Save Money..!

by Reducing Energy Waste

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DSM

Presidential Task Force on Energy Demand Side Management

1 Energy Basics

Why do we need Energy?

Energy is an essential requirement for our day to day activities. We need electrical energy to illuminate our homes and to operate various appliances, we need heat energy to cook our food, and we use mechanical energy to makes our vehicles go, planes fly, boats sail, and machines run.

Energy is indispensable. All living things too, need energy. Plants use the light from the sun to grow. Animals and people eat the plants and use the energy that was stored. Food is fuel for our bodies' energy needs like generating muscle power.

The energy sector in any country can be represented by the following schematic diagram.

Let's make sense of this diagram, from the back to front.

Think of the lamp (bulb) in your bedroom. You will want to use it daily. This is what we understand by 'end use' – the last usage point for a particular energy form, which in this case is electricity.

Think of all the homes in the country. All need lamps to illuminate their homes at night. Phrased differently, we can say that all homes demand electricity to illuminate their homes, which we term as 'the demand for electricity for lighting in homes'.

Electricity does not come free. You pay for it at the end of each month, as indicated in your electricity bill. This is where the market plays a role. Energy does not come free to you, it comes with a price, which in turn is determined by the energy provider, more so by the method of generating it. Unlike in other commodities, there is no apparent market where different providers try to offer electricity to you at competitive prices. In most countries, these markets function as monopolies or oligopolies. Nevertheless, there is a market place where suppliers and users meet and conduct transactions – more simply buying and selling.

In order to meet the electricity demand in your homes, energy needs to be supplied to the energy market at the right time in the exact quantities demanded. This is what we understand by 'supply'.

This supply is maintained steadily by generating electricity either from hydro power, solar, wind, or by burning fossil fuel like diesel, furnace oil or coal. These are termed as ‘resources’.

What are energy resources?

We produce energy from energy resources. A natural resource can be considered an energy resource, if it can be converted to a usable form of energy. We can further divide these resources as indigenous resources and global resources.

Our country is blessed with several types of renewable energy resources. Some of them are widely used and developed to supply the energy requirements of the country. These are known as indigenous resources, meaning that they originate within the country. Our indigenous resources include biomass, hydro power, solar and wind.

In addition to the above indigenous renewable resources, the availability of petroleum within Sri Lankan territory is being investigated.

In the international market, many forms of energy resources are available for Sri Lanka to import and use for its energy needs. However, up to now, Sri Lanka has been largely using only petroleum fuels for this purpose. Liquid and gaseous fossil fuels and coal are the global energy resources used by the country.

More recently, new energy supply technologies such as biofuels and energy carriers such as hydrogen have emerged as alternatives to the above conventional technologies and transfer options. However, use of these technologies for energy supply purposes is still limited in Sri Lanka.

How is energy produced?

There are three major forms of fossil fuels: coal, oil and natural gas. All three were formed many hundreds of millions of years ago before the time of the dinosaurs. They are called fossil fuels, because they were formed from fossilised material, hundreds of millions of years ago. The time period these fossil fuels were formed is referred to as the Carboniferous Period. It was part of the Paleozoic Era, about 360 – 286 million years ago. "Carboniferous" refers to “carbon-bearing”, where carbon is the basic element in coal and other fossil fuels. Around this time, the land was covered with swamps filled with huge trees, ferns and other large leafy plants. The water and seas were filled with algae (algae are in fact microscopic plants).

As the trees and plants of these vast swamps died, they sank to the bottom of the oceans. They formed layers of a spongy material called peat. Over many hundreds of years, the peat was covered by sand and clay and other minerals, which turned into a type of sedimentary rock.

More and more rock piled on top of more rock, and it weighed more and more. It began to press down on the peat. The peat was squeezed and squeezed until the water came out of it and it eventually, over millions of years, turned into coal, oil or petroleum, and natural gas.

How are our homes powered?

As we already know, oil fields are located in the subsurface Earth. Oil companies locate such oil deposits by using seismic surveys to find probable oil fields. Once a suitable location is identified, a well is drilled to bring the oil to the surface, by way of a pump. Natural gas is found in many of the same areas as oil. It's also pumped to the surface and transported through pipelines.

The three types of coal are anthracite, bituminous and lignite. Anthracite is the hardest and releases the most energy, whereas lignite releases the least amount of energy. Like oil, coal too is recovered from the subsurface Earth. Unlike oil, coal is a solid, therefore needs to be mined. Mines are created from shafts dug into areas that have coal, and the coal is brought out from the mines.

Sri Lanka at present, has no coal or commercially developed deposits of oil or natural gas. Therefore, we import oil from oil producing countries, mainly using sea transport. Large bulk carriers bring crude oil and processed fuels to Colombo, Trincomalee and Hambantota ports and unload using the facilities available at these ports. The unloaded oil is stored in oil tanks located in Kolonnawa, Muthurajawela, Sapugaskanda and Trincomalee. Facilities connected to the Colombo port (Kolonnawa tank farm, Muthurajawela tank farm and the Sapugaskanda refinery) are connected through underground fuel transport pipelines. When crude oil is imported, it is sent to the oil refinery in Sapugaskanda. When finished products such as gasoline or diesel is imported, these are distributed from the tank farms using a road tanker fleet, to a network of fuel vending stations around the country. Some major users get these road tankers to deliver large quantities directly to their industrial facilities for storage and use. In these facilities, the fossil fuels are used to generate vast quantities of heat, for the use in a process to convert raw material to a finished product. An example would be making floor tiles using clay. Clay is mined from earth and the varying application of heat to this raw material gives different products. Low heat will be used to dry the tiles first and a very high quantity of heat is used to glaze it in a kiln at the end of the process.

Coal is imported to Sri Lanka using large coal carrier ships and the coal is unloaded firstly to barges in a mid-sea operation. These barges finally transport the coal to the three coal power plants in Puttalam through a dedicated jetty and conveyor system.

In the case of power generation, the fossil fuels are transported to the power plant and kept

in a secondary storage facility, usually in a smaller tank farm or a coal yard. The fossil fuels are then combusted in the power plants, to generate steam, that drive large turbines and produces electricity.

While fossil fuels are imported, renewable energy resources are found within the country. They are harnessed using different technologies to produce electricity. Falling water, for instance, is the most common renewable resource to produce electricity in Sri Lanka. Flowing water has kinetic energy, which can be harnessed by way of a damming a river. The dam will store water in a reservoir, which pushes water through a turbine and produces electricity.

Wind power converts the kinetic energy in wind to mechanical power or electricity. Wind turbines are used to convert kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity to power our homes. Wind turbines, like aircraft propeller blades, turn in the moving air and power an electric generator, supplying electrical energy. A wind turbine is like the opposite of a fan. Instead of using electricity to create a stream of air blowing from a fan, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity.

You maybe familiar with solar panels. These panels are known as solar photovoltaic (PV) panels. They convert the Sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. This electricity can then be used to supply renewable energy to your home or business. Whether on the ground in Hambantota, or on your rooftop, they produce electricity in the same way.

Did you know that fuel wood and even residues like waste, paddy husk can be used to produce power?

Such resources are termed as biomass. Biomass broadly encompasses materials, including wood from various sources, agricultural residues, and animal and human waste. We use these resources, mostly to generate heat required in cooking our food. In some other instances, larger hearths are used to dry agricultural produce like fermented tea leaves, making the world renowned Ceylon Tea. Different types of biomass use different methods to generate electricity as well, though in a limited scale. So far, we have only two kinds of biomass power plants, one which uses paddy husk and the other category of plants which use fuelwood. In both kinds of plants, the biomass is combusted to generate electricity.

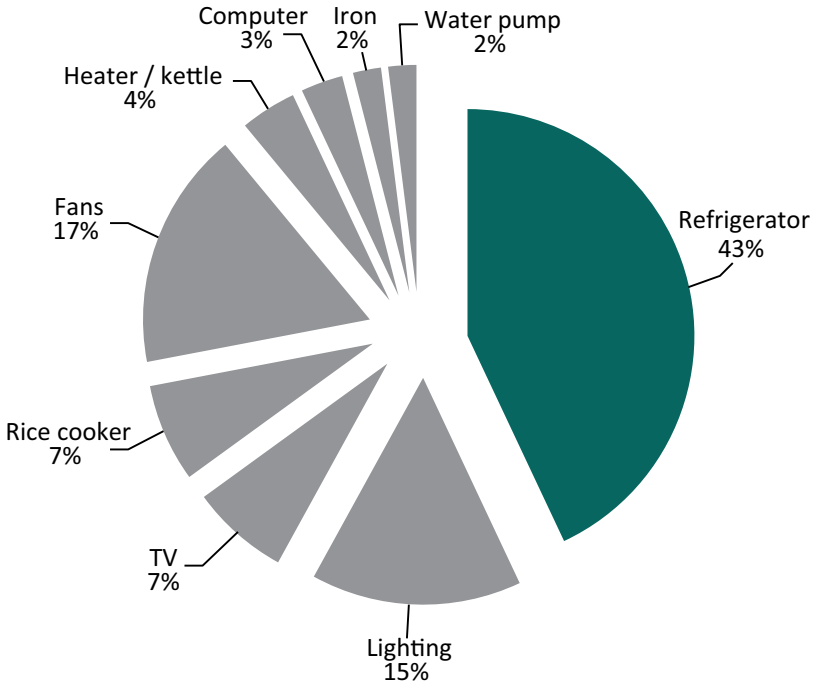
Producing electricity is diverse and interesting. Electricity makes an equally interesting journey to reach your home and light up a bulb.

