CLAIMS

What is claimed is:

1. A ~~diesel~~ distillate boiling range composition comprising a T90 distillation point of ~~375°C~~ 360°C or less, a cetane index of 45 or more, a naphthenes to aromatics weight ratio of 2.5 or more, an aromatics content of 4.5 wt% to ~~18~~ 25 wt%, ~~a cetane index of 55 or more, and~~ a sulfur content of ~~10~~ 1000 wppm or less~~.~~, and a weight ratio of aliphatic sulfur to total sulfur of 0.15 or more, and wherein the distillate boiling range composition has not been exposed to hydroprocessing conditions.

2. The ~~diesel~~ distillate boiling range composition of claim 1, ~~a)~~ wherein the ~~aromatics content is 4.5 wt% to 16 wt%; or b) wherein the aromatics content is 4.5 wt% to 10 wt%, the~~ distillate boiling range composition comprises a naphthenes to aromatics ~~weight~~ ratio ~~is 4.0~~ of 2.6 or more, ~~and the cetane index is 57 or more, the naphthenes content optionally being 40 wt% or more; or c) wherein the~~ an aromatics content ~~is 4.5~~ of 5.0 wt% to ~~10~~ 18 wt%, ~~the naphthenes content is 20 wt% to 35 wt%, and the cetane index is 57 or more~~ and a sulfur content of 500 wppm or less.

3. The distillate boiling range composition of claim 1, wherein the distillate boiling range composition comprises a sulfur content of 500 wppm or less, or wherein the density at 15.6°C is 870 kg/m^3 or less, or wherein the saturates content is 78 wt% or more, or wherein the distillate boiling range composition comprises a weight ratio of basic nitrogen to total nitrogen of 0.15 or more, or wherein the cetane index is 55 or more, or a combination thereof.

4. The distillate boiling range composition of claim 1, wherein the aromatics content is 4.5 wt% to 18 wt%, or wherein the saturates content is 82 wt% or more, or wherein the sulfur content is 500 wppm or less, or wherein the density at 15.6°C is 835 kg/m^3 or less, or a combination thereof.

5. The distillate boiling range composition of claim 1, wherein the distillate boiling range composition comprises a ratio of cetane index to weight percent of aromatics of 2.8 or higher.

6. The distillate boiling range composition of claim 1, wherein the distillate boiling range composition is used as a fuel in an engine, a furnace, a burner, a combustion device, or a combination thereof.

7. The distillate boiling range composition of claim 1, wherein the distillate boiling range composition comprises a carbon intensity of 88 g CO_2eq / MJ of lower heating value or less.

~~3.~~8. A ~~distillate~~ diesel boiling range composition comprising a T90 distillation point of ~~360°C~~ 375°C or less, ~~a cetane index of 45 or more,~~ a naphthenes to aromatics weight ratio of 2.5 or more, an aromatics content of 4.5 wt% to ~~25~~ 18 wt%, a cetane index of 55 or more, a density at 15°C of 810 to 835 kg/m^3, and a sulfur content of ~~1000~~ 10 wppm or less~~, and a weight ratio of aliphatic sulfur to total sulfur of 0.15 or more, the distillate boiling range composition optionally comprising a ratio of cetane index to weight percent of aromatics of 2.8 or higher~~.

~~4.~~9. The ~~distillate~~ diesel boiling range composition of claim ~~3~~ 8, wherein the ~~distillate boiling range composition comprises a~~ aromatics content is 4.5 wt% to 16 wt%, or wherein the naphthenes to aromatics weight ratio ~~of 2.6~~ is 2.9 or more~~, an aromatics content of 5.0 wt% to 18 wt%, and a sulfur content of 500 wppm or less~~ or a combination thereof.

~~5. The distillate boiling range composition of claims 3 or 4, wherein the distillate boiling range composition comprises a sulfur content of 500 wppm or less, or wherein the density at 15.6°C is 870 kg/m^3 or less, or wherein the saturates content is 78 wt% or more, or wherein the distillate boiling range composition comprises a weight ratio of basic nitrogen to total nitrogen of 0.15 or more, or wherein the cetane index is 55 or more, or a combination thereof.~~

~~6.~~10. The ~~distillate~~ diesel boiling range composition of ~~any of claims 3 – 5~~ claim 8, wherein the aromatics content is 4.5 wt% to ~~18~~ 10 wt%, ~~or wherein the saturates content is 82 wt% or more, or wherein the sulfur content is 500 wppm or less, or wherein the density at 15.6°C is 835 kg/m^3 or less, or a combination thereof.~~ the naphthenes to aromatics weight content is 4.0 or more, and the cetane index is 57 or more.

11. The diesel boiling range composition of claim 10, wherein the naphthenes content is 40 wt% or more.

12. The diesel boiling range composition of claim 8, wherein the aromatics content is 4.5 wt% to 10 wt%, the naphthenes content is 20 wt% to 35 wt%, and the cetane index is 57 or more.

13. The diesel boiling range composition of claim 8, wherein the diesel boiling range composition comprises a ratio of cetane index to weight percent of aromatics of 2.8 or higher, or wherein the diesel boiling range composition comprises a volumetric energy density of 36.1 MJ/liter or higher or a combination thereof.

14. The diesel boiling range composition of claim 1, wherein the diesel boiling range composition is used as a fuel in an engine, a furnace, a burner, a combustion device, or a combination thereof, the diesel boiling range composition optionally comprising a carbon intensity of 90 g CO_2eq / MJ of lower heating value or less.

