

Towards a zero energy import and zero waste home

Prof. Ajay Chandak

We are a joint family comprising of my grand mother, mother, my family of 4 members and my brother's family of 3 members. The house located in Dhule town of Maharashtra State has a plot area of 11,000 sq.ft. and built-up area of 2500 sq.ft consisting of 5 bedrooms, hall, kitchen, bathrooms etc. Apart from the constructed portion the remaining plot is utilized for garden and a small workshop.



A view of my house

During the initial stage itself, we had taken care of various issues which affect the use of energy and resources and constructed the house incorporating all possible measures so as to minimize our dependence on external supply of fuel and water in future. We also took initiative to incorporate all measures to reduce electricity consumption and composting the solid waste generated making our home a almost zero-waste home. Our goal is to finally make it self-sustaining for water, and energy needs. I am describing below the various strategies adopted by us

1. Renewable Fuel strategy:

- Parabolic cookers are in use since 2003. When only parabolic cookers were in use around 40% of fuel was saved. SK-14 and another new design of balcony cooker is in use.



- In 2006 a biogas plant was constructed. This is KVIC floating drum design biogas plant. Initially this plant was run on waste flour (collected from the flour mills) and our kitchen waste. After 2008 the plant is running on 100% kitchen waste. There is



a restaurant near to the house and food waste from this restaurant is put in the biogas plant. Capacity of the biogas is 8 CUM per day, which is too high and can support 8 families like ours.

After biogas installation there is no fuel expenses. This is now fossil fuel free house since last three and half year. Even though biogas is capable of fulfilling our fuel needs still solar cookers are in use, primarily because of the great taste it delivers. Now we do not need any LPG or kerosene. We are not only Zero fuel house, but practically fuel surplus house.

- Other EERE initiatives:** Solar water heaters of 250 LPD capacity have been installed since 2001. Practically there are hardly 8-10 days when these water heaters do not work. Earlier we were using electrical heaters when solar water heaters do not work in cloudy weather, now we have biogas in huge surplus, so on cloudy days we use biogas for water heating. It is hardly issue of 8-10 days in a year.
- Electricity Conservation and Efficiency :** All FTLs in house have electronic ballasts; small lighting areas have CFLs or LED cluster lamps. All fans with electronic regulators and night lamps are 1 watt LED lamps.
- Rain Water Harvesting:** Complete campus has rainwater harvesting. All rainwater within the campus is charged in borewell. This borewell used to dry up from the month of Feb. now we have water available round the year. Borewell had hard water earlier, now with fresh water recharge hardness levels have reduced to very great extent and the water is practically potable.
- Management of Biodegradable waste:** We maintain 2 bin systems. Biodegradable waste either goes to biogas plant or composting station. We have three composting stations in the garden. All garden waste (difficult to digest in biogas plant) is composted here. Slurry of biogas plant is spread over the waste and it accelerated decomposition. All biomanure so generated at composting stations is put back in the garden.



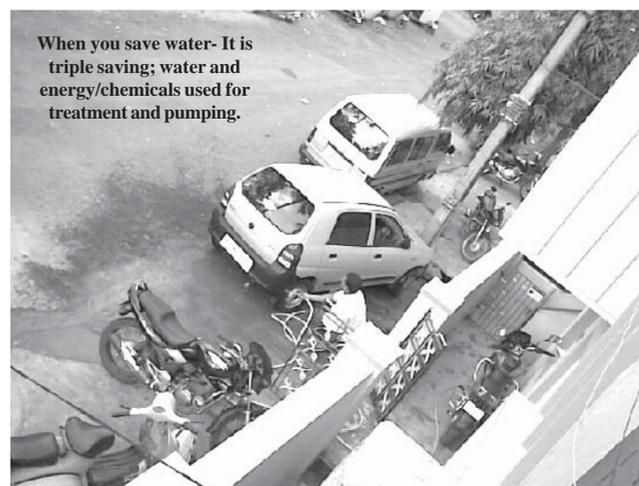
Regarding electricity consumption in our home it is about 300 units per month; much less in comparison to other homes for the similar family size and the house. We are confident that with better options available for adopting electricity conservation and efficiency measures and also the potential of generating on-site electricity, soon our home will become a *Zero energy import and zero waste home*. I am working on this and hope that my success would inspire many others and lead our country towards Energy Independence by the year 2022 as per the mission of IAEMP.

