Energy Efficiency: A Way of Life

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***Abstract*—Being energy efficient is in many aspects a way of thinking and implementing, and the more conscious an individual is about energy use, the more energy conservation will seep into the different aspects of one's life. Every person have their own way of energy efficiency, their awareness about energy, also approach adopted, makes them energy efficient. This paper aims at summing up energy conservation in day-to-day life by an individual. How can we aim towards energy efficient individual or regenerating individual from high energy consumer behavior to being energy producer? A change in behavior is required which is expected outcome of education. Energy optimal behavior is to be cultivated by bringing about awareness among stakeholders of the earth. Each individual can contribute to achieve the aim of energy optimal use.**

Keywords: ***Energy efficiency, energy consumption, attitude, behavior, choices***

I. Introduction

In today's world i.e., IT-enabled life style we unknowingly consume lot of energy in following areas of day-to-day life: personal hygiene - bathing, brushing teeth, flushing; gardening- watering, permaculture, hydroponics; transport mode-walking, cycle, car. Choices that we make has an impact on our energy consumption. Individual must have an energy consumption report card made for his or her own self. Accordingly, energy consumed on daily basis should be recorded to monitor net energy consumption. This approach should help in optimizing needed and consumed energy. It will help in regulating the behavior of individuals by making them aware of the impact of choices that they make on energy consumption. Insight, awareness and education are very important components to bring about change in behavior.

II. Discussion

The conservation of energy, one of physics' most fundamental (and important) laws, states that we can't generate or destroy energy: we can't pull it out of thin air or make it vanish totally; we can only change it from one form to another.

A. Water energy conservation

Shower heads have their own way of being energy efficient some use only 2 gallons/minute of water as against old ones using 6 gallons/minute. Presently some aerated ones use only 1.25 gallons/minute. [1]

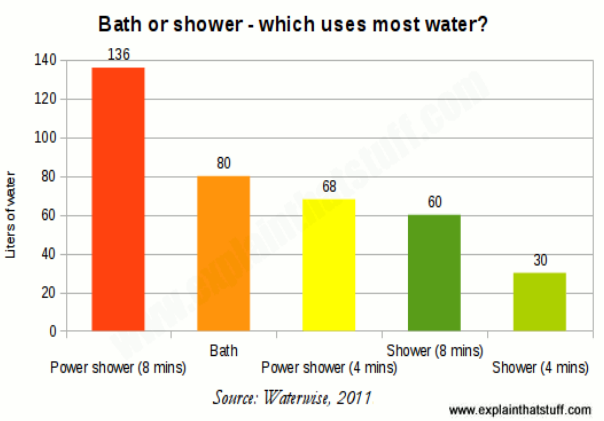

Fig.1:Bathtub needs more energy than shower. Showers vs. Baths: facts, figures and misconceptions by Waterwise, November 24, 2011 [archived with the Wayback Machine].

Which is more expensive: a shower or a bath? Showers use less energy in general since they use less water, although this varies depending on your shower and bath [Fig 1]. If you have a new electric shower with a low-flow head and only use it for three or four minutes, it will be quite efficient and will save you money over a bath.

If you take a power shower and stand under it for 15 minutes, you won't save much—in fact, you might end up paying more! If you have a shower above your tub, taking a shower with the plug in place is a simple method to see if you're saving any water. In general, conserving water saves both energy and money; the less hot water you use, the more you save. The conservation of energy informs us that the only ways to lower the quantity of energy you use in the shower (or the money you spend) are to shower for less time at a lower temperature using a more efficient shower element. [2]

The Center for Water-Energy Efficiency at the University of California, Davis, set out to discover how much energy maybe saved by water optimization. This energy conservation resulted in a reduction of 219,653 metric tons of greenhouse gas emissions, which is the equivalent of taking 50,000 cars off the road for a year. [3] Water conservation is crucial for more than just water conservation; it also aids in energy conservation and greenhouse gas reduction (GHGs). One of the most important conclusions of a landmark study co-authored by UC Davis and the Los Angeles Department of Water and Power is that (LADWP). [4]

B. Thrifting is Energy Optimizing

Cotton is transported from farmers to textile production facilities, retailers, and consumers using energy. Washing, de-sizing, bleaching, rinsing, dyeing, printing, and finishing procedures consume a lot of energy during the manufacturing process. Water is also used to generate the electricity that powers all operations. Growing cotton, manufacturing, and transporting cotton t-shirt takes a lot of energy, but did you realize that caring for it needs even more? A single load of laundry consumes 40 gallons of water. It takes 5 times as much energy to dry a load as it does to wash it. In fact, avoiding ironing and drying at-shirt reduces its carbon impact by a third.[5]

