Claims:

What is claimed is:

1. An oxyfuel gas turbine system comprising:

an oxygen stream;

a carbon dioxide stream;

a control fuel stream;

a combustion unit configured to receive the oxygen stream, the carbon dioxide stream, and the control fuel stream, and combust the control fuel stream, the carbon dioxide stream, and the oxygen stream to produce a gaseous combustion stream having substantially carbon dioxide and water, wherein the gaseous combustion stream has a temperature of at least 1800 degrees Fahrenheit;

a turbine configured to receive the gaseous combustion stream, expand the gaseous combustion stream, and exhaust the expanded gaseous combustion stream as a turbine discharge stream, wherein the turbine discharge stream has a temperature of at least 1200 degrees Fahrenheit; and

a plenum in fluid communication with the turbine for receiving the turbine discharge stream, wherein the plenum is configured to provide a residence time during which at least one individual component of the turbine discharge stream reacts chemically towards equilibrium and substantially converts an intermediate product to an equilibrium product. and

2. The system of claim 1 wherein the turbine is configured to generate power when the gaseous combustion stream is expanded.

3. The system of claim 1 wherein at least a portion of the carbon dioxide from the gaseous combustion stream is used for Enhanced Oil Recovery.

4. The system of claim 1 wherein the residence time is predetermined such that the individual component of the turbine discharge stream reacts chemically until a concentration of the individual component is less than 10% greater than an equilibrium concentration of the individual component.

5. The system of claim 4 wherein the individual component is oxygen.

6. The system of claim 4 wherein the individual component is carbon monoxide.

7. The system of claim 4 wherein the individual component is a hydrocarbon intermediate species.

8. The system of claim 7 wherein the hydrocarbon intermediate species is an unburned hydrocarbon.

9. The system of claim 8 wherein the unburned hydrocarbon is formaldehyde.

10. The system of claim 1 wherein the residence time is predetermined such that at least a predetermined percentage of the individual component of the turbine discharge stream at an exit of the turbine is converted to an equilibrium product at an exit of the plenum.

11. The system of claim 10 wherein the predetermined percentage is 50%.

12. The system of claim 10 wherein the predetermined percentage is 75%.

13. The system of claim 10 wherein the predetermined percentage is 90%.

14. The system of claim 10 wherein the individual component is oxygen.

15. The system of claim 10 wherein the individual component is carbon monoxide.

16. The system of claim 10 wherein the individual component is a hydrocarbon intermediate species.

17. The system for claim 16 wherein the hydrocarbon intermediate species is an unburned hydrocarbon.

~~18. The system for claim 17~~ wherein the unburned hydrocarbon is formaldehyde.

19. The system of claim 1 wherein the residence time is predetermined such that the individual component of the turbine discharge stream reacts chemically until the individual component is suitable for use with an Enhanced Oil Recovery process.

20. The system of claim 19 wherein the individual component is oxygen and the oxygen has a concentration equal to or less than 10 parts-per-million.

21. The system of claim 19 wherein the individual component is carbon monoxide and the carbon monoxide has a concentration equal to or less than 1000 parts-per-million.

22. The system of claim 1 wherein the residence time is substantially between 0.1 and 10 seconds.

23. The system of claim 1 wherein the residence time is substantially between 0.1 and 2 seconds.

24. The system of claim 1 wherein the residence time is greater than or equal to 1 second.

25. The system of claim 1 wherein the plenum has a center line length substantially between 10 and 30 meters.

26. The system of claim 1 wherein the plenum has a center line length greater than or equal to 30 meters.

27. The system of claim 1 wherein the pressure of the gaseous combustion stream is substantially between 12 and 18 bar prior to being acted upon by the turbine.

28. The system of claim 1 wherein the temperature of the gaseous combustion stream is substantially between 1900 and 2700 degrees Fahrenheit.

29. The system of claim 1 wherein the temperature of the gaseous combustion stream is between 2200 and 2500 degrees Fahrenheit.

30. The system of claim 1 wherein the gaseous combustion stream is substantially between 70 and 80 percent carbon dioxide.

31. The system of claim 1 wherein the pressure of the turbine discharge stream is substantially 1 bar.

32. The system of claim 1 wherein the pressure of the turbine discharge stream is substantially between 1 and 2 bar.

33. The system of claim 1 wherein the temperature of the turbine discharge stream is between 1200 and 1800 degrees Fahrenheit.

