THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1) Apparatus for performing electrolysis and generating heat, the apparatus including an electrolysis cell including:
   a) a cell housing defining an electrolyte cavity, the electrolyte cavity containing an electrolyte in use;
   b) a plurality of substantially parallel spaced apart electrode plates provided within the electrolyte cavity, the electrode plates defining at least one anode and at least one cathode at least partially submersed within the electrolyte in use;
   c) at least two connectors, which in use are connected to an electrical power supply thereby allowing an electrical current to be supplied to the electrolyte to thereby perform electrolysis and heating of the electrolyte;
   d) at least one cell outlet in fluid communication with the electrolyte cavity, the at least one cell outlet being coupled to a heat recovery module in use; and,
   e) at least one cell inlet allowing electrolyte to be supplied to the electrolyte cavity.
2) Apparatus according to claim 1, wherein the inlet is coupled to the heat recovery module so that electrolyte is recirculating through the electrolyte cavity and the heat recovery module.
3) Apparatus according to claim 1 or claim 2, wherein the inlet and outlet are arranged so that electrolyte supplied to the cavity flows between the electrode plates.
4) Apparatus according to claim 3, wherein the inlet and outlet are arranged on opposing sides of the electrolyte cavity facing edges of the electrode plates.
5) Apparatus according to claim 4, wherein the inlet and outlet are arranged in lower and upper ends of the cell housing respectively with the electrode plates aligned substantially vertically within the electrolyte cavity and spaced substantially horizontally, in use.
6) Apparatus according to any one of the claims 1 to 5, wherein the electrode plates are at least one of:
   a) laminar;
   b) curved; and,
   c) undulating.
7) Apparatus according to any one of the claims 1 to 6, wherein the electrode plates are separated by a distance of at least one of:
   a) between 0.1 mm and 10 mm;

b) between 1 mm and 2 mm; and,

c) between 2 mm and 5 mm.

8) Apparatus according to any one of the claims 1 to 7, wherein the electrode plates have thickness of at least one of:

a) between 0.1 mm and 10 mm;

b) between 1 mm and 2 mm; and,

c) between 2 mm and 5 mm.

9) Apparatus according to any one of the claims 1 to 8, wherein the anodes are thicker than the cathodes.

10) Apparatus according to any one of the claims 1 to 9, wherein the at least two connectors are electrically connected to electrode plates so that adjacent plates act as anodes and cathodes in use.

11) Apparatus according to claim 10, wherein each cathode is positioned between two anodes.

12) Apparatus according to any one of the claims 1 to 11, wherein the cell housing includes an opening and a cover removably mounted in the opening to allow at least some of the electrode plates to be removed from the electrolyte cavity.

13) Apparatus according to any one of the claims 1 to 12, wherein the apparatus includes an electrode support, the electrodes being coupled to the electrode support so that the electrodes are at least partially submerged in electrolyte in use.

14) Apparatus according to claim 13, wherein the electrode support is coupled to a cover allowing the electrodes to be removed from the electrolyte cavity.

15) Apparatus according to any one of the claims 1 to 14, wherein the cell housing defines a pressure vessel and wherein the pressure inside the electrolyte cavity is greater than atmospheric pressure.

16) Apparatus according to any one of the claims 1 to 15, wherein, in use, the apparatus operates at a temperature that is at least one of:

a) at least 40°C;

b) at least 60°C;

c) at least 80°C; and,

d) at least 100°C.

17) Apparatus according to any one of the claims 1 to 16, wherein the apparatus includes a heat recovery module.

18) Apparatus according to claim 17, wherein the heat recovery module acts as a condenser for condensing vaporised electrolyte.

19) Apparatus according to claim 17 or claim 18, wherein the heat recovery module acts as a separator for separating vaporised electrolyte from gaseous electrolysis products.

20) Apparatus according to any one of the claims 17 to 19, wherein the heat recovery module includes an outlet that allows gaseous electrolysis products to be extracted in use.

