## I. DESCRIPTION

**2.1 TITLE OF INVENTION: Integration of Fuel Cells, Hydrogen Reformer, Fuel Processor, Absorption Chiller, Heat Recovery Steam Generator and Internal Combustion Engines**

2.2 **DESCRIPTION**

2.2.1 Introduction:

2.2.1.1 In the heat recovery phase, waste heat is used to heat up the fuel processor, where impurities are catalytically removed. Additional waste heat is used to heat up supplementary gases used in the reforming process, as well as the processes fuel which is then reformed into hydrogen, which is then used to generate power using fuel cells etc. An absorption chiller is used to recover remaining waste heat and convert same into chilled water, where as a heat recovery steam generator is used to generate steam or hot water from the final remaining waste heat.

2.2.1.2 The system as a whole is known as an Integrated Fuel Cell Engine. The internal combustion engine generated some of the power produced the system, as well as heat. Unlike the conventional practice of rejecting the heat produced by the internal combustion engine, in this invention, the heat is used to purify (fuel processing) and to reform hydrogen, which is then used in fuel cells etc. to produce more electrical energy. The total electrical energy for the same fuel is more than that achievable via conventional internal combustion engine technology, as well as fuel reformer plus fuel cell combination. Further, additional waste heat is recovered by conversion into steam (in the heat recovery steam generator) and into chilled water (chiller) for space cooling.

2.2.1.3 The heat recovered from any or all of the various sources described above may be used to heat up the fuel for catalytically or otherwise remove impurities present in the fuel, or heat up the fuel directly for reforming, or alternatively heat up agents involved in the reforming process, such as steam etc.



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2.2.1.4 The invention may be used with any heat source, such as gas turbines, steam turbines, diesel engines, gasoline engines, gas (natural, bio or liquid petroleum gas) engines, solar or solar thermal etc. Any heat source derived from the combustion process or otherwise.

## III. CLAIMS

3.1 Heat recovered from the internal combustion engine is used to preheat the fuel to the first stage, known as fuel processing where in the presence of catalyst, impurities in the fuel are removed. Thereafter, by recovering more waste heat from the internal combustion engines, the purified fuel is further heated before being reformed into hydrogen. The hydrogen is then used in the fuel cell to produce electrical energy. Remaining waste heat is converted into chilled water in a chiller and steam or hot water is generated in the heat recovery steam generator.