MULTI SOLAR (PVT) AIR CONDITIONING SYSTEM

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ABSTRACT

A new innovation technology includes Multi Solar Air Conditioning system using the Multi Solar (PV/T) Collectors System and an Air conditioning unit that using the excessive solar thermal energy produced by the Multi Solar System (MSS). The basic principle of the Solar Air Conditioning operation: The hot liquid from the thermal source the MSS collectors enters the air conditioning reactor heat exchanger. Normally the liquid from the MSS Collectors are at least 50oC for charging. This temperature will depend on the power delivered by the solar collectors, which in turn depend on the solar radiation, flow rate and the size and efficiency of the collectors. When the entering heat reaches the reactor heat exchanger, it causes the Li Cl solution in the reactor to boil. When boiling the Li Cl returns to crystalline form. At the same time the water evaporates and steam is released to the condenser/evaporator where it condenses on the heat exchanger with the relatively lower temperature. In some cases, when running the system on solar thermal energy, it is recommended that a back-up thermal source such as a small gas- boiler or a simple electric element be installed in parallel to complement the thermal source in the event of prolonged cold/cloudy periods.

Keywords: Cooling, Heating, Air-conditioning, PV/T.

1 PRINCIPAL OF OPERATION

1.1 Three external circuits are connected to the Millennium MSS Air Conditioning:

1.2 • Thermal heat source (e.g. MSS solar collectors)

1.3 • Air conditioning distribution system for cooling and heating (e.g. radiant floor, fan-coil units)

1.4 • Heat sink for charging and discharging (e.g. swimming pool, cooling tower, air cooled condenser or geothermal holes)

1.5 Millennium Mss Air Conditioning System is a modular absorption machine that differs from the "standard" Lithium Bromide type absorption machines in three main aspects:

1.6 • It has internal storage in each of the two accumulators. This allows the machine to store chemical energy with a very high density. This energy can subsequently be used both for cooling and heating. It is important to emphasize that this is chemical energy, not thermal energy that is stored.

1.7 • It works intermittently with two parallel accumulators (Barrel A and Barrel B).

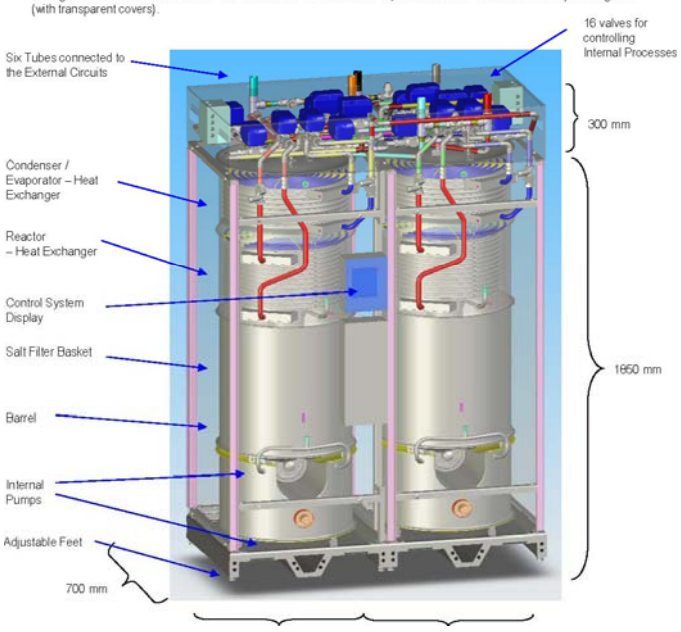
1.8 • It is designed to use relatively low temperatures and is hence optimized for usage with solar thermal collectors. It also works with a stable temperature inside the accumulators, which in turn allows for an effective use of solar thermal collectors.

Millennium MSS Air conditioning system made up of two "barrels" each consisting of a reactor and condenser/evaporator. The two barrels can operate in parallel.

Millennium MSS Air Conditioning system heating and cooling device

ClimateWell 10 is a highly efficient solar air conditioning unit with the unique ability to store energy and to deliver cooling and heating. The patented triple-state absorption technology allows ClimateWell 10 to be the first product to make efficient and integrated energy storage possible. The process cycles between three states of aggregation – solid, liquid and gas – allowing continuous cooling or heating output. ClimateWell 10 also works in conjunction with other thermal sources such as district heating or micro co-generation.

The figure below shows the contents and dimensions of ClimateWell 10, which includes two barrels and a plumbing unit (with transparent covers).



Mode	Storage Capacity *	Maximum Output Capacity **	Electrical COP ***	Thermal Efficiency
Cooling	60 kWh	10/20 kW	77	68%
Heating	76 kWh	25 kW	96	160%

***** Total storage capacity (i.e. including both barrels)

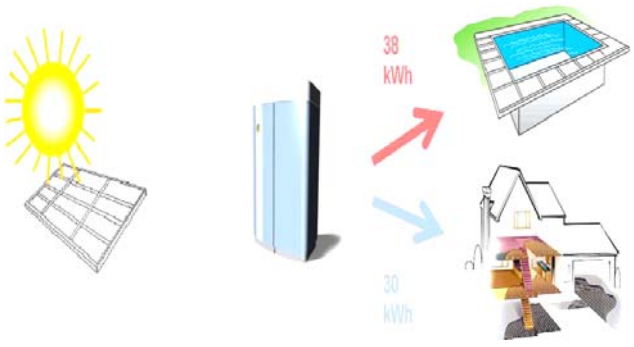
** Cooling capacity per barrel: 10 kW cooling is the maximum capacity. If both barrels are used in parallel (double mode) the maximum cooling output is 20 kW and the maximum heating output is 25 kW.

