CLAIMS:

~~1. A method of expanding an advanced combustion engine's operating envelope during operation in an advanced combustion mode, the method comprising supplying an engine cylinder during operation in the advanced combustion mode with an enriched fuel.~~

~~2. The method of claim 1, wherein the enriched fuel is selected from the group consisting of an enriched gasoline, an enriched diesel fuel, an enriched kerosene, an enriched jet fuel, an enriched biofuel blend, an enriched Fischer-Tropsch derived fuel, an enriched gasoline-diesel blend, an enriched naphtha, and mixtures and/or blends thereof.~~

~~3. The method of claim 1, wherein the enriched fuel is selected from the group consisting of:~~

~~(a) an enriched fuel comprising about 25% or more by volume of aromatics;~~

~~(b) an enriched fuel comprising about 7% or more by volume of olefins; and~~

~~(c) an enriched fuel comprising about 5% or more by volume of cycloparaffins.~~

~~4. The method of claim 1, wherein the enriched fuel is selected from the group consisting of:~~

~~(a) an enriched gasoline comprising about 30% or more by volume of aromatics, cycloparaffins, and olefins;~~

~~(b) an enriched gasoline comprising about 26% or more by volume of~~

~~aromatics and olefins;~~

~~(c) an enriched gasoline comprising about 24% or more by volume of aromatics and cycloparaffins; and~~

~~(d) an enriched gasoline comprising about 10% or more by volume of cycloparaffins and olefins.~~

~~5. The method of claim 1, wherein the enriched fuel is selected from the group consisting of:~~

~~(a) an enriched fuel comprising about 35% or more by volume of aromatics,~~

~~(b) an enriched fuel comprising about 18% or more by volume of olefins; and~~

~~(c) an enriched fuel comprising about 10% or more by volume of cycloparaffins.~~

~~6. The method of claim 1, wherein the enriched fuel is selected from the group consisting of:~~

~~(a) an enriched gasoline comprising about 48% or more by volume of aromatics, cycloparaffins, and olefins;~~

~~(b) an enriched gasoline comprising about 43% or more by volume of aromatics and olefins;~~

~~(c) an enriched gasoline comprising about 40% or more by volume of aromatics and cycloparaffins; and~~

(d) an enriched gasoline comprising about 19% or more by volume of cycloparaffins and olefins.

7. The method of claim 1, wherein the enriched fuel is selected from the group consisting of:

(a) an enriched fuel comprising about 38% or more by volume of aromatics,

(b) an enriched fuel comprising about 19% or more by volume of olefins; and

(c) an enriched fuel comprising about 11% or more by volume of cycloparaffins.

8. The method of claim 1, wherein the enriched fuel is selected from the group consisting of:

(a) an enriched gasoline comprising about 58% or more by volume of aromatics, cycloparaffins, and olefins;

(b) an enriched gasoline comprising about 53% or more by volume of aromatics and olefins;

(c) an enriched gasoline comprising about 45% or more by volume of aromatics and cycloparaffins; and

(d) an enriched gasoline comprising about 20% or more by volume of cycloparaffins and olefins.

9. The method of claim 1, wherein the enriched fuel is a gasoline which is

~~enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene.~~

~~10. The method of claim 1, wherein the advanced combustion engine operates in either a HCCI mode, a PCCI mode, or a LTC mode.~~

~~11. The method of claim 1, wherein the advanced combustion engine operates in a HCCI mode and the enriched fuel is an enriched gasoline.~~

~~12. The method of claim 1, wherein:~~

~~(a) the advanced combustion engine operates in a HCCI mode;~~

~~(b) the enriched fuel is an enriched gasoline;~~

~~(c) the engine cylinder optionally contains a small percentage by volume of EGR prior to combustion of the enriched gasoline in the cylinder;~~

~~(d) upon combustion, the R_{max} value is approximately equal to the R_{max} value observed when a corresponding non-enriched gasoline is combusted in the cylinder in the presence of between about 10% to about 40% by volume EGR; and~~

~~(e) the engine's peak NO_x emission level is between about 5% to about 99% lower than the NO_x emission level generated by combustion of a corresponding non-enriched gasoline under equivalent combustion conditions.~~

~~13. The method of claim 1, wherein:~~

~~(a) the advanced combustion engine operates in a HCCI mode;~~

~~(b) the enriched fuel is selected from the group consisting of (1) an enriched gasoline comprising about 48% or more by volume of aromatics,~~

