CLAIMS:

What is claimed is:

1. A hydrocarbon upgrading process, comprising:

heating a hydrocarbon feed and combining the hydrocarbon feed with an aqueous fluid to produce a heated mixture comprising hydrocarbon and steam, wherein the heating is carried out before, during, and/or after the hydrocarbon feed is combined with the aqueous fluid;

separating, from the heated mixture, a vapor phase product and a liquid phase product;

catalytically cracking at least a portion of the liquid phase product in the presence of a fluidized catalyst to produce a catalytically cracked effluent;

separating a light hydrocarbon product and a bottoms product from the catalytically cracked effluent, wherein the light hydrocarbon product comprises a first C_2 hydrocarbon;

steam cracking at least a portion of the vapor phase product to produce a steam cracker effluent;

separating, from the steam cracker effluent, a tar product and an upgraded steam cracker effluent, wherein the upgraded steam cracker effluent comprises a second C_2 hydrocarbon;

hydroprocessing at least a portion of the tar product with at least a portion of the bottoms product to produce a hydroprocessed product, the at least a portion of the bottoms product and the at least a portion of the tar product being combined before and/or during the hydroprocessing; and

combining at least a portion of the first C_2 hydrocarbon and at least a portion of the second C_2 hydrocarbon, and recovering at least a portion of the combined C_2 hydrocarbon.

2. The process of claim 1, wherein

(i) the hydroprocessing is carried out under the pre-treater hydroprocessing conditions to produce a pretreated tar product;

(ii) the pre-treater hydroprocessing conditions include hydroprocessing the tar product at a temperature (T_{PT}) of 400°C or less, a weight hour space velocity ($WHSV_{PT}$) of ≥ 0.3 hr^{-1} based on a weight of the tar product that is subjected to the pre-treater hydroprocessing conditions, a total pressure (P_{PT}) of $\geq$ 6 MPa, and in the presence of molecular hydrogen supplied at a rate (SR_{PT}) of less than 534 standard cubic meters per cubic meter of the tar product that is subjected to the pre-treater hydroprocessing conditions,

(iii) the pre-treated tar product comprises a vapor potion and a liquid portion;

(iv) the hydroprocessed product is obtained by hydroprocessing the pre-treated tar product under bottoms product hydroprocessing conditions which include hydroprocessing the pre-treated tar product at a temperature (T_{BP}) of ≥ 200°C, a weight hour space velocity ($WHSV_{BP}$) of ≥ 0.3 hr^{-1} based on a weight of the pre-treated tar product, a total pressure (P_{BP}) of ≥ 6 MPa, and in the presence of molecular hydrogen supplied at a rate (SR_{BP}) of ≥ 534 standard cubic meters per cubic meter of the pre-treated tar product; and

(v) $WHSV_{BP}$ is less than $WHSV_{PT}$.

3. The process of claim 1, further comprising (i) pretreating the liquid phase product upstream of the catalytic cracking, and (ii) heating or cooling the liquid phase product upstream and/or downstream of the pretreating, wherein the pretreating includes one or more of desalting, hydroprocessing, and particulate removal.

4. The process of claim 1, further comprising pretreating the light hydrocarbon product before combining the first and second C_2 hydrocarbons, wherein the pretreating includes removing from the light hydrocarbon product at least a portion of one or more of molecular hydrogen, methane, ammonia, carbon dioxide, arsine, mercury, hydrogen sulfide, carbonyl sulfide, mercaptans, and carbon disulfide, oxygenates and water.

5. The process of claim 1, wherein (i) the light hydrocarbon product further comprises a first C_3 hydrocarbon; (ii) the upgraded steam cracker effluent further comprises a second C_3 hydrocarbon; (iii) the process further comprises combining at least a portion of the first C_3 hydrocarbon and at least a portion of the second C_3 hydrocarbon, and recovering at least a portion of the combined C_3 hydrocarbon; and wherein the process further comprises one or more of (a) comprises recovering propylene from at least a portion of one or more of the first C_3 hydrocarbon, the second C_3 hydrocarbon, and the combined C_3 hydrocarbon, and (b) recovering ethylene from at least a portion of one or more of the first C_2 hydrocarbon, the second C_2 hydrocarbon, and the combined C_2 hydrocarbon.

6. The process of claim 1, further comprising:

separating a naphtha from the catalytically cracked effluent;

hydroprocessing at least a portion of the naphtha to produce a hydroprocessed naphtha;

reforming the hydroprocessed naphtha to produce a reformate and molecular hydrogen; and

utilizing at least a portion of the molecular hydrogen for at least one of the tar product hydroprocessing and the naphtha hydroprocessing.

7. The process of claim 1, wherein the hydrocarbon feed comprises medium hydrocarbon and/or heavy hydrocarbon.

8. The process of claim 1, further comprising (i) providing a crude oil, wherein the hydrocarbon feed comprises a first portion of the crude oil, (ii) distilling at least a second portion of the crude oil in at least one atmospheric distillation zone and/or at least one vacuum distillation zone, (iii) conducting an atmospheric bottoms product away from the atmospheric distillation zone, (iv) conducting a vacuum bottoms product away from the vacuum distillation zone, and (v) combining with the liquid phase product at least a portion of the atmospheric bottoms product and/or the vacuum bottoms product.

9. The process of claim 1, wherein the upgraded steam cracker effluent further comprises benzene and/or toluene, and wherein the process further comprises (i) recovering at least a portion of the toluene and/or at least a portion of the benzene and (ii) combining with the reformate at least a portion of the recovered benzene and/or at least a portion of the recovered toluene.

