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LOW CARBON LIFESTYLES

RIGHT CHOICES FOR OUR PLANET

Ministry of Environment, Forest and Climate Change
Government of India

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November 2016

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ISBN: 978-81-933131-0-7

9 788193 313107

Citation:
LOW CARBON LIFESTYLES Right choices for our planet/ Ministry of Environment, Forest and Climate Change, Government of India. 72 pp. 1. Climate change 2. Low carbon lifestyles 3. Optimal use of resources 4. Individual and community actions 5. Sustainable development.

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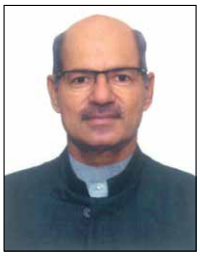


अनिल माधव दवे
Anil Madhav Dave

सत्यमेव जयते

राज्य मंत्री (स्वतंत्र प्रभार)
MINISTER OF STATE (INDEPENDENT CHARGE)
पर्यावरण, वन एवं जलवायु परिवर्तन
ENVIRONMENT, FOREST & CLIMATE CHANGE
भारत सरकार / GOVERNMENT OF INDIA

FOREWORD

A generation defines its future by the response to challenges it faces. Climate change is inarguably one of the most important global challenges that we need to collectively tackle. As Mahatma Gandhi said, the Earth has enough for everyone's need but not for everyone's greed. Overconsumption has been depleting our natural resources and has been causing damage to our planet's life and life support systems. We need to contain the overconsumption before it reaches a point beyond repair.

Climate change is essentially a lifestyle issue. Emissions reduction will only be possible if each of us takes on the responsibility of ensuring that we use natural resources with due care. More often than not, people tend to think that they are not central to either the problem or the solution, that individual actions are just a drop in the ocean and do not make an appreciable difference. However, every drop counts. A challenge of this magnitude needs to be addressed using the collective wisdom of people as well as strengths of institutions, technologies, innovations, policies and measures.

Paris Agreement on Climate Change has also recognized the role of sustainable lifestyles and sustainable patterns of consumption and production in addressing climate change. India is committed to put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation, moderation and optimal utilization of resources.

So far, climate concerns have been quantified at a global or national level, and how individual actions can help have at best been qualitative. This book, on the other hand, focuses on the individual and shows us quantitatively, how simple changes in lifestyle at a personal and community levels can add up to make a significant reduction in global greenhouse gas emissions.

This bottom-up approach is refreshing and a very useful tool for the climate movement that hopes to involve all human beings. It also shows us that the benefits of making these behavioural changes are many—we will see a cleaner and greener environment, cause less wastage, and save more money.

The book is divided into seven sections that cover the gamut of carbon emissions by daily activities–Electricity, Waste management, Transportation, Water, Domestic cooking fuels, Forests and Biodiversity, and Agriculture. Detailed calculation tables with endnotes that provide data links and formulae are provided in the Annexure, for those interested in getting a deeper understanding of how the numbers were arrived at. Short success stories from around the world have been showcased to emphasize that change is possible and beneficial.

The book has been written in a language that can be understood by both a lay person and one who is informed about these issues. The choices presented are practical and easy to adopt. Prepared by the Ministry of Environment, Forest and Climate Change, it is an effort by the Government of India to inspire and motivate the common man to take ownership and responsibility in the global response to climate change. This is the first step towards creating an informed citizenry and will undoubtedly encourage people to adopt the right path in helping us save our planet.

(Anil Madhav Dave)

INTRODUCTION

Gases such as carbon dioxide, methane and nitrous oxide in the Earth's atmosphere are very important for life on the planet as these help in maintaining temperature conditions conducive for life. These gases are called Green House Gases (GHGs).

As in every natural system, a balance is very important.

Human activities like burning petroleum products, burning waste matter or allowing it to decompose in large dumps, and use of nitrogenous fertilizers to cultivate land upset this natural balance by adding more greenhouse gases than necessary into the atmosphere. Of all GHGs, the increase in the concentration of carbon dioxide (CO_2) in the atmosphere is most worrisome.

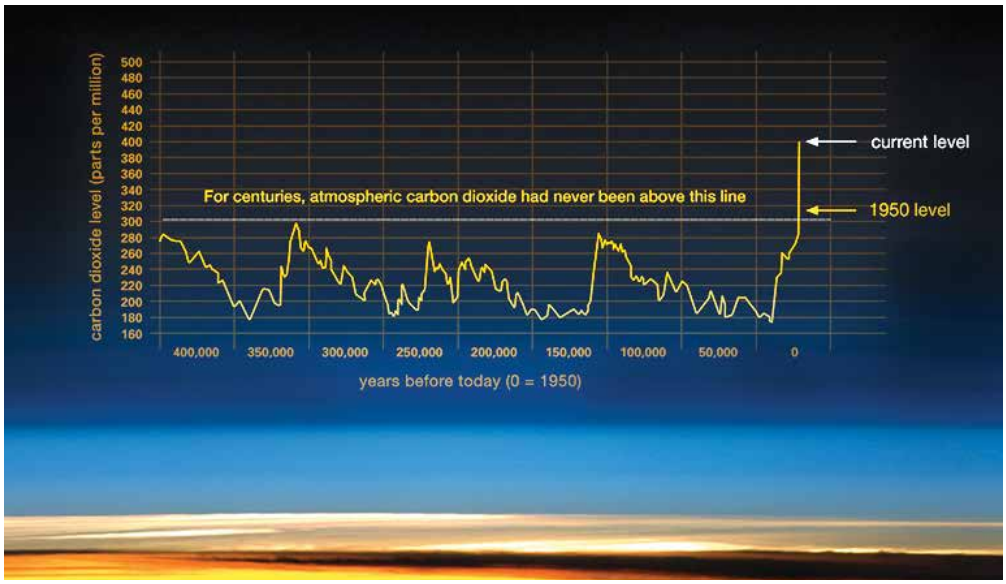
Think of it like covering the Earth with many blankets (of these gases) when only one is sufficient for comfort.

Upsetting this balance is causing the Earth's average temperature to rise. This is called Global Warming.

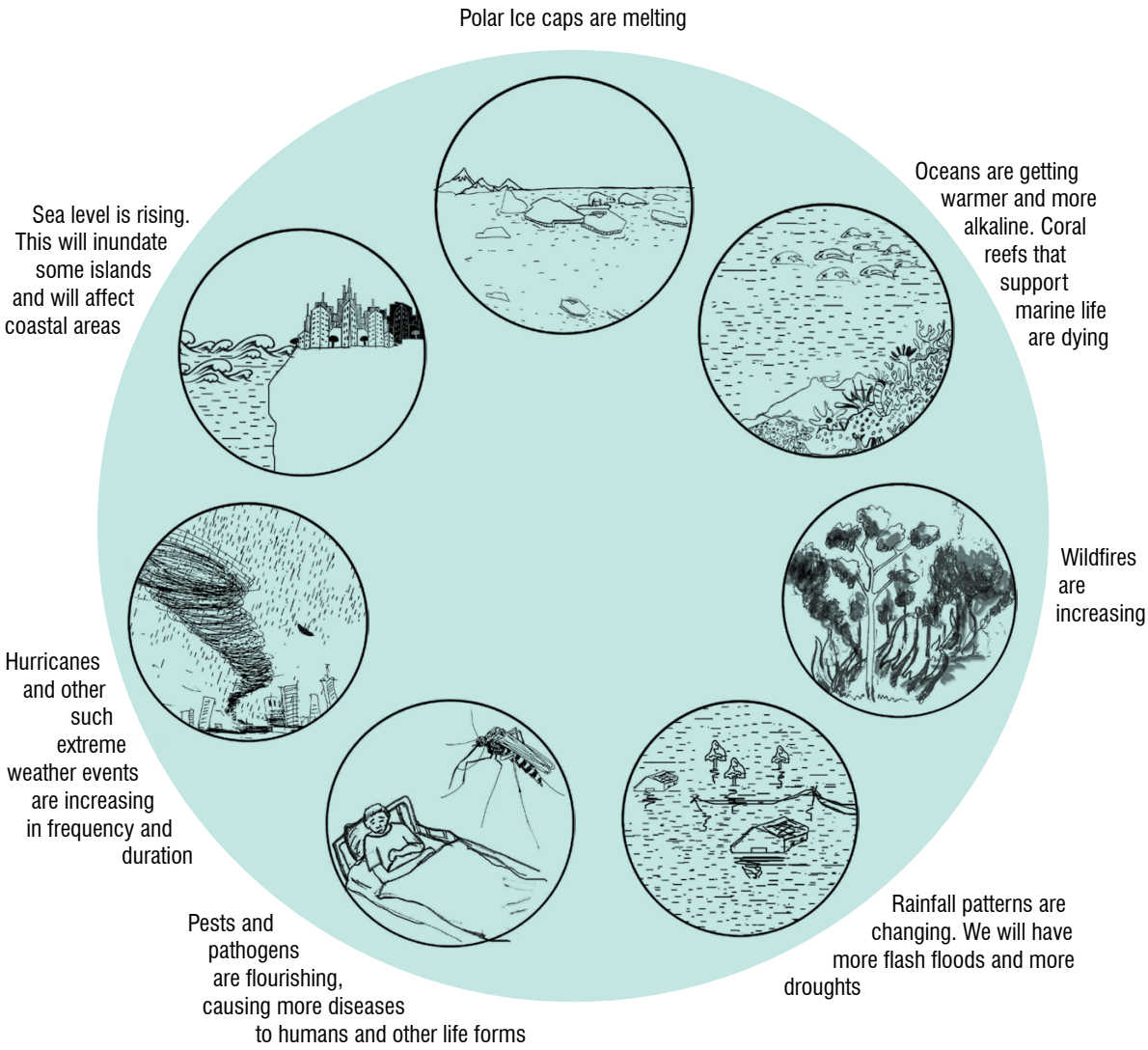
When we get fever and our body temperature rises by just 1-2^0 F, our body systems go out of order.

Similarly, because the Earth's temperature has risen by approximately one degree Celsius, its climate systems are changing. Global warming is causing climate change.

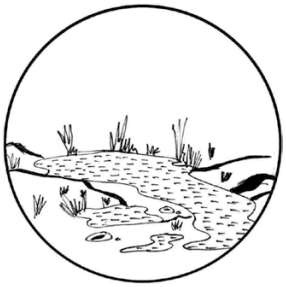
The relentless rise of atmospheric carbon dioxide



IMPACTS OF CLIMATE CHANGE



HOW WILL THIS AFFECT US?