~~cycloparaffins, and olefins; (2) an enriched gasoline comprising about 43% or more by volume of aromatics and olefins; (3) an enriched gasoline comprising about 40% or more by volume of aromatics and cycloparaffins; and (4) an enriched gasoline comprising about 19% or more by volume of cycloparaffins and olefins;~~

~~(c) the engine cylinder optionally contains a small percentage by volume of EGR prior to combustion of the enriched gasoline in the cylinder;~~

~~(d) upon combustion, the Rmax value is approximately equal to the Rmax value observed when a corresponding non-enriched gasoline is combusted in the cylinder in the presence of between about 10% to about 40% by volume EGR; and~~

~~(e) the engine's peak NOx emission level is between about 5% to about 99% lower than the NOx emission level generated by combustion of a corresponding non-enriched gasoline under equivalent combustion conditions.~~

~~14. The method of claim 1, wherein:~~

~~(a) the advanced combustion engine operates in a HCCI mode;~~

~~(b) the enriched fuel is selected from the group consisting of (1) an enriched gasoline comprising about 58% or more by volume of aromatics, cycloparaffins, and olefins; (2) an enriched gasoline comprising about 53% or more by volume of aromatics and olefins; (3) an enriched gasoline comprising about 45% or more by volume of aromatics and cycloparaffins; and (4) an enriched gasoline comprising about 20% or more by volume of cycloparaffins and olefins.~~

~~(c) the engine cylinder does not contain EGR prior to combustion of the enriched gasoline in the cylinder; and~~

~~(d) the engine's peak NOx emission level is between about 5% to about 99% lower than the NOx emission level generated by combustion of a corresponding~~

~~non-enriched gasoline under equivalent combustion conditions.~~

~~15. The method of claim 1, wherein:~~

~~(a) the advanced combustion engine operates in a HCCI mode;~~

~~(b) the enriched fuel is gasoline which is enriched in a hydrocarbon fraction selected from the group consisting of a cyclopentane, toluene, and diisobutylene;~~

~~(c) the engine cylinder does not contain EGR prior to combustion of the enriched gasoline in the cylinder; and~~

~~(d) the engine's peak NOx emission level is between about 5% to about 99% lower than the NOx emission level generated by combustion of a corresponding non-enriched gasoline under equivalent combustion conditions.~~

~~16. The method of claim 1, wherein the enriched fuel is selected from the group consisting of:~~

~~(1) an enriched fuel comprising either (a) about 25%-50% by volume of aromatics, or (b) about 15%-25% by volume of olefins, or (c) about 5%-20% by volume of cycloparaffins;~~

~~(2) an enriched fuel comprising (a) about 25%-50% by volume of aromatics (b) about 15%-25% by volume of olefins, and (c) about 5%-20% by volume of cycloparaffins;~~

~~(3) an enriched fuel comprising (a) about 35%-45% by volume of aromatics (b) about 15%-20% by volume of olefins, and (c) about 5%-15% by volume of cycloparaffins;~~

~~(4) an enriched fuel comprising (a) about 35% by volume of aromatics (b) about 18% by volume of olefins, and (c) about 10% by volume of cycloparaffins;~~

~~(5) an enriched fuel comprising about 25%-50% by volume of aromatics and about 15%-25% by volume of olefins;~~

~~(6) an enriched fuel comprising about 25%-50% by volume of aromatics and about 5%-20% by volume of cycloparaffins;~~

~~(7) an enriched fuel comprising about 15%-20% by volume of olefins and about 5%-15% by volume of cycloparaffins;~~

~~(8) an enriched gasoline comprising about 45%-65% by volume of aromatics, cycloparaffins, and olefins;~~

~~(9) an enriched gasoline comprising about 45%-60% by volume of aromatics, cycloparaffins, and olefins;~~

~~(10) an enriched gasoline comprising about 48%-58% by volume of aromatics, cycloparaffins, and olefins;~~

~~(11) an enriched gasoline comprising about 40%-60% by volume of aromatics and olefins;~~

~~(12) an enriched gasoline comprising about 45%-60% by volume of aromatics and olefins;~~

~~(13) an enriched gasoline comprising about 43%-53% by volume of aromatics and olefins;~~

~~(14) an enriched gasoline comprising about 40%-60% by volume of aromatics and cycloparaffins;~~

~~(15) an enriched gasoline comprising about 45%-55% by volume of aromatics and cycloparaffins;~~

~~(16) an enriched gasoline comprising about 45% by volume of aromatics and cycloparaffins;~~

~~(17) an enriched gasoline comprising about 10%-30% by volume of cycloparaffins and olefins;~~

~~(18) an enriched gasoline comprising about 15%-30% by volume of cycloparaffins and olefins;~~