By the end of the 1990s, when shopping was at its peak, shoppers were buying roughly 65 outfits per person each year. Consumers purchase 60% more apparel than they did in year 2000, but each outfit is maintained half as long. Many old garments end up in landfills — the average American tossed away over 70 pounds of clothes each year– the equivalent of 191 t-shirts per person and only around 15% of their old apparel was recycled or donated. Water footprints were reduced and fewer chemicals were used during thrifting. Water is used in practically every stage of the garment manufacturing process. Cotton requires a lot of water to grow: one t-shirt requires up to 2,700 liters (713 gallons) of water, while a pair of pants requires over 8,000 liters. Cotton is another a crop that requires lot of pesticides. Pesticides can affect both groundwater and surface water. Pesticide use promotes soil acidity and agricultural run-off, which causes hypoxia in neighboring surface waterways and, as a result, ecosystem disruption. Pesticide use is reduced as demand for fresh cotton decline

Buying secondhand keeps garments out of landfills, which saves energy because each piece of clothing gets more wear. In fact, according to a 2007 research, recycling or reusing cotton clothing requires only 2.6 percent of the energy needed to produce a garment from virgin materials.[6]

Prepare to confront the "Eight Rs" if you believe the notion of the "Three Rs" of recycling is challenging. You'll appreciate the new Rs: recall the need; refuse and assess; reduce; reuse; replenish; repair; refit; recycle; and repeat if you recycle.[7]

C. Economy-driving

Bicycling and walking aren't simply fun ways to get around; they also help to reduce greenhouse gas emissions, traffic congestion, and our dependence on oil. Other environmental disadvantages of motorized traffic, such as noise and the degradation of open space, wetlands, and other habitats, are also reduced.

The way we drive our gasoline cars determine the economy of running the car and also emissions. Economy is reduced by 1/3 on freeways and by 1/20 in city. We may reduce our environmental effect by lowering idling time and employing overdrive and cruise control. Remember to have your car tuned up, tyres pumped, and oil and air filter cleaned out on a regular basis if you want to boost your gas mileage and fuel efficiency by 4%.

Modern transportation is primarily reliant on petroleum, and passenger cars and light-duty trucks (i.e., sport vehicles, pickup trucks, and minivans) account for half of the transport sector's carbon dioxide emissions.

One gallon of gasoline produces around 20 pounds of CO_2, implying that the average vehicle emits approximately 6 to 9 tons of CO_2 per year. It turns out that we can do a lot to mitigate the negative effects of driving, beginning with the type of vehicle we drive. A 30-mpg automobile will save nearly $3,000 in fuel costs over the course of its lifetime compared to a 20-mpg car. Choose the least polluting, most efficient vehicle that matches your demands when purchasing your next vehicle. Simply switching from a vehicle that gets 20 mpg to one that gets 25 mpg reduces your annual greenhouse gas emissions by 1.7 tons. [8]

How do you calculate a car's energy consumption? The total energy is calculated after the acceleration and braking energies have been computed separately. We derive the average energy consumption of the vehicle, 137.8 Wh/km, by dividing the latest estimated value of total energy (3205.39 Wh) by the total length of the WLTC drive cycle (23.266 km).

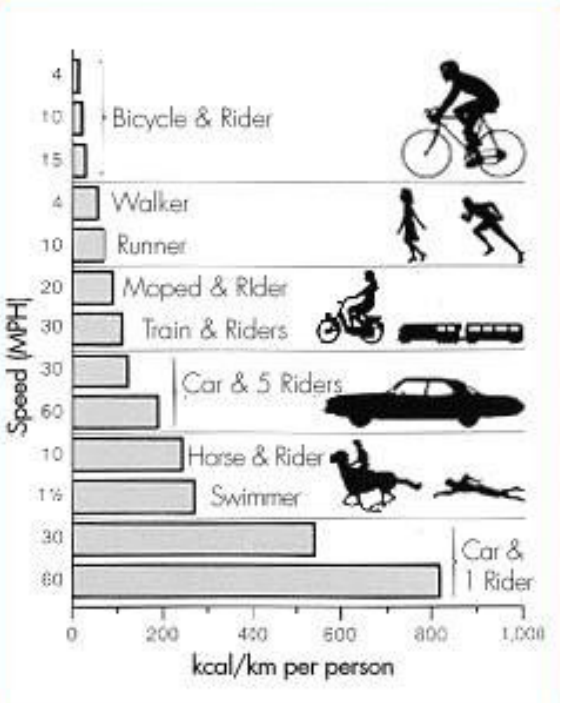

Fig. 2: Energy Consumption of Different Modes

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A mile on a bicycle requires less energy than a mile on foot. Bicycling is up to five times more efficient than walking. When we compare the number of calories burned by riding to the number of calories expended by driving a car, the disparity is startling. A hundred calories can fuel a cyclist for three miles, but just 280 feet (85 meters) in a car [Fig 2]. Unlike cars, which run on fossil fuel, bikers run on food, which is a renewable energy source. The type of food consumed by a cyclist can have an impact on their performance. [9]

As per table1 below it is obvious that energy efficiency is directly effected by our Life style, our eating habits, car sharing concerns, each and every thing counts and adds to energy factor of an Individual.

vegetables are around. 25 and. 1 W/m^2, respectively, and poultry and beef are around .04 W/ m^2 and .02 W/m^2, respectively. Any true diet, then, will have an average of no more than .4 W/ m^2 (grain-only diet) and most likely closer to .1W/m^2, with lower values as more animal products are consumed.