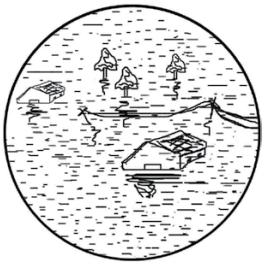


Fresh water resources will be severely affected. Many countries will be water-stressed. This may result in water conflicts, among other problems

Lesser water resources, severity of droughts and changing rainfall patterns will affect food production

The risks of hunger and malnutrition may increase

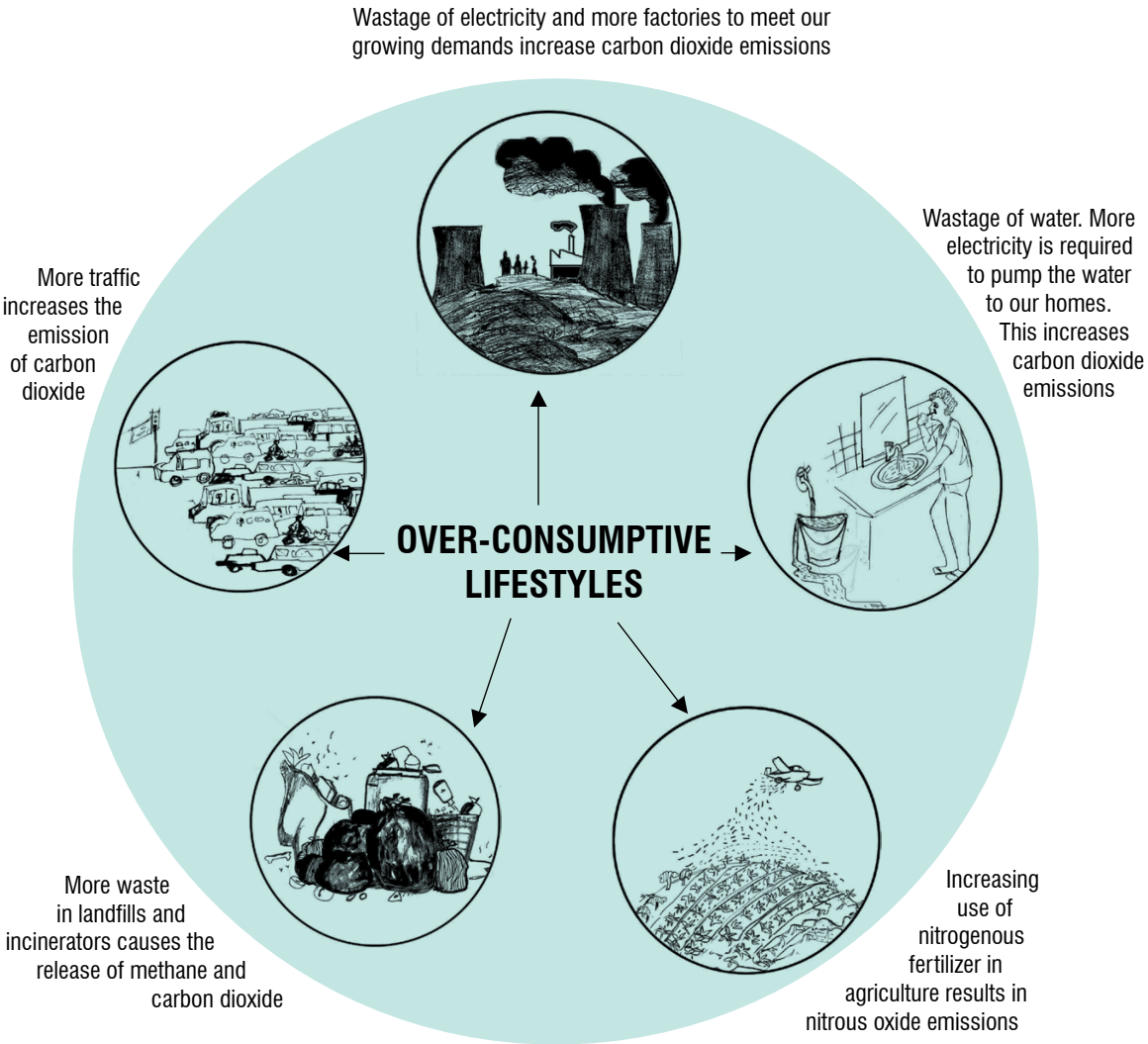
Some islands may disappear along with their life forms. The number of climate refugees may increase due to inundation of coastal areas and water and food scarcity



Diseases may increase due to heat waves, floods, drought and the persistence of disease vectors

EACH AND EVERY ONE OF US MAY BE AFFECTED

CAUSES OF CLIMATE CHANGE

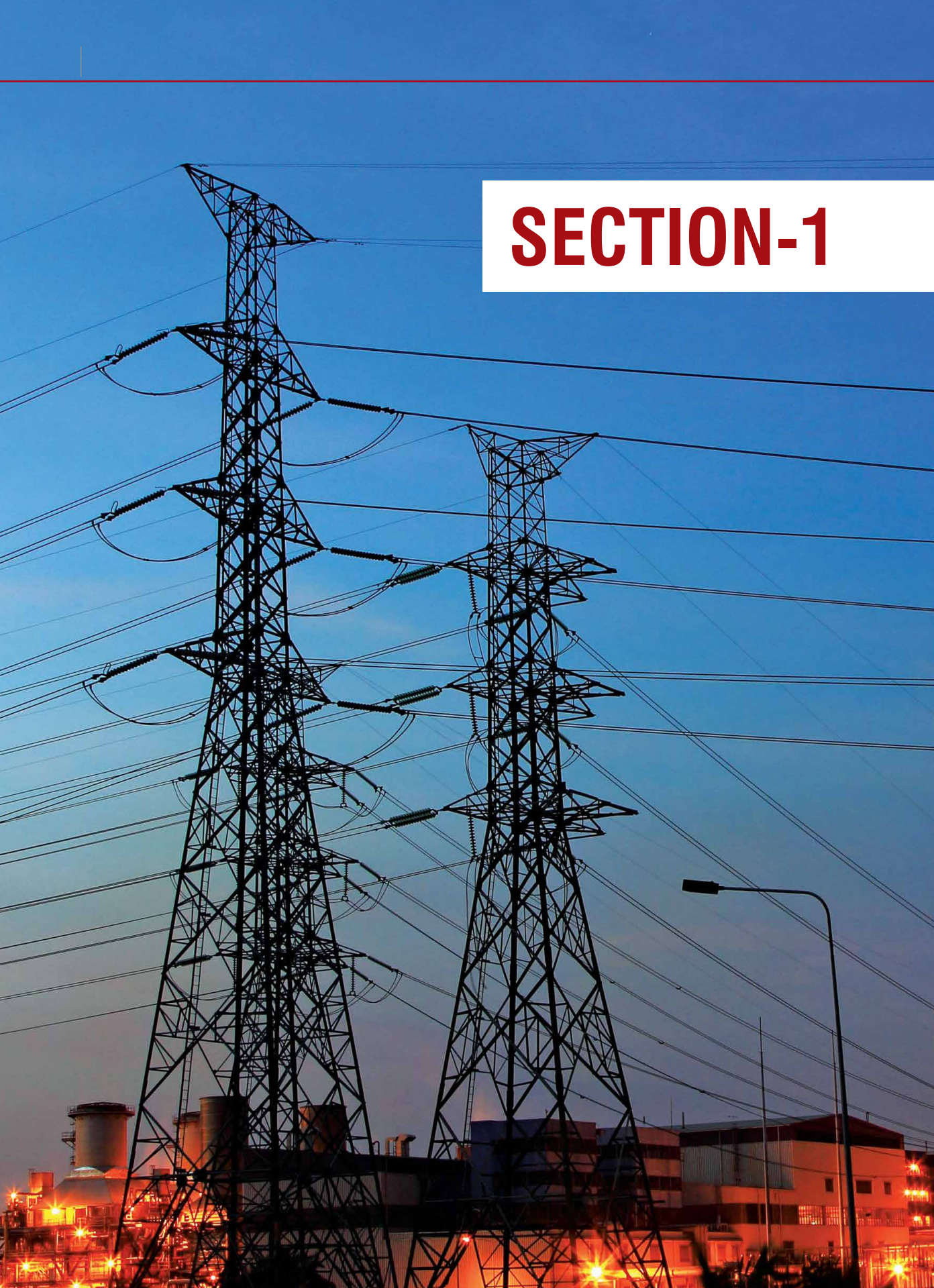


WHAT CAN WE DO?

WE ARE THE CAUSE. WE CAN BE THE SOLUTION.

Each of us should consciously reduce our GHG, specifically CO_2 emissions. This booklet will guide you on steps you can take and the quantitative impact they will have. Detailed calculations are available in the Annexure.

Simple individual actions that help reduce emissions, when totalled over a large population, have considerable impact. Every step that reduces greenhouse gas emissions also results in monetary savings. Together we can create a win-win situation, for the planet and for us.



SECTION-1

ELECTRICITY

India's electricity consumption per capita in 2013 was just one fourth of the global average#. When we compare the BRICS countries, India's electricity consumption per capita was the lowest at 765 units*, as compared to Brazil at 2529 units, the Russian Federation at 6539 units, China at 3762 units and South Africa at 4325 units. However, this cannot make us complacent because our energy use is projected to increase to meet developmental needs.

Investing in energy efficient products and making small changes in our daily activities can substantially reduce our electricity bills and contribute to a considerable reduction in emissions.

Data sources for all numerical values in this text are available on page 51. Detail calculations for data in the tabular columns are available in the Annexure.

* 1 unit = 1 kWh

AS ON OCTOBER 2016, CLOSE TO 180,000,000 LED LAMPS HAVE BEEN DISTRIBUTED TO HOUSEHOLDS

THAT'S 50,000 TONNES OF CO_2 EMISSIONS REDUCTION EVERY DAY

LIGHT RIGHT

- Replace just 5 incandescent bulbs with LED lamps. Save ₹ 2000* per year on electricity bills. Contact your electricity distribution company for purchasing LED lamps at a reduced cost.
- Students, turn off lights and fans when you go out to play or for your lunch break at school. That's equivalent to planting 314 trees.

ACTIVITY	ANNUAL COST SAVINGS	EQUIVALENT NUMBER OF TREES PLANTED
Replace 5 incandescent bulbs with LED lamps	₹ 2000	27
Turn off lights and fans at home, when not in use	₹ 180	2
Turn off lights and fans in your school, when not in use	₹ 32000	314
Install occupancy sensor lights in specific rooms in your office	₹ 27000	254

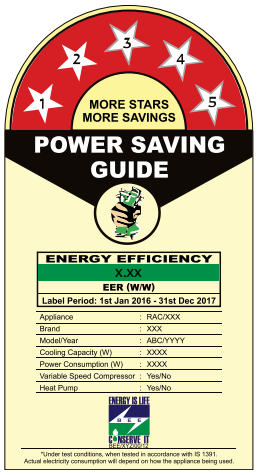
* As on November 4th 2016, 1 US $ = ₹ 66.7.
This conversion can be used throughout the text to calculate saving in US$

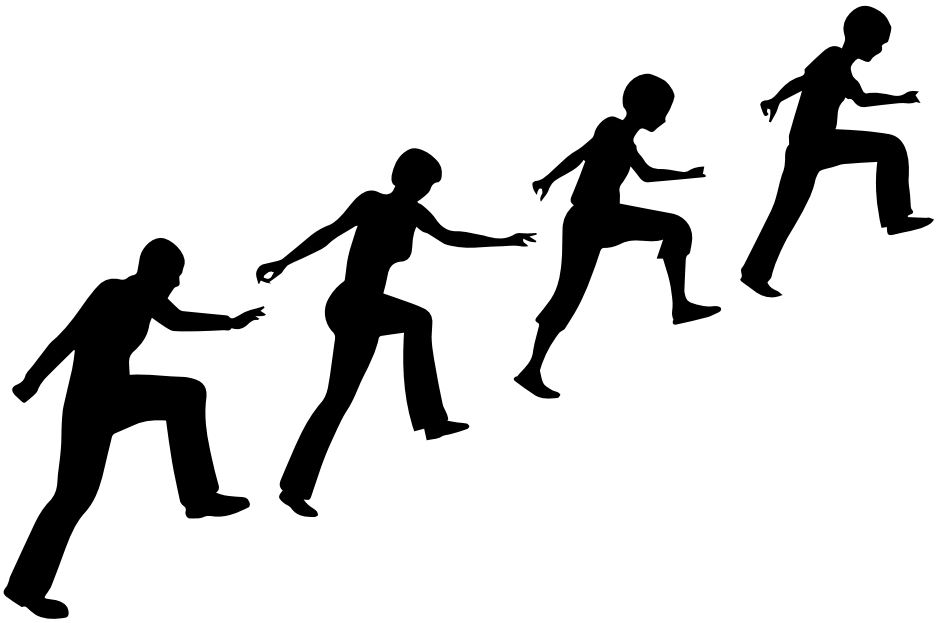
THE AC INDUSTRY IN INDIA IS EXPECTING SALES OF 4,000,000 UNITS IN 2016. IF EVERYONE BOUGHT A 5 STAR RATED AC, THERE WOULD BE 800,000 TONNES LESS CO_2 EMISSIONS

SWITCH SMART

- Geysers come with a factory setting of 60^0 C, but water at 40^0 C is comfortable enough for a bath. Change the geyser setting once. Save ₹ 1200 annually.
- Looking to buy a new electrical appliance? Look out for this label and buy a product that has been rated 5 star by the Bureau of Energy Efficiency (BEE).