~~(19) an enriched gasoline comprising about 13%-25% by volume of cycloparaffins and olefins;~~

~~(20) an enriched gasoline comprising about 25%-50% by volume of aromatics;~~

~~(21) an enriched gasoline comprising about 35%-45% by volume of aromatics;~~

~~(22) an enriched gasoline comprising about 35% by volume of aromatics;~~

~~(23) an enriched gasoline comprising about 15%-25% by volume of olefins;~~

~~(24) an enriched gasoline comprising about 15%-20% by volume of olefins;~~

~~(25) an enriched gasoline comprising about 18% by volume of olefins;~~

~~(26) an enriched gasoline comprising about 5%-20% by volume of cycloparaffins;~~

~~(27) an enriched gasoline comprising about 5%-15% by volume of cycloparaffins;~~

~~(28) an enriched gasoline comprising about 10% by volume of cycloparaffins; and~~

~~(29) an enriched gasoline comprising (a) about 25%-50% by volume of aromatics (b) about 15%-25% by volume by volume of olefins, and (c) about 5%-20% by volume of cycloparaffins, wherein the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene.~~

~~17. The method of claim 12, wherein the engine's HCCI operating envelope includes loads that are about 10% to about 30% higher than those achieved when the engine uses.a non-enriched gasoline.~~

~~18.~~1. A method of expanding an advanced combustion engine's operating envelope during operation in an advanced combustion mode, the method comprising supplying an engine cylinder during operation in the advanced combustion mode with a blend ~~comprising an enriched fuel and about 5% or more by volume of an alcohol.~~

~~19. The method of claim 18, wherein the blend is~~ selected from the group consisting of:

(a) a blend comprising about 5% to about 15% by volume of ~~an alcohol~~ ethanol and about 85% to about 95% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane;

(b) a blend comprising about 15% to about 25% by volume of ~~an alcohol~~ ethanol and about 75% to about 85% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane;

(c) a blend comprising about 25% to about 35% by volume of ~~an alcohol~~ ethanol and about 65% to about 75% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane;

(d) a blend comprising about 35% to about 45% by volume of ~~an alcohol~~ ethanol and about 55% to about 65% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane;

(e) a blend comprising about 45% to about 55% by volume of ~~an alcohol~~ ethanol and about 45% to about 55% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane;

(f) a blend comprising about 55% to about 65% by volume of ~~an alcohol~~ ethanol and about 35% to about 45% ~~of an enriched fuel~~ by volume of a gasoline enriched in cyclopentane;

(g) a blend comprising about 65% to about 75% by volume of ~~an alcohol~~ ethanol and about 25% to about 35% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane;

(h) a blend comprising about 75% to about 85% by volume of ~~an alcohol~~ ethanol and about 15% to about 25% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane; and

(i) a blend comprising about 85% to about 95% by volume of ~~an alcohol~~ ethanol and about 5% to about 15% by volume of ~~an enriched fuel~~ a gasoline enriched in cyclopentane.

~~20. The method of claim 18, wherein the alcohol is ethanol and the enriched fuel is an enriched gasoline.~~

~~21. The method of claim 18, wherein the enriched fuel is gasoline which is~~

~~enriched in a hydrocarbon fraction selected from the group consisting of a cyclopentane, toluene, and diisobutylene.~~

~~22.~~2. The method of claim ~~18~~ 1, ~~wherein the blend comprises an enriched gasoline and ethanol, and~~ wherein the blend comprises about 10% by volume or more of ethanol and about 45% or more by volume of aromatics, cycloparaffins, and olefins.

~~23.~~3. The method of claim ~~18~~ 1, ~~wherein the blend comprises an enriched gasoline and ethanol, and~~ wherein the blend comprises about 10% by volume or more of ethanol and about 40% or more by volume of aromatics and olefins.

~~24.~~4. The method of claim ~~18~~ 1, ~~wherein the blend comprises an enriched gasoline and ethanol, and~~ wherein the blend comprises about 10% by volume or more of ethanol and about 40% or more by volume of aromatics and cycloparaffins.

~~25.~~5. The method of claim ~~18~~ 1, ~~wherein the blend comprises an enriched gasoline and ethanol, and~~ wherein the blend comprises about 10% by volume or more of ethanol and about 10% or more by volume of cycloparaffins and olefins.

