CLAIMS:

1. A separation process, comprising:

(a) providing a first stream, the first stream comprising ≥ 1.0 wt. % methane, ≥ 1.0 wt. % molecular hydrogen, and ≥ 2.0 ppbw of NO_x,, the weight percents being based on the weight of the first stream;

(b) producing an upgraded first stream by exposing the first stream during a first time interval to a first removal agent to remove ≥ 50.0 wt. % of the first stream's NO_x, based on the weight of the stream's NO_x, wherein the first stream contacts the first removal agent at a space velocity (GHSV) ≥ $2.5x10^4$ hr^{-1}, and wherein the upgraded first stream comprises < 3 ppbw of NO_x;(c) during a second time interval following the first time interval at least partially regenerating the first removal agent;

(d) exposing the upgraded first stream to a temperature sufficient to condense at least a portion of the first stream's methane;

(e) conducting away a second stream, the second stream comprising at least a portion of the condensed methane; and

(f) conducting away a third stream, the third stream comprising at least a portion of the upgraded first stream's molecular hydrogen.

2. The process of claim 1, wherein:

(i) the first stream comprises ≥ 10.0 wt. % methane and ≥ 2.0 ppbw of NO, and further comprises ≥ 0.05 mole % water per mole of the first stream;

(ii) step (b) further comprises exposing the first stream to a second removal agent to remove ≥ 50.0 wt. % of the first stream's water, based on the weight of the first stream's water, and wherein the first stream contacts the second removal agent at a space velocity (GHSV) ≥ $2.0x10^3$ hr^{-1};

(iii) ≥ 75.0 wt. % of the first stream's NO based on the weight of the first stream's NO is removed during step (b); and

(iv) step (c) further comprises at least partially regenerating the second removal agent during the second time interval.

3. The process of claim 2, wherein the first removal agent comprises ≥ 90.0 wt. % of at least one solid absorbent and the second removal agent comprises ≥ 90.0 wt. % of a second solid absorbent.

4. The process of claim 2 wherein (i) the second removal agent is located upstream of the first removal agent with respect to the flow of the first stream during step (b) and (ii) during step (b) the second removal agent removes ≤ 1.0 wt. % of the first stream's NO_x, based on the weight of the first stream's NO_x, and the first removal agent removes ≤ 1.0 wt. % of the first stream's water based on the weight of the first stream's water.

5. The process of claim 1, further comprising producing ≥ 50.0 wt.% of the first stream based on the weight of the first stream by one or more of hydrocarbon pyrolysis, catalytic cracking of hydrocarbon, dehydrogenation of saturated hydrocarbon, or acetylene hydrogenation.

6. The process of claim 1, wherein the first stream further comprises ≥ 1.0 wt. % of C_{2+} olefin based on the weight of the first stream.

7. The process of claim 1, further comprising subjecting the first stream upstream of step (b) to one or more of (i) selective hydrogenation, sulfur removal, heavy hydrocarbon removal, water removal, CO_2 removal, or CO removal.

8. The process of claim 1, wherein (i) the exposing of step (b) includes a temperature in the range of 4.0°C to 50.0°C at a pressure in the range of 13 bar (absolute) to 40 bar (absolute); and (ii) the regenerating of step (c) includes a temperature in the range of 100.0°C to 400.0°C and a pressure in the range of 1 bar (absolute) to 10 bar (absolute).

9. The process of claim 1, wherein (i) step (d) includes exposing the upgraded first stream to a temperature ≤ -100.0°C; (ii) the second stream comprises ≥ 50.0 wt. % of the condensed methane based on the weight of the condensed methane based on the weight of the condensed methane; and (iii) the third stream comprises ≥ 50.0 wt. % of the upgraded first stream's molecular hydrogen based on the weight of the upgraded first stream's molecular hydrogen.

10. A hydrocarbon upgrading process, comprising:

(a) providing a first stream comprising ≥ 10.0 wt. % methane, ≥ 1.0 wt. % of molecular hydrogen, ≥ 2.0 ppbw of NO_x, the weight percents being based on the weight of the first stream, and ≥ 0.05 mole % of water per mole of the first stream; and

(b) during a first time interval exposing the first stream to (i) a second removal agent to remove ≥ 50.0 wt. % of the first stream's water based on the weight of the first stream's water and (ii) to a first removal agent to remove ≥ 50.0 wt. % of the first stream's NO_x based on the weight of the mixture's NO_x to produce a first upgraded mixture, wherein the first stream contacts the first removal agent at a space velocity (GHSV) ≥ $2.5x10^4$ hr^{-1}, and wherein the upgraded first stream comprises < 3 ppbw of NO_x.

11. The process of claim 10, further comprising:

(c) during a second time interval at least partially regenerating the first and second removal agents.

12. The process of claim 11, wherein the exposing of step (b) (ii) is conducted for a time duration t_1 and the exposing of step (b)(i) is conducted for a time duration t_2.

