Solar Water heater: An employment generation perspective to reduce carbon footprint.

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Abstract: In the present world of global warming, a lot of action has been done to control temperatures around the world. The best way to control global warming is to reduce emissions rather than carbon capture. One such initiative is described in this article. Solar water heaters across the urban local bodies of India contribute to reduced carbon emissions.

Keywords: solar water heater, carbon emission, electricity consumption, urban local bodies

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Introduction: India takes bath every day with hot water. In urban areas, mostly geysers and immersion rods are used for the purpose of heating water. Where as in rural areas, coal and wood are burnt to heat water besides geysers. Thus, in total national electricity consumption, geysers occupy a prominent share and indirectly contribute to pollution by the production of CO2 in electricity production. Indian power sector is mostly coal based. Nuclear power generation accounts only for 3 percent of total energy produced. So, India adds a lot of carbon foot print to its environment to meet its electricity demands.

Literature Survey: Maria et al did an empirical analysis to support all three aims of clean energy technologies- security, competitiveness and sustainanbility. The paper focused on feed-in-tariff and results indicated significant FIT impacts in terms of PV capacity[6]. Jamalia et al reviewed and presented the barriers to renewable energy sources in Barbados. The paper reviews potential challenges in deploying alternative energy sources with the help of interviews and questionnaires[7]. Juliana et al did an empirical study to investigate dimensions and components of diversity in solar PV industry.A total of nine indicators discussed recent developments of technologies,markets and dynamic potential of solar PV industry[8].Amir et al concluded solar energy to be the best option to energy poverty and to reduce GHG emissions and indoor air pollution.Amir says that solar energy susbstitutes kerosene and firewood in domestic purposes[9]. Bikash highlighted the energy demands of the state of Odisha.Odisha derives its energy mostly from hydroenergy and thermal power plants.Due to depleting fossil fuels, the state of Odisha looks towards solare energy.Odisha receives a huge amount of solar insolation[10].

Policy : The ambitious project is to supply hot water to households only through solar and not to use geysers running on conventional electricity. The policy is to give incentives to

people at the level of municipal corporations/municipalities, in the form of a rebate in property tax. This rebate is given because of the reduction in emissions of carbon-di-oxide in the manufacture of conventional electricity. Each household earns a savings of 1500 units of electricity annually.

Methodology: Total population of india is 134 crores. Rural population percentage is 68.84%.Rest of the 31.2 percent population lives in urban areas. These urban areas classified into 3255 urban local bodies across the country[3]. On an average, it takes five liters of water to take bath by an average person. In india, the average size of a family is 3 to 5 people. A 100-300 liter capacity solar water heater is used for residential purposes. It heats the water upto 80Celsius on a bright sunny day in a time period of 10 minutes. Hostels, hotels and industries need larger capacities. Annual electricity savings of 1500 units are achieved per geyser per household[4]. A 100 liter system can prevent emissions of 0.4 to 1.0 tonnes of Carbondioxide per year.

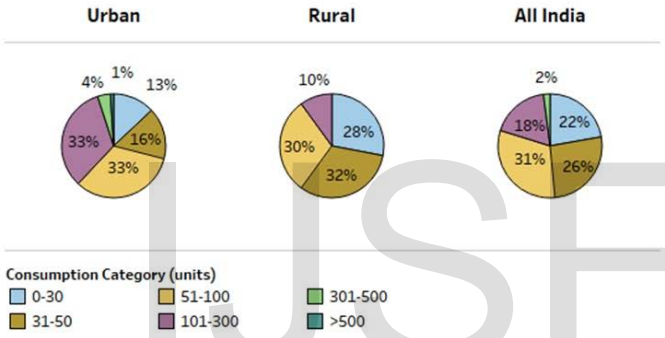

Fig: household electricity consumption across india.[1]