21) Apparatus according to any one of the claims 17 to 20, wherein the heat recovery module includes a heat exchanger for recovering heat from the electrolyte to at least one of:

a) condensed vaporised electrolyte; and,

b) perform work using recovered heat.

22) Apparatus according to any one of the claims 17 to 21, wherein the heat recovery module heats a heat transfer medium using heat recovered from the electrolyte.

23) Apparatus according to claim 22, wherein the recovered heat is used by a thermal engine including:

a) a boiler that in use generates pressurised vapour using the recovered heat; and,

b) a thermal engine coupled to a generator that in use generates electricity using pressurised vapour from the boiler.

24) Apparatus according to any one of the claims 17 to 23, wherein the heat recovery module includes a thermal engine.

25) Apparatus according to any one of the claims 1 to 24, wherein the apparatus includes a power supply for supplying the electrical current.

26) Apparatus according to claim 25, wherein the power supply includes a thermal engine.

27) Apparatus according to any one of the claims 1 to 26, wherein the electrical current is direct current having an electrical potential of at least one of:

a) at least 2 V;

b) at least 5 V;

c) at least 10 V;

d) between 15 and 25 V;

e) up to 30 V;

f) up to 40 V; and,

g) up to 60 V.

28) Apparatus according to any one of the claims 1 to 27, wherein the electrical current is applied to generate an electric field having a field strength of at least one of:

a) at least 3000 Volts per meter;

b) at least 12000 Volts per meter; and

c) at least 24000 Volts per meter.

29) Apparatus according to any one of the claims 1 to 28, wherein the electrical current is direct current having an electrical current of at least one of:

a) at least 0.5 A;

b) at least 1 A;

c) at least 2A;

d) between 2 A and 10 A;

e) about 5 A;

f) up to 10 A;

g) up to 20 A; and,

h) up to 50 A.

30) Apparatus according to any one of the claims 1 to 29, wherein the electrical current is applied to generate an electric field having a current density of at least one of:

a) at least 500 Ampere per square meter;

b) at least 1000 Ampere per square meter; and

c) about 3000 Ampere per square meter or higher.

31) Apparatus according to any one of the claims 1 to 30, wherein the apparatus includes:

a) a trigger circuit coupled to the at least two connectors;

b) a switch; and,

c) a load coupled to the at least two connectors via the switch, wherein in use, the trigger circuit selectively activates the switch to thereby couple the at least two connectors to the load.

32) Apparatus according to claim 31, wherein the trigger circuit includes:

a) a sensor for sensing at least one of:

i) current flow in the connectors and;

ii) electrical potential across the connectors; and

b) an electronic controller for controlling the switch in accordance with at least one of the sensed:

i) sensed current and;

ii) sensed electrical potential.

33) Apparatus according to claim 32, wherein, in use, the electronic controller:

a) compares the at least one sensed current and sensed electrical potential to a threshold; and

b) operates the switch to divert at least some current through the load in the event that the threshold is exceeded.

34) Apparatus according to any one of the claims 31 to 33, wherein the load is at least one of:

a) an electrolysis cell;

b) a resistive load;

c) a battery, and

d) an electrical machine.

35) Apparatus according to any one of the claims 31 to 34, wherein, in use, the electrolysis cell is adapted to operate at a temperature of at least 60°C, a pressure of at least atmospheric pressure, and with a direct current having an applied electric field of at least 3000 V/m and a current density of at least $500A/m^2$.

36) Apparatus according to any one of the claims 1 to 35, wherein the apparatus include a pyroelectric material that in use generates electrical energy in response to temperature changes within the apparatus.

37) Apparatus according to claim 36, wherein the pyroelectric material is provided in the electrolyte cavity and is electrically connected to the at least two connectors.

38) Apparatus according to claim 37, wherein the pyroelectric material is at least one of electrically insulated and electrically connected to the electrolyte.

39) Apparatus according to any one of the claims 36 to 38, wherein at least one electrode is made of a pyroelectric material.