Prof. Ajay Chandak

Prof. Ajay Chandak is a well known energy efficiency and renewable energy expert with specialization in Solar Thermal applications. A Life Member of IAEMP, he can be reached at renewable.consultant@gmail.com



This is how many of us misuse water. Treated and pumped to our homes from far-off rivers or ponds! Because, they hardly pay anything for the most precious resource!



When you save water- It is triple saving; water and energy/chemicals used for treatment and pumping.

With majority of population in our country deprived of potable water and citizens fighting over its availability or even killing each other – What would you call this man? We know it is not your photograph because;

You can wash your car with just half a bucket of water!

Would you like to know more about judicious and intelligent use of resources?

Join IAEMP's Home Energy Management Programme
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User's Views on Solar Water Heaters

Sunil Sood

Electricity is costliest but the best form of energy

It is meant to light our homes,
-So that our children could study & learn computers

It is meant to run pumps,
-So that we get water to drink & cook food

It is meant to run motors and machines in Industries
-So that we have employment & growth

It is meant to light public places,
-So that we remain safe during the nights

It is meant to maintain tele-communication networks
-So that we could exchange information on Internet

It is meant to run Metro
-So that road traffic could be eased

It is meant to run agricultural pumps
-So that farmers could produce food grains for us



Why waste high quality energy called 'ELECTRICITY' to generate hot water to take bath

BE WISE & CONSIDERATE

HANG YOUR ELECTRIC GEYSER ADPOT SOLAR WATER HEATER

The first time I realized the tremendous potential of Solar Water Heaters was sometimes in 1994, when I happened to attend an awareness programme sponsored by IREDA (Indian Renewable Energy Development Agency Ltd.) At that time I was not too sure about their economic viability. I just thought that the Govt. subsidies may be making them viable. I had considered that as mere waste of money.

One day I read a newspaper report about subsidies being given on Diesel, LPG, and Kerosene by the Central Govt. which accounted for more than Rs. 8,000 crores! (in the year 1994; presently subsidies may be more than Rs.50,000 crores per year) I was aware that domestic consumers are supplied electricity at reduced rates. This made me think seriously about the subsidies available for solar energy products, which were pittance in comparison to what was available for fossil fuels.

I did some study on the techno-economic viability of the Solar Energy Based Devices such as Solar Water Heater, Solar Cookers, and Solar Lighting etc. and found to my pleasant surprise that Solar Water Heating Systems had a great potential to save energy. Presently about 6 % of the energy is used for low grade heating like water heating and drying etc. This can be easily met with solar thermal devices like solar water heaters for at least 300 days in a year.

The overall economics of these products has become very attractive in comparison to the conventional systems. For example, the initial cost barrier of the solar water heaters has been overcome by availability of soft loan from the Ministry of New & Renewable Energy Sources (MNRE), Govt. of India. Even with cash purchase, solar water heating systems for 2-3 bedroom houses costs more or less same as electric geysers, since instead of buying 2-3 geysers for all the bedrooms, one can manage with a single solar water heater.

I have been using a solar water heater since last 10 years and got benefited in the following ways.

- Average savings in electricity bills of Rs. 100/- per month for 10 months in a year The saving in electricity bill is low because we are only two persons and we were using immersion heater (Which was risky). If we were using Geyser than we would have saved not less than Rs. 200/- my friends with larger families have reported a saving of more than Rs. 300/- per month with the same capacity.
- Time saving. I now save about 15-20 minutes, which I was spending while using the heater. This time now I utilize for meditation.
- We drive extra benefits of free hot water by using the same for washing clothes and for cleaning of oily utensils.
- I feel personal satisfaction that I have done something for the betterment of the country's economy and the environment..

SAVING CALCULATION BY USE OF SOLAR WATER HEATING SYSTEM

1.0 Before we carry out the saving calculations let us refresh the fundamentals involved.

a) What is Kcal?

Kilocalorie (Kcal) is the amount of heat to be added (or removed) to raise (or lower) the temperature of 1Kg water by 1deg Centigrade.

b) What is calorific value?

It is the amount of heat liberated when unit quantity of fuel is burned under standard conditions. The calorific value is measured in Kcal. Calorific values of different fuels are given below:

Coal	-	3,000-5,000 Kcal/Kg	Heavy fuel oil	-	9,900 Kcal/litre
Kerosene	-	8,900 Kcal/Litre	LPG	-	12,000 Kcal/Kg
Diesel Fuel	-	9,400 Kcal/Kg	Electricity	-	860 Kcal/Kwh

c) What is efficiency of utilization?