Application	Typical Requirement of Hot Water at 60°C.
Household bathing using buckets	10-20 liters per person per bath.
Household bathing using shower with a mixing tap	20-30 liters for 10-15 minute bath
Shaving, while a tap runs	7-10 liters
Household bathing in bathtub (one filling)	50-75 liters
Wash basin with a mixing tap (hand wash, brushing of teeth, etc.)	3-5 liters per person per day.
Kitchen washing	2-3 liters per person per day.
Dishwasher	40-50 liters per wash cycle
Clothes washing machine	40-50 liters per cycle

Table 1: requirement of water by various applications[4]

	Northern Region	Eastern Region	Southern Region*	Western Region*
Expected no. of days of use of hot water per year	200 days	200 days	300 days	250 days
Expected yearly electricity saving on full use of solar hot water (units of electricity)	1000	1000	1500	1250
Monetary savings at different prices of electricity, Rs/year				
Rs. 4/kwh	4000	4000	6000	5000
Rs. 5/kwh	5000	5000	7500	6250
Rs. 6/kwh	6000	6000	9000	7500

Table 2 : usage days of hot water per year[4]

Indicator	Dimension
rural population	92,24,56,000 (68.84 %)
Urban population	41,75,44,000 (31.2 %)
Number of families	134,00,00,000/5=26.8 crores.
Number of families with electricity connections	104,00,00,000 /5=2,80,00,000
Number of solar water heaters needed	2,89,27,920
Daily Hot water requirement for a family of 5	75 liters
Water heater installations required	
a) Urban areas	26.8*0.312*15*10^7/1000= 12,54,240
b) Rural areas	26.8*0.6884*15*10^7/100=2,76,73,680
Output indicators	
Annual electricity savings	2,89,27,920*1500= 43,391,880,000KWh=43.4Gwh
reduction in CO2 emission	2,89,27,920 *0.5=14463960 tons=14.4Mtons

Table 3: indicators of solar heating and reduction in CO_2 emissions.

The rural and urban divide of population is in the ratio 68.84 to 31.2.The total population of the country is 134 crores and counting. If the entire population takes bath daily with 15 liters of solar heated water, the calculations are as shown in the table 3.For the sake of ease of calculations, let every household have a headcount of five on an average. In urban areas, let each apartment building have 14 floors with six households on each floor. Let every apartment building be installed with a 1000 liter capacity solar water heater on the terrace. Let the quantity of water be five liters even its a shower or a bath tub. Upon calculations, urban areas need a count of more than twelve lakh solar water heaters whereas rural areas need more than two crore solar water heaters. However, the capacity installed in rural households would be 100 liters. The entire solar water heater installations across india would reduce carbon emissions by 14.4 mega tonnes. The area needed to install a solar water heater is in the range of 15-18square meters.

The amount of time needed to realise the policy must be minimum. Thus, the policy must be initiated at panchayat level and municipality/municipal corporation levels. This would create employment in every municipal corporation. Because, a municipal corporation has a population ranging from one lakh to three lakhs. Upon calculations, its sixty thousand households multiplied by installation cost of thirty thousand rupees each. Moreover, apart from taking bath with hot water, solar heated water could be used in pressure cookers to cook food and also to soak clothes.

Muncipalities acheiving an annual target would be given incentives. Let there be a rebate in house tax for contributing to reduce pollution of environment. Every 100 liter capacity solar water heater would reduce electricity consumption by 1500 units annually and annual carbon emission by one ton.

The time required to deliver, install and commission a solar water heater is approximately five days[5]. Therefore, a municipal corporation with sixty thousand households would give an employment of 3lakh workman days. This calls for around ten solar installation companies in a given municipal corporation with a population of 3lakhs. A municipality or a municipal corporation is called urban local body(ULB). Such ULBs are to a count of 3500 across India.

Conclusion: Apart from creating employment at the level of municipalities, household solar water heater installations reduce the carbon footprint by 14.4 mega tons. Such a policy is not only environment friendly but also reduces annual household electricity consumption by 1500 units each. The cost of installation is around twenty thousand rupees. However, payback period of installations is 3 to 4 years and the installations life span is 25 years with little maintenance. This gives a passive earning to citizens of India.

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