CLAIMS

1. A gas turbine system, comprising:

a first compressor configured to receive and compress only a recycled exhaust gas into a compressed recycle exhaust gas;

a second compressor configured to receive and compress only enriched air having an oxygen concentration between 30 wt % and 50 wt % to generate a compressed oxidant;

a combustion chamber configured to separately receive the compressed recycle exhaust gas and the compressed oxidant and substantially stoichiometrically combust a fuel stream to generate a discharge stream having a CO_2 concentration of between 15 wt % and 20 wt % and an oxygen concentration of less than 1 wt %, wherein the compressed recycle exhaust gas serves as a diluent to moderate combustion temperatures; and

an expander coupled to the first compressor and configured to receive the discharge stream from the combustion chamber to generate the recycled exhaust gas and at least partially drive the first compressor;

wherein the fuel stream comprises a hydrocarbon fuel.

2. The system of claim 1, wherein the enriched air is derived from membrane separation, pressure swing adsorption, temperature swing adsorption, and any combination thereof.

3. The system of claim 1, wherein the enriched air is derived from a reject stream of an air separation unit.

4. The system of claim 3, wherein the reject stream has an oxygen concentration between 50 wt % and 70 wt %.

5. The system of claim 1, wherein the hydrocarbon fuel 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.

6. The system of claim 1, further comprising a purge stream taken from the compressed recycle exhaust gas and treated in a CO_2 separator to generate a CO_2 stream and a residual stream comprising nitrogen gas.

7. A method of generating power, comprising:

compressing only a recycled exhaust gas in a main compressor to generate a compressed recycle exhaust gas;

compressing only enriched air having an oxygen concentration between 30 wt % and 50 wt % in an inlet compressor to generate a compressed oxidant;

separately injecting the compressed recycle exhaust gas and the compressed oxidant into a combustion chamber;
substantially stoichiometrically combusting the compressed oxidant and a hydrocarbon fuel in the combustion chamber and in the presence of the compressed recycle exhaust gas, thereby generating a discharge stream having a CO_2 concentration of between 15 wt % and 20 wt % and an oxygen concentration of less than 1 wt %, wherein the compressed recycle exhaust gas acts as a diluent configured to moderate the temperature of the discharge stream; and
expanding the discharge stream in an expander to at least partially drive the main compressor and generate the recycled exhaust gas.

8. The method of claim 7, wherein the enriched air is derived from a reject stream of an air separation unit, the reject stream having an oxygen concentration between 50 wt % and 70 wt %.

9. An integrated system, comprising:
a gas turbine system, comprising:
a first compressor configured to receive and compress only a recycled exhaust gas into a compressed recycle exhaust gas;
a second compressor configured to receive and compress only enriched air to generate a compressed oxidant, the enriched air having an oxygen concentration between 30 wt % and 50 wt %;
a combustion chamber configured to separately receive the compressed recycle exhaust gas and the compressed oxidant and stoichiometrically combust a fuel stream to generate a discharge stream having a CO_2 concentration of between 15 wt % and 20 wt % and an oxygen concentration of less than 1 wt %, wherein the compressed recycle exhaust gas serves as a diluent to moderate combustion temperatures;
an expander coupled to the first compressor and configured to receive the discharge stream from the combustion chamber to generate the recycled exhaust gas and at least partially drive the first compressor; and
an exhaust gas recirculation system, comprising:
a heat recovery steam generator communicably coupled to a steam gas turbine, the heat recovery steam generator being configured to receive the recycled exhaust gas from the expander to create steam that generates electrical power in the steam generator;
one or more cooling units configured to cool the recycled exhaust gas received from the heat recovery steam generator and remove condensed water from the recycled exhaust gas; and
a boost compressor configured to increase the pressure of the recycled exhaust gas before injection into the first compressor to provide the compressed recycle exhaust gas;
wherein the fuel stream comprises a hydrocarbon fuel.

10. The system of claim 9, wherein the boost compressor increases the pressure of the recycled exhaust gas stream to a pressure between 17 psia and 21 psia.

11. The system of claim 9, wherein the enriched air is mixed with atmospheric air to obtain the oxygen concentration between 30 wt % and 50 wt %.

12. The system of claim 9, wherein the enriched air is derived from membrane separation, pressure swing adsorption, temperature swing adsorption, an air separation unit, and any combination thereof.

13. The system of claim 12, wherein the air separation unit has a reject stream having an oxygen concentration between 50 wt % and 70 wt %, the reject stream providing at least a portion of the enriched air.

14. The system of claim 9, wherein the hydrocarbon fuel 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.