The efficiency of utilization for all fuels is not same. The normal efficiencies recorded are:

- Electricity	: 90%	- Coal	: 40 – 70%
- Fuel Oil	: 60 - 70%	- Diesel Oil	: 70 - 85%

2.0 Calculations for heating 100 Litres Water from 20°C to 60°C

The formula for calculating total heat required to raise the temperature of water is

$$Q = m s (t_1 - t_2)$$

Where, Q is the total heat required in kcal
M is the mass in kgs. (100 litres is equal to 100 kgs)
t₁ is the initial temperature (20°C)
t₂ is the initial temperature (60°C)

Let us assume that we have to heat 100 litres of water per day from 20°C to 60° with the use of Electricity. Assuming an overall efficiency of 90%, the electricity consumption works out to:

$$\frac{100 \times 1 \times (60-20)}{0.90 \times 860} = 5.2 \text{ kWh (units), say 5 units}$$

Assuming electricity tariff as Rs.5.0 per unit, the potential savings in Rupees

$$= \text{Rs.} 5 \times 5 = \text{Rs.} 25 \text{ per day}$$

The savings per year for a minimum of 200 days

$$= 200 \times 25 = \text{Rs.} 5,000 \text{ per year}$$

However, the savings may be much less if the usage is less.

The total savings for industrial / commercial applications will be much more since the number of days can be taken as 325 days instead of 200 days. Similarly calculations for other forms of energy like Diesel / Coal / LPG can be done using the respective efficiency factors.

I am a great admirer of this technology and consider solar water heaters as the 'King' of all solar energy based products. In the end, as a person who is keenly watching the developments in the field I have a few question to ask everybody. Here they are:

To the Government

- Why depreciation benefits are not given to the domestic users?
- Why the use of Solar Water Heaters is still not made Compulsory for Hotels, Hospitals etc in many states?
- Why these devices are not being given publicity in TVs?
- Why budgetary allocations are so low for Solar Water Heaters?

To the Manufacturers

- Why they are not joining hands to give common publicity? Even poultry owners have come out with a common campaign to encourage consumption of Eggs. ("Roz Khayen Ande-Sunday Ho Ya Monday")

- Why they are not representing effectively (lobbying) to the Government for their cause?

- Why they are not trying to develop new products to utilize free hot water in summer season?

To the General Public

- We are a nation of the Sun worshipers. Then why this indifference towards solar energy based technologies?
- When you can spend lakhs to construct a house bigger than you actually need then why can't you spend few more thousands of rupees to install a solar water heater in your house?
- We talk of patriotism. We feel sad when we loose a cricket match; but where our patriotism disappears on economic issues?

To Electricity Distribution Companies (DISCOMS)

- Though in Karnataka and some other states incentive is given to the users of Solar Water Heaters, I wonder why DISCOMS in majority of the states are still lagging behind. Why these companies are not giving subsidy for installing a solar water heater when they can get benefited by selling the saved electricity at higher rates to industrial and commercial consumers and also help in reducing peak demand and resultant power cuts.

These are some of the questions which have come to my mind. How I wish somebody could answer them for me. In the meantime I can only think of some more questions!

HEM News

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A monthly newsletter on "Home Energy Management Programme" of IAEMP

Editorial



K. Jayalakshmi

The irony about home energy management is that people would like to make the change, but do not often know how to! Even when they make the change to CFLs or LEDs, this is prompted more by the market trend than energy conservation. There is a dearth of information reaching the average householder. But we need to go beyond providing information to actually implementing.

Providing the answers

HEM News is two issues old and growing wiser by the day. Our national convenor, Sunil Sood, has led the campaign from the front with his own experiences. Of course, what HEMP has set out to accomplish is more than an awareness campaign. It is a transformation of consumer practices and mindset. To make that transformation as effortless as possible and widespread, there must be ample examples that go beyond theory and rhetoric. The best examples must come from the preachers. It is our earnest request to all HEMP members to start the exercise, one step at a time.

Energy sources are shrinking by the day, even as demand for energy goes up. Today we have more and more parts of our life tied up to switches. Coal and oil imports meanwhile make a huge dent on the nation's expenditure. Among the various sectors, industrial and domestic ones are those that guzzle most energy. While it is up to the government to lay down the rules for the industry, managing energy at homes can be done faster and easier. It is in our hands.