10. The process of claim 1, wherein the upgraded steam cracker effluent further comprises benzene and/or toluene, and wherein the process further comprises (i) recovering at least a portion of the toluene and/or at least a portion of the benzene, and (ii) alkylating a portion of the recovered benzene and/or at least a portion of the recovered toluene to produce one or more of additional toluene, ethylbenzene, and xylene.

11. A hydrocarbon upgrading process, comprising:

heating a hydrocarbon feed and combining the hydrocarbon feed with an aqueous fluid to produce a heated mixture comprising hydrocarbon and steam, wherein the heating is carried out before, during, and/or after the hydrocarbon feed is combined with the aqueous fluid;

separating from the heated mixture a vapor phase product and a liquid phase product;

catalytically cracking the liquid phase product in the presence of a fluidized catalyst to produce a catalytically cracked effluent;

separating a light hydrocarbon product and a bottoms product from the catalytically cracked effluent, wherein the light hydrocarbon product comprises methane, a first C_2 hydrocarbon, a first C_3 hydrocarbon, and a first C_4 hydrocarbon;

separating from the light hydrocarbon product, at least a portion of the first C_4 hydrocarbon to produce an upgraded light hydrocarbon product;

demethanizing at least a portion of the upgraded light hydrocarbon product by at least contacting that portion of the upgraded light hydrocarbon product with a first portion of the first C_4 hydrocarbon, and recovering (i) a raffinate comprising methane and (ii) an extract comprising C_2, C_3, and C_4 hydrocarbon;

steam cracking the vapor phase product to produce a steam cracker effluent;

separating from the steam cracker effluent a tar product and an upgraded steam cracker effluent, wherein the upgraded steam cracker effluent comprises a second C_2 hydrocarbon; a second C_3 hydrocarbon, and a second C_4 hydrocarbon, wherein the second C_4 hydrocarbon is richer in butadiene in comparison with the first C_4 hydrocarbon;

hydroprocessing at least a portion of the tar product with at least a portion of the bottoms product to produce a hydroprocessed product, the at least a portion of the bottoms product and the at least a portion of the tar product being combined before and/or during the hydroprocessing;

removing butadiene from the second C_4 hydrocarbon to produce an upgraded C_4 hydrocarbon; and

combining at least a portion of the extracted C_4 hydrocarbon with at least a portion of the upgraded C_4 hydrocarbon.

12. The process of claim 11, further comprising recovering ethylene from at least a portion of the extracted C_2 hydrocarbon and/or a portion of the second C_2 hydrocarbon.

13. The process of claim 11, further comprising pretreating the light hydrocarbon product before combining the first and second C_2 hydrocarbons, wherein the pretreating includes removing from the light hydrocarbon product at least a portion of one or more of molecular hydrogen, methane, ammonia, carbon dioxide, arsine, mercury, hydrogen sulfide, carbonyl sulfide, mercaptans, and carbon disulfide, oxygenates and water.

14. The process of claim 11, further comprising (i) combining at least a portion of the extracted C_2 hydrocarbon and at least a portion of the second C_2 hydrocarbon, (ii) recovering at least a portion of the combined C_2 hydrocarbon, and (iii) recovering ethylene from at least a portion of the combined C_2 hydrocarbon.

15. The process of claim 11, wherein the process further comprises (i) combining at least a portion of the extracted C_3 hydrocarbon and at least a portion of the second C_3 hydrocarbon, and recovering at least a portion of the combined C_3 hydrocarbon; and/or (ii) comprises recovering propylene from at least a portion of one or more of the extracted C_3 hydrocarbon, the second C_3 hydrocarbon, and combined C_3 hydrocarbon.

16. The process of claim 11, further comprising:

separating a naphtha from the catalytically cracked effluent;

hydroprocessing at least a portion of the naphtha to produce a hydroprocessed naphtha;

reforming the hydroprocessed naphtha to produce a reformate and molecular hydrogen; and

utilizing at least a portion of the molecular hydrogen for at least one of the tar product hydroprocessing and the naphtha hydroprocessing.

17. The process of claim 11, wherein the hydrocarbon feed comprises medium hydrocarbon and/or heavy hydrocarbon.

18. The process of claim 11, further comprising (i) providing a crude oil, wherein the hydrocarbon feed comprises a first portion of the crude oil, (ii) distilling at least a second portion of the crude oil in at least one atmospheric distillation zone and/or at least one vacuum distillation zone, (iii) conducting an atmospheric bottoms product away from the atmospheric distillation zone, (iv) conducting a vacuum bottoms product away from the vacuum distillation zone, and (v) combining with the liquid phase product at least a portion of the atmospheric bottoms product and/or at least a portion of the vacuum bottoms product.

19. The process of claim 11, wherein the upgraded steam cracker effluent further comprises benzene and/or toluene, and wherein the process further comprises (i) recovering at least a portion of the toluene and/or at least a portion of the benzene and (ii) combining with the

reformate at least a portion of the recovered benzene and/or at least a portion of the recovered toluene.

20. The process of claim 11, wherein the upgraded steam cracker effluent further comprises benzene and/or toluene, and wherein the process further comprises (i) recovering at least a portion of the toluene and/or at least a portion of the benzene, and (ii) alkylating a portion of the recovered benzene and/or at least a portion of the recovered toluene to produce one or more of additional toluene, ethylbenzene, and xylene.