~~26.~~6. The method of claim ~~18~~ 1, wherein the blend is selected from the group consisting of blends comprising:

(1) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about ~~0-5%~~ 5% by volume of ethanol and (a) about 20%-80% by volume of aromatics, or (b) about 4-60% by volume cycloparaffins, or (c) about 6-70% by volume olefins, or (d) about 20-90% by volume of aromatics, cycloparaffins, and olefins, or (e) about 16-85% by volume aromatics and olefins, or (f) about 14-80% aromatics and cycloparaffins, or (g) about 5-70% cycloparaffins and olefins;

(2) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 5-14% by volume of ethanol and (a) about 15%-75% by volume of aromatics,

or (b) about 3-55% by volume cycloparaffins, or (c) about 4-65% by volume olefins, or (d) about 17-85% by volume of aromatics, cycloparaffins, and olefins, or (e) about 14-80% aromatics and olefins, or (f) about 13-75% aromatics and cycloparaffins, or (g) about 4-65% cycloparaffins and olefins;

(3) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 15-90% by volume of ethanol and (a) about 10-70% by volume of aromatics, or (b) about 2-50% by volume cycloparaffins,or (c) about 3-60% by volume olefins, or (d) about 10-80% by volume of aromatics, cycloparaffins, and olefins, or (e) about 8-75% by volume aromatics and olefins, or (f) about 8-70% aromatics and cycloparaffins, or (g) about 3-60% cycloparaffins and olefins;

(4) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about ~~0-5%~~ 5% by volume of ethanol and (a) about 25%-70% by volume of aromatics, or (b) about 5-50% by volume cycloparaffins, or (c) about 7-60% by volume olefins, or (d) about 30-80% by volume of aromatics, cycloparaffins, and olefins, or (e) about 26-75% by volume aromatics and olefins, or (f) about 24-70% aromatics and cycloparaffins, or (g) about 10-60% cycloparaffins and olefins;

(5) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 5-14% by volume of ethanol and (a) about 20%-65% by volume of aromatics, or (b) about 4-45% by volume cycloparaffins, or (c) about 5-55% by volume olefins, or (d) about 22-75% by volume of aromatics, cycloparaffins, and olefins, or (e) about 19-70% aromatics and olefins, or (f) about 18-65% aromatics and cycloparaffins, or (g) about 7-55% cycloparaffins and olefins;

(6) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 15-90% by volume of ethanol and (a) about 15-60% by volume of aromatics, or (b) about 3-40% by volume cycloparaffins,or (c) about 4-50% by volume olefins, or (d) about 15-70% by volume of aromatics, cycloparaffins, and olefins, or (e) about 13-65% by volume aromatics and olefins, or (f) about 12-60% aromatics and cycloparaffins, or (g) about 5-50% cycloparaffins and olefins;

(7) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about ~~0-5%~~ 5% by volume of ethanol and (a) about 35%-80% by volume of aromatics, or (b) about 10-60% by volume cycloparaffins, or (c) about 18-70% by volume olefins, or (d) about 48-90% by volume of aromatics, cycloparaffins, and olefins, or (e) about 43-85% by volume aromatics and olefins, or (f) about 40-80% aromatics and cycloparaffins, or (g) about 19-70% cycloparaffins and olefins;

(8) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 5-14% by volume of ethanol and (a) about 30%-75% by volume of aromatics, or (b) about 5-55% by volume cycloparaffins, or (c) about 8-65% by volume olefins, or (d) about 43-85% by volume of aromatics, cycloparaffins, and olefins, or (e) about 38-80% aromatics and olefins, or (f) about 35-75% aromatics and cycloparaffins, or (g) about 11-65% cycloparaffins and olefins;

(9) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 15-90% by volume of ethanol and (a) about 25-70% by volume of aromatics, or (b) about 3-50% by volume cycloparaffins,or (c) about 5-60% by volume olefins, or (d) about 33-80% by volume of aromatics, cycloparaffins, and olefins, or (e) about 30-75% by volume aromatics and olefins, or (f) about 28-70% aromatics and cycloparaffins, or (g) about 8-60% cycloparaffins and olefins;

(10) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about ~~0-5%~~ 5% by volume of ethanol and (a) about 38%-70% by volume of aromatics, or (b) about 11-50% by volume cycloparaffins, or (c) about 19-60% by volume olefins, or (d) about 58-80% by volume of aromatics, cycloparaffins, and olefins, or (e) about 53-75% by volume aromatics and olefins, or (f) about 45-70% aromatics and cycloparaffins, or (g) about 20-60% cycloparaffins and olefins;

(11) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 5-14% by volume of ethanol and (a) about 32%-65% by volume of aromatics, or (b) about 6-45% by volume cycloparaffins, or (c) about 9-55% by volume olefins, or (d) about 48-75% by volume of aromatics, cycloparaffins, and olefins, or (e) about

