen rich syngas.

54. The process as set forth in claim 53, wherein purification of said hydrogen rich syngas is performed by pressure swing adsorption, membrane or liquid absorption.

55. The process as set forth in any one of claims 48 through 54, wherein treating said bitumen includes providing said bitumen as a froth or diluted bitumen (dilbit) as a feed to an atmospheric distillation unit.

CLAIMS:

1. A process for upgrading heavy oil or bitumen to formulate synthetic hydrocarbons, comprising:

(a) providing a source of heavy oil or bitumen feedstock;

(b) treating said feedstock to form one or more distilled fractions and a non-distilled bottom fraction;

(c) feeding said bottom fraction to a syngas generating circuit to generate a hydrogen lean syngas stream via a non-catalytic partial oxidation reaction, wherein said hydrogen lean syngas stream has a hydrogen to carbon monoxide ratio of less than one part hydrogen to one part carbon monoxide;

(d) adding an external source of hydrogen to said hydrogen lean syngas to generate a hydrogen rich syngas stream optimum for Fischer-Tropsch reaction; and

(e) reacting said hydrogen rich syngas stream in a Fischer-Tropsch reactor to formulate said synthetic hydrocarbons, at least one of which is synthetic crude oil.

2. The process as set forth in claim 1, wherein said external source of hydrogen comprises a hydrogen rich syngas stream produced from a hydrogen rich syngas generator.

3. The process as set forth in claim 2, wherein said hydrogen rich syngas generator is selected from the group consisting of a steam methane reformer (SMR), autothermal reformer (ATR) and combinations thereof.

4. The process as set forth in claim 2, wherein said hydrogen rich syngas generator uses hydrogen rich feed to generate said hydrogen rich syngas stream.

5. The process as set forth in claim 4, wherein said hydrogen rich feed is selected from the group consisting of natural gas, FT vapours, FT naphtha, hydroprocessor vapours and combinations thereof.

6. The process as set forth in claim 2, further including purifying at least a portion of said hydrogen rich syngas.

7. The process as set forth in claim 6, wherein purification of said hydrogen rich syngas is performed by pressure swing adsorption, membrane or liquid absorption.

8. The process as set forth in claim 1, wherein said bitumen is provided as a froth or diluted bitumen (dilbit), and step b) includes feeding said feedstock to an atmospheric distillation unit.

9. The process as set forth in claim 1, wherein said bottom fraction is fed to a gasifier within said syngas generating circuit.

10. The process as set forth in claim 9, wherein said bottom fraction is converted to a sour hydrogen lean syngas stream.

11. The process as set forth in claim 10, further including the step of treating said hydrogen lean syngas stream to a sour syngas treatment operation.

12. The process as set forth in claim 11, further including the step of treating said hydrogen lean syngas stream to a series of unit operations prior to reaction in said Fischer-Tropsch reactor.

13. The process as set forth in claim 1, wherein said synthetic hydrocarbons include at least one of Fischer-Tropsch vapours, paraffinic naphtha, light Fischer-Tropsch liquid and heavy Fischer-Tropsch liquid.

14. The process as set forth in claim 1, further including the step of processing said synthetic hydrocarbons in a hydroprocessing unit.

15. The process as set forth in claim 1, wherein said one or more distilled fractions comprise straight run distillate, vacuum gas oil (VGO) fraction and deasphalted oil (DAO), and said process further including the step of processing said straight run distillate, vacuum gas oil (VGO) fraction and deasphalted oil (DAO) in a hydroprocessing unit.

16. The process as set forth in claim 15, wherein said hydroprocessing unit includes at least one operation selected from the group consisting of hydrocracking, thermocracking, hydrotreating, isomerization, fractionation and combinations thereof.

17. The process as set forth in claim 1, further including the step of augmenting the process with an auxiliary source of hydrogen.

18. The process as set forth in claim 17, wherein said auxiliary source of hydrogen comprises hydroprocessing unit gas.

19. The process as set forth in claim 18, wherein said auxiliary source of hydrogen comprises hydrogen rich gas from hydrocracker, thermal cracker, hydrotreater, isomerization unit, fractionator and combinations thereof.

20. The process as set forth in claim 17, wherein said auxiliary source of hydrogen comprises natural gas.

21. The process as set forth in claim 2, wherein said hydrogen rich syngas generator includes at least one of an autothermal reformer, a steam methane reformer and a combination thereof for receiving as feedstock at least one of natural gas, Fischer-Tropsch vapours, Fischer Tropsch naphtha, refinery fuel gas and combinations thereof, to generate hydrogen rich syngas.

22. The process as set forth in claim 1, wherein said bitumen is an in situ source.

23. The process as set forth in claim 1, wherein said bitumen is a mineable source.

24. A process for upgrading bitumen to formulate hydrocarbon products, comprising: (a) providing a source of processed bitumen or heavy oil feedstock in the form of a non-distilled bottoms fraction; (b) forming said hydrocarbon products via Fischer-Tropsch reaction of hydrogen lean syngas generated from non-catalytic partial oxidation reaction of said non-distilled bottoms fraction, wherein said hydrogen lean syngas stream has a hydrogen to carbon monoxide ratio of less than one part hydrogen to one part carbon monoxide; and (c) adding an external source of hydrogen to said hydrogen lean syngas to create an optimum syngas composition for the synthesis of said hydrocarbon products at least one of which is synthetic crude oil.

25. The process as set forth in claim 24, wherein said external source of hydrogen comprises a hydrogen rich syngas stream produced from a hydrogen rich syngas generator.

26. The process as set forth in claim 25, wherein said hydrogen rich syngas generator is selected from the group consisting of a steam methane reformer (SMR), autothermal reformer (ATR) and combinations thereof.

27. The process as set forth in claim 26, wherein said hydrogen rich syngas generator uses hydrogen rich feed to generate said hydrogen rich syngas stream.

28. The process as set forth in claim 27, wherein said hydrogen rich feed is selected from the group consisting of natural gas, FT vapours, FT naphtha, hydroprocessor vapours and combinations thereof.

29. The process as set forth in claim 27, further including purifying at least a portion of said hydrogen rich syngas.

30. The process as set forth in claim 29, wherein purification of said hydrogen rich syngas is performed by pressure swing adsorption, membrane or liquid absorption.

31. The process as set forth in claim 24, wherein treating said bitumen includes providing said bitumen as a froth or diluted bitumen (dilbit) as a feed to an atmospheric distillation unit.

32. The process as set forth in claim 2, further comprising subjecting at least a portion of said hydrogen rich syngas stream to a water gas shift (WGS) reaction.

33. The process as set forth in claim 25, further comprising subjecting at least a portion of said hydrogen rich syngas stream to a water gas shift (WGS) reaction.

34. The process as set forth in claim 1, wherein said hydrogen rich syngas stream optimum for Fischer-Tropsch reaction is a hydrogen to carbon monoxide ratio of from 1.8:1 to 2.2:1.

35. The process as set forth in claim 24, wherein said hydrogen rich syngas stream optimum for Fischer-Tropsch reaction is a hydrogen to carbon monoxide ratio of from 1.8:1 to 2.2:1.