13. The process of claim 12, wherein the first and second time interval are non-overlapping intervals.

14. The process of claim 12, further comprising:

(d) during the second time interval, exposing the first stream to (i) a fourth removal agent for a time duration t_4 to remove ≥ 50.0 wt. % of the first stream's water based on the weight of the first stream's water and (ii) to a third removal agent for a time duration t_3 to remove ≥ 50.0 wt. % of the first stream's NO_x based on the weight of the mixture's NO_x to produce a second upgraded mixture, wherein the first stream contacts the third removal agent at a space velocity (GHSV) ≥ $2.5x10^4$ hr^{-1}; and

(e) at least partially regenerating the third and fourth removal agents during the first time interval.

15. The process of claim 14, wherein t_2 is in the range of t_1•0.75 to t_1•1.25 and t_4 is in the range of t_3•0.75 to t_3•1.25.

16. The process of claim 14, further comprising combining at least a portion of the first upgraded mixture with at least a portion of the second upgraded mixture.

17. The process of claim 14, wherein ≥ 90.0% (wt. basis) of the second removal agent is located upstream of ≥ 90.0% (wt. basis) of the first removal agent and (ii) ≥ 90.0% (wt. basis) of the fourth removal agent is located upstream of ≥ 90.0% (wt. basis) of the third removal agent.

18. The process of claim 14, wherein substantially all of (i) the first and (ii) the second removal agents are located in a first vessel, substantially all of (ii) the third and (iii) the fourth removal agents are located in a second vessel, and steps (a) through (e) are operated cyclically.

19. The process of claim 14, wherein the process includes at least one of

(i) the first stream contacts the first removal agent at a space velocity (GHSV) ≥ 5.0×10^4 hr^{-1} and t_2 is in the range of $t_1 \bullet 0.9$ to $t_1 \bullet 1.1$,

(ii) the first stream contacts the third removal agent at a space velocity (GHSV) ≥ 5.0×10^4 hr^{-1} and t_4 is in the range of $t_3 \bullet 0.9$ to $t_3 \bullet 1.1$,

(iii) the first and second time intervals are each ≤ 100 hours;

(iv) the first and third removal agents comprise a first adsorbent and the second and fourth removal agents comprise a second adsorbent; or

(v) the first adsorbent has a NOx adsorbent capacity ≥ 0.11 during at least one of t_1 or t_3.

20. A process for separating a methane-rich stream and a molecular hydrogen-rich stream from a first stream, the process comprising:

(a) providing the first stream, the first stream comprising ≥ 10.0 wt. % methane, ≥ 1.0 wt. % molecular hydrogen, and ≥ 2.0 ppbw of NO_x, the weight percents being based on the weight of the first stream, and ≥ 0.05 mole % of water per mole of the first stream;

(b) producing a first upgraded stream by exposing at least a first portion of the first stream during a first time interval to (i) a second removal agent to remove ≥ 50.0 wt. % of the first stream's water, based on the weight of the first stream's water, and (ii) a first removal agent to remove ≥ 50.0 wt. % of the first stream's NO_x, based on the weight of the stream's NO_x, wherein the first stream contacts the first removal agent at a space velocity (GHSV) ≥ 2.5×10^4 hr^{-1}, and wherein the upgraded first stream comprises < 3 ppbw of NO_x;

(c) at least partially regenerating the first and second removal agents during a second

time interval following the first time interval;

(d) conducting at least a portion of the first upgraded stream to a cold box, the cold box being operated under conditions sufficient to condense at least a portion of the first upgraded stream's methane;

(e) removing a second stream from the cold box, the second stream being the methane-rich stream which comprises at least a portion of the condensed methane; and

(f) removing a third stream from the cold box, the third stream being the molecular hydrogen-rich stream which comprises at least a portion of the first upgraded stream's molecular hydrogen.

21. The process of claim 20, further comprising:

(g) producing a second upgraded stream by exposing a second portion of the first stream during the second time interval to (i) a fourth removal agent to remove ≥ 50.0 wt. % of the second portion's water, based on the weight of the second portion's water, and (ii) a third removal agent to remove ≥ 50.0 wt. % of the second portion's NO_x, based on the weight of the stream's NO_x, wherein the first stream contacts the second removal agent at a space velocity (GHSV) ≥ $2.5x10^4$ hr^{-1};

(h) at least partially regenerating the third and fourth removal agents during the first time interval; and

(i) conducting at least at least a portion of the second upgraded stream to the cold box.

22. The process of claim 21, wherein (i) the first removal agent comprises ≥ 1.0 wt. % of at least one Redox agent based on the weight of the first removal agent and/or (ii) the third removal agent comprises ≥ 1.0 wt. % of at least one Redox agent based on the weight of the third removal agent.

23. The process of claim 21, wherein (i) the first stream further comprises ≥ 1.0 wt. % of C_{2+} unsaturates based on the weight of the first stream, (ii) the first removal agent comprises ≥ 1.0 wt. % of one or more of palladium, platinum, or nickel based on the weight of the second removal agent, (iii) the third removal agent comprises ≥ 1.0 wt. % of one or more of palladium, platinum, or nickel based on the weight of the third removal agent, (iv) ≤ 1.0 wt. % of the first stream's C_{2+} olefin is hydrogenated during the exposing of step (b) based on the weight of the first stream's C_{2+} olefin, and (v) ≤ 1.0 wt. % of the first stream's C_{2+} olefin is

hydrogenated during the exposing of step (g) based on the weight of the first stream's C_{2+} olefin.

24. The process of claim 21, wherein steps (a) – (i) are operated cyclically.