**CLAIMS:**

1. A method for generating hydrogen in a refinery, the method comprising:

introducing a fuel stream comprising a reformable fuel into an anode of a molten carbonate fuel cell, an internal reforming element associated with the anode, or a combination thereof;

introducing a cathode inlet stream comprising $CO_2$ and $O_2$ into a cathode of the molten carbonate fuel cell;

generating electricity within the molten carbonate fuel cell;

generating an anode exhaust comprising $H_2$ and $CO_2$;

performing a separation on the anode exhaust to form a $CO_2$-rich gas stream having a $CO_2$ content greater than a $CO_2$ content of the anode exhaust, and a $CO_2$-depleted gas stream comprising hydrogen and having a $CO_2$ content less than the $CO_2$ content of the anode exhaust; and

delivering the $CO_2$-depleted gas stream to one or more second refinery processes,

wherein the molten carbonate fuel cell is operated (i) such that a $CO_2$ utilization in the cathode is at least about 60% and either (ii) so as to achieve a thermal ratio from about 0.25 to about 1.15, or (iii) such that an amount of the reformable fuel introduced into the anode, the internal reforming element associated with the anode, or the combination thereof, provides a reformable fuel surplus ratio of at least about 1.5, or (iv) both (ii) and (iii).

2. The method of claim 1, wherein the cathode inlet stream comprises one or more $CO_2$-containing streams derived directly or indirectly from one or more first refinery processes.

3. The method of claim 1, further comprising separating $H_2O$ from at least one of the anode exhaust, the $CO_2$-depleted stream, and the $CO_2$-rich stream in one or more separation stages.

4. The method of claim 1, wherein a ratio of net moles of syngas in the anode exhaust to moles of $CO_2$ in a cathode exhaust is at least about 2.0.

5. The method of claim 1, wherein a fuel utilization in the anode is about 50% or less and/or wherein an amount of the reformable fuel introduced into the anode, the internal reforming element associated with the anode, or the combination thereof, provides a reformable fuel surplus ratio of at least about 2.0 and/or wherein the molten carbonate fuel cell is operated at a thermal ratio from about 0.25 to about 1.0.

6. The method of claim 1, wherein the molten carbonate fuel cell is operated to generate electrical power at a current density of at least about 150 $mA/cm^2$ and at least about 80 $mW/cm^2$ of waste heat, the method further comprising performing an effective amount of an endothermic reaction to maintain a temperature differential between an anode inlet and an anode outlet of about 100°C or less.

7. The method of claim 6, wherein performing the endothermic reaction consumes at least about 40% of the waste heat.

8. The method of claim 1, wherein an electrical efficiency for the molten carbonate fuel cell is between about 10% and about 40% and/or a total fuel cell efficiency for the molten carbonate fuel cell is at least about 55%.

9. The method of claim 1, wherein the $CO_2$-depleted gas stream comprises an $H_2$-rich gas stream and a syngas stream, each of which having a $CO_2$ content less than the $CO_2$ content of the anode exhaust.

10. The method of claim 2, wherein at least one process in the one or more first refinery processes is a process in the one or more second refinery processes.

11. The method of claim 2, wherein the fuel stream is derived from one or more third refinery processes.

12. The method of claim 11, wherein at least a portion of the fuel stream passes through a pre-reforming stage prior to being introduced into the anode.

13. The method of claim 11, wherein at least a portion of the fuel stream passes through a desulfurization stage prior to being introduced into the anode.

14. The method of claim 9, further comprising separating $H_2O$ from one or more of the anode exhaust, the $CO_2$-rich gas stream, and the a $CO_2$-depleted gas stream.

15. The method of claim 2, wherein the anode exhaust has a molar ratio of $H_2$ to CO of at least about 3.0:1, and has a $CO_2$ content of at least about 10 vol %.

16. The method of claim 2, further comprising modifying an $H_2$ content of one or more of the anode exhaust, the $CO_2$-rich gas stream, and the a $CO_2$-depleted gas stream using a water gas shift process.

17. The method of claim 2, wherein the separating of the anode exhaust comprises using a membrane.

18. The method of claim 1, wherein the $CO_2$-depleted gas stream is further separated into a first $H_2$-rich stream having a first $H_2$ purity and a second $H_2$-rich stream having a second $H_2$ purity, wherein the second $H_2$-rich stream is compressed to a pressure greater than the first $H_2$-rich stream.

19. The method of claim 1, wherein at least one of the one or more second refinery processes involves using hydrogen as a reactant and/or as a combustant.

~~20. The method of claim 1, wherein the molten carbonate fuel cell is operated at steady state conditions with regard to the $CO_2$ utilization in the cathode, the thermal ratio, and/or the reformable fuel surplus ratio.~~