40) Apparatus according to claim 39, wherein electrodes are unevenly spaced to enhance the pyroelectric effect.

41) Apparatus according to any one of the claims 1 to 40, wherein the apparatus includes two dissimilar metals in electrical and thermal contact with the apparatus that in use generates electrical energy in response to temperature changes within the apparatus.

42) Apparatus for use in electrolysis, the apparatus including:

a) an electrolysis cell including:

i) a cell housing defining an electrolyte cavity, the electrolyte cavity containing an electrolyte and being pressurised in use;

ii) at least one cell outlet in fluid communication with the electrolyte cavity so that in use electrolysis products can be collected therefrom;

iii) a plurality of electrodes provided within the electrolyte cavity, the plurality of electrodes defining at least one anode and at least one cathode; and

iv) at least two connectors, which in use are connected to an electrical power supply thereby allowing electrical current to be supplied to the electrolyte; and,

b) a heat recovery module including:

i) a module housing defining:

(1) a cell cavity, the electrolysis cell being removably mounted within the cavity; and,

(2) a medium cavity in thermal communication with the cell cavity, the medium cavity containing a heat recovery medium in use; and,

c) an inlet and an outlet in fluid communication with the medium cavity so that in use heat recovery medium can pass through the medium cavity to thereby recover heat from the electrolysis cell.

43) Apparatus according to claim 42, wherein the apparatus electrolysis cell includes a cell inlet in fluid communication with the electrolyte cavity so that in use electrolyte can be supplied thereto.

44) Apparatus according to claim 43, wherein the apparatus includes an electrolyte supply for supplying heated electrolyte to the cell inlet.

45) Apparatus according to any one of the claims 42 to 44, wherein the cell housing includes a base and cover, the cover being removably mounted to the base, and the cover and base being sealing engaged in use.

46) Apparatus according to any one of the claims 42 to 45, wherein the cell housing defines a pressure vessel.

47) Apparatus according to any one of the claims 42 to 46, wherein the electrodes include a plurality of substantially laminar electrode plates.

48) Apparatus according to claim 47, wherein the electrode plates are laterally spaced.

49) Apparatus according to claim 48, wherein the electrode plates are at least one of:

a) equidistantly spaced; and,

b) unevenly spaced.

50) Apparatus according to claim 47 or claim 48, wherein the electrode plates extend in first and second orthogonal directions, the electrode plates being spaced in a third orthogonal direction.

51) Apparatus according to any one of the claims 47 to 50, wherein the electrode plates are separated by a distance of between 0.1 and 10 mm.

52) Apparatus according to any one of the claims 47 to 51, wherein the electrode plates are arranged in use so that electrolysis products travels between the electrode plates to the cell outlet.

53) Apparatus according to any one of the claims 47 to 52, wherein the at least two connectors are electrically connected to electrode plates so that adjacent plates act as anodes and cathodes in use.

54) Apparatus according to any one of the claims 42 to 53, wherein the apparatus includes an electrode support, the electrodes being coupled to the electrode support so that the electrodes are at least partially submerged in electrolyte in use.

55) Apparatus according to claim 48, wherein the electrode support is coupled to a cover allowing the electrodes to be removed from the electrolyte cavity.

56) Apparatus according to any one of the claims 42 to 55, wherein the heat recovery module is positioned outwardly of the electrolysis cell.

57) Apparatus according to any one of the claims 42 to 56, wherein the medium cavity has a tubular shape and the cell housing has a substantially cylindrical shape.

58) Apparatus according to any one of the claims 42 to 57, wherein the module housing has an elongate substantially annular shape defining a cylindrical cell cavity and an annular medium cavity extending substantially circumferentially around the cell cavity.

59) Apparatus according to any one of the claims 42 to 58, wherein the apparatus includes an insulating jacket, the heat recovery module being provided within the insulating jacket in use.

60) Apparatus according to claim 59, wherein the insulating jacket includes a jacket housing, the jacket housing and module housing cooperating to define a insulation cavity that contains a thermally insulating material in use.

