CLAIMS

What Is Claimed Is:

1. A power generation system comprising:

a) at least one vessel capable of a maintaining a pressure below atmospheric comprising a reaction chamber;

b) two electrodes configured to allow a molten metal flow therebetween to complete a circuit;

c) a power source connected to said two electrodes to apply an ignition current therebetween when said circuit is closed;

d) a plasma generation cell (e.g., glow discharge cell) to induce the formation of a first plasma from a gas delivered thereto; wherein effluence of the plasma generation cell is directed towards the circuit (e.g., the molten metal, the anode, the cathode, an electrode submerged in a molten metal reservoir);

wherein when current is applied across the circuit, the effluence of the plasma generation cell undergoes a reaction to producing a second plasma and reaction products; and

e) a power adapter comprising a thermophotovoltaic converter configured to convert and/or transfer energy from the second plasma into mechanical, thermal, and/or electrical energy;

wherein energy from the second plasma is absorbed in a blackbody radiator to produce blackbody radiation and said blackbody radiation is converted in the thermophotovoltaic converter.

2. The power generation system according to claim 1, wherein said gas in the plasma generation cell comprises a mixture of hydrogen (H_2) and oxygen (O_2).

3. The power generation system according to claim 2, wherein the relative molar ratio of oxygen to hydrogen is from 0.01-50 (*e.g.* from 0.1-20, from 0.1-15, etc.).

4. The power generation system according to any one of claims 1-3, wherein said molten metal is tin.

5. The power generation system according to any one of claims 1-4, wherein the power adapter comprises a photovoltaic converter in a geodesic dome (see, e.g., Figure 12), wherein

the photovoltaic converter may comprise a receiver array (*e.g.*, a dense receiver array) comprised of triangular elements; and

wherein each triangular element comprises a plurality of concentrator photovoltaic cells capable of converting the blackbody radiation into electricity.

6. The power system according to any one of claims 1-5, wherein the positively biased electrode of the two electrodes is, comprises, or is connected to the blackbody radiator.

7. The power system according to any one of claims 5-6, wherein the photons having an energy less than the bandgap of the photovoltaic cells are reflected back towards the plasma generation cell.

8. The power system according to any one of claims 1-7, further comprising a PV window between a reaction cell comprising the second plasma and the thermophotovoltaic converter.

9. The power system according to claim 8, wherein the PV window comprises (or predominantly comprises) flat surfaces, the power adapter comprises a photovoltaic (PV) converter, and the PV converter comprises a flat dense receiver array panel to receive the plasma emission through the PV window with a geometry matching the PV window.

10. The power generation system of any one of claims 1-9, wherein the reaction products do not wet the PV window (e.g., when the molten metal comprises or is tin).

11. The power generation system of any one of claims 1-10, wherein each electrode of the two electrodes comprises a molten metal reservoir and an electrical feedthrough to supply the current only to the molten metal therein and thereby supply the ignition current.

12. The power generation system of claim 11, wherein at least one of the reservoirs are thermally insulated by a liner.

13. The power generation system of claim 12, wherein the liner comprises at least one of carbon and tungsten and is optionally coated with a ceramic coating.

14. The power generation system of any one of claims 1-13, wherein the molten metal flowing between the two electrodes is formed from dual molten metal injection systems independently in fluid communication with one or more molten metal reservoirs comprising the molten metal;

wherein each molten metal injection system comprises an electromagnetic pump and a nozzle, wherein each electromagnetic pump flows molten metal through the nozzle to form a stream of molten metal;

wherein said electrodes are in communication with the molten metal streams thereby forming dual molten metal streams of opposite polarity; and

wherein said complete circuit is formed by intersection the dual molten metal streams.

15. The power generation system of claim 14, wherein at least one reservoir comprises an electrical break to electrically isolate the electrodes from each other.

16. The power generation system of claim 14 or 15 further comprsing a flexible element and at least one actuator to tilt the injector electrode of the reservoir to cause alignment of the molten metal streams.

17. The power generation system of claim 16, wherein the reservoir comprises a baseplate supported by a plurality of supports wherein the at least one actuator to tilt the injector electrode of the reservoir lengthens or shortens at least one support; or

wherein the flexible element comprises a stationary frame on one end and a moveable frame one the opposite end, and further comprises at least one actuator attached to the movable frame and the frame wherein the actuators contract on one side and expand on opposing sides of the flexible element to cause the injector to tilt; or

wherein the flexible element comprises a bellows.

18. The power generation system of any one of claims 14-17, wherein the dual molten streams intersect in a chamber comprising a window and light produced from the second plasma or the blackbody radiation exits the window to heat a load.

19. The power generation system of claim 18, wherein the load is an oven chamber (or air/water/steam therein) heated by the light produced from the second plasma or the blackbody radiation.

20. The power generation system of claim of any of claims 1-19, wherein said the second plasma reaction occurs in a reaction chamber comprising a PV window; and

wherein the molten metal or oxidized molten metal is removed from the PV and:

a) the PV window comprises at least one of quartz, sapphire, aluminum oxynitride, CaF_2, and MgF_2;

b) the PV window is heated above the melting point of an oxide of the molten metal (*e.g.*, tin oxide);

c) hydrogen reduction of the oxide of the molten metal occurs by flowing hydrogen gas into the reaction chamber at a pressure sufficient to achieve said hydrogen reduction; and/or

d) the PV window has molten metal injected onto its surface during generation of the second plasma (*e.g.*, from an electromagnetic pump).

21. The power generation system of any one of claims 1-20, comprising at least one PV window and at least one thermal absorber wherein optical power from the second plasma reaction is transferered through the PV window to the thermal absorber by radiative power transfer, and said thermal absorber transmits thermal power from said radiative power transfer.