It does not require training in rocket science to make the first move. Changing lights and gadgets for more efficient ones or saving fuel in the kitchen by some effective time management calls, above all, for a willingness to conserve energy. From there to detecting the various energy leaks and plugging them is a small leap. Does one need to operate the washing machine daily or reserve it for the really dirty, heavy clothes? How well to use that water? Can the community be involved in some way to reduce the energy and water consumed? For instance, in Bangalore, the government has made certain initiatives to modernise dhobi ghats and prop them up with heavy machinery. Will this drive more people to use these services?

When it comes to personal transport, there is plenty we can do to reduce our energy impact. Do we have the will to make the change? There are ways we can reduce the oil consumed during the drive. Do not miss the tips in this issue on how to get your money's worth of petrol!

And then, what about the energy life cycle of the goods we use at home? Can we become more conscious of this and start asking questions when we buy goods? These are questions that should jog our minds as we explore various ways to tighten the home energy consumption. HEMP will be working at it, with the cooperation of its members. While there are some attempts by the government and its affiliates in this area, it is inadequate. We at HEMP believe it is better to be prepared well in time instead of panicking at the last minute. Already, there are ominous signs of peak oil arriving by the end of this decade. With climate change constraints begging a move away from a carbon economy, the time is ripe for moving onto the next stage.

The irony about home energy management is that people would like to make the change, but do not often know how to! Even when they make the change to CFLs or LEDs, this is prompted more by the market trend than energy conservation. There is a dearth of information reaching the average householder. But we need to go beyond providing information to actually implementing.

With state governments in the country looking at two way power grids, the time is ripe for HEMP to go full throttle. Consumers have no idea how they can start generating energy at home, but would they love to! Expertise is lacking in official circles and that is where HEMP can make a big difference. In this issue, Prof. Ajay Chandak inspires us with his energy generating home. Any reason why many of us cannot do the same?

HEM News will bring diverse stories of success from its members and from across the country. Together, we can make homes energy efficient, and slowly self-reliant in energy.

Impact of HEMP- Charity begins at Colleague's Home!

-Sunil Sood



Sri Arvind Kumar
DGM, MECON Ltd.,
Ranchi

It is a matter of pride for us that the launch of 'Home Energy Management Programme' has started having impact not only in the homes of the active participants but also in the homes of office colleagues. I am happy to report that one of my senior colleagues Shri Arvind Kumar, Dy. General Manager, with MECON Ltd., Ranchi has expressed keen interest and commitment to adopt all possible measure for efficient utilization of energy and resources in his home. He has read first two issues of 'HEM news' and was quite impressed with its contents and called me up to visit his home.

I was pleasantly surprised to note that he was already quite conscious of the need to use energy and resources judiciously and had adopted several routine conservation measures like not leaving the lights and fans ON when not in use. He is also using CFLs wherever appropriate. He was keen to switch over to energy efficient appliances and gadgets and also for providing a solar water heater but the present accommodation being a company provided one; he is unable to do much but he has decided to incorporate all the measures in his new home which is under construction.

Presently his average monthly electricity consumption is about 250 units which he intends to bring down by at least 20% through intensive conservation techniques as explained in the 'Energy Independence Pyramid' and also by making small changes like replacement of Incandescent Bulbs in the bath rooms with LED Lamps, replacing the regulator fans.. He is confident that his new home will be at least 40-50% more efficient than the present one as he will be incorporating all the measures recommended under the HEMP.

Tips for filling your vehicles*

1. Fill up in the early morning

Remember that all service stations have their storage tanks buried below ground. The colder the ground, the denser the fuel, when it gets warmer petrol expands, so buying in the afternoon or in the evening.... your litre is not exactly a litre.

In the petroleum business, the specific gravity and the temperature of the petrol, diesel and other petroleum products play an important role. A one degree rise in temperature is a big deal for this business. But the service stations do not have temperature compensation at the pumps.

2. Fill up in the slow mode

If you look carefully at the filling hose, you will see that the nozzle trigger has three stages: low middle, and high. In low mode, pumping is carried out on low speed, thereby minimizing the vapours that are created, during pumping. All hoses at the pump have a vapour return. If pumping is on the fast rate, some of the liquid that goes to your tank becomes vapour. Those vapours are being sucked up and back into the underground storage tank so you're getting less worth for your money. Insist that filling be carried out in low mode.

3. Fill up when your tank is half full

The reason for this is, the more fuel you have in your tank, the less air occupying its empty space. Petrol evaporates faster than you can imagine. Petroleum storage tanks have an internal floating roof. This roof serves as zero clearance between the petrol and the atmosphere, so it minimizes the evaporation, but vehicle fuel tank has no such floating roof.

