CLAIMS

What is claimed is:

1. A method comprising:

contacting, in an oligomerization process, ethylene with a selective-higher-olefin catalyst to yield an oligomerization reactor effluent comprising C_6 hydrocarbons which include 1-hexene and C_8 hydrocarbons which include 1-octene;

recovering 1-hexene and 1-octene from the oligomerization reactor effluent;

contacting, in a hydrotreating process, 1-hexene, 1-octene, or both 1-hexene and 1-octene recovered from the oligomerization reactor effluent with a hydrogenation catalyst to yield an aromatization feed comprising hexane, octane, or both; and

contacting, in an aromatization process, the aromatization feed with an aromatization catalyst to yield an aromatization effluent comprising benzene.

2. The method of claim l, wherein the C_6 hydrocarbons are present in an amount of about 20 wt. % to about 99 wt. % based on a total weight of the oligomerization reactor effluent, and the C_8 hydrocarbons are present in an amount of about 0.1 wt.% to about 75 wt. % based on a total weight of the oligomerization reactor effluent.

3. The method of claim l, wherein recovering 1-hexene and 1-octene from the oligomerization reactor effluent comprises:

fractionating the oligomerization reactor effluent into a first stream comprising heavy hydrocarbons comprising C_{9+} hydrocarbons and spent catalyst, a second stream comprising octenes, and a third stream comprising hexenes,

wherein, of the first stream, the second stream, and the third stream, only a portion of the third stream is fed to the hydrotreating process.

4. The method of claim l, wherein recovering 1-hexene and 1-octene from the oligomerization reactor effluent comprises:

fractionating the oligomerization reactor effluent into a first stream comprising heavy hydrocarbons comprising C_{9+} hydrocarbons and spent catalyst, a second stream comprising octenes, and a third stream comprising hexenes,

wherein, of the first stream, the second stream, and the third stream, only a portion of the second stream and only a portion of the third stream are fed to the hydrotreating process.

5. The method of claim l, wherein recovering 1-hexene and 1-octene from the oligomerization reactor effluent comprises:

fractionating the oligomerization reactor effluent into a first stream comprising heavy hydrocarbons comprising C_{9+} hydrocarbons and spent catalyst and a second stream comprising hexenes and octenes,

wherein, of the first stream and the second stream, only a portion of the second stream is fed to the hydrotreating process.

6. The method of claim l, wherein recovering 1-hexene and 1-octene from the oligomerization reactor effluent comprises:

fractionating the oligomerization reactor effluent into a first stream comprising spent catalyst and a second stream comprising hexenes, octenes, and heavy hydrocarbons comprising C_{9+} hydrocarbons,

wherein, of the first stream and the second stream, only a portion of the second stream is fed to the hydrotreating process.

7. The method of claim l, wherein recovering 1-hexene and 1-octene from the oligomerization reactor effluent comprises:

separating the oligomerization reactor effluent into a first stream comprising heavy hydrocarbons comprising C_{9+} hydrocarbons and spent catalyst, a second stream comprising octenes, and a third stream comprising hexenes;

fractionating the third stream to yield a 1-hexene stream and a C_6 feed stream; and

flowing the C_6 feed stream to the hydrotreating process.

8. The method of claim l, further comprising:

fractionating a refinery stream to recover a naphtha stream; feeding the naphtha stream to the hydrotreating process; and

contacting, in the hydrotreating process, naphtha with the hydrogenation catalyst to yield one or more of n-hexane and n-octane in the aromatization feed.

9. The method of claim l, wherein the aromatization effluent further comprises toluene, ethylbenzene, xylene, 1-hexene, 1-octene, or a combination thereof, the method further comprising:

fractionating the aromatization effluent into a benzene stream, a toluene stream, a xylene stream, and a raffinate stream.

10. The method of claim 9, wherein the aromatization process is further configured to produce a hydrogen effluent, the method further comprising:

flowing a portion of the benzene stream and a portion of the hydrogen effluent to a hydrogenation process to yield cyclohexane; and

feeding the cyclohexane to the oligomerization process.

11. The method of claim l, wherein the oligomerization reactor effluent further comprises cyclohexane and other hexanes, the method further comprising:

recovering cyclohexane and the other hexanes from the oligomerization reactor effluent;

flowing the other hexanes recovered from the oligomerization reactor effluent to the hydrotreating process; and

recycling cyclohexane recovered from the oligomerization reactor effluent to the oligomerization process.