43-70% aromatics and olefins, or (f) about 40-65% aromatics and cycloparaffins, or (g) about 15-55% cycloparaffins and olefins;

(12) ~~ethanol and an enriched gasoline, wherein the blend is comprised of~~ about 15-90% by volume of ethanol and (a) about 26-60% by volume of aromatics, or (b) about 4-40% by volume cycloparaffins,or (c) about 6-50% by volume olefins, or (d) about 38-70% by volume of aromatics, cycloparaffins, and olefins, or (e) about 33-65% by volume aromatics and olefins, or (f) about 30-60% aromatics and cycloparaffins, or (g) about 10-50% cycloparaffins and olefins;

(13) ~~an alcohol and an enriched gasoline, wherein the blend is comprised of~~ about 5% to about 95% by volume of the alcohol and the enriched gasoline comprises (a) about 25%-50% by volume of aromatics (b) about 15%-25% ~~by volume~~ by volume of olefins, and (c) about 5%-20% by volume of cycloparaffins~~, and wherein the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene;~~

~~(14) an alcohol and an enriched gasoline, wherein the blend is comprised of about 5% to about 95% by volume of the alcohol and the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene;~~

~~(15) an alcohol and an enriched fuel, wherein the blend is comprised of about 5% to about 95% by volume of the alcohol and the enriched fuel is selected from the group consisting of an enriched gasoline, an enriched diesel fuel, an enriched kerosene, an enriched jet fuel, an enriched biofuel blend, an enriched Fischer-Tropsch derived fuel, an enriched gasoline-diesel blend, an enriched naphtha, and mixtures and/or blends thereof;~~

~~(16) an alcohol and an enriched fuel, wherein the blend is comprised of about 5% to about 95% by volume of the alcohol and the enriched fuel is selected from the group consisting of an enriched gasoline, an enriched diesel fuel, an enriched~~

~~kerosene, an enriched jet fuel, an enriched biofuel blend, an enriched Fischer-Tropsch derived fuel, an enriched gasoline-diesel blend, an enriched naphtha, and mixtures and/or blends thereof, wherein the enriched fuel is in some aspects enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene;~~

~~(17) an alcohol and an enriched gasoline, wherein the blend is comprised of about 5% to about 95% by volume of ethanol; and~~

~~(18) an ethanol and an enriched gasoline, wherein the blend is comprised of about 5% to about 95% by volume of ethanol, and wherein the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene~~.

~~27. The method of claim 19, wherein the alcohol is ethanol and the enriched fuel is a gasoline which is enriched in a hydrocarbon fraction selected from the group consisting of a cyclopentane, toluene, and diisobutylene.~~

~~28. The method of claim 19, wherein the alcohol is ethanol and the enriched fuel is a gasoline which is enriched in cyclopentane.~~

~~29. An enriched fuel comprising a fuel which is enriched in a hydrocarbon fraction selected from the group consisting of an aromatic fraction, a cycloparaffin fraction, and an olefinic fraction.~~

~~30. The enriched fuel of claim 29, wherein the enriched fuel is selected from the group consisting of an enriched gasoline, an enriched diesel fuel, an enriched kerosene, an enriched jet fuel, an enriched biofuel blend, an enriched Fischer-Tropsch derived fuel, an enriched gasoline-diesel blend, an enriched naphtha, and mixtures and/or blends thereof.~~

7. The method of claim 1, wherein the enriched gasoline comprises about

25% or more by volume of aromatics, about 7% or more by volume of olefins, and/or about 5% or more by volume of cycloparaffins.

8. The method of claim 1, wherein the enriched gasoline is selected from the group consisting of:

(a) comprising about 30% or more by volume of aromatics, cycloparaffins, and olefins;

(b) comprising about 26% or more by volume of aromatics and olefins;

(c) comprising about 24% or more by volume of aromatics and cycloparaffins; and

(d) comprising about 10% or more by volume of cycloparaffins and olefins.

~~31.~~9. The ~~enriched fuel~~ method of claim ~~29~~ 1, wherein the enriched ~~fuel~~ gasoline is selected from the group consisting of:

(a) ~~an enriched fuel~~ comprising ~~greater than~~ about 35% or more by volume of aromatics,

(b) ~~an enriched fuel~~ comprising ~~greater than~~ about 18% or more by volume of olefins; and

(c) ~~an enriched fuel~~ comprising ~~greater than~~ about 10% or more by volume of cycloparaffins.