4. Do not fill up when the truck is unloading

If there is a fuel truck transferring the fuel into the storage tanks, do not fill up. Most likely the petrol/diesel is being stirred up as the fuel is being delivered, and you might pick up some of the dirt that normally settles on the bottom

* The tips are compiled from the material available on the net.

Share your ideas

Do you have an idea which can save energy and resources at Homes? Do you want to share case study of your home? Or just have a word of appreciation for this issue. Share your knowledge with others and promote yourself too, by writing to 'HEM News'

Please note the following points while making your submissions:

- ❖ Articles must be original, in electronic version, 500 words or less. If you are using material from external sources, please acknowledge them.
- ❖ Articles should be in MS word, single spaced, with easily readable font, preferably arial size 12. Photos should be of high resolution.
- ❖ Please include contact information (full name, title/organization, phone numbers, and email ID) with your submission.
- ❖ Please e-mail your submissions to The Editor, "HEM News" at sunilsolar@yahoo.co.in
- ❖ There are no deadlines for submissions. You may submit articles anytime.
- ❖ We reserve the right to edit, rewrite or reject any article.

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The power of a watt of power

Let us tap it through IAEMP's 'Home Energy Management Programme'

Often the solution to big problems lies in attending to small things. We all know that and even quote several sayings and proverbs on the importance of small things but fail to follow them. We undermine the importance of small savings and take refuge in quoting percentage instead of absolute figures. For an industry, 0.001 % energy savings may be nothing in term of percentage but in terms of absolute figure the savings may be able to meet energy needs of thousands of homes. Let us see what can be achieved if we save even a watt of power.

The average monthly electricity consumption in Indian households varies from a low of about 40 units for a lower income group to as high as 2000 units or even more for very high income group. Considering the population of different income groups, the national average may be about 150 units per month per household.

Assuming the energy consumption spread over 24 hours, this translates into a connected load of :

150 X 1000 Whrs

----- = 208.33 watts say 200 watts

24 Hrs X 30 Days

It effectively means that we are having a load of 200 watts continuously ON for 24 Hrs. In actual practice it will be much higher. Maximum Demand will vary considerably during the 24 hours period.

Now if we decide to reduce even 1 Watt load (0.5 % of our load)

What this much reduction can do? Let us see:

1. It can light a home for 5 Hours!

1 Watt X 24 Hrs X 365 Days = 8760 Whrs = 8.76 units of electricity per year

For how many hours this much energy can light an un-electrified home with the help of 5w CFL/LED Lamps?

8760 / 5 w X 365 (no of days) = 4.8 Hours Say 5 Hours

This light will illuminate their homes much better and avoid use of Kerosene Lamps for 5 hours resulting in corresponding reduction in emissions. So if there is a mechanism by which we save in this manner and donate the saved energy to an un-electrified home what additional investment will be required to create transmission and distribution of donated energy? How best it can be done. If we save more say 10% which is also easily possible then 20 Homes can be provided with light. How many of us be willing to donate in this manner?

2. It can help avoid power cuts for 40 Hrs!

Forget about donating saved electricity to villagers how reduction of 1 watt load can help us in avoiding power cuts due to higher demand? Assuming lower average of 150 units per month, the daily consumption works out to 5 units. Thus 8.76 units saved in a year can help in avoiding power cuts for 8.76 / 5 =1.75 days or 40 hrs per year. Imagine how we can totally avoid power cuts in this manner.

3. It will help growth of business and improve country's economy.

By making electricity available in the un-electrified homes, we will be actually helping ourselves! With the electricity availability, the working hours will increase and demand for electrical and electronic goods in villages will grow. This will lead to indirect increase in demand of Steel, Aluminum, Copper, cement etc having a cascade effect. Thus, effectively creating a huge market helping the country's economy leading to increased income for all of us!

Better economic conditions in the villages will minimize the migration of villagers in to the cities and may even get reversed! This will go long way in de-congestion of our over-populated cities.

How to realize the maximum savings?

I am sure that by now you would have got convinced about 'The power of a watt of power'. Just imagine the potential savings of hundreds of watts which can reduce your consumption by as much as 20-50 %. But the basic questions remain. What exactly needs to be done to realize this saving?

The answer in a single line is-

Join IAEMP's "Home Energy Management Programme (HEMP) and just follow the practical guidelines.

Through HEMP, we are creating a 'Demand Chain' to promote conservation, efficiency and renewable energy. We have also launched a "Electricity Saving Incentive Scheme" to encourage energy savings in homes.

For any queries please contact:

(Sunil Sood)

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