ACTIVITY	ANNUAL COST SAVINGS	EQUIVALENT NUMBER OF TREES PLANTED
Buy a BEE 5 star rated frost-free refrigerator	₹ 700	10
Buy a BEE 5 star rated split air conditioner	₹1400	19
Buy a BEE 5 star rated fan	₹ 330	4
Reduce the temperature setting on the geyser(one time action)	₹ 1200	17
Replace 100 old desktops in an office, with laptops	₹ 2,00,000	1771





ONE LITTLE STEP CAN GO A LONG WAY

START BY MAKING ONE SMALL CHANGE.

- Choose a clothes line over a dryer. Reduce electricity bills by ₹ 2700 per year.
- Bathe in quick succession without letting the hot water in the geyser cool. Reduce electricity bill by ₹ 2500 per year.
- Yoga is beneficial to the mind, body, pocket and the Earth. Do an hour of yoga instead of running on a treadmill. Save ₹ 3200 in electricity bill every year or your gym fees.
- Take the stairs instead of an elevator at work. Together, your office can reduce CO_2 emissions by 1200 kg every year.
- Turn off all appliances at the plug point, not just with a remote. Devices draw 'stand-by' power when kept on at the plug point. This may seem negligible, but it isn't so. Switch off an HD set-top box at the plug point and not just with a remote to reduce electricity bills by ₹ 1000 annually. Think of the many devices we keep on at the plug point even when not in use — the TV, microwave, music system etc.
- Turn off all computer workstations at school / office at the plug point, when you leave for the day. They draw stand-by power too.

SET THE AC THERMOSTAT TO 25^0 C AND KEEP THE CEILING FAN ON. SAVE ENERGY WITHOUT COMPROMISING ON COMFORT

As is evident in the table below, simple actions have a large impact in saving money and reducing your carbon footprint.

ACTIVITY	ANNUAL COST SAVINGS	EQUIVALENT NUMBERS OF TREES PLANTED
Use a clothesline to dry your clothes (just one wash load a week)	₹ 2700	37
Use the geyser efficiently	₹ 2500	34
Do an hour of yoga instead of running on a treadmill	₹ 3200	44
Take the stairs at work. Reduce 50 elevator moves between ground and 3rd floor	₹ 13000	122
Switch off the HD set top box at the plug point	₹ 1000	13
Set school computer workstations to sleep mode after a class, instead of letting them idle	₹ 8400	81
Power off all computer workstations at the end of the day at school	₹ 2900	28

ENERGY SOLDIERS - POWERFUL AGENTS OF CHANGE

"Earlier our electricity bill used to be between ₹300-400. Now it does not exceed ₹250," says Budhram a student of Government Senior Secondary School Rambas, in Narnaul district of Haryana.

Budhram, one of the many Energy Soldiers in the schools under Bal Urja Rakshak Mission, says that people in his neighbourhood including his own family would not switch off lights even during the day and when not required, but that is not the case now. He and other Bal Urja Rakshak Dal members educate villagers on how to use electricity efficiently and reduce electricity bills. Aum Prakash, Energy Teacher in one of the schools, says that many people have now started using energy efficient bulbs after they impressed upon them how the electricity consumed by these bulbs is much less. He said they educate people on how fluorescent tubes give brighter light and save electricity.

Bal Urja Rakshak Mission, initiated in Haryana in 2008 as a pilot project, is targeted at High Schools. Each participating school mobilizes a team of 20 Urja Rakshaks (Energy Soldiers), 4 Energy Leaders and 2 Energy Teachers. The Energy Team organizes different events and competitions to generate awareness and understanding about energy conservation.

Initiated with the objective of bringing about attitudinal and behavioural changes in children regarding energy conservation, the programme makes full use of children's potential as persuasive and powerful agents of change who can reach out to their family, fellow students, teachers and their immediate community.

Source: Press Information Bureau, Government of India. (2014). Inculcating Energy Saving Culture. Available: http://pib.nic.in/newsite/mbErel.aspx?relid=113257. Last accessed 30th Oct 2016.

NEIGHBOURHOODS ACROSS EUROPE TAKE UP THE ENERGY CONSERVATION CHALLENGE

Stimulating a sense of competition can be an excellent way to raise awareness, as one European Union (EU) funded project has demonstrated. Inspired by a Belgian campaign, Energy Neighbourhoods has gathered together cities and municipalities across the EU to challenge their citizens to save energy.

People had to compete collectively—teams of friends, colleagues and neighbours gathered into Energy Neighbourhoods. The challenge then taken up by cities in 16 countries was to make participants save at least 9% energy over four winter months in 2010/2011 and in 2012/2013.

8,626 households and 22,420 household members took part. On average, they achieved energy savings of 8.94% in the first year and 12.94% in the second year.

"It was all about small things, like switching off lights," says project coordinator Anke Merziger. **It may have been small things but the EU competitors saved 5.66 million kWh and 2425 tonnes of CO_2, while at the same time bridging the gap between theory and practice.**

The top EU prize went to a town near Athens that reduced its energy consumption by 64%. Participants claim they have kept up the good habits. Some countries have since extended this project to a national level. France, Belgium, Hungary, Slovenia, Sweden and Austria have been particularly dynamic in urging households to save energy.

Source: European Commission. (2014). Neighbourhoods take up energy saving challenge. Available: https://ec.europa.eu/easme/en/news/neighbourhoods-take-energy-saving-challenge. Last accessed 30th Oct 2016.

WHEN THE SUN SHINES.....GENERATE ELECTRICITY

In particular, switching to renewable energy for part or all your electricity and hot water needs is one of the greenest measures.

ACTIVITY	ANNUAL COST SAVINGS	EQUIVALENT NUMBER OF TREES PLANTED
Install a solar water heater	₹ 5000	68
Power your home with a 640 Wp photovoltaic panel	₹ 4500	61
Switch to a 1 kWp solar inverter during power cuts	₹ 7000	98
Power a school with a 7 kWp solar photovoltaic system	₹ 52000	505

SHIVALIK PUBLIC SCHOOL, PATIALA - A SHINING EXAMPLE

Spread over a 2 acre campus, the school invested in a Grid-Tie solar photovoltaic (SPV) system, since rising electricity costs were proving to be a money guzzler. Comprising of 6 string inverters of 8.5 kWp each, amounting to a total of 50kWp, the SPV system is generating 60,000 to 72,000 units of electricity per annum and is equipped to handle the complete power load of the school. This has not just reduced the school's dependence on grid power supply to nearly zero, it also generates income by selling additional power to the grid (electricity is not used during holidays and after school working hours, but the system generates power even then). The capital investment has paid back over 2 years.

Source: Su-kam Solar. (2013). Su-Kam commissions unique solar power plant in Patiala. Available: http://www.su-kam.com/power-solution/solar-solutions/customized-solar-power-for-education-sector. Last accessed 30th Oct 2016.

TWIN BENEFIT - CAR PARKS FOR SOLAR POWER

A 100 kWp Grid-Tie solar photovoltaic system has been implemented in the car park area of IFFCO Tower, Gurugram. Taking 19% capacity utilization factor for grid-connected solar, a 100 kWp plant generates around 1,66,440 units of electricity per year. At a normative electricity tariff of ₹ 5 per unit, the plant will save ₹ 8,32,200 per year.

KHADI - THE GREEN CLOTH GOES SOLAR

India has a rich tradition of handspun and handwoven cloth called Khadi. Cotton, silk or wool are spun into a yarn using a spinning wheel called Charkha and the yarn is then woven into cloth.

Charkhas are typically hand operated and the sector is in need of modernization to improve productivity. To do so without environmental implications, the Ministry of Micro, Small and Medium Enterprises is implementing a Charkha Solarization project, to promote the use of solar operated spinning wheels, which will bolster productivity, provide incremental income for thousands of poor artisans and significantly increase employment opportunities in the rural sector.

SECTION-2

WASTE MANAGEMENT

A philosophy of reuse, recycling and repair is inherent among the people of India and wastage of any form has traditionally been looked down upon.

In recent times, the magnitude and diversity of wastes in India has increased and the government has launched the Swachh Bharat Mission to tackle the problem.

Rotting organic waste generates methane, which is 21 times more potent than carbon dioxide as a greenhouse gas. Burning solid waste generates carbon dioxide emissions and pollutes the air with aerosols and toxic chemicals.

REDUCE, REDUCE, REDUCE

Activity	Equivalent number of trees planted
Reduce food waste by just 1 kg a day	11-47
Reduce the use of 1 plastic bag a day	1
Reduce the use of 1 paper bag a day	2
Do not use bottled water in the office. Reduce 100 crates of 500 ml water bottles	7
Reduce the use of just 1 ream of paper per month at work and set the printer to double side printing.	8

SEGREGATE, SEGREGATE, SEGREGATE

The key to better waste management is segregation of wastes at source.

Sell / donate recyclable materials. Paper, plastic, textiles, e-waste, metals and glass can all be recycled.

Activity	Equivalent number of trees planted
Send used notebooks and examination papers for recycling from the school	270
Maintain textbooks well and hand over these to your juniors (school of 1500 students)	1125
Reuse old chart paper in school	15
Collect unused sheets from old notebooks to make new ones (school of 1500 students)	75
Start an aluminium can collection campaign. 1500 cans collected per month	253

WASTE TO RESOURCE

There are many home and community level composting systems available in the market. Explore those options today.

Saahas and Daily Dump have provided waste management solutions to a large number of independent homes, residential apartment complexes, educational institutions, offices and convention centres in Bengaluru. From an organic waste composter for a single home called 'khamba', to a community waste hub, 'Kasa Rasa', which receives, composts and recycles waste from a radius of 5 km, many individuals and organizations are helping reduce thousands of tonnes of GHG emissions.

Compost segregated organic wastes at home / school / office.

Activity	Equivalent number of trees planted
Compost 50 kg of organic waste daily from a canteen	1060
Compost 1 kg of organic waste daily in your home	35

COMING TOGETHER TO RECOVER RESOURCES FROM WASTE

The Brazilian Recycling Commitment (CEMPRE), a non-profit association funded by businesses like Unilever, Coca-Cola, Tetrapak, McDonald's, Nestle, Proctor and Gamble, Pepsico, Johnson & Johnson, and many others, promotes recycling as a component of integrated waste management in Brazil. The companies came together in 1992 to form CEMPRE as an instrument to assist local governments in managing packaging waste that is generated by use of their products. Over time, the operations of CEMPRE have extended to waste from electrical and electronic equipment, end of life vehicles and other waste streams. Partnering businesses have also grown to include companies like Dell, HP, Walmart, Carrefour and Mercedes Benz. CEMPRE runs an education and information programme targeting multiple audiences, manages a database on packaging and environment, organizes waste picking activities into recycling co-operatives, and works with industry and government to improve packaging. CEMPRE has formed a partnership with other NGOs in Latin America to promote exchange of information, good practices and learnings.

Source: CEMPRE. (2016). About us. Available: http://www.cempre.org.br/. Last accessed 30th Oct 2016.

TETRA PAK: TAKING RESPONSIBILITY

The layers that make up an aseptic Tetra Pak carton – paper fibres, polymers and aluminium – can all be recycled using relatively simple techniques and turned into new products, cutting the amount of waste sent to landfill and reducing demand for resources.