~~32.~~10. The ~~enriched fuel~~ method of claim ~~29~~ 1, wherein the enriched ~~fuel~~ gasoline is selected from the group consisting of:

(a) ~~an enriched gasoline~~ comprising about 48% or more by volume of aromatics, cycloparaffins, and olefins;

(b) ~~an enriched gasoline~~ comprising about 43% or more by volume of aromatics and olefins;

(c) ~~an enriched gasoline~~ comprising about 40% or more by volume of aromatics and cycloparaffins; and

(d) ~~an enriched gasoline~~ comprising about 19% or more by volume of cycloparaffins and olefins.

~~33.~~11. The ~~enriched fuel~~ method of claim ~~29~~ 1, wherein the enriched fuel is selected from the group consisting of:

(a) an enriched fuel comprising about 38% or more by volume of aromatics,

(b) an enriched fuel comprising about 19% or more by volume of olefins; and

(c) an enriched fuel comprising about 11% or more by volume of cycloparaffins.

~~34.~~12. The ~~enriched fuel~~ method of claim ~~29~~ 1, wherein the enriched ~~fuel~~ gasoline is selected from the group consisting of:

(a) ~~an enriched gasoline~~ comprising about 58% or more by volume of aromatics, cycloparaffins, and olefins;

(b) ~~an enriched gasoline~~ comprising about 53% or more by volume of aromatics and olefins;

(c) ~~an enriched gasoline~~ comprising about 45% or more by volume of aromatics and cycloparaffins; and

(d) ~~an enriched gasoline~~ comprising about 20% or more by volume of cycloparaffins and olefins.

13. The method of claim 1, wherein the advanced combustion engine operates in either a HCCI mode, a PCCI mode, or a LTC mode.

14. The method of claim 13, wherein the advanced combustion engine operates in a HCCI mode.

~~35. The enriched fuel of claim 29, wherein the enriched fuel is a gasoline which is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene.~~

~~36. The enriched fuel of claim 29, wherein the enriched fuel is selected from the group consisting of:~~

~~(1) an enriched fuel comprising either (a) about 38%-70% by volume of aromatics, or (b) about 19%-60% by volume of olefins, or (c) about 11%-50% by volume of cycloparaffins;~~

~~(2) an enriched fuel comprising (a) about 25%-50% by volume of aromatics (b) about 15%-25% by volume of olefins, and (c) about 5%-20% by volume of cycloparaffins;~~

~~(3) an enriched fuel comprising (a) about 35%-45% by volume of aromatics (b) about 15%-20% by volume of olefins, and (c) about 5%-15% by volume of cycloparaffins;~~

~~(4) an enriched fuel comprising (a) about 35% by volume of aromatics (b)~~

~~about 18% by volume of olefins, and (c) about 10% by volume of cycloparaffins;~~

~~(5) an enriched fuel comprising about 25%-50% by volume of aromatics and about 15%-25% by volume of olefins;~~

~~(6) an enriched fuel comprising about 25%-50% by volume of aromatics and about 5%-20% by volume of cycloparaffins;~~

~~(7) an enriched fuel comprising about 15%-20% by volume of olefins and about 5%-15% by volume of cycloparaffins;~~

~~(8) an enriched gasoline comprising about 45%-75% by volume of aromatics, cycloparaffins, and olefins;~~

~~(9) an enriched gasoline comprising about 48%-70% by volume of aromatics, cycloparaffins, and olefins;~~

~~(10) an enriched gasoline comprising about 58%-68% by volume of aromatics, cycloparaffins, and olefins;~~

~~(11) an enriched gasoline comprising about 40%-80% by volume of aromatics and olefins;~~

~~(12) an enriched gasoline comprising about 45%-70% by volume of aromatics and olefins;~~

~~(13) an enriched gasoline comprising about 53%-65% by volume of aromatics and olefins;~~

~~(14) an enriched gasoline comprising about 40%-70% by volume of aromatics and cycloparaffins;~~

~~(15) an enriched gasoline comprising about 42%-65% by volume of aromatics and cycloparaffins;~~

~~(16) an enriched gasoline comprising about 45%-55% by volume of aromatics and cycloparaffins;~~

~~(17) an enriched gasoline comprising about 19%-60% by volume of cycloparaffins and olefins;~~

~~(18) an enriched gasoline comprising about 20%-50% by volume of cycloparaffins and olefins;~~

~~(19) an enriched gasoline comprising about 22%-40% by volume of cycloparaffins and olefins;~~