Electricity is produced in a power plant. This current is sent through transformers to increase the voltage to carry the power through long distances. The electrical charge goes through high-voltage transmission lines that stretch across the country. These are usually located in sparsely populated areas like paddy fields, marshes…etc., because they pose a huge risk of electrocution. Access to such areas is restricted to the general public.

Next, the current reaches a grid substation, where the voltage is lowered so it can be sent on smaller power lines, known as medium voltage lines. It travels through these lines to your neighborhood. Smaller transformers (identified as distribution substations) reduce the voltage again to make the power safe to use in our homes. These smaller transformers may be mounted on the poles, perhaps, which may have already caught your eye before. They connect to your house and pass through a meter that measures how much of electricity your home will use. The electricity travels through wires inside the walls to the outlets and switches all over your house. And it is dangerous! So never play with electricity. Use it wisely.

How do we use energy at home?

Do you know what electrical item at home consumes most electricity? Look at following chart, you will understand that refrigerators consume the highest number of units (43%). Fans are the second highest (17%), followed by lighting (15%).



Why is energy important to Sri Lanka?

After the industrial revolution, the amount of work done by labourers and from animal draught power, was replaced by energy-using machines. So the same amount of work done by several men at great labour costs got replaced by a very inexpensive machine process. The place held by labour as a major factor of production was taken over by energy. It is evident that economic development of any country today is mainly driven by a well operated energy supply, because of this reason. Energy helped people to reduce drudgery and earn leisure, so that they earn a better living standard and a more enjoyable lifestyle. It released human capacity to do many new things fuelling economic development.

Types of energy

Let us discuss some of the most common types of energy at our disposal.

Mechanical energy

Mechanical energy is energy stored in objects and is the sum of two other energy sources: kinetic energy and potential energy.

- Kinetic energy is motion. The faster an object moves, the higher its kinetic energy. The energy of rivers (hydraulic energy) and of the wind (wind energy) are forms of kinetic energy. This energy can be converted into mechanical energy by water mills, windmills or pumps connected to turbines or into electricity when it drives a generator.

- Potential energy is the energy stored in immobile objects and the energy of position. As its name indicates, it is a potential form of energy; in other words, it only manifests itself when converted into kinetic energy. For example, when a ball is lifted, it acquires potential energy (from gravity) that only becomes apparent when it falls back.

Thermal energy

Thermal energy is simply heat. It is caused by the movement of molecules and atoms within substances. Thermal energy therefore represents an object's internal kinetic energy.

In a steam engine or turbine, it is converted into mechanical energy; in a thermal power plant, it is converted first into mechanical energy and then to electricity.

Chemical energy

Chemical energy is energy stored in the bonds of atoms and molecules. Some chemical reactions, known as exothermic reactions, can break these bonds to release their energy.

During combustion, which is an exothermic reaction, oil, gas, coal and biomass convert their chemical energy into heat — and often light. In batteries, the electrochemical reactions that occur produce electricity.

Radiant energy

Radiant energy is energy carried by radiation. Both visible light and infrared radiation are forms of radiant energy, emitted by the sun. The energy of the sun's rays can be recovered and converted into electricity (photovoltaic solar energy) or heat (solar thermal power).

Nuclear energy

Nuclear energy is energy stored in the centre of atoms, more specifically in the bonds between the particles (protons and neutrons) that make up the nucleus of an atom. When atomic nuclei are broken by a nuclear reaction, heat is released. In nuclear power plants, the uranium nuclei are split in a process known as fission and some of the heat released is converted into electricity.

The energy from the Sun – both light and heat, originate from a nuclear fusion process, which occurs inside the core of the Sun. The type of fusion that takes place in this case is known as proton – proton fusion.

Electrical energy

Electrical energy is the energy transferred from one system to another using electricity, which is the movement of charged particles. Electricity is actually an energy carrier rather than a type of energy in itself.

Some popular myths

In understanding energy, you must also pay attention to some of the most popular myths prevailing in the country.

#1Electricity charges in Sri Lanka is the most expensive in the world!

Actually, most homes in the country, that is, around 70% of us, get it at an unbelievably low price. Probably it is the lowest tariffs available anywhere in the world, that is, if you are using less than 90 kWh (90 units) of electricity per month. Comparing an electricity bill of LKR 1,300 with your phone bills will make you understand the truth. However, if you pass 90 kWh limit in a given month, you end up paying a higher electricity bill.

#2 Sri Lankan electricity utilities are horrible!

This is far from the truth! They are almost as efficient and effective as in the developed world. As a country in the South Asian region, we have very low incidence of power outages and supply quality too has improved quite much in the recent past.

#3 There are electronic 'plug on' gadgets which can reduce electricity bills!

There are unscrupulous elements selling 'power saving' gadgets, promising to reduce a certain percentage of your electricity bills. Beware, there are no such devices available.

#4 There are LED lamps which will not move the energy meter

Yes, the seller will even demonstrate this! However, these lamps are not suitable for general lighting. They use very little electricity, insufficient to move an energy meter. But that little amount is also not sufficient to light up your home! So use a better LED lamp, you will be still saving electricity. But remember, if the meter is not moving, you are not getting any use out of the lamp.

#5 Largest user of electricity at homes is by the iron!

The truth is, the iron is using a lot of power (measured in Watts, around 1,500 W) but used for very limited time (say a few hours in a given week). Actually the largest user is the refrigerator. It is using a lesser amount of power – around 90 W, but is operated continuously throughout the month. Finally, the iron will use only about 7 – 8 kWh per month and the refrigerator will use around 45 – 70 kWh per month. Further, refer the chart on the energy balance of the home, you will understand what equipment contribute more to your energy bill.

#6 Cheapest way to cook rice and boil water is using electricity

No, it is still cheaper to use LP gas, to cook rice or boil water. Electricity is a far superior form of energy compared to LP gas. Using electricity to generate heat is a wasteful activity. We have to use the cheapest form of energy to achieve lower end tasks such as generating heat. LP gas can be used very efficiently, especially when using a pressure cooker.

#7 You can work with live electric cables, if you wear good footwear

This is a very dangerous myth! Our national supply is made at 230 V, which is sufficient to kill a person instantly, if he touches a bare electrical conductor. Some people assume that wearing rubber slippers can isolate the person from earth, reducing the possibility of letting electricity pass through the body. This is far from the truth. Many things can work against this argument and let the current pass through the body, even if one is wearing footwear. Never work with live electric cables. Always ensure that supply is cut-off before you attempt anything with electric cables.

How do we contribute?

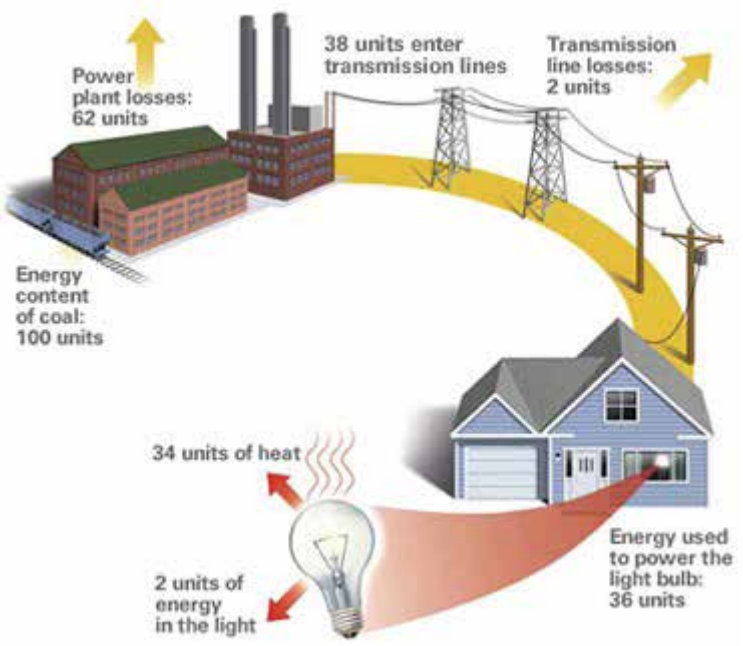
As you may have understood by now, each time you use an electrical appliance, it exerts an impact on the national grid. Read the example below, you would understand this better.