34. The system of claim 1 wherein the temperature of the turbine discharge stream is between 1350 and 1700 degrees Fahrenheit.

35. The system of claim 1 wherein the carbon dioxide stream is compressed in one or more compressors prior to being received by the combustion unit.

36. The system of claim 1 wherein the plenum is in fluid communication with a heat recovery steam generator.

37. The system of claim 36 wherein the heat recovery steam generator is configured to generate power.

38. The system of claim 1 wherein the plenum is directly coupled to the turbine.

39. The system of claim 1 wherein the oxygen stream is generated using an Air Separation Unit.

40. The system of claim 1 wherein the control fuel stream is generated from at least one of a carbon dioxide flood reservoir and a hydrocarbon fuel supply pipeline.

41. The system of claim 1 wherein the carbon dioxide stream comprises between 70 and 100 percent of the carbon dioxide from the gaseous combustion stream.

42. The system of claim 1 wherein the carbon dioxide stream is generated from an oil well.

43. The system of claim 1 wherein the carbon dioxide stream is generated primarily from a first source during startup of the oxyfuel gas turbine system and the carbon dioxide stream is generated primarily from a second source during continued operation of the oxyfuel gas turbine system.

44. The system of claim 43 wherein the first source is an oil well and the second source is the gaseous combustion stream.

45. The system of claim 1 wherein the carbon dioxide stream is compressed between substantially 12 and 18 barg prior to being received by the combustion unit.

46. The system of claim 1 wherein the plenum is in fluid communication with a steam reformer and the steam reformer is configured to use heat from the plenum exhaust stream to reform water and methane in the control fuel stream into hydrogen and carbon monoxide.

47. The system of claim 46 wherein the steam reformer is in fluid communication with and located up stream from a heat recovery steam generator.

48. The system of claim 46 wherein the steam reformer comprises a heat exchanger and a catalyst.

49. An oxyfuel gas turbine system comprising:

a combustion unit configured to produce a gaseous combustion stream;

a turbine configured to receive the gaseous combustion stream, expand the gaseous combustion stream, and exhaust the expanded gaseous combustion stream as a turbine discharge stream wherein the turbine discharge stream has a temperature of at least 1200 degrees Fahrenheit; and

a steam reformer configured to receive the turbine discharge stream; extract heat from the turbine discharge stream; and transfer the heat into a reformer feed stream to generate a reformer product stream.

50. The system of claim 49 wherein the reformer feed stream includes at least a portion of a control fuel stream.

51. The system of claim 50 wherein the reformer feed stream includes steam.

52. The system of claim 51 wherein the reformer feed stream includes carbon dioxide.

53. The system of claims 50 wherein the combustion unit is configured to receive an oxygen stream, a carbon dioxide stream, and a combined fuel stream, wherein the combined fuel stream comprises a mixture of the control fuel stream and the reformer product stream.

54. The system of claims 53 wherein the combustion unit is configured to combust the oxygen stream, the carbon dioxide stream, and the combined fuel stream to produce the gaseous combustion stream.

55. The system of claims 50 wherein a portion of the reformer product stream is further shifted and separated to generate a hydrogen-rich stream and a carbon oxide-rich stream.

56. The system of claim 55 wherein the combustion unit is configured to receive an oxygen stream, a carbon dioxide stream, and a combined fuel stream, wherein the combined fuel stream comprises a mixture of the control fuel stream and the carbon oxide-rich stream.

57. The system of claim 56 wherein the combined fuel stream further includes a portion of the H2-rich stream.

58. The system of claim 55 wherein the hydrogen-rich stream is suitable for sale as a product or to be piped to a different process.

59. The system of claims 49 wherein the reformer is coupled to a heat recovery steam generator for further cooling the turbine discharge stream.

60. The system of claims 49 further comprising a plenum located upstream of the reformer, wherein the plenum is configured to provide a residence time during which an individual component of the turbine discharge stream reacts chemically toward equilibrium and substantially converts an intermediate product to an equilibrium product.