61) Apparatus according to any one of the claims 42 to 60, wherein the inlet and outlet are coupled to a thermal engine in use.

62) Apparatus according to claim 61, wherein the thermal engine includes:

a) a boiler that in use generates steam using heat from the heat transfer medium; and,

b) a steam turbine coupled to a generator that in use generates electricity using steam from the boiler.

63) Apparatus according to any one of the claims 42 to 62, wherein the at least two connectors are coupled to a power supply in use.

64) Apparatus according to any one of the claims 42 to 63, wherein the apparatus includes:

a) a trigger circuit coupled to the at least two connectors;

b) a switch; and,

c) a load coupled to the at least two connectors via the switch, wherein in use, the trigger circuit selectively activates the switch to thereby couple the at least two connectors to the load.

65) Apparatus according to claim 64, wherein the trigger circuit includes:

a) a sensor for sensing at least one of:

i) current flow in the connectors and;

ii) electrical potential across the connectors; and

b) an electronic controller for controlling the switch in accordance with at least one of the sensed:

i) sensed current and;

ii) sensed electrical potential.

66) Apparatus according to claim 65, wherein, in use, the electronic controller:

a) compares the at least one sensed current and sensed electrical potential to a threshold; and

b) operates the switch to divert at least some current through the load in the event that the threshold is exceeded.

67) Apparatus according to any one of the claims 64 to 66, wherein the load is at least one of:

a) an electrolysis cell;

b) a resistive load;

c) a battery, and

d) electrical machine

68) Apparatus according to any one of the claims 42 to 67, wherein the apparatus include a pyroelectric material that in use generates electrical energy in response to temperature changes within the apparatus.

69) Apparatus according to claim 68, wherein the pyroelectric material is provided in the electrolyte cavity and is electrically connected to the at least two connectors.

70) Apparatus according to claim 69, wherein the pyroelectric material is at least one of electrically insulated and electrically connected to the electrolyte.

71) Apparatus according to any one of the claims 68 to 70, wherein at least one electrode is made of a pyroelectric material.

72) Apparatus according to claim 71, wherein electrodes are unevenly spaced to enhance the pyroelectric effect.

73) Apparatus according to any one of the claims 42 to 72, wherein the apparatus include a plurality of electrolysis cells removably mounted in respective cell cavities in the heat recovery module.

74) Apparatus for use in electrolysis, wherein the apparatus includes:

a) an electrolysis cell including at least two connectors, which in use are connected to an electrical power supply thereby allowing electrical current to be supplied to an electrolyte;

b) a trigger circuit coupled to the at least two connectors;

c) a switch; and,

d) a load coupled to the at least two connectors via the switch, wherein in use, the trigger circuit selectively activates the switch to thereby couple the at least two connectors to the load.

75) Apparatus according to claim 74, wherein the trigger circuit includes:

a) a sensor for sensing current flow and/or electrical potential in the connectors; and

b) an electronic controller for controlling the switch in accordance with the sensed current.

76) Apparatus according to claim 75, wherein, in use, the electronic controller:

a) compares the sensed current and/or electrical potential to a threshold; and

b) operates the switch to divert at least some current through the load in the event that the threshold is exceeded.

77) Apparatus according to any one of the claims 74 to 76, wherein the load is at least one of:

a) an electrolysis cell;