15. The diesel boiling range composition of claim 14, wherein the diesel boiling range composition is used in an engine of a vehicle, a tailpipe emission of at least one of NOx, CO_2, CO, and hydrocarbons for the engine being reduced relative to a fuel having an aromatics content of 25 wt% or more.

16. The diesel boiling range composition of claim 14, wherein the diesel boiling range composition is used in an engine of a vehicle, a fuel consumption for the engine being reduced relative to a fuel having an aromatics content of 25 wt% or more and being reduced relative to a fuel having an aromatics content of 3.0 wt% or less.

~~7.~~17. A diesel boiling range composition comprising a T10 distillation point of 250°C or more, a T90 distillation point of 375°C or less, a naphthenes to aromatics weight ratio of 1.6 or more, an aromatics content of 4.5 wt% to 25 wt%, a cetane index of 55 or more, and a sulfur content of 10 wppm or less.

~~8~~18.. The diesel boiling range composition of claim ~~7~~ 17, wherein the aromatics content is 4.5 wt% to 10 wt%, the naphthenes to aromatics weight ratio is 4.0 or more, and the cetane index is 65 or more.

19. The diesel boiling range composition of claim 17, wherein the aromatics content is 5.0 wt% to 25 wt%.

~~9.~~20. The ~~distillate boiling range composition or~~ diesel boiling range composition of ~~any of claims 1 to 8~~ claim 17, wherein the ~~distillate boiling range composition or~~ diesel boiling range

composition comprises a ratio of cetane index to weight percent of aromatics of 2.8 or higher, or wherein the diesel boiling range composition comprises a volumetric energy density of 36.1 MJ/liter or higher or a combination thereof.

~~10. Use of a composition comprising a distillate boiling range composition or a diesel boiling range composition according to any of claims 1 9 as a fuel in an engine, a furnace, a burner, a combustion device, or a combination thereof, the composition optionally comprising a carbon intensity of 90 g CO_2eq / MJ of lower heating value or less.~~

~~11. The use of a composition according to claim 10, wherein the use of the composition is in an engine of a vehicle, wherein i) a fuel consumption for the engine being reduced relative to a fuel having an aromatics content of 25 wt% or more and being reduced relative to a fuel having an aromatics content of 3.0 wt% or less, or ii) wherein the use of the composition is in an engine of a vehicle, a tailpipe emission of at least one of NOx, CO_2, CO, and hydrocarbons for the engine being reduced relative to a fuel having an aromatics content of 25 wt% or more, or iii) a combination of i) and ii).~~

~~12.~~21. A method for forming a diesel boiling range composition, comprising:

fractionating a crude oil comprising a final boiling point of 550°C or more to form at least a diesel boiling range fraction, the crude oil comprising a naphthenes to aromatics volume ratio of 1.6 or more and a sulfur content of 0.2 wt% or less, the diesel boiling range fraction comprising a T90 distillation point of 375°C or less; and

hydrotreating the diesel boiling range fraction to form a hydrotreated diesel boiling range fraction comprising a naphthenes to aromatics weight ratio of 1.6 or more, an aromatics content of 4.5 wt% to 22 wt%, a cetane index of 55 or more, a density at 15°C of 810 to 835 kg/m^3, and a sulfur content of 10 wppm or less.

~~13.~~22. The method of claim ~~12~~ 21, wherein the diesel boiling range fraction comprises a sulfur content of 40 wppm to 500 wppm prior to the hydrotreating; or wherein the diesel boiling range fraction is hydrotreated prior to the fractionating, the fractionating comprising forming at least the hydrotreated diesel boiling range fraction; or wherein the hydrotreated diesel boiling range fraction comprises a carbon intensity of 90 g CO_2eq / MJ of lower heating value or less; or a combination thereof.

23. The method of claim 21, wherein the hydrotreated diesel boiling range fraction comprises an aromatic content of 4.5 wt% to 18 wt%, or wherein the hydrotreated diesel boiling range fraction comprises a naphthenes to aromatics weight ratio of 2.8 or more, or a combination thereof.

~~14.~~24. The method of claim ~~12 or 13~~ 21, further comprising exposing the hydrotreated diesel boiling range fraction to aromatic saturation conditions to form an aromatic saturated, hydrotreated diesel boiling range fraction comprising an aromatics content of 4.5 wt% to 10 wt%, a naphthenes to aromatics weight ratio is 4.0 or more, and a cetane index of 57 or more, the aromatic saturated, hydrotreated diesel boiling range fraction optionally comprising a naphthenes content of 40 wt% or more.

~~15.~~25. The method of ~~any of claims 12 – 14, I)~~ claim 21, wherein the hydrotreated diesel boiling range fraction comprises an aromatics content ~~of~~ is 4.5 wt% to 10 wt%, a naphthenes to aromatics weight ratio is 2.4 or more, a naphthenes content of 20 wt% to 35 wt%, and a cetane index is 57 or more~~, or II) wherein the hydrotreated diesel boiling range fraction comprises an aromatics content of 4.5 wt% to 18 wt%, or wherein the hydrotreated diesel boiling range fraction comprises a naphthenes to aromatics weight ratio of 2.8 or more, or a combination thereof~~.

26. The method of claim 21, further comprising blending at least a portion of the diesel boiling range fraction with a renewable distillate fraction.