Tetra Pak has been promoting and facilitating post-consumer recycling. Their activities include:

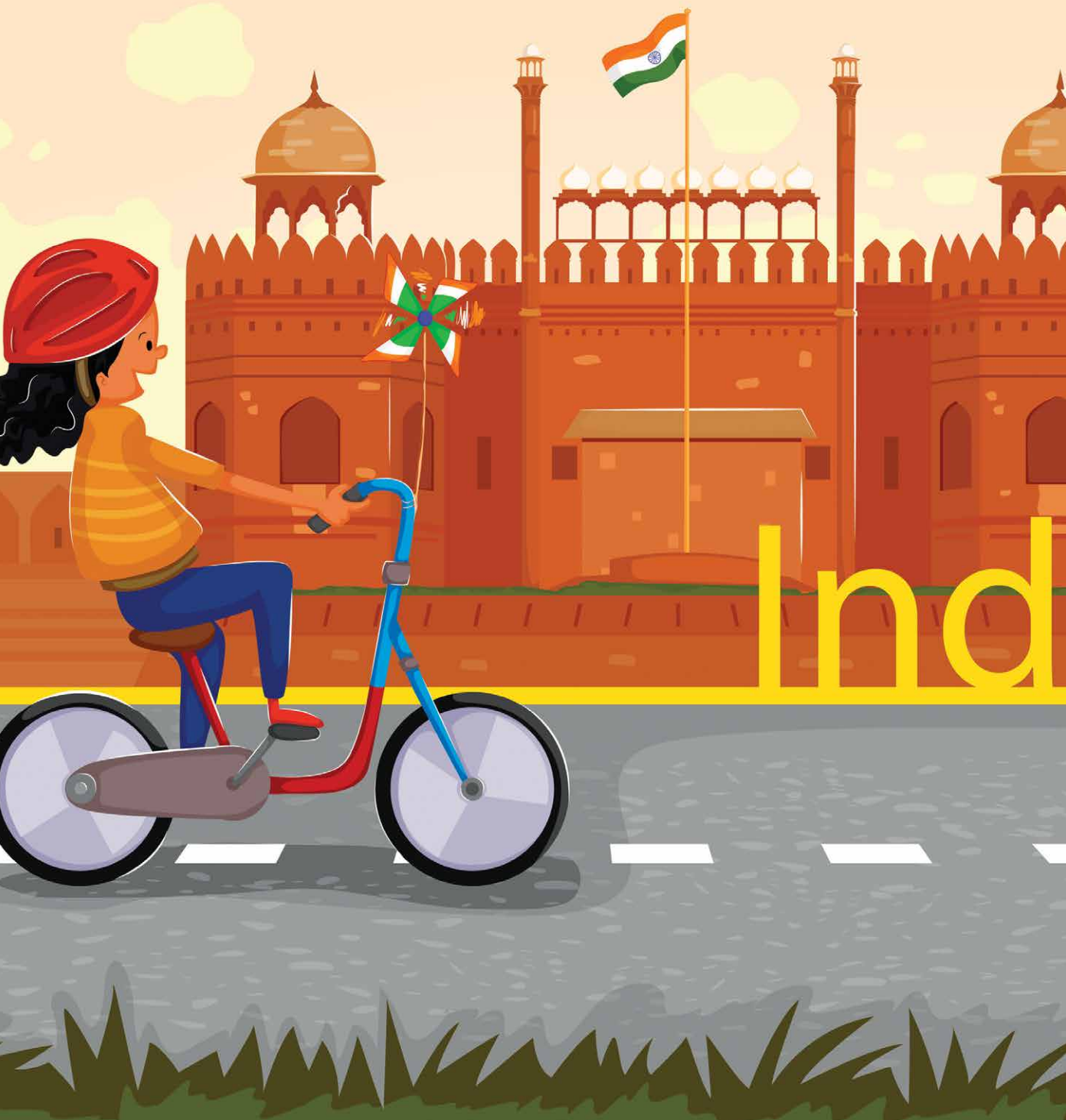
- increasing consumer awareness
- supporting collection and sorting infrastructure
- boosting business opportunities for recycling entrepreneurs, and
- expanding market opportunities for recycled materials.

In 2010 they set themselves a goal of doubling recycling rate to 40% by 2020. Over the past five years, they have increased the number of their packages that are recycled annually from 32 billion (20.1%) to 43 billion (23.6%).

While Tetra Pak does not own or operate any recycling services, nor use recycled paperboard, they act as a catalyst to encourage recycling, working with partners and stakeholders in countries around the world, adapting their approach to local conditions. Over 160 companies in more than 45 markets – from small enterprises to multinational companies – currently recycle the base materials used in Tetra Pak cartons.

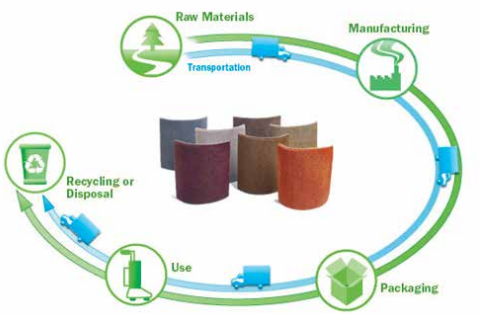
Source: Tetra Pak. (2016). Sustainability. Available: http://www.tetrapak.com/in/sustainability/recycling. Last accessed 30th Oct 2016.

SECTION-3



TRANSPORTATION

Globally, transportation contributed to 14% of 2010 greenhouse gas emissions and road transportation contributed to 72% of these.



BUY LOCAL

When you buy anything, transportation is a factor that comes into play. Raw materials are transported to a factory, finished goods are transported to a warehouse and from there to retailers. Transportation of food is more energy intensive because in many cases it is done in refrigerated ships/rail coaches/trucks.

- Reduce waste. Waste adds an additional burden on transportation, apart from its own contribution to greenhouse gas emissions.
- Simple lifestyle changes will ensure lesser greenhouse gas emissions, lesser traffic on the roads and cost savings.

Activity	Annual Cost savings	Equivalent number of trees planted
Walk or cycle short distances instead of driving	₹ 270 - 1700	1-6
Walk or cycle to school if you live less than a km away	₹ 3000	11
A school bus gets 50 cars off the road	₹ 15000 / car	2456
If you cannot take the school bus, try a car-pool. 2 cars off the road	₹ 15000 / car	111

Ramesh Sreekantan, a cycling enthusiast, lives 15–20 km from his place of work (depending on the route). According to him, it takes him 40 minutes to drive and 45 minutes to cycle to work. He can bypass traffic jams more easily on a cycle, the exercise makes him feel energized and refreshed, and it is not dangerous to cycle on the busy roads, provided you wear proper cycling gear- helmet, shiny lights, bright coloured shirts with reflectors — all of which may make one look strange but gets one noticed, which is the most important thing. "If they see you they are unlikely to knock you over. So it is important to be visible", he says. Frustrated at the traffic conditions, Bengaluru is seeing many people like Ramesh switching to cycles. Workplaces are also providing shower areas for cyclists to freshen up before they start work.

Source: Citizen Matters. (2013). Cycling to work: Something all the nay-sayers should read Available: http://bangalore.citizenmatters.in/articles/cycling-to-work some-questions-answered. Last accessed 30th Oct 2016.

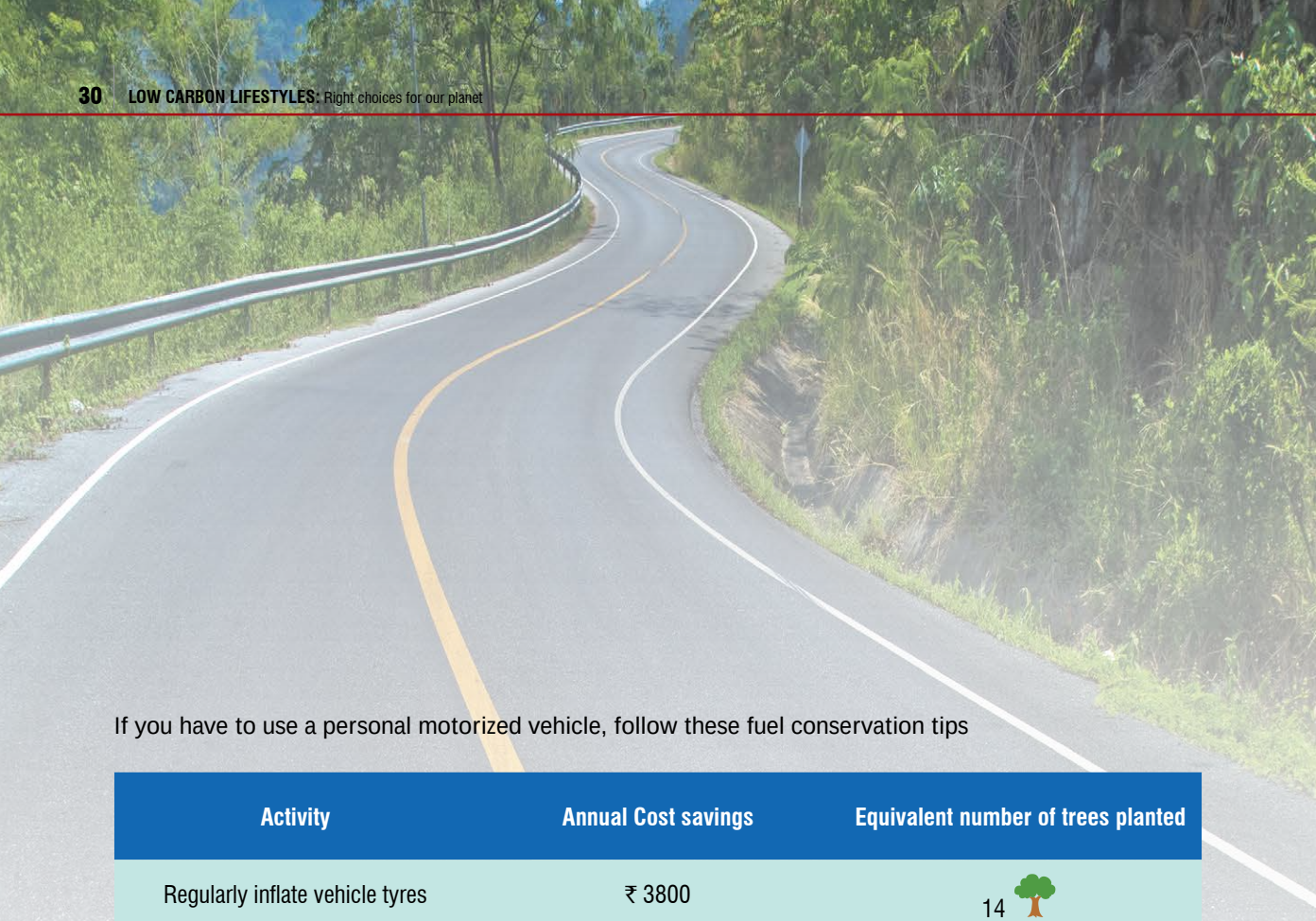
Choose modes of transport within the city in this order

- Walk / cycle
- Local train / Metro / bus
- Motorized two wheeler / Car pool
- Car

For outstation travel

- Train
- Bus
- Personal vehicle
- Plane

Activity	Equivalent number of trees planted
Take a train between Delhi and Jaipur instead of a flight	12
Take a bus between Delhi and Jaipur instead of a flight	9
Take a train between Delhi and Mumbai instead of a flight	37
Avoid one trip between Delhi and New York	269



If you have to use a personal motorized vehicle, follow these fuel conservation tips

Activity	Annual Cost savings	Equivalent number of trees planted
Regularly inflate vehicle tyres	₹ 3800	14
Switch off the ignition at traffic red lights	₹ 2500 - 3300	8-12
Drive at a steady 45 kmph on highways	₹ 350 per 500 km	3

ADDITIONALLY

- Get your vehicle serviced and the engine tuned regularly. Keep the air filters clean. Studies have shown that you can save 6% fuel by doing so.
- Use the recommended grade of oil. Thicker engine oil can increase fuel consumption by 2%.
- Drive in the correct gear. Incorrect gear shifting can lead to 20% increase in fuel consumption.
- Anticipate stops and reduce speed. Jamming the brakes converts a lot of useful energy into waste heat.
- Keep your foot off the clutch when not changing gears.
- Reduce unnecessary load in the car. Overhead luggage racks increase wind resistance and hence fuel consumption.
- Plan your trips and your route. Take less congested routes even if these are slightly longer.