*** Coefficient of Performance (COP) = cooling or heating output (kW) divided by electrical input. The only electrical input is 4 small circulation pumps and internal controls. COP in conventional compressor-based chillers and packaged air conditioning units is usually stated as cooling capacity (kW) divided by compressor electrical input. Since the Millennium MSS air conditioning doesn't have a refrigeration compressor, COP is stated here as annual cooling/heating energy delivered divided by total electrical input of the pumps and internal controls.

Cooling

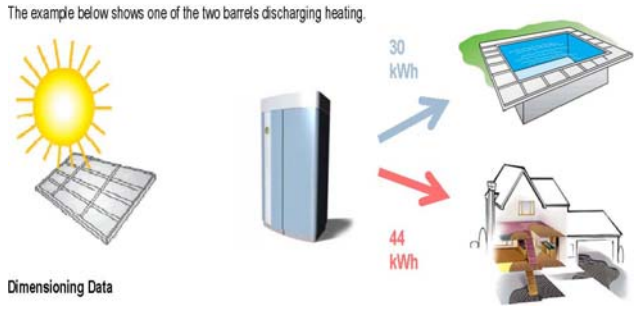
The water returns from the distribution system at a higher temperature than when it left the condenser / evaporator (we have cooled the building). This heat causes the water in the evaporator to boil and the steam passes down to the reactor, where it condenses, since the reactor is relatively cooler.Steam that condenses into water in the reactor will dilute the LiCl solution. The diluted LiCl solution is then pumped through the filter basket, where it mixes with the salt and regains its saturation. The saturation is needed to continuously provide a temperature difference between the condenser/evaporator and the reactor.

The example below shows one of the two barrels discharging cooling:



Heating

Heating is just cooling in reverse, meaning that the charged energy is extracted as heat by connecting the condenser/evaporator to the heat sink and the reactor to the distribution system. Water returns from the distribution system at a lower temperature than when it left the reactor (we have heated the building). This water boils the water in the condenser/evaporator and steam passes down to the reactor. Steam condenses into water which dilutes the LiCl solution in the reactor. The diluted LiCl solution is pumped through the salt filter basket where it mixes with the salt and regains its saturation. The saturation is needed to continuously provide a temperature difference between the condenser / evaporator and the reactor. During discharging, the heating energy is extracted by connecting the evaporator to the heat sink and the reactor to the distribution system. Under charging, heat can also be extracted by connecting the condenser to the distribution system under charging mode.



2 DESCRIPTION OF THE MULTI SOLAR (MSS) TECHNOLOGY

The Multi Solar system is an innovative (PATENT NO 5522944) Solar PV/Thermal System that makes it possible to convert solar energy into Electrical energy (PV) and Thermal energy at the same time using a single integrated flat plate collector system. The MSS collects the sun's irradiation full spectrum and uses air and water pipes to cool the PV cells in order to increase the relative efficiency of the electric system and at the same time produces hot water and hot air which can be channeled for further thermal use. The cooled PV cells can provide up to 30% higher annual electrical production than the usual PV system. This is accomplished by preventing the efficiency degradation of regular PV caused by excessive heat (negative heat coefficient of half percent per degree of heat in any normal photovoltaic panel). The thermal efficiency of the MSS collector system reaches up to 70% thermal

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energy (35% hot water and 35% hot air). With the additional 15% efficiency of the PV electrical production the MSS reaches to 85% efficiency: The Most Efficient Solar Collector in the World.

The thermal energy produced as a by-product during the cooling process can be channeled for washing, shower and hot air for space heating. It can be also be used to heat the interior environment during the cold season or air conditioning using absorption pumps.

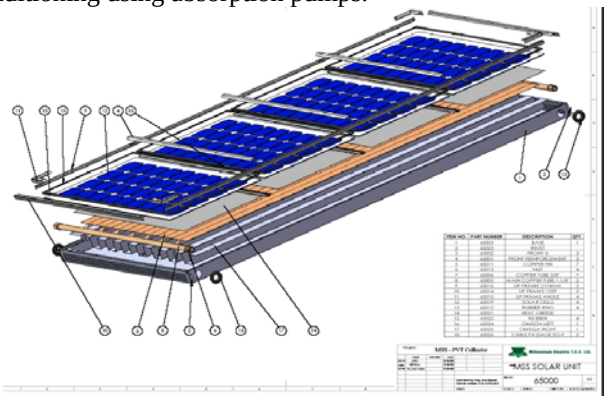

Figure 1: MSS COLECTORE

	Style	Size	Justified
Electrical Properties Millennim mss air conditioning components	**Max Power [W]**	**Percentage Operating Hours**	**Average Energy Consumption [kWh/year**
Water Pumps	80	20%	140
LiCl Pumps	80	20%	701
Control System	10	100%	88
Total	**170**W		**931 kWh/ year**

- 90 to 170 W is needed for the machine during normal operation and the average power is 106 W which comes from the MSS PV Cells.

Full load amps are 6 A only.

Environmental Properties

Millennium Climate well 10 can produce up to 10 kW of cooling power with just 106 w of average electrical power input. A great deal of electrical energy can be saved if Millennium MSS Air conditioning unit is replacing a compressor type chiller. Take into consideration that most electrical power is produced by burning fossil fuels resulting in CO2 emissions. A typical single family home could save around 15 tons of CO2 per year and all materials can be recycled. The LiCl solution can also be recycled.