If you used an incandescent lamp to light up your home, the final lighting energy service you enjoy can be merely 2 energy units, provided by 100 energy units in the form of imported coal. The efficiency loss along the energy flow is remarkable, and beyond common understanding. However, if you use an LED lamp instead, you can derive the same 2 units of lighting energy service and use only 15 energy units in the form of coal. This is because the LED lamp uses only 9 W of electricity, compared to that of 60 W an incandescent lamp, used to deliver 850 lumens of light.

Apart from the efficiency improvements in modern equipment and appliances, using aged equipment also deprive you of good quality energy services. If each one of us can reduce the energy demand from the grid by even a little amount, it can cause a major saving of national wealth. This is even more pronounced during the times of the peak electricity demand. The peak demand is the time of the day you would use most electricity, which is usually from 1830 to 2130 hrs. Can you imagine the impact you will pose to the system, if you decide to iron your clothes at this particular time, using a 1,600 W iron?

Let's be conscious of what we do and how we choose to use our equipment during different times of the day. Being energy conscious is a need of the hour.

This book will show you how to be an energy conscious citizen.

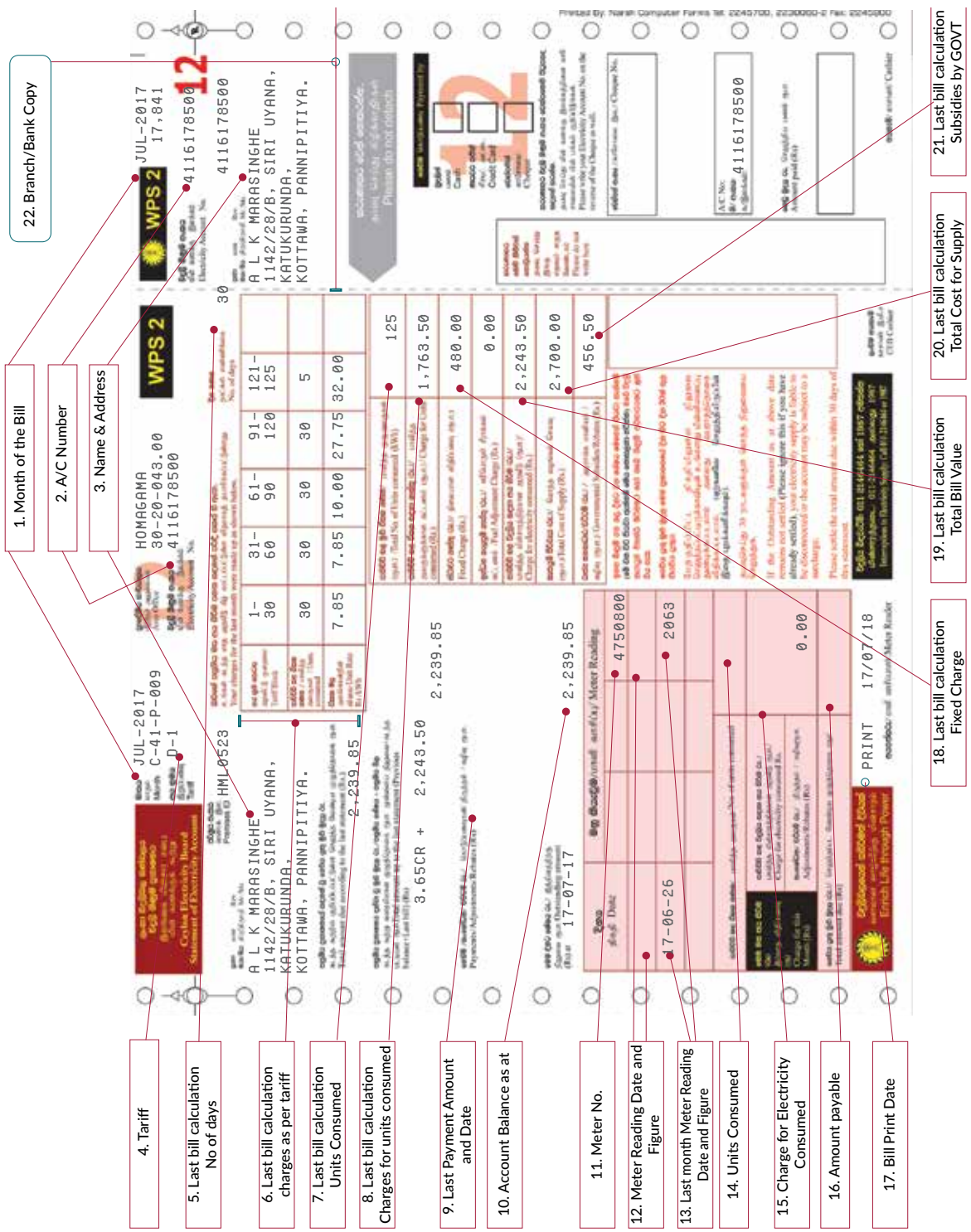


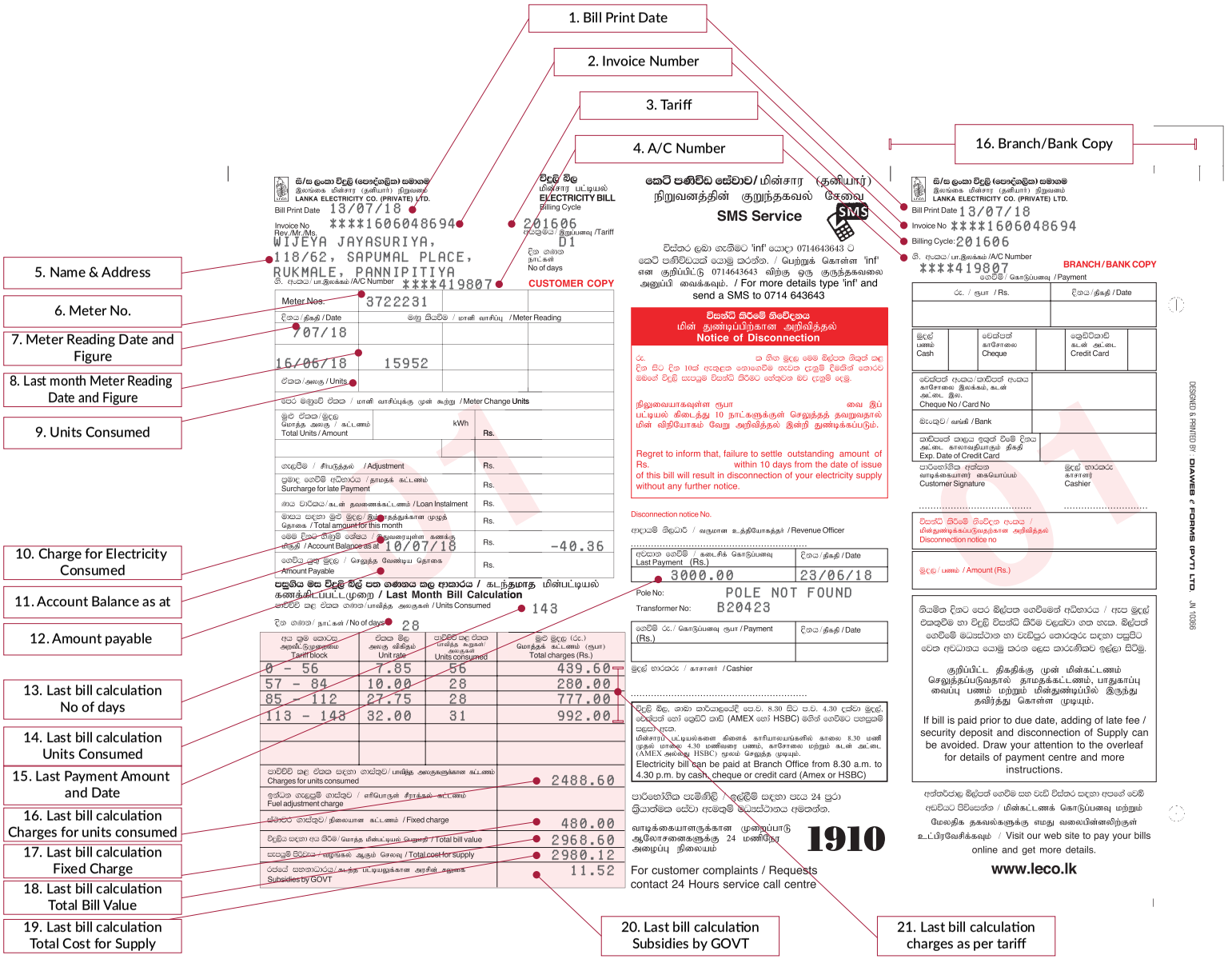
2 Electricity bill

Perhaps, you would not know to read an electricity bill at all. Or, even if you did, it could be just a few lines, like the number of units, your parent's name and home address... etc.