PUBLIC TRANSPORTATION - MULTIPLE BENEFITS

Bogota, one of the world's 30 largest cities has a population of 11 million in its metropolitan area. Bogotá's bus rapid transit (BRT) system and network of non-motorized transport infrastructure has become an example for nations grappling with congested roadways, growing urban populations, and rising transport-related greenhouse gas emissions. Centered around the TransMilenio Bus Rapid Transit, the city's multimodal transit system and innovative policies have made inroads in reducing traffic congestion, accidents, crime, and air pollution. For example, before TransMilenio, commutes averaged 1.5 hours in each direction, with private vehicles accounting for less than one-fifth of trips yet occupying 95 per cent of roads. Now, average commute times in Bogotá have been cut by 20 minutes, air quality has improved by 40 per cent, and accidents have decreased by 79 per cent. While problems still exist, Bogotá remains a commonly cited success story of comprehensive transportation planning. The BRT system in Bogotá is moving 2.4 million passengers every day in 112 kilometers (70 miles).

Source: Centre for Clean Air Policy. Reducing Traffic Congestion in Bogotá Through Bus Rapid Transit and Non-Motorized Transport. Available: http://ccap.org/assets/CCAP-Booklet_Colombia.pdf. Last accessed 30th Oct 2016.

SECTION-4

WATER

Energy is used for pumping and treating water that comes through our pipes. Energy is also required for pumping and treating wastewater. Conservation of water will therefore conserve energy and reduce greenhouse gas emissions.

Water is expected to be a major source of conflict in the future because demand is soaring and freshwater reserves are being severely stressed. Plumetting groundwater resources in many regions and high water use inefficiencies are a cause of grave concern.

Climate change will also impact freshwater supply. Global warming is resulting in shifting rainfall patterns, an increase in the number of dry days, torrential rainfall over short periods of time, and extreme weather events, all of which increase the likelihood of droughts and floods. This in turn will affect food supplies and human health.

Water is inextricably linked with energy and climate change. Water conservation is therefore of paramount importance.

WATER-WISE HOMES

- Fix leaks in taps, showers and flushes
- Do not let the tap run when you brush your teeth, shave or soap your hands
- Use a bucket and small mug to water plants instead of a hosepipe
- Use a bucket and cloth to wash your vehicle instead of a hosepipe
- Water plants with water that has been used to wash vegetables and lentils
- Wash only full loads in the washing machine

Activity	Equivalent number of trees planted
Install water efficient showers and reduce time under a shower	4 - 12
Install aerator faucets and use less water for dishwashing	2 - 6
Install dual flush tanks in the washroom	4 - 10
Harvest 1000 litres of water per household per day over 40 days of rainfall	2 - 7

Look around and you may find many more ways to conserve this precious resource.

WATER-WISE SCHOOLS

- Conduct a water audit in school.
- Invest in rainwater harvesting, dual flush toilets and low flow tap fixtures.
- Use drip irrigation for the gardens. Students can create drip irrigation systems with waste materials as a project.
- Create awareness among students on the importance of water conservation
  - Conduct a water awareness week
  - Take a field trip to a water treatment plant
  - Take a field trip to a lake and learn more about lake ecosystems
  - Integrate water education in other subjects like English, Maths and Arts
  - Ensure that students do not throw water from their bottles down the drain

Activity	Equivalent number of trees planted
Conserve 10000 litres of water /day in school	147 - 371

ROOFTOP RAINWATER HARVESTING AT CHHATTISGARH SCHOOL REDUCES ABSENTEEISM

A rooftop rainwater harvesting model was constructed by an NGO Samerth at Madiya Kachar village in Bilaspur district, Chhattisgarh, to combat the contaminated water that the community, which is predominantly the Baiga tribe, had access to. The school was chosen for the following reasons:

- It had a flat roof that could capture maximum rainwater.
- The number of school-going children at Madiya Kachar was higher than at nearby schools.
- Iron contamination was highest in the village.
- The dropout rate of school-going children was rising rapidly due to the non-availability of drinking water within the school premises.
- The drinking water source was 1 km away from the school building.

The model structure had a capacity of 66,000 litres and was set up at the primary school building at Madiya Kachar. A village committee was formed and the school and Aanganwadi staff was trained to maintain and monitor this rainwater harvesting structure. The villagers now have access to clean and safe drinking water. Neighbouring villages are trying to replicate this model due to it being sustainable.

Many other case studies of rainwater harvesting in educational institutions, large and small, as well as in offices and industries are available on the India Water Portal.

Source: India Water Portal. (2015). Rooftop rainwater harvesting at Chhattisgarh school reduces absenteeism. Available: http://www.indiawaterportal.org/articles/rooftop-rainwater-harvesting-chhattisgarh-school-reduces-absenteeism. Last accessed 30th Oct 2016.

GREEN HOME

Built in Bengaluru in 1994, Mr A R Shivakumar's house on a 40'x60' plot of land, runs completely on rain water and the family has not needed to pay a water bill in 19 years. About 85% of the rainwater falling on the roof is channelled into a tank of 4500 litres on the ground floor roof. The overflow of this tank is allowed to flow into an underground sump of 25000 litres capacity. Once both tanks are full, the rainwater is diverted to recharge pits, to replenish groundwater. The remaining 15% of the rooftop rainwater is diverted into a second sump of 10000 litres capacity.

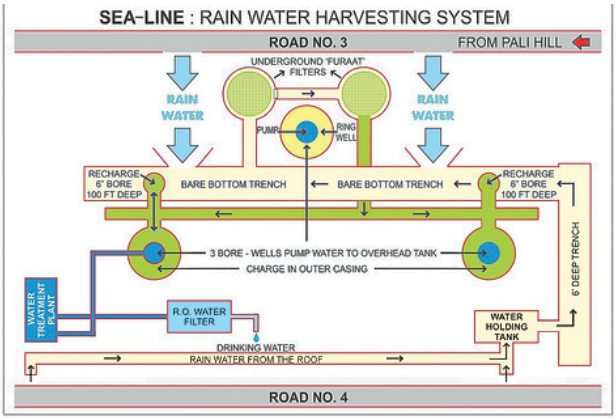
Soap water from the washing machine is stored in an underground sump and pumped up to a tank on the roof for flushing.

Water coming out from the kitchen sink is used for gardening.

The family of 4 needs 400 litres of water per day (excluding flushing), which is completely supplied by the harvested rainwater.

Solar panels generate most of the electricity and water heating needs of the house. A solar cooker is inbuilt into the house in the form of a cooking unit, which extends to catch the sun just outside the window. Solar passive architecture has been used to reduce electricity loads, while keeping the house at a comfortable temperature and with adequate light through the day.

Source: The Alternative. (2013). Bangalore's Greenest Homes: AR Shivakumar's Sourabha literally catches every drop. Available: http://www.thealternative.in/lifestyle/bangalores-greenest-homes-shivakumar-literally-catches-every-drop-of-water/. Last accessed 30th Oct 2016.



NO WATER, NO POWER - NO PROBLEM!

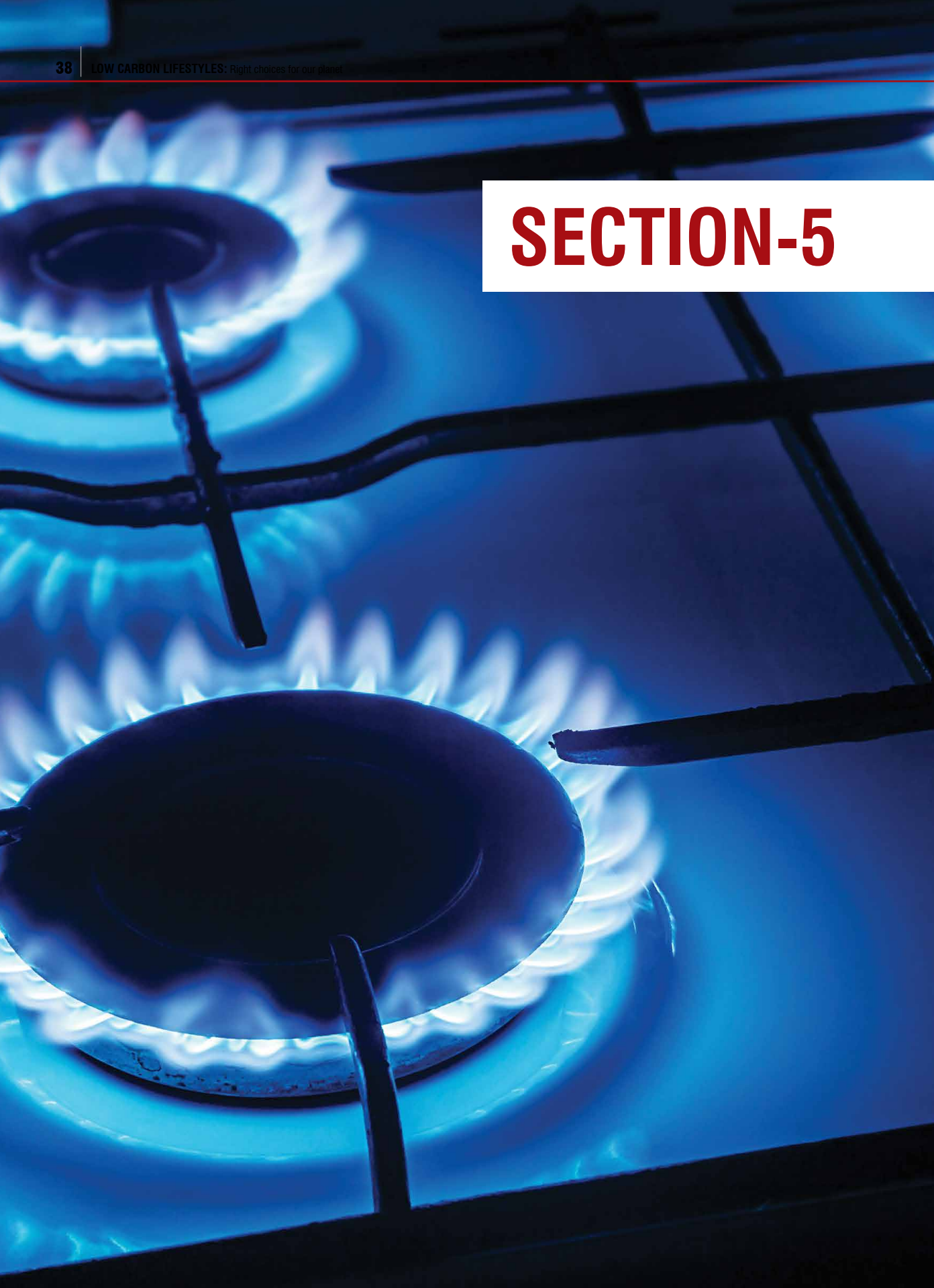
Sea-Line Co-operative Society, an apartment community in Mumbai, is now completely water and partially power-secure, thanks to good initiative, planning and management.

Sea-Line Co-operative Society, is a residential complex with 25 apartments in Bandra-a suburb in Mumbai. Built on a plot of 700 sq. m and with a rooftop of 220 sq. m, it houses 70 residents who require 6000 kilolitres (kL) water per year but managed to procure just about 5000 kL while paying through their noses — ₹ 20,000 per month, to be exact. The society implemented a rainwater harvesting system, costing ₹ 6.5 lakh that catches every drop falling in the catchment area. Rainwater is treated through a Reverse Osmosis filter and supplied for drinking. Groundwater is also recharged.