~~(20) an enriched gasoline comprising about 25%-50% by volume of aromatics;~~

~~(21) an enriched gasoline comprising about 35%-45% by volume of aromatics;~~

~~(22) an enriched gasoline comprising about 35% by volume of aromatics;~~

~~(23) an enriched gasoline comprising about 15%-25% by volume of olefins;~~

~~(24) an enriched gasoline comprising about 15%-20% by volume of olefins;~~

~~(25) an enriched gasoline comprising about 18% by volume of olefins;~~

~~(26) an enriched gasoline comprising about 5%-20% by volume of cycloparaffins;~~

(27) an enriched gasoline comprising about 5%-15% by volume of cycloparaffins;

(28) an enriched gasoline comprising about 10% by volume of cycloparaffins;

(29) an enriched gasoline comprising (a) about 25%-50% by volume of aromatics (b) about 15%-25% by volume by volume of olefins, and (c) about 5%-20% by volume of cycloparaffins, wherein the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene; and

(30) an enriched gasoline comprising (a) about 35%-45% by volume of aromatics (b) about 15%-20% by volume by volume of olefins, and (c) about 10%-20% by volume of cycloparaffins, wherein the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene.

37. A blend comprising an enriched fuel and about 5% or more by volume of an alcohol.

38. The blend of claim 37, wherein the enriched fuel is an enriched gasoline and the alcohol is ethanol.

39. The blend of claim 37, wherein the blend is selected from the group consisting of:

(a) a blend comprising about 5% to about 15% by volume of an alcohol and about 85% to about 95% by volume of an enriched fuel;

(b) a blend comprising about 15% to about 25% by volume of an alcohol and about 75% to about 85% by volume of an enriched fuel;

~~(c) a blend comprising about 25% to about 35% by volume of an alcohol and about 65% to about 75% by volume of an enriched fuel;~~

~~(d) a blend comprising about 35% to about 45% by volume of an alcohol and about 55% to about 65% by volume of an enriched fuel;~~

~~(e) a blend comprising about 45% to about 55% by volume of an alcohol and about 45% to about 55% by volume of an enriched fuel;~~

~~(f) a blend comprising about 55% to about 65% by volume of an alcohol and about 35% to about 45% of an enriched fuel;~~

~~(g) a blend comprising about 65% to about 75% by volume of an alcohol and about 25% to about 35% by volume of an enriched fuel;~~

~~(h) a blend comprising about 75% to about 85% by volume of an alcohol and about 15% to about 25% by volume of an enriched fuel; and~~

~~(i) a blend comprising about 85% to about 95% by volume of an alcohol and about 5% to about 15% by volume of an enriched fuel.~~

~~40. The blend of claim 37, wherein the blend comprises an enriched gasoline and ethanol, and wherein the blend comprises about 10% by volume or more of ethanol and about 45% or more by volume of aromatics, cycloparaffins, and olefins.~~

~~41. The blend of claim 37, wherein the blend comprises an enriched gasoline and ethanol, and wherein the blend comprises about 10% by volume or more of ethanol and about 40% or more by volume of aromatics and olefins.~~

~~42. The blend of claim 37, wherein the blend comprises an enriched gasoline and ethanol, and wherein the blend comprises about 10% by volume or more~~

~~of ethanol and about 40% or more by volume of aromatics and cycloparaffins.~~

~~43. The blend of claim 37, wherein the blend comprises an enriched gasoline and ethanol, and wherein the blend comprises about 10% by volume or more of ethanol and about 10% or more by volume of cycloparaffins and olefins.~~

~~44. The blend of claim 37, wherein the blend comprises about 10% by volume or more of ethanol and a gasoline which is enriched in a hydrocarbon fraction selected from the group consisting of a cyclopentane, toluene, and diisobutylene.~~

~~45. The blend of claim 37, wherein the alcohol is ethanol and the enriched fuel is a gasoline which is enriched in a hydrocarbon fraction selected from the group consisting of a cyclopentane, toluene, and diisobutylene.~~

~~46. The blend of claim 37, wherein the blend is selected from the group consisting of blends comprising:~~

~~(1) ethanol and an enriched gasoline, wherein the blend is comprised of about 0-5% by volume of ethanol and (a) about 35%-80% by volume of aromatics, or (b) about 10-60% by volume cycloparaffins, or (c) about 18-70% by volume olefins, or (d) about 48-90% by volume of aromatics, cycloparaffins, and olefins, or (e) about 43-85% by volume aromatics and olefins, or (f) about 40-80% aromatics and cycloparaffins, or (g) about 19-70% cycloparaffins and olefins;~~