But there's more to a bill. These illustrated bills, one from each Utility, will help you in understanding the bill.

The first is from the Ceylon Electricity Board, followed by the bill from the Lanka Electricity Company Pvt Ltd.


1. Month of the Bill
2. A/C Number
3. Name & Address
22. Branch/Bank Copy
4. Tariff
5. Last bill calculation No of days
6. Last bill calculation charges as per tariff
7. Last bill calculation Units Consumed
8. Last bill calculation Charges for units consumed
9. Last Payment Amount and Date
10. Account Balance as at
11. Meter No.
12. Meter Reading Date and Figure
13. Last month Meter Reading Date and Figure
14. Units Consumed
15. Charge for Electricity Consumed
16. Amount payable
17. Bill Print Date
18. Last bill calculation Fixed Charge
19. Last bill calculation Total Bill Value
20. Last bill calculation Total Cost for Supply
21. Last bill calculation Subsidies by GOVT



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3 Your home

3.1 Lighting

Lighting accounts for 15% of electricity in a normal household. Therefore, investing in efficient lighting saves a great deal.
Check the difference yourself.



	Incandescent	CFL	LED
Wattage of the lamp (W)	60	13	9
Electricity consumption of the month (kWh)	60x4x30 =7,200 =7.2	13x4x30 =1,560 =1.56	9x4x30 =1,080 =1.08
Cost at the end of the month	165.60	35.90	24.90

[Each kilowatt hour (kWh) is generated at Rs. 23.00]

CFLs and LEDs are energy saving devices.

- A CFL uses only 1/5 of energy of an incandescent lamp.
- They are cost effective
- Have a higher efficacy – higher output of light
- 6 – 12 times longer lifetime than incandescent lamps
- Environmentally friendly, for they last longer and need to be disposed less frequently

These lamps are available in a wide range of shapes, sizes and colours to suit your taste.
The colour depends on the Correlated Colour Temperature (CCT) , which is a measure of whiteness (chromatically) in degrees Kelvin (K). A higher CCT makes an object more bluish-white, while a lower CCT makes an object reddish-white. Warm light usually has a colour temperature below 3,200 K while a cooler temperature is above 3,200 K. An incandescent lamp has a CCT of 2,800 K.

Colour Temperature (K)	Light Description	Application
2,700-3,000	Warm White	Colour Similar to an incandescent bulb. Ideal for kitchens and bathrooms. Reflects natural Skin tones and Wood Colour. Attracts lesser insects.
3,000-3,500	Neutral White	Standard colour for fluorescent lamp and CFL. Slight yellow to pure White. Ideal for Rooms
4,100	Cool White	Pure White colour for general use. Ideals for rooms, offices
5,000-6,500	Daylight	Simulates natural daylight
5,000-6,500	Cool daylight	White light with a slight blue tone. Ideal for retail shops, commercial purposes.

We should choose the right light and direct it to the right place. Different rooms and settings require different lighting levels. The following table gives you an idea of lighting levels in some frequently used areas.

Place	Lumens/m^3
Sitting	50
Reading room	300
Kitchen	200
Bathroom	100
Entrance	100
Office	200
Garage / outdoor	50

Activities like reading, writing and stitching require higher levels of lighting. However, watching TV and having meals don't require so much light.

You can use various lighting systems to illuminate your space fashionably, at the same time, giving due respect to efficient lighting. Here are some common applications.

Lighting system	Usable areas
Rope lighting	Tiny lights are embedded in a long, plastic tube that can be bent. They can be used where dusting is difficult and only a small amount of light is required, such as tops of cabinets.
Cupboard lights	They are halogen puck shaped lights or tiny track lights, which illuminate objects in the open or in glass fronted cabinets.
Under cabinet lights	They add brightness to work areas, such as kitchens.
Metals	They give a softer look and are either metal or painted to look metal, in particular, pewter, rusted-looking iron, wrought iron, brushed nickel and bronze and stainless steel. They are most used in kitchens.
Dimmer switches	These allow the brightness to be turned down to create a softer mood, and save electricity.
Glass beaded shades	In this type, each bead catches a little light and glows.
Pendant lights	They dangle from the ceiling on cord chains.
Reproduction fixtures	They are used to match an arts crafts home or blend with mission style furniture.
Wall scones	They are shaped like half-moon to light hallways and stairways.
Recessed lights	These are useful when the ceiling height is under 2.5 m and it is preferred when fixtures do not hang down.
Touchier	These are floor lamps that point upwards, thereby provide a lot of light without harshness.

Good lighting practices

Space	Practice
Bathroom	General lighting from luminaires, side mounted lights around the mirror Spotlights for a wonderful sense of colour and space Only cord-pull switches, which are water, steam and splash proof
Bedroom	Brighter lights for the dressing table and wardrobes Reading lights around the bed Soft-toned lights to enrich design and enhance mood Overhead lighting fitted to a dimmer switch to enable alteration of lighting intensity
Dining room	Soft and warm wall lights, either in white or with a hint of colour that enhances the wall colour Spotlight to enhance a favourite painting or an ornament Accent lighting, such as small halogen lights inside cupboards Provision of dimmer switches to adjust the lighting levels to suit the occasion or task
Corridors and stairs	Energy saving lamps, as lamps in such places need to be glowing most of the time A bright pool of lighting on the floor at the end of the corridor to create a welcoming effect No spotlights on stairways to avoid dangerous shadow
Kitchen	Recessed ceiling lights or up lighters to provide basic background light Strip lighting over work surfaces to provide bright light required for working Luminaires to be concealed under wall mounted units
Living room	Consider the lighting system as a series of layers. Sensible to use a number of side or table lamps to fill the lights where and when required Spotlights can be used to add a real sense of style and elegance
Work rooms	Bright white halogen lighting for detailed work or hobbies Sufficient overhead lighting to illuminate keyboard areas Avoid glare and screen reflection of computers

3.2 Refrigeration

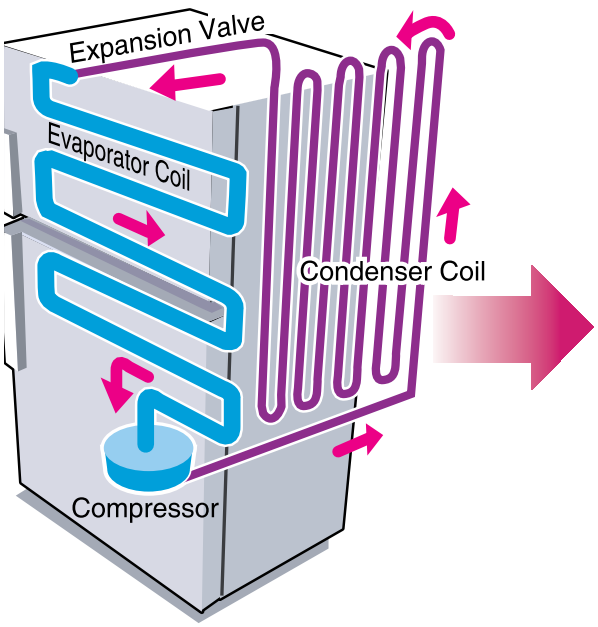
Perhaps, old is not always gold!!

Most refrigerators, especially freezers are energy guzzlers.

You may not realise it, but they consume 30 – 50% units of a normal household. But most refrigerators are underutilised. They don't contain more than

- A few bottles of water
- Dry fish – funnily enough to prevent cats getting at it
- Sugar and other sweet things – to prevent them from ant attacks
- Leftovers of cooked food

This often fills only 10% of the capacity!!



The quest for the best refrigerator

Refrigerators use mechanical force to remove heat from food items. This heat is absorbed by a liquid known as a refrigerant. The refrigerant circulates in a closed loop. It absorbs heat and becomes a gas. (A portion of the heat dissipates through a condenser coil). Then the gas is compressed by a compressor to a high pressure gas, causing it to become a hot gas. The absorbed heat dissipates to the environment through condenser coils. Once the heat dissipates (removed), the gas becomes a liquid-gas mixture and recirculates through the network of pipes located inside the freezer and refrigerator. The cycle is repeated as long as the refrigerator remains on.