Even when comparing a biking vegan to a regular American automobile, a vehicle journey requires 15-30 times more energy, but its fuel source utilizes at least 25-100 times less land per unit energy, providing driving a lower land footprint than biking.

Each activity of cycling/walking consumes its own piece of energy and equivalence as shown in table 2 below. [10]

Table 1: Rough Estimates of Energy use and Climate Impact of Different Kinds of Transportation.

Mode of Transport	Energy Consumption (MJ/passenger-km)	Climate Impact (gCO_2e/passenger-km)
Biking, vegan diet	.11	40
Biking, avg US diet	.11	65
Prius, double occupancy	.85	75
Biking, paleo diet	.11	135
Prius, single occupancy	1.7	150
Typical (25 mpg) US car, single occupancy	3.3	300

Depending on the automobile and your diet, the climate implications of a bike ride can be unexpectedly similar to those of a vehicle excursion. However, there are environmental factors other than climate change to consider, such as land use. How much land do you believe is required to fuel a vehicle trip (through oil extraction) versus the land required to fuel a bike ride (through agriculture)? Unlike the greenhouse gas scenario, this is independent of your vehicle or diet; the bike journey almost likely necessitates additional land.

Land usage estimates for fossil fuel extraction vary widely, but in general, each square meter of land used for oil extraction produces at least 3,000 liters of oil each year, with some estimates reaching as high as 300,000 liters per m^2 - yr for traditional oil production. These estimates correspond to around 120 to 12,000 GJ of energy per m^2-year, or 10 to 1000 W/m^2.

This range of food output per unit of land is substantially lower. Cereal grains have the highest calories per unit land of any food; however, the World Bank estimates that we only produce roughly 7500 kg of grains per hectare-year. Using grain calorie density (3.6 kcal/g), that's just 120 GJ/hectare-year, or .4 W/m^2, which is at least 25 times less than the power density of fossil fuel extraction! When accounting for the area used to house the animals and cultivate their food, similar figures for other forms of food are far lower- fruits and

Table 2: Energy Required Per Activity

Activity	MPG food	MPG gas/lard	kWh/100-mi
Biking, incidental	290	1300	2.8
Biking, long-haul	160	720	5.1
Walking, incidental	75	340	10.4
Walking, long-haul	40	180	20

Another thing to keep in mind is that cycling and walking usually involve only one “passenger.” While comparing Prius models, keep in mind that a Prius with four passengers achieves 200 MPG per passenger (18 kWh/100 miles per passenger), so keep that in mind when making comparisons.

When compared to autos, the economies of walking and biking appear to be quite good— especially when food consumption is assumed to be as potent as gasoline. This is all well and good until one realizes that every kilocalorie of food ingested has consumed around 10 kcal of fossil fuel energy due to the way we raise, harvest, distribute, and prepare our food (dominated by oil). Our 7000 kcal gallon of food required 70,000 kcal of fossil-fuel energy, or little more than two gallons of gasoline, to generate. So, multiply the calculated "food economy" values by 2.2 to get the fuel economy that supported the bike ride or trek. Walking now consumes

18–34 MPG of oil equivalent, while bike uses 70–130 MPG of oil equivalent. When the life cycle of each mode of transportation, was analyzed. It was discovered that cycling emits more than 30 times less carbon per trip than driving a fossil fuel automobile and around 10 times less carbon than driving an electric car. [11]

This is not to say that you should ditch your bike or boots in favor of a car with better performance. Rather, we should think about ways to reduce the energy intensity of our agriculture and eating habits. We used to have to spend less than one kilocalorie of energy for every kilocalorie of food served to the plate, or we would have starved to death. So, we know that a 10:1 input-to-output energy ratio isn't strictly required. Choosing our dietary sources and types can make a significant difference in this situation. [12]

Climate change is regarded as one of the most serious challenges to our Mother Earth in this age of globalization. According to current reports, the energy sector's greenhouse gas (GHG) emissions are the primary cause of global warming. Scientists and policymakers have increased their focus on mitigating climate change challenges by reducing total energy use in numerous sectors, including transportation, buildings, industry, and agriculture, as a result of the growing concern.[13]

The most recent global CO_2 concentration reported is well above the maximum acceptable concentration level [14] Buildings account for around 32% of total world final energy consumption. [15]. Behavioral change is the most powerful method to solve the dual challenges of climate change and air pollution, as Prime Minister Narendra Modi recently stated when accepting the coveted CERA Week Global Energy and Environment Leadership Award. [16]

IV. Conclusion

The choices that we make during each day has impact on our energy consumption. Awareness regarding energy use or energy consumed by each choice one makes in each activity of day-to-day life is directly influencing energy use. Each and every choice be it transport, personal hygiene, food habits, clothing use, etc., add up to our energy use score. Every time one should have in back of mind while choosing the modes, what impact one's actions will have on energy usage in directly impacting the environment of Earth, which is to be handed out to future generations in a Healthy L ivable form.

We still have a long way to go. We have to diversify to several additional areas in today's world in future to lower our energy use and environmental effect.

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