b) a resistive load; ,

c) a battery; and

d) electrical machine

78) Apparatus according to any one of the claims 42 to 77, wherein the apparatus includes two dissimilar metals in electrical and thermal contact with the apparatus that in use generates electrical energy in response to temperature changes within the apparatus.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1) Apparatus for performing electrolysis and generating heat, the apparatus including an electrolysis cell including:
   a) a cell housing defining an electrolyte cavity, the electrolyte cavity containing an electrolyte in use;
   b) a plurality of substantially parallel spaced apart electrode plates provided within the electrolyte cavity, the electrode plates defining at least one anode and at least one cathode at least partially submersed within the electrolyte in use;
   c) at least two connectors, which in use are connected to an electrical power supply thereby allowing an electrical current to be supplied to the electrolyte to thereby perform electrolysis and heating of the electrolyte;
   d) at least one cell outlet in fluid communication with the electrolyte cavity, the at least one cell outlet being coupled to a heat recovery module in use; and,
   e) at least one cell inlet allowing electrolyte to be supplied to the electrolyte cavity wherein the apparatus further includes:
      i) a trigger circuit coupled to the at least two connectors;
      ii) a switch; and,
      iii) a load coupled to the at least two connectors via the switch, wherein in use, the trigger circuit selectively activates the switch to thereby couple the at least two connectors to the load.
2) Apparatus according to claim 1, wherein the inlet is coupled to the heat recovery module so that electrolyte is recirculating through the electrolyte cavity and the heat recovery module.
3) Apparatus according to claim 1 or claim 2, wherein the inlet and outlet are arranged so that electrolyte supplied to the cavity flows between the electrode plates.
4) Apparatus according to claim 3, wherein the inlet and outlet are arranged on opposing sides of the electrolyte cavity facing edges of the electrode plates.
5) Apparatus according to claim 4, wherein the inlet and outlet are arranged in lower and upper ends of the cell housing respectively with the electrode plates aligned substantially vertically within the electrolyte cavity and spaced substantially horizontally, in use.
6) Apparatus according to any one of the claims 1 to 5, wherein the electrode plates are at least one of:

a) laminar;
b) curved; and,
c) undulating.

7) Apparatus according to any one of the claims 1 to 6, wherein the electrode plates are separated by a distance of at least one of:
   a) between 0.1 mm and 10 mm;
   b) between 1 mm and 2 mm; and,
   c) between 2 mm and 5 mm.
8) Apparatus according to any one of the claims 1 to 7, wherein the electrode plates have thickness of at least one of:
   a) between 0.1 mm and 10 mm;
   b) between 1 mm and 2 mm; and,
   c) between 2 mm and 5 mm.
9) Apparatus according to any one of the claims 1 to 8, wherein the anodes are thicker than the cathodes.
10) Apparatus according to any one of the claims 1 to 9, wherein the at least two connectors are electrically connected to electrode plates so that adjacent plates act as anodes and cathodes in use.
11) Apparatus according to claim 10, wherein each cathode is positioned between two anodes.
12) Apparatus according to any one of the claims 1 to 11, wherein the cell housing includes an opening and a cover removably mounted in the opening to allow at least some of the electrode plates to be removed from the electrolyte cavity.
13) Apparatus according to any one of the claims 1 to 12, wherein the apparatus includes an electrode support, the electrodes being coupled to the electrode support so that the electrodes are at least partially submerged in electrolyte in use.
14) Apparatus according to claim 13, wherein the electrode support is coupled to a cover allowing the electrodes to be removed from the electrolyte cavity.
15) Apparatus according to any one of the claims 1 to 14, wherein the cell housing defines a pressure vessel and wherein the pressure inside the electrolyte cavity is greater than atmospheric pressure.