Modern refrigerators, especially freezers use about 1/10th of electricity used by refrigerators built 20 years ago.

So, if you have an old, old refrigerator, buy a new one. You will be saving both money and energy.

Be mindful of your actions

Choose the right size

The bigger the refrigerator capacity, the more energy it consumes. Look at the table below.

Capactiy	Normal Consumption	Monthly Units (kWh/month)
190	25	8
240	30	6

A 190 litre refrigerator would be sufficient for a family of five.

Mind the door

Open doors result in a drop of 10 – 20 ^{0}C.

Don’t stand with the door opened while you drink water.

Tidy up

Store items in order. Defrosting items on the top shelf, cooked meals, fruits next, and vegetables in the bottom-most drawer. A tidy refrigerator is easy to search.

Use baskets or containers

Vegetables, fruits…etc. can be stored according to your preference or day's need in baskets or containers. It's easy to pick the right basket at the right time, rather than picking something from here and something from there. Store food in closed containers, if not the air in the refrigerator will absorb the moisture from food, causing it to lose its freshness.

Store liquids in closed vessels

Uncovered foods, especially liquids release moisture into the refrigerator, making the compressor work harder.

Don't store hoot food

Cool them down to room temperature before putting them in. Hotter the food, the more heat the compressor has to remove.

Put back cold food soon after use

Cool food out of the refrigerator makes them gain heat. It is hard work for the compressor to cool them all over again.

Defrost

Move frozen items from the freezer to the refrigerator. The food items will be automatically defrosted, ready for use in 10 – 12 hours. Less food in the freezer is less work for the compressor. Defrost the refrigerator when it develops an ice layer, one-centimeter thick.

Mind the beading

Ensure door seals are clean and closed properly. Rapid ice build ups are indicative of poor sealing. Ensure that the polymer sealing gasket along the border of the door is firm. To test this, place a paper or a ten rupee note between the door gasket and the fridge and close the door. Try to remove the note, if you feel the tension and if you fear that the note might tears off, then your gasket is in good condition. If the note comes out easily, then it hints a leakage.

Ensure proper ventilation

Ensure proper ventilation around the coils at the back of the refrigerator. Refrigerators with no coils at the back, need ventilation around both sides and the back.

Proper placement

Place refrigerators away from direct sunlight/ hot environments.

Keep the coils clean

Dust build-up on coils make refrigerators work harder.

Right settings

If items that require deep freezing, such as ice cream, meat, fish... etc are absent from the refrigerator, lower the settings to a bare minimum. Maintain settings at 40% level (between 2 and 3 in a scale from 1 to 5), when deep frozen items are stored.

When away for days, you can either shut down the refrigerator, or adjust the settings to a minimum. This will maintain the internal temperature and the compressor won't get activated for defrosting.

Discard junk

Store only what's really wanted. A refrigerator is not the best place to store sweets and dry fish.

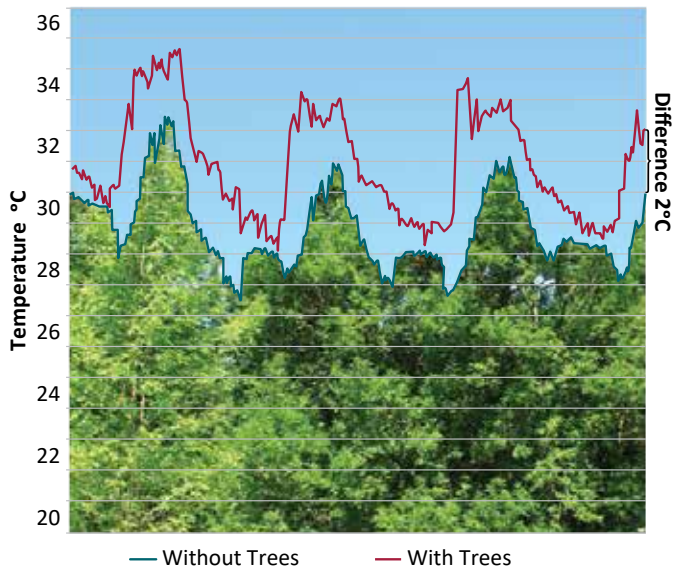
Proper location

Place the refrigerator away from cooking apparatus and any other hot blasts.

3.3 Ventilation and thermal comfort

Being simple is being sensible!

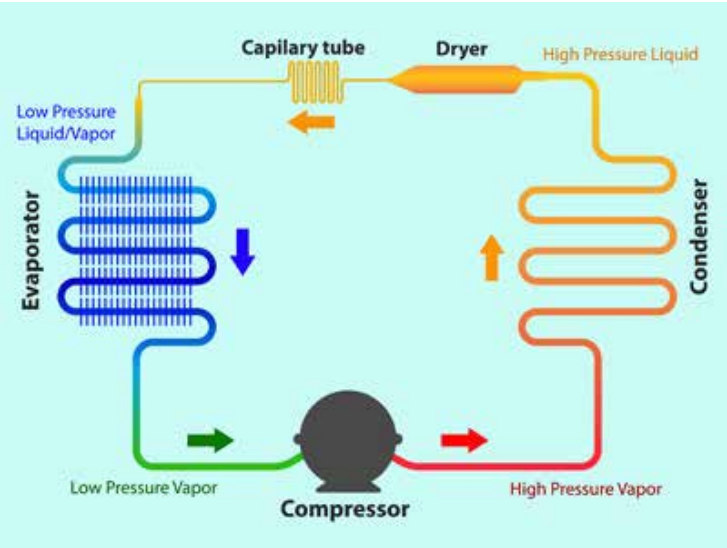
Growing trees around your home reduces the heat gain a great deal. Why pay so much for fans and air conditioning? Be trendy. Grow trees around your home and reduce your bill.



Remember,

Use air conditioning moderately. Keep the places cool, not freezing cold. The ideal temperature is 26 ^{0}C.

An air conditioner is a refrigerator sans the insulation box. It uses evaporation of a refrigerant to provide cooling, resulting in comfort level rooms.

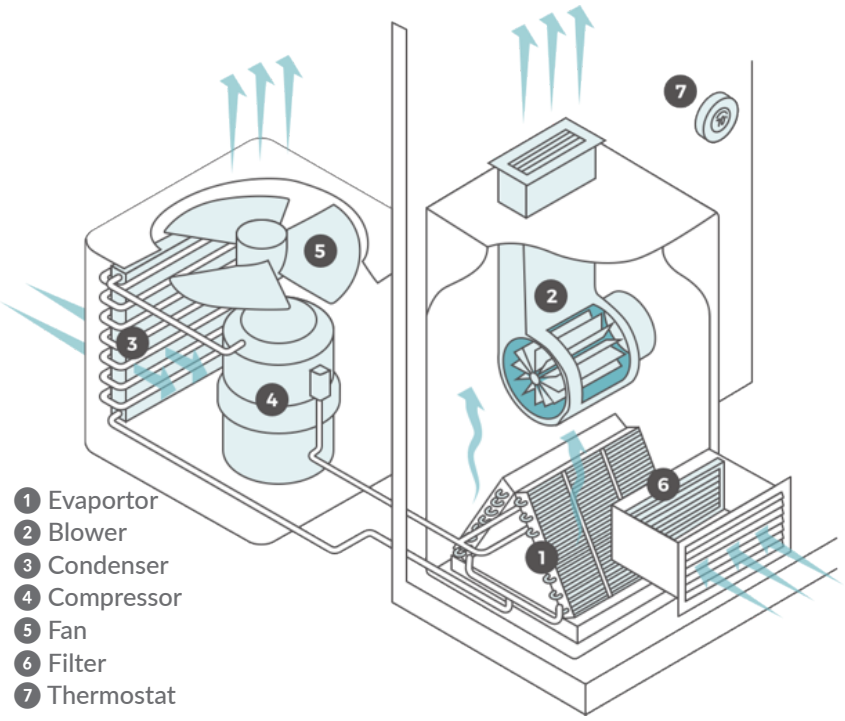


The compressor compresses the refrigerant, causing it to become a hot, high pressure gas (red in the diagram).

The hot gas runs through a set of coils (condenser), dissipating heat and condensing into a hot liquid refrigerant.

The hot liquid refrigerant runs through an expansion valve and evaporates, becoming a cold, low pressure liquid gas refrigerant mixture (light blue in the diagram).

The cold refrigerant runs through a set of coils (evaporator), absorbing heat, thus cooling the air inside the building.



Think twice before switching on an AC. Use a fan, unless it's absolutely necessary.

