

CLAIMS

1. An integrated system, comprising:
 - a gas turbine system, comprising:
 - a first compressor configured to receive and compress a cooled recycle gas stream into a compressed recycle stream;
 - a second compressor configured to receive and compress a feed oxidant into a compressed oxidant;
 - a combustion chamber configured to receive the compressed recycle stream and the compressed oxidant and substantially stoichiometrically combust a fuel stream, wherein the compressed recycle stream serves as a diluent to moderate combustion temperatures; and
 - an expander coupled to the first compressor and configured to receive a discharge from the combustion chamber to generate a gaseous exhaust stream and at least partially drive the first compressor; and
 - an exhaust gas recirculation system, comprising:
 - a heat recovery steam generator configured to receive the gaseous exhaust stream from the expander and generate steam and a cooled exhaust stream; and
 - a boost compressor configured to receive and increase the pressure of the cooled exhaust stream to provide the cooled recycle gas stream for injection into the first compressor; and
 - at least one cooling unit configured to receive at least one of the cooled exhaust stream and cooled recycle gas stream and to generate
 - a water dropout stream from water in the at least one of the cooled exhaust stream and the cooled recycle gas stream and
 - the cooled recycle gas stream,
 - wherein the water dropout stream is fluidly coupled to the heat recovery steam generator to generate additional steam.
2. The system of claim 1, wherein the exhaust gas recirculation system further comprises a steam gas turbine configured to receive the steam and generate electrical power.

3. The system of claim 1 or 2, wherein the feed oxidant is air, oxygen-rich air, and any combination thereof.
4. The system of any one of claims 1 to 3, wherein the fuel stream is selected from the group consisting of: natural gas, methane, naphtha, butane, propane, syngas, diesel, kerosene, aviation fuel, coal derived fuel, bio-fuel, oxygenated hydrocarbon feedstock, and any combination thereof.
5. The system of any one of the preceding claims, wherein the gaseous exhaust stream is provided to the heat recovery steam generator at a pressure above atmospheric.
6. The system of any one of the preceding claims, wherein the temperature of the gaseous exhaust stream exiting the expander is about between 1180°F and 1250°F.
7. The system of any one of the preceding claims, wherein the boost compressor increases the pressure of the cooled recycle gas stream to a pressure between about 17.1 psia to about 21 psia.
8. The system of any one of the preceding claims, further comprising a purge stream taken from the compressed recycle stream.
9. The system of claim 10, wherein the purge stream is treated in a CO₂ separator to generate a carbon dioxide stream and a residual stream substantially comprising nitrogen gas.
10. The system of claim 10 or 11, wherein at least a portion of the purge stream is sent to a location for carbon dioxide sequestration, carbon dioxide sales, carbon capture, venting, or combinations thereof.
11. A method of generating power, comprising:
 - compressing a cooled recycle gas stream in a first compressor to generate a compressed recycle stream;
 - compressing a feed oxidant in a second compressor to generate a compressed oxidant;

combusting a fuel stream and the compressed oxidant in the presence of the compressed recycle stream in a combustion chamber, thereby generating a discharge, wherein the compressed recycle stream is adapted to moderate the temperature of the discharge;

expanding the discharge in an expander to generate a gaseous exhaust stream and at least one unit of power;

recovering heat from the gaseous exhaust stream in a heat recovery steam generator to produce steam and a cooled exhaust stream;

cooling at least one of the cooled exhaust stream and the cooled recycle gas stream in a cooling unit to remove at least a portion of condensed water therefrom;

routing the portion of condensed water from the cooling unit to the heat recovery steam generator to generate additional steam; and

increasing the pressure of the cooled exhaust stream in a boost compressor to provide the cooled recycle gas stream for injection into the first compressor.

12. The method of claim 11, further comprising generating electrical power from the steam in a steam gas turbine.

13. The method of claim 11 or 12, further comprising:

removing a portion of the compressed recycle stream in a purge stream;

treating the purge stream in a CO₂ separator; and

discharging a carbon dioxide stream and a residual stream substantially comprising nitrogen gas from the CO₂ separator.

14. An integrated system, comprising:

a gas turbine system, comprising:

a first compressor configured to receive and compress a cooled recycle gas stream into a compressed recycle stream;

a second compressor configured to receive and compress a feed oxidant into a compressed oxidant;

a combustion chamber configured to receive the compressed recycle stream and the compressed oxidant and substantially stoichiometrically combust a fuel stream; and

an expander coupled to the first compressor and configured to receive a discharge from the combustion chamber to generate a gaseous exhaust stream at a temperature of at least about 1180°F to 1250°F and to generate at least one unit of power; and

an exhaust gas recirculation system, comprising:

a heat recovery steam generator configured to receive the gaseous exhaust stream from the expander and to generate steam and a cooled exhaust stream;

a boost compressor configured to receive and increase the pressure of the cooled exhaust stream to a pressure between about 17.1 psia to about 21 psia; and

a first cooling unit configured to receive the cooled exhaust stream from the boost compressor and generate a water dropout stream from water in the cooled exhaust stream, the water dropout stream being fluidly connected to the heat recovery steam generator to generate additional steam, and

the cooled recycle gas stream for injection into the first compressor.

15. The system of claim 14, further comprising a purge stream taken from the compressed recycle stream and treated in a CO₂ separator to generate a carbon dioxide stream and a residual stream substantially comprising nitrogen gas.

16. The system of claim 9, further comprising a nitrogen expander, fluidly coupled to the CO₂ separator, configured to generate power from the residual stream substantially comprising nitrogen gas.

17. The system of claim 16, wherein the nitrogen expander receives the residual stream substantially comprising nitrogen gas without addition of fuel or oxidant.

18. The system of any one of claims 1 to 10, wherein the cooling unit is configured to provide water to the heat recovery steam generator.