16) Apparatus according to any one of the claims 1 to 15, wherein, in use, the apparatus operates at a temperature that is at least one of:
    a) at least 40ºC;
    b) at least 60ºC;
    c) at least 80ºC; and,
    d) at least 100ºC.
17) Apparatus according to any one of the claims 1 to 16, wherein the apparatus includes a heat recovery module.
18) Apparatus according to claim 17, wherein the heat recovery module acts as a condenser for condensing vaporised electrolyte.
19) Apparatus according to claim 17 or claim 18, wherein the heat recovery module acts as a separator for separating vaporised electrolyte from gaseous electrolysis products.
20) Apparatus according to any one of the claims 17 to 19, wherein the heat recovery module includes an outlet that allows gaseous electrolysis products to be extracted in use.
21) Apparatus according to any one of the claims 17 to 20, wherein the heat recovery module includes a heat exchanger for recovering heat from the electrolyte to at least one of:
    a) condensed vaporised electrolyte; and,
    b) perform work using recovered heat.
22) Apparatus according to any one of the claims 17 to 21, wherein the heat recovery module heats a heat transfer medium using heat recovered from the electrolyte.
23) Apparatus according to claim 22, wherein the recovered heat is used by a thermal engine including:
    a) a boiler that in use generates pressurised vapour using the recovered heat; and,
    b) a thermal engine coupled to a generator that in use generates electricity using pressurised vapour from the boiler.
24) Apparatus according to any one of the claims 17 to 23, wherein the heat recovery module includes a thermal engine.
25) Apparatus according to any one of the claims 1 to 24, wherein the apparatus includes a power supply for supplying the electrical current.
26) Apparatus according to claim 25, wherein the power supply includes a thermal engine.
27) Apparatus according to any one of the claims 1 to 26, wherein the electrical current is direct current having an electrical potential of at least one of:

a) at least 2 V;

b) at least 5 V;

c) at least 10 V;

d) between 15 and 25 V;

e) up to 30 V;

f) up to 40 V; and,

g) up to 60 V.

28) Apparatus according to any one of the claims 1 to 27, wherein the electrical current is applied to generate an electric field having a field strength of at least one of:

a) at least 3000 Volts per meter;

b) at least 12000 Volts per meter; and

c) at least 24000 Volts per meter.

29) Apparatus according to any one of the claims 1 to 28, wherein the electrical current is direct current having an electrical current of at least one of:

a) at least 0.5 A;

b) at least 1 A;

c) at least 2A;

d) between 2 A and 10 A;

e) about 5 A;

f) up to 10 A;

g) up to 20 A; and,

h) up to 50 A.

30) Apparatus according to any one of the claims 1 to 29, wherein the electrical current is applied to generate an electric field having a current density of at least one of:

a) at least 500 Ampere per square meter;

b) at least 1000 Ampere per square meter; and

c) about 3000 Ampere per square meter or higher.

31) Apparatus according to any one of the claims 1 to 30, wherein the trigger circuit includes:

a) a sensor for sensing at least one of:

i) current flow in the connectors and;

ii) electrical potential across the connectors; and

b) an electronic controller for controlling the switch in accordance with at least one of the sensed:
   i) sensed current and;
   ii) sensed electrical potential.

32) Apparatus according to claim 31, wherein, in use, the electronic controller:
   a) compares the at least one sensed current and sensed electrical potential to a threshold; and
   b) operates the switch to divert at least some current through the load in the event that the threshold is exceeded.

33) Apparatus according to any one of the claims 1 to 32, wherein the load is at least one of:
   a) an electrolysis cell;
   b) a resistive load;
   c) a battery, and
   d) an electrical machine.

34) Apparatus according to any one of the claims 1 to 33, wherein, in use, the electrolysis cell is adapted to operate at a temperature of at least 60ºC, a pressure of at least atmospheric pressure, and with a direct current having an applied electric field of at least 3000 V/m and a current density of at least 500A/m^2.

35) Apparatus according to any one of the claims 1 to 34, wherein the apparatus include a pyroelectric material that in use generates electrical energy in response to temperature changes within the apparatus.

36) Apparatus according to claim 35, wherein the pyroelectric material is provided in the electrolyte cavity and is electrically connected to the at least two connectors.

37) Apparatus according to claim 36, wherein the pyroelectric material is at least one of electrically insulated and electrically connected to the electrolyte.

38) Apparatus according to any one of the claims 35 to 37, wherein at least one electrode is made of a pyroelectric material.

39) Apparatus according to claim 38, wherein electrodes are unevenly spaced to enhance the pyroelectric effect.

40) Apparatus according to any one of the claims 1 to 39, wherein the apparatus includes two dissimilar metals in electrical and thermal contact with the apparatus that in use generates electrical energy in response to temperature changes within the apparatus.