Set the thermostat at 26 ^{0}C. An extra 1 ^{0}C difference in the temperature adds 4% to the cooling costs.

You can set the thermostat at even higher temperatures, if fans are used in air conditioned rooms.

Install a programmable thermostat to track your schedule.

Keep filters clean. Clean ductwork/vents. Clogged filters reduce air flow, forcing compressors to work hard.

Keep windows/doors closed, when the cooling system is on. Window shades can reduce/ block sunlight and heat during daytime.

Install window unit ACs on the shadiest side of the building. Grow trees to shade the unit from sunlight.

Seal cracked/ broken windows, electrical outlets and switches on walls. Seal leaks where plumbing, ducting and electrical wiring penetrates walls.

Fans

Limit the use of ceiling fans. They consume more energy than pedestal fans or table fans.

Keep your fan in good working condition. Check the manufacturer's recommendation for care and maintenance.

Place the fan so that you feel the breeze directly.

Table Fan is more efficient than the Ceiling Fan	Table Fan 	Ceiling Fan 
Wattage	40	70 -75
Hours per Day	8	8
Monthly Consumption	10	17
Monthly Cost	230	391

Did you know?

Landscaping is a natural and beautiful way to help keep your home cool and comfortable. Carefully position trees to deliver effective shade. Such trees can save upto 25% of a typical household's energy.

3.4 Irons and washing machines

Smart clothing

You may not realise it, but doing your laundry is one of the biggest energy drainers at home. It requires a lot of energy to tumble/ heat the water used to wash your clothes and even more energy to dry it!

The quest for the best

Tips for purchasing good irons

- No matter how tedious and cumbersome it may be, yet washing and ironing are essential
- Tips for buying good irons
- Steam – smoothens out wrinkles. Check that the water reservoir is easy to fill
- Non-stick coated finish or stainless steel soleplate – easy gliding
- Swivel cord base – better handling
- Variable heat /fabric setting
- Use a thermostatically controlled iron that switches itself off when the correct temperature is reached.

Tips for purchasing good washing machines

- Buy a front loading washing machine. Their increased capacity makes it possible to do larger loads at once.
- Buy a washing machine that does not have a central agitator. Agitators burn a lot of energy during a wash cycle. Some top loading models may have these.
- Buy a unit that will suit yur family size. A family of 4 – 6 people will be very well served by a 5 kg unit.

Ironing

- Start at the very beginning. Opt to purchase clothes that need little or no ironing.
- Iron in the bedroom. You can use your bed to sort out laundry. Have hangers close at hand.
- Iron all clothes at once, starting from delicate ones to tough cottons, varying temperatures as you proceed.
- Lay a piece of thin aluminium foil under the ironing board cover. The foil will reflect heat, so you will actually iron from both sides at once. Progress from garments needing the lowest temperature to the highest.

- Iron double thickness fabric on the inside first and then the outside.
- To avoid flattening embroidery/ eyelets, iron them facedown on a thick towel
- Use distilled water in steam irons
- Clogged steam irons don't deliver enough steam. Prevent the steam vents being clogged. Follow manufacturer's instructions.
- Iron a fresh banana leaf to clean the soleplate. Remove residues from vents with cotton swabs or pipe cleaners. Do not use sharp objects.
- Rest the iron surface vertically, while ironing is in progress.

Washing machines

Semi-automatic to fully automatic machines use 230 to 725 W. a fully automatic machine, whether loaded completely or partially, will run for 30 – 45 minutes completing all the operations and typically washing 4.5 – 5 kg. However, a semi-automatic machine has a run time of about 16 minutes and can wash 3 – 5 kg.

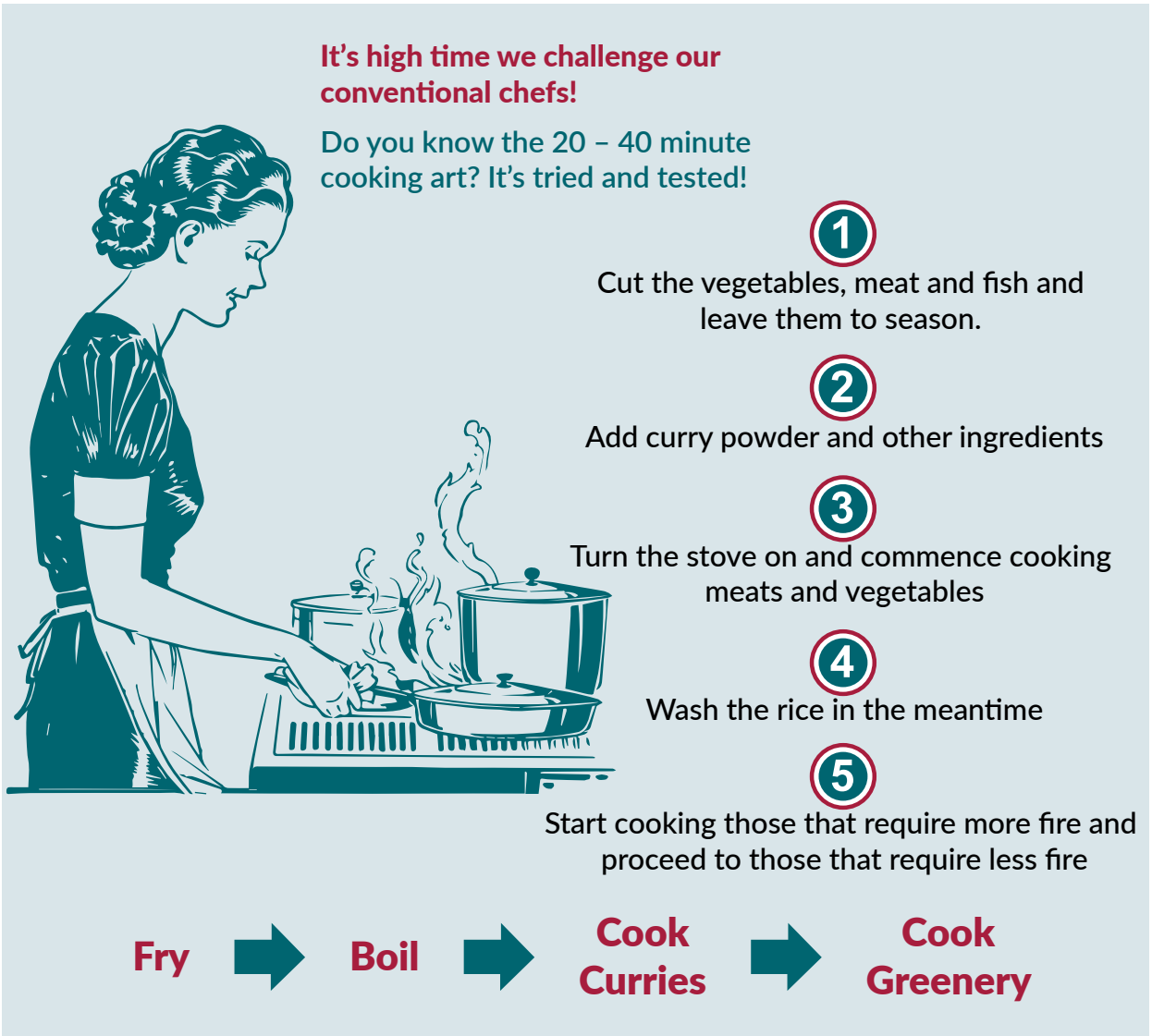
Know the following

- Select your washing machine according to your family needs.
- Look for a washing machine with more than one water fill-level so, that if the load is small, the water level can be adjusted sufficiently.
- A washing machine that uses relatively less water will prove to be the most economical in the

long run, and a machine that gives you a choice of cycles is also an advantage.

- Machines with heaters installed in them consume more power for heating water.
- Do not under-load the machine. Even of the machines are partially loaded, the energy consumed will be the same as that of a fully loaded one.
- Avoid using the dryer, as it consumes substantial energy. For example, the dryer may grab 5,000 W, whereas the washing machine only uses 550 W. Opt to dry clothes in the sun. operating dryers require more energy
- Hang clothes inside out to avoid discolouration.
- Chose a washing cycle depending on how dirty and soiled the clothes are. Shorter cycles consume less power. Sort the items according to the cycle they need.
- Clean the lint filter after use each time. A clean filter ensures greater efficiency.

3.5 Cooking



The quest for efficient stoves

- 87% of households use fuelwood for cooking
- 84% of the total LP gas consumed goes in for domestic applications.
- Yet, owing to preliminary technologies in using fuelwood and inefficient LP gas cookers, a huge amount of energy wastage occurs in domestic cooking.