61. The system of claim 60 further comprising a heat recovery steam generator down stream from the reformer.

62. The system of claims 49 further comprising a plenum coupled downstream of the reformer, wherein the plenum is configured to provide a residence time during which an individual component of the turbine discharge stream reacts chemically toward equilibrium and substantially converts an intermediate product to an equilibrium product.

63. The system of claim 62 further comprising a heat recovery steam generator down stream from the plenum.

64. The system of claim 49 wherein a distance between the reformer and a discharge nozzle of the turbine is less than 5 meters.

65. The system of claim 49 wherein the residence time between the reformer and a discharge nozzle of the turbine is less than 0.1 s.

66. The system of claim 49 wherein the gaseous combustion stream has a temperature substantially between 1900 and 2700 degrees Fahrenheit.

67. The system of claim 49 wherein the steam reformer is in fluid communication with and located up stream from a heat recovery steam generator.

68. The system of claim 49 wherein the steam reformer is directly coupled to the turbine.

69. The system of claim 49 wherein the steam reformer comprises a heat exchanger and a catalyst.

70. An method for use with an oxyfuel gas turbine system, the method comprising:

providing an oxygen stream, a carbon dioxide stream, and a control fuel stream;

combusting the oxygen stream, the carbon dioxide stream, and the control fuel stream to produce a gaseous combustion stream;

expanding the gaseous combustion stream across a turbine to form an expanded gaseous combustion stream; and

providing a residence time for the expanded gaseous combustion stream to reach substantial chemical equilibrium, wherein the residence time is provided by a plenum configured to retain the expanded gaseous combustion stream for the residence time.

71. The method of claim 70 further comprising the step of generating power from the step of expanding the gaseous combustion stream across a turbine.

72. The method of claim 70 further comprising the steps of:

extracting carbon dioxide from the gaseous combustion stream; and

applying the carbon dioxide in an Enhanced Oil Recovery process.

73. The method of claim 70 wherein the residence time is substantially between 0.1 and 10 seconds.

74. The method of claim 70 wherein the residence time is substantially between 0.1 and 2 seconds.

75. The method of claim 70 wherein the residence time is greater than or equal to 1 second.

76. The method of claim 70 wherein the plenum has a center line length substantially between 10 and 30 meters.

77. The method of claim 70 wherein the plenum has a center line length greater than or equal to 30 meters.

78. The method of claim 70 wherein the combusting step produces a gaseous combustion stream having a temperature substantially between 1900 and 2700 degrees Fahrenheit.

79. The method of claim 70 wherein the combusting step produces a gaseous combustion stream having a temperature substantially between 2200 and 2500 degrees Fahrenheit.

80. The method of claim 70 wherein the combusting step produces a gaseous combustion stream having a composition substantially between 70 and 80 percent carbon dioxide.

81. The method of claim 70 further comprising the step of compressing the carbon dioxide stream prior to the combusting step.

82. The method of claim 70 further comprising the step of generating power, using a Heat recovery steam generator, from the expanded gaseous combustion stream after the step of providing a residence time.

83. The method of claim 70 further comprising the step of reforming methane using heat extracted from the expanded gaseous combustion stream after the step of providing a residence time, wherein the methane is reformed into hydrogen and carbon monoxide.

84. An method for use with an oxyfuel gas turbine system, the method comprising:

providing an oxygen stream, a carbon dioxide stream, a control fuel stream, and a reformed control fuel stream;

combusting the oxygen stream, the carbon dioxide stream, and the reformed control fuel stream to produce a gaseous combustion stream having a temperature of at least 1800 degrees Fahrenheit;

expanding the gaseous combustion stream across a turbine to form an expanded gaseous combustion stream; and

reforming the control fuel stream to form the reformed control fuel stream using heat extracted from the expanded gaseous combustion stream, wherein the reformed control fuel stream is characterized by an increase in hydrogen as compared to the control fuel stream.

85. The method of claim 84 further comprising the step of generating power from the step of expanding the gaseous combustion stream across a turbine.

86. The method of claim 84 wherein the combusting step produces a gaseous combustion stream having a temperature substantially between 1900 and 2700 degrees Fahrenheit.

87. The method of claim 84 wherein the combusting step produces a gaseous combustion stream having a temperature substantially between 2200 and 2500 degrees Fahrenheit.

88. The system of claim 49 wherein the reformer is selected from the group consisting of a steam reformer and an auto thermal reformer.