This system has made them water sufficient and has managed to recharge their groundwater to such an extent that water is now seen at a depth of just 1.2 metres from the ground!

Sea-Line has also taken some steps towards being self-sufficient for electricity. It has two different sets of solar panels — one for heating water and the other to generate electricity for the common spaces in the building. With an investment of ₹ 10 lakh on the two solar panels, the Society has today managed to be partially independent for its energy needs. The energy produced from the solar panel powers the common spaces such as the office and the corridors.

Source: India Water Portal. (2014). No water, no power - no problem!.Available: http://www.indiawaterportal.org/articles/no-water-no-power-no-problem. Last accessed 30th Oct 2016.



SECTION-5

FUEL EFFICIENCY IN THE KITCHEN

Most urban households use Liquid Petroleum Gas (LPG) for cooking, and sometimes also for water heating. Rural households, on the other hand, predominantly use firewood and biomass chips for cooking, water heating and space heating. A major programme in India namely Pradhanmantri Ujjwala Yojana is to provide LPG connection to Below Poverty Line households.

Biomass is said to be a carbon neutral fuel, but burning it in enclosed spaces results in increased pollutants and particulate matter, which is harmful to human health.

There are many programmes underway for promoting fuel efficient biomass cookstoves that reduce usage of wood and time (for collecting biomass and for cooking).

LPG is a fossil fuel and burning it releases CO_2. Improper combustion of LPG can lead to the generation of carbon monoxide. In urban homes, we tend to waste a lot of LPG without even realizing it.

FUEL EFFICIENT COOKING

- Put the lid on fuel losses. Cover pots and pans while cooking
- Reduce the flame once food starts boiling. Experiments conducted have revealed a saving of 25% fuel when the flame was reduced after boiling had started. Try it yourself. You will find that the time taken to cook is just the same
- Use optimum quantity of water for cooking. Surplus water uses additional fuel
- Keep all ingredients ready at hand before turning on the gas
- Do not keep an idle flame burning
- Use broad bottomed vessels that cover the flame completely
- A small burner uses lesser fuel to cook the same item, when compared to a large burner. It may take a little more time, but is fuel efficient
- Allow refrigerated food to come to room temperature before heating it
- Clean the burners regularly
- Soak rice and lentils for some time before cooking
- Eat together, so that food is not to be heated multiple times

Activity	Annual Cost savings	Equivalent number of trees planted
Use fuel efficient cooking methods Reduce gas usage by 20 minutes a day	₹ 630	6
Use a pressure cooker to cook rice and lentils	₹ 1200	13
Use fuel efficient biomass stoves		122

- Go Solar, if you can. A range of solar cookers are available for homes and it's easy to cook rice and lentils in these. Solar cooking systems are especially advised for community / large scale cooking.

Rishi Valley Residential School at Madanapalle, Andhra Pradesh, has installed a solar cooking system for its kitchen which prepares food for 500 inmate-students. The School's Dining Manager says the system serves them for 300 sunny days and saves them nearly ₹ 2 lakh annually on cooking gas.

At the solar-operated Tirumala Tirupati Devasthanam kitchen at Tirupati food is cooked daily for 15,000 pilgrims. The system installed in 2002 atop the shrine's 'Nitya Annadanam Canteen' adopted the solar cooking technology to drastically cut down on diesel fuel it was using till then. The temple now sells the emission reduction credits it earns to a Swiss green energy technology investor firm, Good Energies Inc. It not only takes care of energy and ecology but is also a source of revenue for the temple. The shrine now saves ₹ 17 lakh per annum. The system reduces carbon dioxide emissions by 1.2 tonnes per day.

Source: The Hindu. (2012). Looking up to the sun. Available: http://www.thehindu.com/todays-paper/tp-features/tp-propertyplus/looking-up-to-the-sun/article3611695.ece. Last accessed 30th Oct 2016.

SECTION-6

FORESTS AND BIODIVERSITY

Forests provide multiple benefits including timber and non timber produce such as fibre, fodder, fuelwood, fruits, medicines, honey and essential oils. In addition, forests have their own intrinsic value, supporting millions of other organisms. They act as natural regulators of climate and are carbon sinks.

India being a mega-diverse country hosts 16 types of forests that are storehouses of biodiversity. More than 20% of the country's population is directly dependent on forests for at least a part of their livelihood.

Respecting trees and forests is a tradition in many countries of the world. India's tradition of worshipping trees has conserved forests for years. Famous movements like Chipko and Bishnoi are examples of people's love for their forests and wild life.

- The health of our forests is important for the health of our planet.
- World over, the loss of forests and biodiversity is a major concern. Deforestation, caused mainly due to anthropogenic activities, is responsible for 12% of total global emissions.
- Climate change may further intensify forest degradation and fragmentation as a result of increased forest fires and changing weather patterns.
- Invasive species may increase in number and become more powerful as native species find it difficult to adapt to the changing climate.
- Conserving forests in all regions of the world needs to be given utmost importance.

On an average, a tree can sequester about 10 kg of CO_2 each year.

WHAT CAN WE DO?

- Do not waste paper
- Look for alternatives to wooden furniture, flooring and articles
- Plant a tree on your birthday
- Help organizations that are implementing forestry programmes on a larger scale
- Buy local forest produce that is sustainably sourced
- Volunteer when a National Park invites the public to participate in any of its activities, or volunteer with an NGO working in this sector, to get a better understanding of forest ecosystems

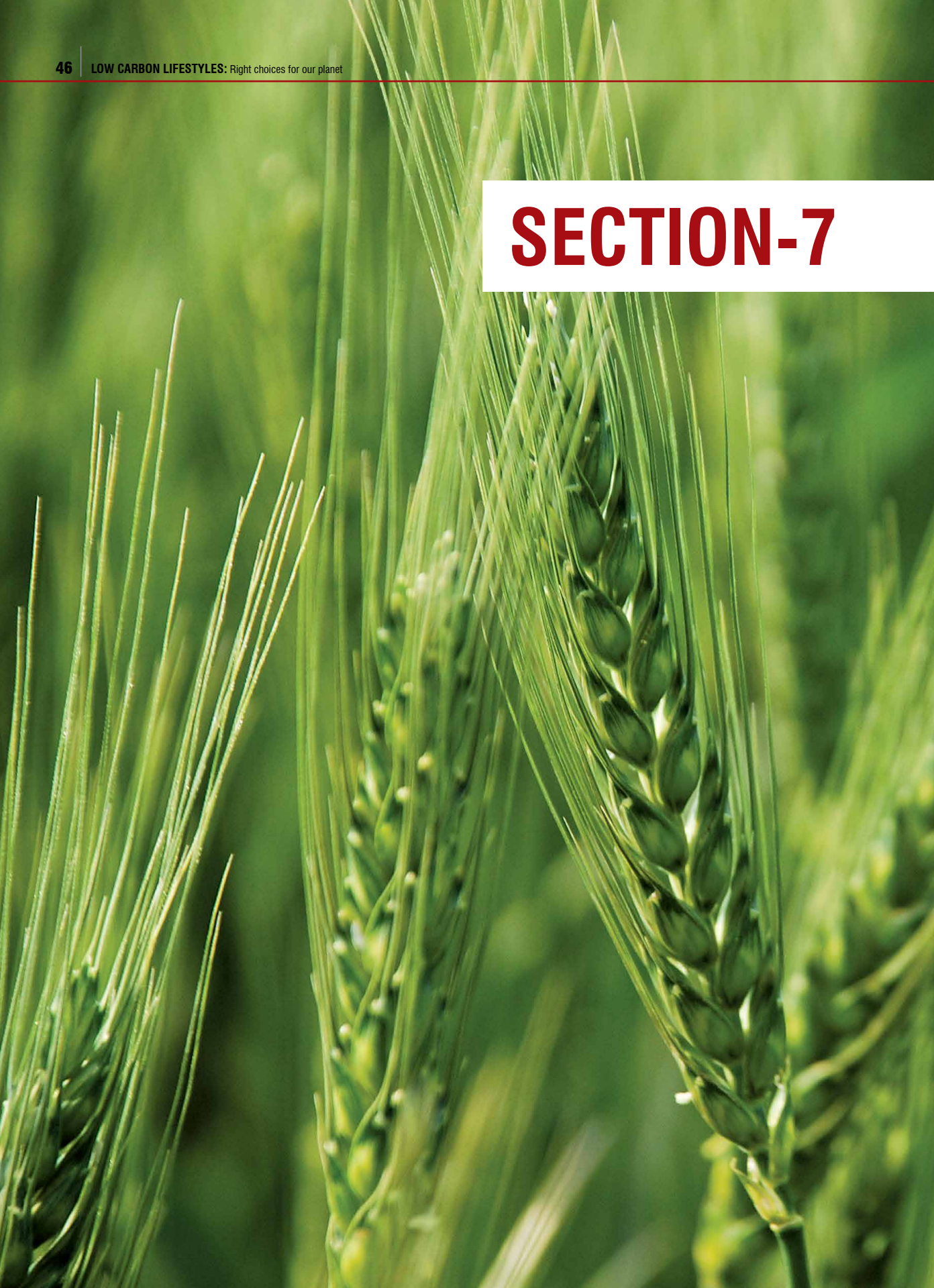
STORY OF THE SENDENYU VILLAGE, KOHIMA

Members of this village started witnessing a loss of biodiversity and decrease in wildlife populations in the surrounding forests. Subsequent discussions initiated by the village council, resulted in the creation of a 10 sq. km Sendenyu wildlife reserve. Though the villagers were good hunters themselves, they decided to donate personal land to the wildlife reserve, so as to rejuvenate the forest and its biodiversity. The land was earlier used for timber and firewood collection. In return, the landowners received LPG connections from the forest department under the Forest Development Authority (FDA) funds.

Source: Kalpavriksh. (2015). Community Conserved Areas in India: A Directory. Available: http://www.kalpavriksh.org/images/CCA/Directory/Nagaland_CaseStudy_SendenyuVgeKohima.pdf. Last accessed 30th Oct 2016.

BAMBOO IN THE NORTH-EAST REGION OF INDIA

India, with 140 species, is the second largest producer of bamboo in the world and has huge traditional knowledge base about bamboo. People in the north-east region of India use bamboo extensively for various purposes, from construction of buildings to micro-irrigation, and it is a part of their tradition and lifestyle.



SECTION-7

AGRICULTURE

India produces 260 million tonnes of food grains, and nearly 50% of the Indian population derives its livelihood from agriculture.

As a sector, agriculture contributes to climate change and will also be impacted adversely by it.

Agricultural activities such as paddy cultivation, burning of agricultural residue, use of synthetic fertilizers, use of fossil fuel for field operations and overturning of soil produce greenhouse gases.

While untimely and sometimes deficient monsoons have often affected agricultural productivity, changing rainfall patterns, floods, drought and the rise of temperature are likely to impact food grain production further.

It is therefore important to focus on this sector from two angles:

- How to reduce GHG emissions without compromising on agricultural productivity, and
- How to mitigate the impacts of climate change on food productivity.

With rising demand for food due to population increase and higher living standards, and declining per capita land and water resources, sustainable agriculture practices are of great importance.

COPING WITH DEFICIT RAINFALL - DIRECT SEEDED RICE IN UNPUDDLED SOIL

Direct seeded rice (DSR) is the practice of sowing rice under dry conditions with the help of machinery, without puddling. It is a technique that consumes 25% less water and reduces methane emissions as compared to conventional transplanted rice. Energy demand for pumping of irrigation water is also reduced, further reducing greenhouse gas emissions. It helps farmers cope with deficit and delayed monsoons and is therefore a technique that caters to both adaptation to climate change and mitigation of GHG emissions. Moreover, due to reduction in labour, energy and time, it is monetarily beneficial to farmers. Direct sowing can be practiced for cultivating both coarse rice and basmati rice in Punjab, Haryana and western Uttar Pradesh.