The traditional three-stoned hearth

- Very low efficiency – 5 – 8%

Anagi stove

- Efficiency – 17 – 20%

Efficiency can be maximised by

- Using both burners at once
- Burning woodchips
- Pairing burners with proper sized utensils
- Ensuring adequate ventilation

LP gas cookers

Efficiency – very much higher compared to fuelwood stoves

Efficiency can be maximised by

- Adjusting the burne to get a blue flame
- Using pressure cookers, stainless steel utensils
- Pairing burners with proper sized utensils
- Minimising the height between the flame and pan
- Keeping burners clean

Induction cookers

The key to efficient cooking is, understanding your cooking habits

- Hit the right balance

Match the cooking method to the meal. Don't use an oven to toast bread, a toaster should do that. The rice cooker is used to cook rice, not other curries.

- Pair off the burner with the right pan
- Oversized pans waste energy. A 6 inch diameter pan on a 8 inch burner wastes half the burner's energy.
- Avoid spilling flames
  Gas flames spilling over the sides of the pots waste energy.
- Keep lids on
  Cooking without lids require 3 times energy as cooking with lids on.
- Use high conductivity materials
  For better heat conductance, use stainless steel cookware on LP gas cookers
- Use minimum water
  Use minimum water to boil foods. Excess water requires excess heat to boil.
- Don't overcook
  Overcooked food not only tastes awful, but also wastes energy.
- Keep the oven door closed
  Heat escapes through open doors
- Avoid heating food over and over again
- Having meals together is one of the happiest moments for a family. Inculcate this habit, try to have meals together as much as possible. This will also decline the need of heating food at different times to serve different family members and thus save energy.

Be trendy

Modernise your food habits

- Eat fresh fruits and vegetables. Less cooking means less energy wastage.
- Cooking rice is more efficient in rice cookers than in conventional pots.
- Soak grains overnight, so that they will require less time to be cooked in the morning.
- Cooking rice in pressure cookers save even more energy.
- Pressure cookers save 50 – 75% energy.

The table below compares the time taken to cook in an open vessel vs. pressure cooker

Item	Open vessel (minutes)	Pressure cooker (minutes)
Potatoes	25	8
Eggs	30	6
Rice	25	8
Gram	90	25

How should you use the pressure cooker?

Fill the pressure cooker with adequate water. Don't fill too much of water, surplus water requires 50% more energy to boil.

Meanwhile, place the food in separators.

Place the separator inside the cooker and then close the lid.

When steam issues steadily from the vent, press the weight /whistle onto the vent.

After sometime, the cooker starts whistling. This indicates that the cooker has attained the right amount of pressure.

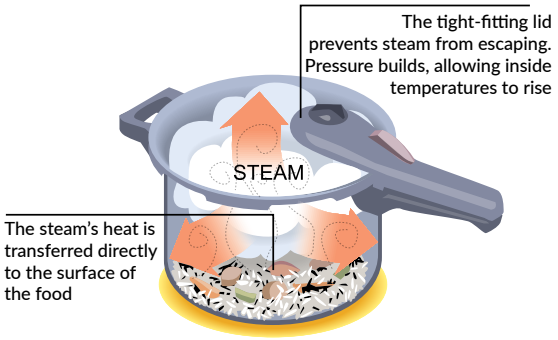
Now reduce the heat supplied, but make sure that there is sufficient heat to maintain the pressure.

After the specified cooking time, turn off the cooker.

Allow the pressure cooker to cool off for about 10 – 12 minutes before opening the lid. Take off the weight when it is cooling and later loosen the handle clasp.

Before taking off the cooker lid, ensure that the weight is disengaged.

Clean the weight and air vent regularly (with a toothpick) to allow clear passage of stem.



3.6 Domestic appliances

You will need to know a few important tips when shopping for some commonly used domestic appliances. Also, planning their usage is important. The following tips will help you to decide on an efficient schedule.

Convection ovens

- Load the oven to its maximum capacity for efficient operation.
- Do not open the doors frequently, for, each time you open the door to peep inside, the temperature drops by 25 degrees of Fahrenheit.
- Switch off the oven ten minutes before the stipulated completion time. The ingredients continue to be baked or boiled till the oven completely cools down. Alternatively, the excess heat can also be used for pre-heating other food items.
- A microwave oven is a much better choice when it comes to energy conservation since it cooks faster, but is capital intensive. Microwave ovens are fast replacing the first generation of gas-run ovens.
- Some manufacturers recommend pre-heating of ovens. Keep this pre-heating time as little as possible or avoid it.

Mixers and Juicers

- Use the right blade for different uses. Check with the manufacture's specification.
- Plan your use of mixers in such a way that they are used in their optimum capacity instead of using it frequently for less quantities from time to time. Grind weekly requirements of spices, fine sugar, chillies, curry powder…etc., once a week or as it suits your requirement.
- Ensure that the container is not filled upto the brim, as otherwise the fluid churned will spill out when the mixer is running. The spilled liquid can enter the motor and may cause damage.
- Never overload the mixer or fill it completely. It unnecessarily loads the motors. This will result the frequent need to change rubber socket under the container, since the stress tends to wear it away.
- Never use the same socket to run mixers, in simultaneous use with refrigerators or other electrical appliances. The high instantaneous current may damage the electrical parts in the equipment.

Geysers and Boilers

- Shower baths are more economical than tap baths and the cost of a showerhead can be recovered in a few months' time.
- Heating water in geysers or boilers consume a substantial amount of energy. Electric geysers range from 2,000 – 3,000 W. A geyser of 3,000 W takes 50 minutes to heat 50 litres of water to 35 degrees Celsius. A geyser of 2,000 W takes 75 minutes to do the same work.
- It is advisable to use a storage geyser instead of an instant geyser. Energy efficient water heaters may cost a little more initially, but has reduced operating costs.
- Check the thermostat settings of the geyser. Manufactures tend to set them at the highest point initially to please the customers with quick heating.
- Buy a geyser with proper insulation in the outer shell. Insulate the piping from the geyser to the taps or conceal them within walls. If the water heater you have now is not properly insulated, add adequate insulation around it.
- Ensure that the water heater is placed away from the draft.
- Ensure that scaling does not occur inside the geysers, as it acts as a resistant. Wherever water quality is hard, a periodic de-scaling is a must for efficient usage.
- Get the heater element in the geyser changed every five or six years, as the element develops resistance.
- Water heating from fuelwood or gas stoves is more economical compared to electrical geysers.
- Solar water heaters are always a sensible choice since the fuel is used free. Once the system is installed, there is no running cost.

4 Your life

4.1 Climate change

Is the climate really changing?

Yes, indeed. In fact, the face of Earth has been changing throughout history and it continues to do so even today. But these changes have been triggered by different factors in different periods. The past causes included natural phenomena, but the most recent causes, scientists believe, are human induced. According to them, development activities around the world have added massive amounts of greenhouse gases into the air, which are capable of accelerating climate change.

Greenhouse gases are those that trap the heat in the atmosphere. Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and fluorinated gases are the principal gases in the atmosphere.

CO_2 enters the atmosphere through the burning of fossil fuels (oil, natural gas, coal), solid waste, trees, and wood products. CO_2 is removed from the atmosphere or sequestered, by green plants, by absorption for photosynthesis.

CH_4 is emitted from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

N_2O is emitted during agricultural and industrial activities and from combustion of fossil fuels and solid waste.

Fluorinated gases like hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride are synthetic, powerful greenhouses gases that are emitted from a variety of industrial activities.

Fluorinated gases are sometimes used as substitutes for ozone depleting substances. These gases, although typically emitted in small quantities, are potent greenhouse gases, therefore are referred to as High Global Warming Potential (GWP) gases.

4.2 Carbon footprint

Your carbon footprint is the sum of all emissions of carbon dioxide (CO_2), which were induced by your activities, usually calculated for the time period of a year.

Almost everything that you do emits some amount of carbon dioxide. Since CO_2 is a greenhouse gas, we should attempt to cut down on our personal carbon dioxide emissions, if we are to save

our planet. In order to cut down on CO_2, we need to know how much we generate, in the first place. To help you with this quest, we have developed an 'easy-to-use' carbon calculator on Microsoft Excel spread sheet application, for school children. You can log onto www.energy.gov.lk and search for the carbon footprint calculator.

4.3 How do our actions contribute?

The emission of CO_2 from the activities you carry out, vary according to the intensity of the activity. For example, if you go to school by car, your contribution would be much more than going to school by bus or train or even in a school van. Assume that the distance from your home to school is 10 km, so if you go by car, perhaps, there would be no more than four people in the vehicle. Therefore, the amount of carbon dioxide emitted from the car is divided by four, to calculate the impact of a single person. Similarly, if you travel this distance by bus, there would be about 80 passengers in the bus. Therefore, the amount of carbon dioxide emitted from the bus is divided by 80, to calculate the impact of a single person. Hence, the more you use public transport, the more environment friendly you are!