~~(2) ethanol and an enriched gasoline, wherein the blend is comprised of about 5-14% by volume of ethanol and (a) about 30%-75% by volume of aromatics, or (b) about 5-55% by volume cycloparaffins, or (c) about 8-65% by volume olefins, or (d) about 43-85% by volume of aromatics, cycloparaffins, and olefins, or (e) about 38-80% aromatics and olefins, or (f) about 35-75% aromatics and cycloparaffins, or (g) about 11-65% cycloparaffins and olefins;~~

~~(3) ethanol and an enriched gasoline, wherein the blend is comprised of~~

~~about 15-90% by volume of ethanol and (a) about 25-70% by volume of aromatics, or (b) about 3-50% by volume cycloparaffins,or (c) about 5-60% by volume olefins, or (d) about 33-80% by volume of aromatics, cycloparaffins, and olefins, or (e) about 30-75% by volume aromatics and olefins, or (f) about 28-70% aromatics and cycloparaffins, or (g) about 8-60% cycloparaffins and olefins;~~

~~(4) ethanol and an enriched gasoline, wherein the blend is comprised of about 0-5% by volume of ethanol and (a) about 38%-70% by volume of aromatics, or (b) about 11-50% by volume cycloparaffins, or (c) about 19-60% by volume olefins, or (d) about 58-80% by volume of aromatics, cycloparaffins, and olefins, or (e) about 53-75% by volume aromatics and olefins, or (f) about 45-70% aromatics and cycloparaffins, or (g) about 20-60% cycloparaffins and olefins;~~

~~(5) ethanol and an enriched gasoline, wherein the blend is comprised of about 5-14% by volume of ethanol and (a) about 32%-65% by volume of aromatics, or (b) about 6-45% by volume cycloparaffins, or (c) about 9-55% by volume olefins, or (d) about 48-75% by volume of aromatics, cycloparaffins, and olefins, or (e) about 43-70% aromatics and olefins, or (f) about 40-65% aromatics and cycloparaffins, or (g) about 15-55% cycloparaffins and olefins;~~

~~(6) ethanol and an enriched gasoline, wherein the blend is comprised of about 15-90% by volume of ethanol and (a) about 26-60% by volume of aromatics, or (b) about 4-40% by volume cycloparaffins,or (c) about 6-50% by volume olefins, or (d) about 38-70% by volume of aromatics, cycloparaffins, and olefins, or (e) about 33-65% by volume aromatics and olefins, or (f) about 30-60% aromatics and cycloparaffins, or (g) about 10-50% cycloparaffins and olefins;~~

~~(7) an alcohol and an enriched gasoline, wherein the blend is comprised of about 5% to about 95% by volume of the alcohol and the enriched gasoline comprises (a) about 25%-50% by volume of aromatics (b) about 15%-25% by volume by volume of olefins, and (c) about 5%-20% by volume of cycloparaffins, and wherein the enriched gasoline is enriched in a hydrocarbon selected from the group consisting~~

~~of cyclopentane, toluene, and diisobutylene;~~

~~(8) an alcohol and an enriched gasoline, wherein the blend is comprised of about 5% to about 95% by volume of the alcohol and the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene;~~

~~(9) an alcohol and an enriched fuel, wherein the blend is comprised of about 5% to about 95% by volume of the alcohol and the enriched fuel is selected from the group consisting of an enriched gasoline, an enriched diesel fuel, an enriched kerosene, an enriched jet fuel, an enriched biofuel blend, an enriched Fischer-Tropsch derived fuel, an enriched gasoline-diesel blend, an enriched naphtha, and mixtures and/or blends thereof;~~

~~(10) an alcohol and an enriched fuel, wherein the blend is comprised of about 5% to about 95% by volume of the alcohol and the enriched fuel is selected from the group consisting of an enriched gasoline, an enriched diesel fuel, an enriched kerosene, an enriched jet fuel, an enriched biofuel blend, an enriched Fischer-Tropsch derived fuel, an enriched gasoline-diesel blend, an enriched naphtha, and mixtures and/or blends thereof, wherein the enriched fuel is in some aspects enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene;~~

~~(11) an alcohol and an enriched gasoline, wherein the blend is comprised of about 5% to about 95% by volume of ethanol; and~~

~~(12) an ethanol and an enriched gasoline, wherein the blend is comprised of about 5% to about 95% by volume of ethanol, and wherein the enriched gasoline is enriched in a hydrocarbon selected from the group consisting of cyclopentane, toluene, and diisobutylene.~~

~~47. The blend of claim 39, wherein the alcohol is ethanol.~~