CLAIMS

1. A vehicular power system comprising:

a motive power unit; and

an auxiliary power unit comprising:

a container;

a modular assembly configured to be selectively received within the container, the modular assembly comprising:

a molten metal anode solid oxide fuel cell comprising:

a plurality of half-cells each comprising a cathode and a solid electrolyte; and

a liquid bath anode into which the plurality of half-cells are at least partially submerged such that upon operation of the auxiliary power unit, an oxygen-bearing reactant flows through the plurality of half-cells to electrochemically react with at least one of a molten metal and a fuel-bearing reactant that are contained within the liquid bath anode; and

a perforate lid defining a plurality of apertures therein such that each aperture defined in the perforate lid forms a releasable coupling with a corresponding one of plurality of the half-cells to permit the corresponding one of the plurality of half-cells to be individually removable from the modular assembly;

a first seal disposed between the perforate lid and the container;

a plurality of second seals, wherein respective ones of the plurality of second seals are disposed between a half-cell of the plurality of half-cells and the perforate lid;

an inert gas environment formed by cooperation between the perforate lid, the container, the plurality of half-cells, the first seal and the plurality of second seals, the inert gas environment defining a volumetric space between the liquid bath anode and the perforate lid;

a furnace nested within the container and thermally cooperative with the molten metal anode solid oxide fuel cell such that upon operation of the furnace, the molten metal in the bath is maintained in a substantially molten state; and

electrical circuitry cooperative with the molten metal anode solid oxide fuel cell such that an electric current produced by the molten metal anode solid oxide fuel cell may be delivered through the electrical circuitry to a vehicular load.

2. The vehicular power system of claim 1, wherein the molten metal is selected from the group consisting of tin, antimony, bismuth, tin and combinations thereof.

3. The vehicular power system of claim 1, wherein the furnace is disposed between the container and the molten metal anode solid oxide fuel cell.

4. The vehicular power system of claim 3, further comprising a thermal insulator disposed adjacent a surface of the container to reduce thermal communication between the liquid bath anode and an ambient environment proximate the auxiliary power unit.

5. The vehicular power system of claim 1, wherein the cathode and the electrolyte of each half-cell define an elongate tubular structure with a closure at a distal end thereof that is submerged within the liquid bath anode and a proximal end thereof defining an aperture that is not submerged within the liquid bath anode but fluidly cooperative with the oxygen-bearing reactant.

6. The vehicular power system of claim 5, wherein the elongate tubular structure defines a flanged surface adjacent the proximal end.

7. The vehicular power system of claim 1, wherein the load is selected from the group consisting of a vehicular climate control system and the motive power unit.

8. The vehicular power system of claim 1, wherein the liquid bath anode further comprises a sequestering agent disposed therein.

9. The vehicular power system of claim 1, wherein the auxiliary power unit further comprises at least one of (a) an electrical generator or alternator and (b) a processor-based controller to regulate the flow of the electric current to the vehicular load through the electrical circuitry.

10. The vehicular power system of claim 1, wherein the first seal comprises at least one L-shaped seal.

11. The vehicular power system of claim 1, wherein the second seal comprises at least one ring-shaped seal.

12. The vehicular power system of claim 1, wherein the first seal comprises at least one L-shaped seal and the second seal comprises at least one ring-shaped seal.

13. A method of providing auxiliary power to a vehicle that comprises a motive power unit and an auxiliary power unit, the method comprising:

operating a furnace to provide heat to the auxiliary power unit that comprises a container that is mounted to the vehicle and a modular assembly that is received within the container through an open upper surface that is defined in the container, the modular assembly comprising:

a molten metal anode solid oxide fuel cell comprising a plurality of half-cells each comprising a cathode and a solid electrolyte, and a liquid bath anode into which the plurality of half-cells are at least partially submerged;

a perforate lid defining a plurality of apertures therein such that each aperture defined in the perforate lid forms a releasable coupling with each of the plurality of the half-cells;

a first seal disposed between the perforate lid and the container;

a plurality of second seals, wherein respective ones of the plurality of second seals are disposed between a half-cell of the plurality of half-cells and the perforate lid; and

an inert gas environment formed by cooperation between the perforate lid, the container, the plurality of half-cells, the first seal, and the plurality of second seals, the inert gas environment defining a volumetric space between the liquid bath anode and the perforate lid;

passing an oxygen-bearing reactant through a plurality of half-cells and into the liquid bath anode;

oxidizing at least a portion of the molten metal with the oxygen-bearing reactant;

reducing the oxidized molten metal with a fuel-bearing reactant that is present within the liquid bath anode; and

supplying electrical current produced by the molten metal solid oxide fuel cell to at least one of an electrical load and a climate control system situated on the vehicle.

14. The method of claim 13, wherein operation of the auxiliary power unit takes place during periods when the motive power unit is not being operated.

15. The method of claim 13, wherein the fuel-bearing reactant used in the auxiliary power unit is the same as that used for the motive power unit.