Source: CRIDA

CLIMATE-SMART AGRICULTURE

- Promote and support organic farming. Use of organic fertilizers instead of chemical ones is better for the soil, air, climate and human health.
- Soil is a carbon sink. Reduce tillage, so as to allow the soil to accumulate carbon.
- Use nitrogenous fertilizers judiciously. These fertilizers release nitrous oxide, a greenhouse gas, into the atmosphere.
- Avoid flooding agricultural lands and over-watering which deplete water resources and soil nutrients. Adopt irrigation practices that use less water.
- Do not burn agricultural residue that can be used for mulching and composting.
- Use animal waste to produce biogas for cooking purposes and the leftover slurry as organic fertilizer.
- Consume locally grown and seasonal vegetables.

ZERO TILL SOWING OF WHEAT IN PUNJAB, HARYANA, WESTERN UP AND OTHER NORTH INDIAN STATES

Zero till sowing of wheat reduces the need to burn paddy residue and enables taking up of wheat sowing with minimal soil disturbance. Its advantages are many:

- Saves tillage costs and energy
- Eliminates the need for seedbed preparation
- Saves water
- Reduces the weed problem and contributes to the improvement of wheat yield
- Enables early sowing of wheat, thus effectively diminishing the impact of heat wave at maturity
- The zero tilled wheat is more tolerant to heavy rains received during the crop growth
- Eliminates the need for burning of paddy residue, improving soil carbon sequestration.

Source: CRIDA

POKKALI: SALT TOLERANT LOWLAND PADDY CULTIVATION IN SOUTHERN KERALA

Pokkali is the name of a paddy variety, and it also refers to the land and a particular cultivation method. Grown in the unique ecosystem created by the Vembanadu-Kol wetlands in the state of Kerala, a Globally Important Agriculture Heritage System (GIAHS), Pokkali, exists by complementing the natural system, utilizing indigenous knowledge and local resources.

Pokkali paddy is the most saline tolerant paddy variety in the world and is grown without any kind of pesticide or insecticide. The leftover stems from the paddy act as food for the shrimp cultivated during the paddy fallow period. The shrimp larvae pumped in from the nearby estuary are harvested before the next planting season. Pokkali acts as a sustainable agricultural method at a time of challenges to food and nutritional self-sufficiency and transmuted climate along the coastal areas of the largest wetland of India.

Source: ATREE

SUSTAINABLE PRODUCTION OF COTTON: A CASE FROM WARANGAL

The Sustainable Agriculture Production Programme, initiated in Warangal district of India, identified the traditional Indian practice of tank-silt application, which was historically followed by farmers, and brought in scientific innovations to this technique to help farmers cope with uncertainties caused by climate change. The traditional practice of application of tank-silt for farming was scientifically validated and was found to have substantial climate adaptive benefits as well as emissions mitigation potential.

Source: WWF

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ANNEXURE
ELECTRICITY

Assumptions:
Emission factor for electricity generation[1] = 0.82 kg CO_2/kWh
(Average emission of all stations in the grid weighted by net generation)
Average cost of electricity(residential)[2] = ₹ 5.95/kWh

Change just 5 lamps in your home to more energy efficient ones

Reduce annual CO_2 emissions by 37 to 278 kg
Reduce annual electricity bills by ₹ 266 to ₹ 2014

Appliance	Wattage (W)*	Estimated Daily Use (hrs)	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
Bulb (ICL)	60	3.5	76.65	0.82	62.85	5.95	456
Light Emitting Diode (LED)	7	3.5	8.94	0.82	7.33	5.95	53
Savings					**55.52**		**403**
Savings for 5 bulb changes					**277.60**		**2014**
Compact Fluorescent Lamp (CFL)	14	3.5	17.89	0.82	14.67	5.95	106
Light Emitting Diode (LED)	7	3.5	8.94	0.82	7.33	5.95	53
Savings					**7.33**		**53**
Savings for 5 bulb changes					**36.66**		**266**
T8 Tubelight	36	3.5	45.99	0.82	37.71	5.95	274
T5 Tubelight	28	3.5	35.77	0.82	29.33	5.95	213
Savings					**8.38**		**61**
Savings for 5 changes					**41.90**		**304**

** Endnote 3*

Annual CO_2 emission reduction of 37-278 kg is equivalent to 3-27 additional trees

Use a BEE 5 star rated refrigerator

Reduce annual CO_2 emissions by 101 kg
Reduce annual electricity bills by around ₹ 730

Appliance	Annual Electricity Consumption (kWh)*	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
BEE 2 star rated 280 ltr frost-free fridge	343	0.82	281.26	5.95	2041
BEE 5 star rated 280 ltr frost-free fridge	219	0.82	179.58	5.95	1303
Savings	124		101.68		738
BEE 2 star rated 180 ltr direct cool fridge	340	0.82	278.80	5.95	2023
BEE 5 star rated 180 ltr direct cool fridge	217	0.82	177.94	5.95	1291
Savings	123		100.86		732

** Endnote 4*

Annual CO_2 emission reduction of 101 kg is equivalent to 10 additional trees

Use BEE 5 star rated split air conditioners (1.5 tonnes)

Reduce annual CO_2 emissions by 197 kg per air conditioner

Reduce annual electricity bills by ₹ 1428 per air conditioner

Appliance	Wattage (W)*	Estimated Annual Use (hrs)	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
1.5 ton split AC, 2 star	1707	1200	2048	0.82	1679.69	5.95	12188
1.5 ton split AC, 5 star	1507	1200	1808	0.82	1482.89	5.95	10760
Savings					196.80		1428

** Endnote 5*

Annual CO_2 emission reduction of 197 kg is equivalent to 19 additional trees

Use BEE 5 star rated fans

Reduce annual CO_2 emissions by 46 kg on every fan

Reduce annual electricity bills by ₹ 334 on every fan

Appliance	Wattage (W)*	Estimated Annual Use (hrs)*	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
1 star fan (210 cum air delivery)	65	4320	280.80	0.82	230.26	5.95	1671
5 star fan (210 cum air delivery)	52	4320	224.64	0.82	184.20	5.95	1337
Savings					**46.05**		**334**

** Endnote 6*

Annual CO_2 emission reduction of 46 kg is equivalent to 4 additional trees

Power your home using solar photovoltaic energy

A 640 Wp Photovoltaic panel can power 5 tubelights and 3 fans for 300 days of the year

Reduce annual CO_2 emissions by 617 kg

Reduce annual electricity bills by ₹ 4480

Appliance	Daily Electricity Reqt / Production (kWh)*	Annual Electricity Requirement / Production (kWh)*	Emission Factor (kg CO_2/ kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
5 T5 tubelights used for 4 hours/day and 3 fans used for 10 hours/day	2.51	753	0.82	617.46	5.95	4480
640 Wp panel powering 5 T5 tubelights and 3 fans	2.56	768	0	0	0	0
Savings				**617.46**		**4480**

** Endnote 7*

Annual CO_2 emission reduction of 617 kg is equivalent to 61 additional trees

Switch to a solar inverter for your electricity requirements during power cuts

A 1 kWp photovoltaic panel generates 4 kWh power if there is sunshine for 5 hours. It occupies an area of around 10 m^2

With a 1kWp system, reduce annual CO_2 emissions by 984 kg

Reduce annual electricity bills by ₹ 7140 for 25 years

Appliance	Daily Electricity Reqt/ Production (kWh)*	Annual Electricity Requirement/ Production (kWh)*	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
Inverter working on electricity mains	4	1200	0.82	984	5.95	7140
Solar inverter charged by a 1 kWp panel	4	1200	0	0	0	0
Savings				**984**		**7140**

** Endnote 8*

Annual CO_2 emission reduction of 984 kg is equivalent to 98 additional trees

Install a solar water heater

Reduce annual CO_2 emissions by 687 kg

Reduce annual electricity bills by ₹ 4986

Appliance	Electricity Required (kWh)*	Daily Electricity Consumption (kWh)*	Annual Electricity Consumption (kWh)*	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/ kWh)	Annual Cost (₹)
25 ltrs geyser	1.16	4.66	838.00	0.82	687.16	5.95	4986
Solar water heater	0	0	0		0		0
Savings					**687.16**		**4986**

** Endnote 9*

Annual CO_2 emission reduction of 687 kg is equivalent to 68 additional trees

Do not buy voltage stabilizers for equipment that do not need them

(Check manufacturer's instructions)

Reduce annual CO_2 emissions by 359 kg

Reduce annual electricity bill by ₹ 2606

Appliance	Wattage (W)*	Estimated Daily Use (hrs)	Estimated Annual Use (hrs)	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/ kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
1 kVA voltage stabilizer for refrigerator	50	24	8760	438.00	0.82	359.16	5.95	2606
No voltage stabilizer	0	0	0	0		0		0
Savings						**359.16**		**2606**

** Endnote 10*

Annual CO_2 emission reduction of 359 kg is equivalent to 36 additional trees

Reduce the temperature setting on the geyser

Geysers come with a factory setting of 60^0 C but water at 40^0 C is enough for a comfortable bath

Reduce annual CO_2 emissions by 172 kg

Reduce annual electricity bills by ₹ 1247

Activity	Electricity Required (kWh)*	Daily Electricity Consumption (kWh)*	Annual Electricity Consumption (kWh)*	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
Temp setting at 60^0 C	1.16	2.33	419.00	0.82	343.58	5.95	2493
Temp setting at 40^0 C	0.58	1.16	209.50	0.82	171.79	5.95	1246
Savings					**171.79**		**1247**

** Endnote 11*

Annual CO_2 emission reduction of 172 kg is equivalent to 17 additional trees

Use the geyser efficiently

Bathe in quick succession and don't keep the geyser on for longer than necessary

Reduce annual CO_2 emissions by 344 kg

Reduce annual electricity bills by ₹ 2493

Activity	Electricity Required (kWh)	Daily Electricity Consumption (kWh)*	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
4 people (bathe at different times)	1.16	4.66	838	0.82	687.16	5.95	4986
4 people (bathe at quick succession)	1.16	2.33	419	0.82	343.58	5.95	2493
Savings					**343.58**		**2493**

** Endnote 11*

Annual CO_2 emission reduction of 344 kg is equivalent to 34 additional trees

Eat together

Heat food at one go to reduce unnecessary use of the microwave oven for just 5 mins a day

Reduce annual CO_2 emissions by 30 kg

Reduce annual electricity bills by ₹ 217

Activity	Wattage (W)*	Reduction in Daily Use (hrs)	Reduction in Annual Use (hrs)	Annual Electricity Consumption Reduction (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission Reduction (kg)	Electricity Cost (₹/kWh)	Annual Cost Saving (₹)
Reduce use of Microwave oven (20 l)	1200	0.08	30.42	36.50	0.82	**29.93**	5.95	**217**

** Endnote 12*

Annual CO_2 emission reduction of 30 kg is equivalent to 3 additional trees

Use a cold cycle in the washing machine

Energy required to heat water for a hot wash cycle is high and therefore better avoided. Reduce just two hot wash cycles per week

Reduce annual CO_2 emissions by 64 kg

Reduce annual electricity bills by ₹ 464

Activity	Electricity consumption/ cycle (kWh)*	Reduction in hot wash cycles/year	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission Reduction (kg)	Electricity Cost (₹/kWh)	Annual Cost Saving (₹)
Wash temp 60⁰ C	1	104	104	0.82	85.28	5.95	619
Wash temp 25⁰ C	0.25	104	26	0.82	21.32	5.95	155
Savings					63.96		464

** Endnote 13*

Annual CO_2 emission reduction of 64 kg is equivalent to 6 additional trees

Dry your clothes in the sun

Just one washload a week dried on a line instead of a dryer can make a difference