Following are the amounts of carbon dioxide emitted from various fossil fuel and electricity. Note it, even electricity is produced by burning oil and coal in Sri Lanka, therefore, it is not always 'clean'.

Some activities and the typical amounts of carbon dioxide they emit are shown below.

Fuel	Unit	CO_2 emissions
Electricity	kg/kWh	0.58
Diesel	kg/l	2.74
Gasoline	kg/l	2.28
LPG	kg/kg	2.73
Kerosene	kg/l	2.52
Firewood	kg/kg	1.51

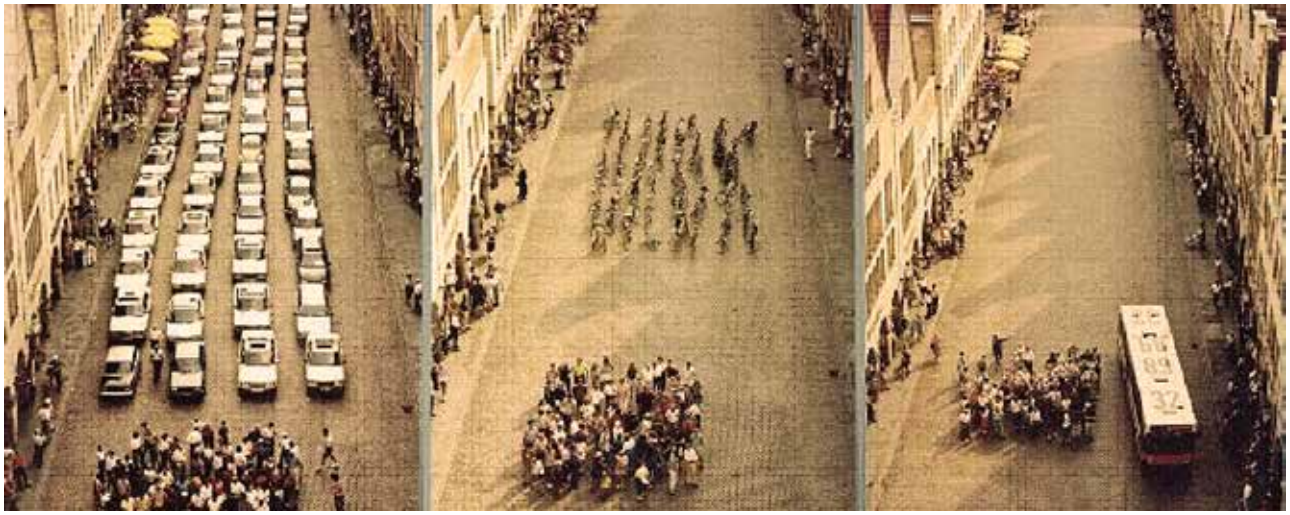
5 Your community

5.1 Transport

Travel smart!

Your transport bill can be reduced drastically, if you select the most efficient mode of transport, improve the fuel economy of your vehicle, improve your driving habits and ensure quality maintenance.

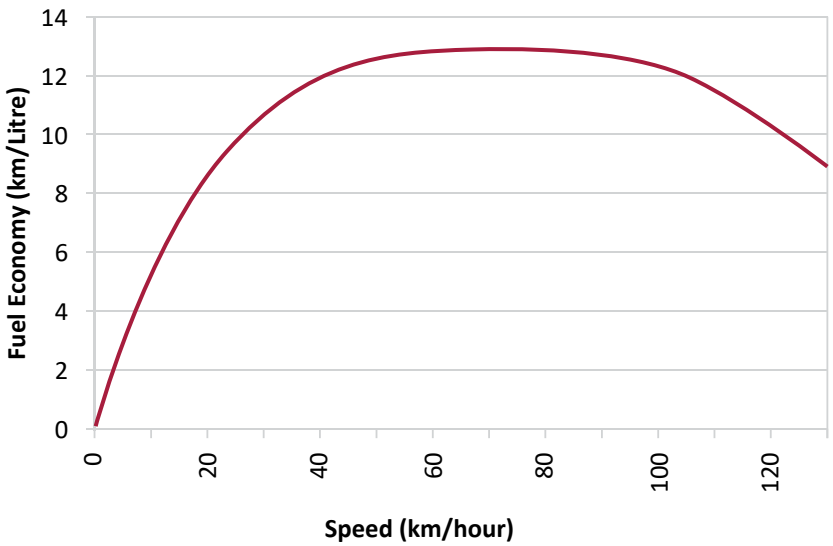
Let's plan well



- Reduce unwanted trips.
- Opt to cycle or walk short distances. It's good for your health, too.
- Use public transport whenever possible. Imagine that there are 60 people who wanted to travel to the same destination. Look at the following picture. If all 60 opted to travel by car, look at the road space they will require! Traffic!! But if all sixty opted to travel by public transport, they will require only a single bus.
- Avoid heavy traffic.
- Promote carpooling.
- Avoid unnecessary traveling. For instance, use internet banking to settle your utility bills and payments.

Control excessive acceleration and breaking

- Avoid snap accelerations.
- Prevent instant breaking, unless for safety reasons.
- Anticipate traffic conditions and make use of inertia of the vehicle (conserve the momentum wherever possible).
- Be mindful of speed when you are driving on a highway. The optimum speed is between 50 – 100 km/hr, because this speed range gives the longest distance for the least amount of fuel. Phrased differently, you can drive more km per litres at this speed range.
- Anticipate traffic conditions and make use of the inertia of the vehicle.



Minimise idle running

- Minimise idle running of vehicles. Idling can consume 1 – 2 litres of fuel per hour depending on the engine capacity and the use of A/C.
- Turn off your vehicle when it is parked or has to stop for a duration longer more than 2 minutes.

Proper maintenance

- Keep the engine tuned properly. Fixing back a noticeably out of tune engine can improve the fuel economy of the vehicle by 4%.
- Change filters, lubricants and coolants at the proper mileage or time.
- Check wheel alignment at appropriate mileage. It can save upto 2% of fuel.

- By changing blocked air filters of a car with a carburetted engine, you can reduce the fuel consumption by 2 – 6%.
- Tighten the fuel cap properly. This will help you to prevent wastage of fuel by evaporation.

Quality lubricants

- Use good quality lubricants with the correct viscosity grade as recommended in the "Owner's Guide" of the vehicle.
- Change lubricants before exceeding the specified mileage or period.

Good driving practices

- A badly packed roof-rack can increase fuel consumption by almost 10%, due to increasing the drag force. Install roof-racks only when desired.
- Always tow the suitcases and other luggage in the boot of the car.
- Always start driving in the 1st gear, except when you are in a muddy path or going downhill, in which case, drive on the 2nd gear. You can change to a higher gear, when you are within the city and you are sure that the engine will not struggle. Get into a top gear the sooner it is permitted.
- Gear changes made at the right moment increase fuel economy of the vehicle. The engine revolution is faster and it consumes relatively more fuel in a low gear.
- Using the clutch to remain stationary (pause while driving) leads to a loss of fuel. It is advisable to have the vehicle in a neutral mode.
- Use the hand break when the vehicle needs to be stopped on a gradient. Do not forget to release it while restarting.

5.2 Shop energy-wise

When shopping for appliances, be conscious about the energy factor. It maybe hard to get rid of that age old refrigerator at home or that rattling ceiling fan... but still, it needs to be done, in the long run, an efficient appliance will pay for itself and begin to add to your savings. Here's a checklist to help you save more on energy.

- Do I really need to buy it?

Am I buying it because of a tempting advertisement, or to keep up with my neighbours? Or do I really need it?

- Proper sizing

Don't buy appliances that are larger or more powerful than what you really need.

- Be conscious about energy and environment labels

Common household appliances like lamps, ceiling fans, refrigerators, Air Conditioners and even computers have energy labels. Make sure you purchase an efficient appliance, because, although it will be costlier initially, it will save money substantially in the long run. Go for energy saving features and designs. Check out the energy features of appliances as meticulously as you check the price and performance. Find out which features increase energy use and think whether you really need those features. For instance, a clothes dryer may consume 5,000 watts, while the washing machine only needs 550 watts. Some appliances have special energy saving features such as special thermostats.

- Comparison shopping

As more and more appliances make their way to the market, it is critical that we do a comparison for cost effectiveness. Purchase considerations should balance time, convenience, money and energy conservation factors. Though features maybe similar, there are significant differences in energy consumption of appliances.

Compiled by

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