12. The method of claim l, further comprising:

cracking ethane, propane, butane, pentane, naphtha, or mixtures thereof in a steam cracker to yield a cracker effluent comprising ethylene; and

flowing ethylene recovered from the cracker effluent to the oligomerization process.

13. The method of claim 12, wherein the cracker effluent further comprises light hydrocarbons, the method further comprising:

using light hydrocarbons recovered from the cracker effluent as a cooling source for an oligomerization reactor in the oligomerization process, for a first fractionation process located downstream of the oligomerization process, for a second fractionation process located downstream of the aromatization process, or a combination thereof.

14. The method of claim 2, further comprising:

recovering steam from the steam cracker; and

using steam as a heating source for the oligomerization process, for a first fractionation process located downstream of the oligomerization process, for a second fractionation process located downstream of the aromatization process, or a combination thereof.

15. The method of claim l, wherein the step of contacting ethylene and a selective-higher-olefin catalyst is performed in the presence of a diluent recovered from the aromatization effluent, wherein the diluent is a raffinate, benzene, toluene, xylene, branched alkanes, or combinations thereof.

16. The method of claim l, further comprising:

flowing a raffinate recovered from the aromatization process to a steam cracker; and

cracking the raffinate in the steam cracker.

17. The method of claim l, wherein the oligomerization reactor effluent further comprises C_{9+} hydrocarbons, the method further comprising:

blending the C_{9+} hydrocarbons, a raffinate stream obtained from the aromatization effluent, or both the C_{9+} hydrocarbons and the raffinate stream into a motor fuel stream.

18. The method of claim l, further comprising:

flowing hydrogen obtained from the aromatization effluent to the oligomerization process, the hydrotreating process, or both the oligomerization process and the hydrotreating process.

19. A method comprising:

contacting, in an oligomerization process, ethylene with a selective-higher-olefin catalyst to yield an oligomerization reactor effluent comprising C_6 hydrocarbons which include 1-hexene and C_8 hydrocarbons which include 1-octene;

contacting, in a hydrotreating process, a hydrogenation catalyst with 1-hexene, 1-octene, or both 1-hexene and 1-octene recovered from the oligomerization reactor effluent to yield an aromatization feed comprising hexane, octane, or both; and

contacting, in an aromatization process comprising a plurality of aromatization reactors and at least one furnace, the aromatization feed with an aromatization catalyst to yield an aromatization effluent comprising benzene.

20. The method of claim 12, further comprising.

flowing a raffinate recovered from the aromatization process to the steam cracker; and cracking the raffinate in the steam cracker.

21. The method of claim 19, further comprising:

fractionating a refinery stream to recover a naphtha stream;

feeding the naphtha stream to the hydrotreating process; and

contacting, in the hydrotreating process, naphtha with the hydrogenation catalyst to yield one or more of n-hexane and n-octane in the aromatization feed.

22. The method of claim 21, wherein the aromatization effluent further comprises toluene, ethylbenzene, xylene, 1-hexene, 1-octene, or a combination thereof, the method further comprising:

fractionating the aromatization effluent into a benzene stream, a toluene stream, a xylene stream, and a raffinate stream.

23. The method of claim 22, wherein the aromatization process is further configured to produce a hydrogen effluent, the method further comprising:

flowing a portion of the benzene stream and a portion of the hydrogen effluent to a hydrogenation process to yield cyclohexane; and

feeding the cyclohexane to the oligomerization reactor.

24. The method of claim 23, further comprising.

flowing a portion of the hydrogen effluent to the oligomerization process, the hydrotreating process, or both the oligomerization process and the hydrotreating process.

25. The method of claim 21, further comprising:

flowing a raffinate recovered from the aromatization process to a steam cracker; and cracking the raffinate in the steam cracker to produce a cracker effluent.

26. The method of claim 25, wherein the cracker effluent comprises ethylene and further comprising flowing the ethylene to the oligomerization reactor.

27. The method of claim 26, wherein the oligomerization reactor effluent further comprises C_{9+} hydrocarbons, the method further comprising:

blending the C_{9+} hydrocarbons, a raffinate stream obtained from the aromatization effluent, or both the C_{9+} hydrocarbons and the raffinate stream into a motor fuel stream.