MUG Heat Pump
for
Heating Water

Case Study

Content

1. **ALTERNATE SYSTEM CURRENTLY INSTALLED**

SOLAR WATER SYSTEM WILL ALSO BE INSTALLED AT SITE FOR HOT WATER SUPPLY AS A BACKUP FOR HEAT PUMPS

2. MULTI-UTILITY ENERGY EFFICIENT HEATGENERATORS

Simple things and technology often work best and so it is here. Using the proven principles of refrigeration and air conditioning, cooling and or heating effects can be simultaneously delivered if required. In addition to the cold utility generated from the evaporator side heat from the condenser can also be delivered as a hot utility. Condenser heat is approximately the sum of the energy supplied to the compressor and the heat gained from the cold utility in the evaporator. Heat exchanges are enabled using patented Tube-Tube Heat Exchanger Technology which is patented. Heat Generator technology has been used in air conditioning globally for more than 50 years and our technology is also well proven. The MWE Multi Utility Heat Generator is at the leading edge in terms of energy efficiency and durability in all weather conditions. The system uses a high performance system configuration and components along with the Vented-Double Wall TT_HE Technology to enable direct integrating with the potable water streams or process fluid streams to enable high COP and reduced CO_2 emissions.

2.1 Some of the basic features of the MWE MUG are as under:-

- **High Reliability**: field-proven patented vented-double-wall Tube to Tube Heat Exchangers TT_HE is used to assure contamination free hot and cold water delivery
- **Energy Efficient**: can heat tap water from 27 to 50 to 60^{o}C with a heating Coefficient of Performance (COP_h), typically in the range of 3 to 4; while simultaneously cooling potable water from 27 to 18^{o}C or excess cooling from 12 to 7^{o}C with a cooling COP of 2 to 3; overall energy saving would be over 66 to 75% when compared with electric water heating and conventional water cooling or air conditioning
- **Low Internal Volume**: fast start-up; hot and cold water generation in a few minutes
- **Durable**: no worries about contamination of water and water tank pressurization
- **Non Water Contamination: Most heat Generator water heaters use a single wall heat exchanger for exchanging heat between the refrigerant and water being heated. This poses the danger of the water getting contaminated by the refrigerant which is not desirable.**
- **Intelligent Application engineering:-** There will be no wastage of water and waiting time to get hot or cold water at the taps as the MWE MUG_HPs and the unique water tank and piping configuration ensures cold or hot will flow almost immediately from the tap.
- **Surplus cooling** effect can be delivered as Air Conditioning using chilled water Fan Coil Units, FCUs,
- **Integrated Intelligent Information System:-**
    - The system will be so custom designed that it will be integrated with Scada

(**supervisory control and data acquisition system**)

- Our intelligent Scada system will **monitor the energy consumption, flow, pressure and usage of hot and chilled water.**
- System is engineered to monitor and operate the heat pumps depending upon the demand to conserve energy.
- Data of usage and consumption will be available in digital format.
- A complete alert mechanism is activated in case of abnormal variations.
- Our IIIS is web enabled, performance is monitored by our technical team and alert mechanism as per customer's choice can be provided.

Particulars	**Heat Exchangers with ΔT of 5°C to 10°C**	Tube tube heat exchangers (tthe) with **20°C to 40°C**
Instant Hot / chilled water	Not possible	Streams of Hot water available within seconds
Recirculation of Pump	Mandatory	Not required
Pumps Required in non pressurized system	Primary and Secondary pump required of higher capacity due to higher flow rate of water	Only Primary Pump required to put the hot water in tank.
Pumps required in pressurized system	Secondary pump required	No pump Required
Storage Tank	Mandatorily required to recirculate the water to achieve desired temperature	Optional
Feed Water for Boiler at70°C	Not Possible	Possible in single pass taking water at 20 °C and delivering upto 70 °C
Power saving	Overall COP is less if all pumping power consumption is considered.	Overall COP is high even is pumping cost is considered.

3. PERFORMANCE TEST READINGS :

Performance Test Readings

		G2	B3(A)		B3(B)	
Date		12/04/2013	12/07/2013		12/07/2013	
Time	Hrs	850	1050	1120	1545	1615
Water flow	W_{flow} l/m	6	6	6	6	6
Condenser Inlet water temperature	$t_{cond.i}$ ^0C	38	32	31	30	31
Condenser outlet water temperature	$t_{cond.o}$ ^0C	57	51	51	49	50.7
Heat load	Q_{cond} kW	7.95	7.95	8.37	7.95	8.25
Outlet air temp	$t._{evp.i}$ ^0C	13.7	16.3	17.3	18.2	17.7
Inlet air temp.	$t._{evp.o}$ ^0C	18.1	23.3	23.3	25.6	25
Evaporator pressure	$P._{evp}$ psig	60	80	80	80	80
Condenser pressure	$P._{cond}$ psig	350	270	260	260	270
Voltage		237.00	230.00	230.00	235.00	235.00
Current	A	12.20	9.20	9.30	10.20	9.30
Heat pump power	$P._{comp}$ kW	2.31	1.69	1.71	1.92	1.75
COP		3.44	4.70	4.89	4.15	4.72

4. INSTALLATION PHOTO : 11 units installed on each building.

5. RETURN ON INVESTMENT : CONSIDERING ONE BUILDING

INPUT	Quantity of hot water required in liters	5000
	Inlet Water temp.	25
	Out let water temp. Required	55
	COP	4.15

Efficiency (in %)			75	75
Parameter	Heat Generator	Electric Geyser	Diesel	LPG
Calorific value (kcal/kg)		860.00	10700.00	11600.00
Heat Required in kcal.	150000.00	150000.00	150000.00	150000.00
KWH HEATING REQUIREMENT	42.03	174.42		
Heat delivered per kg			8025.00	8700.00
Total fuel required in kg			19	17.24
Cost/unit	10.00	10.00	52.00	78.00
Total cost PER day	420.29	1744.19	971.96	1344.83
Saving per day		1323.90	551.68	924.54

Payback

Parameter	Heating	Cooling
Cooling capacity TR		3
Heat Required in kcal.	150000	
KWH HEATING REQUIREMENT	42	
Current Kw/Tr		0.7
Cost/unit Rs.	10	10
Total cost PER Hour		21
Total Cost per Day	420	328
Total Cost Per Year	84,057	98,280
Annual Saving considering only 200 days of opertion	2,64,780	98,280
Total Saving		3,63,060
Total Cost of Project		2,40,000
Saving on Direct taxes with weighted Depreciation of 80%		57,600
Net cost of Project		1,82,400
Return on Investment in months		6