Reduce annual CO_2 emissions by 371 kg

Reduce annual electricity bills by ₹ 2692

Activity	Wattage (W)*	Dryer cycle time (hrs)*	Annual Use Time (hrs)	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
5.5 kg washload dried in a dryer	2900	3	156	452.40	0.82	370.97	5.95	2692
5.5 kg washload dried on a line	0	0	0	0		0		0
Savings						**370.97**		**2692**

Endnote 14

Annual CO_2 emission reduction of 371 kg is equivalent to 37 additional trees

Switch off all appliances at the plug point and not with a remote

Switch off the HD set top box at the plug point when you turn off the TV

Reduce annual CO_2 emissions by 135 kg

Reduce annual electricity bills by ₹ 977

Activity	Wattage (W)*	Estimated daily reduction in stand-by time (hrs)*	Annual Electricity Consumption Reduction (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission Reduction (kg)	Electricity Cost (₹/kWh)	Annual Cost Saving (₹)
Turn off HD set top box with DVR at plug point	25	18	164.25	0.82	**134.69**	5.95	**977**

** Endnote 15*

Annual CO_2 emission reduction of 135 kg is equivalent to 13 additional trees

Go out and play instead of watching TV or playing on a device

- Reduce annual CO_2 emissions by 22 - 89 kg
- Reduce annual electricity bills by ₹ 159 - 643

Appliance	Wattage (W)*	Daily Reduction in Use (hrs)	Annual Electricity Consumption Reduction (kWh)	Emission Factor (kg CO_2/ kWh)	Annual CO_2 Emission Reduction (kg)	Electricity Cost (₹/kWh)	Annual Cost Saving (₹)
32" LCD, BEE 5 star rated TV	36.71	2	26.80	0.82	**21.97**	5.95	**159**
X-box 360 S	88	2	64.24	0.82	**52.68**	5.95	**382**
Desktop with LCD screen	148	2	108.04	0.82	**88.59**	5.95	**643**

** Endnote 16*

Annual CO_2 emission reduction of 22-89 kg is equivalent to 2-9 additional trees

Use a table lamp for studying. It provides better task based lighting

- Reduce annual CO_2 emissions by 57 kg
- Reduce annual electricity bills by ₹ 413

Activity	Wattage (W)*	Estimated Daily Use (hrs)	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
ICL room light	100	2	73	0.82	59.86	5.95	434
LED table lamp	5	2	3.65	0.82	2.99	5.95	22
Savings					56.87		413

** Endnote 17*

Annual CO_2 emission reduction of 57 kg is equivalent to 5 additional trees

Turn off lights and fans when not in use

- Reduce annual CO_2 emissions by 26 kg
- Reduce annual electricity bills by ₹ 186

Activity	Wattage (W)*	Daily Reduction in Use (hrs)	Annual Electricity Consumption Reduction (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission Reduction(kg)	Electricity Cost (₹/ kWh)	Annual Cost Saving (₹)
ICL Bulb	60	1	21.9	0.82	17.96	5.95	130
Fan	52	1	9.36	0.82	7.68	5.95	56
Savings					**25.63**		**186**

** Endnote 18*

Annual CO_2 emission reduction of 26 kg is equivalent to 2 additional trees

Do an hour of yoga instead of running on a treadmill

- Reduce annual CO_2 emissions by 446 kg
- Reduce annual electricity bills by ₹ 3238

Activity	Wattage (W)*	Daily Use (hrs)	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/ kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
2 hp continuous duty treadmill	1491	1	544.215	0.82	446.26	5.95	3238
One hour of Yoga	0	1	0	0.82	0		0
Savings					**446.26**		**3238**

** Endnote 19*

Annual CO_2 emission reduction of 446 kg is equivalent to 44 additional trees

Assumptions for school related data:

Average cost of electricity[20] = ₹ 8.5/kWh

Number of working days of a school[21] = 220

Number of students = 1500

Switch to energy efficient lighting in school

Reduce annual CO_2 emissions by 1641 - 1876 kg

Reduce annual electricity bills by ₹ 17017 - 19448

Appliance	Wattage (W)	Estimated daily use (hrs)	Estimated annual use (hrs)	Annual electricity consumption (kWh)	Emission factor (kg CO_2/ kWh)	Annual CO_2 emission (kg)	Electricity cost (₹/kWh)*	Annual cost (₹)
CFL	14	6.5	1430	20.02	0.82	16.42	8.5	170
LED	7	6.5	1430	10.01	0.82	8.21	8.5	85
Savings / change						**8.21**		**85**
Savings for 200 changes						**1641.64**		**17017**
T8 Tubelight	36	6.5	1430	51.48	0.82	42.21	8.5	437
T5 Tubelight	28	6.5	1430	40.04	0.82	32.83	8.5	340
Savings/change				11.44		**9.38**		**97**
Savings for 200 changes						**1876.16**		**19448**

Annual CO_2 emission reduction of 1641-1876 kg is equivalent to 164-187 additional trees

Don't let your computer workstation idle between classes. Set it to sleep mode once you finish your class

Reduce annual CO_2 emissions by 811 kg

Reduce annual electricity bill by ₹ 8400

Appliance	Wattage (W)*	Estimated daily use (hrs)	Annual electricity consumption (kWh)	Emission factor (kg CO_2/kWh)	Annual CO_2 emission (kg)	Electricity cost (₹/kWh)*	Annual cost (₹)
Idle mode	115	1	25.30	0.82	20.75	8.5	215
Sleep mode	2.6	1	0.57	0.82	0.47	8.5	5
Savings / workstation					**20.28**		**210**
Savings for 40 workstations					**811.08**		**8400**

** Endnote 22*

Annual CO_2 emission reduction of 811 kg is equivalent to 81 additional trees

Power off the computer workstations at the plug point at the end of the day

Reduce annual CO_2 emissions by 282 kg

Reduce annual electricity bill by ₹ 2920

Appliance	Wattage (W)*	Estimated daily use (hrs)	Estimated annual use (hrs)	Annual electricity consumption (kWh)	Emission factor (kg CO_2/kWh)	Annual CO_2 emission (kg)	Electricity cost (₹/kWh)	Annual cost savings (₹)
Standby mode	2.3	17	3740	8.60	0.82	7.05	8.5	73
Off	0	0	0	0		0		0
Savings / workstation						7.05		73
Savings for 40 workstations						282.15		2920

** Endnote 22*

Annual CO_2 emission reduction of 282 kg is equivalent to 28 additional trees

Turn off lights and fans when you go out of the classroom

Reduce annual CO_2 emissions by 3143 kg

Reduce annual electricity bill by ₹ 32580

Appliance	Wattage (W)	Reduction in daily use (hrs)	Reduction in annual use (hrs)	Annual electricity reduction (kWh)	Emission factor (kg CO_2/kWh)	Annual CO_2 emission reduction (kg)	Electricity cost (₹/kWh)	Annual cost savings (₹)
4 T5 Tubelights	112	2	440	49.28	0.82	40.41	8.5	419
2 Fans	130	2	440	57.20	0.82	46.90	8.5	486
Savings / Classroom						87.31		905
Savings for 36 classrooms						3143.29		32580

Annual CO_2 emission reduction of 3143 kg is equivalent to 314 additional trees

Install solar photovoltaic panels to take care of part of your electricity needs

Reduce annual CO_2 emissions by 5051 kg

Reduce annual electricity bills by ₹ 52360

Appliance	Daily Electricity Production (kWh)*	Annual Electricity Production (kWh)*	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emission (kg)	Electricity Cost (₹/kWh)	Annual Cost (₹)
7 kWp panel	28	6160	0.82	5051.2	8.5	52360
Savings				**5051.2**		**52360**

** Endnote 8*

A 7 kWp solar photovoltaic system will power 200 T8 tubelights for 6 hours. For designing an optimum system for your school, please contact a systems provider.

Annual CO_2 emission reduction of 5051 kg is equivalent to 505 additional trees

Assumptions for workplace related data:

Average cost of electricity[20] = ₹ 8.94/kWh *Number of working days = 250*

Get an energy audit conducted by a certified energy auditor

Check HVAC systems, pumps, UPSs, lighting & other electrical appliances

Replace old desktops with laptops

For 100 replacements

Reduce annual CO_2 emissions by 17712 kg

Reduce annual electricity bill by ₹ 193100

Appliance	Wattage (W)*	Estimated daily use (hrs)	Estimated annual use (hrs)	Annual electricity consumption (kWh)	Emission factor (kg CO_2/kWh)	Annual CO_2 emission (kg)	Electricity cost (₹/kWh)	Annual cost (₹)
Desktop with LCD screen	148	8	2000	296	0.82	242.72	8.94	2646
Laptop	40	8	2000	80	0.82	65.60	8.94	715
Savings per replacement						177.12		1931
Savings for 100 replacements						17712		193100

The savings will be much higher if you make a change from a desktop with a Cathode Ray Tube screen to a laptop.

** Endnote 23*

Annual CO_2 emission reduction of 17712 kg is equivalent to 1771 additional trees

Instal occupancy sensor lights in conference rooms, bathrooms and passageways

Change 200 lamps to occupancy sensor based LED lamps

Reduce annual CO_2 emissions by 2542 kg

Reduce annual electricity bill by ₹ 27714

	Total Wattage (W)*	Extra time lights are (hrs)	Daily Electricity Consumption (kWh)	Annual Electricity Consumption (kWh)	Emission Factor (kg CO_2/kWh)	Annual CO_2 Emissions (kg)	Electricity cost (₹/kWh)	Annual cost (₹)
CFLs (14W x 200 nos.)	2800	5	14	3500	0.82	2870	8.94	31290
Occupancy sensor lights	1600	1	1.6	400	0.82	328	8.94	3576
Savings						2542		27714

** Endnote 24*

Annual CO_2 emission reduction of 2542 kg is equivalent to 254 additional trees

Take the stairs

Reduce 50 lift moves between the ground and third floor

Reduce annual CO_2 emissions by 1221 kg

Reduce annual electricity bill by ₹ 13317

Appliance	Wattage (W)*	Reduction in daily use (hrs)*	Reduction in annual use (hrs)	Annual electricity reduction (kWh)	Emission factor (kg CO_2/kWh)	Annual CO_2 emission reduction (kg)	Electricity cost (₹/kWh)	Annual cost savings (₹)
Office lift carrying 16-20 persons	42900	0.14	34.72	1489.58	0.82	1221.46	8.94	13317

** Endnote 25*

Annual CO_2 emission reduction of 1221 kg is equivalent to 122 additional trees

WASTE MANAGEMENT

Assumptions
Emission Factor - Composting of organic waste[26] = 0.32 kg CO_2e /kg waste
Emission Factor - Land filling of organic waste[26] = 1.29 kg CO_2e /kg waste
Emission Factor - Production of plastic bag[27] = 0.03 kg CO_2e /bag
Emission Factor - Production of paper bag[27] = 0.08 kg CO_2e /bag

Do not waste food

Reduce food waste by just 1 kg/day

Reduce annual CO_2 emissions by 118 - 470 kg

Activity	Waste reduction / day (kg)	Waste reduction / year (kg)	Emission Factor (kg CO_2e/kg waste)	Annual CO_2e Emissions Reduction (kg)
Organic waste composted	1	365	0.32	**117.90**
Organic waste sent to landfill	1	365	1.29	**469.76**

Annual CO_2 emission reduction of 118-470 kg is equivalent to 11-47 additional trees

Carry a reusable bag when you go shopping. Refuse additional packaging and reuse bags as much as possible

Reduce just one paper or plastic bag a day

Reduce annual CO_2 emissions by 11 - 28 kg

Activity	No of bags reduced a year	Emission Factor (kg CO_2/bag)	Annual CO_2 Emissions Reduction (kg)
Reduce use of 1 plastic bag a day	365	0.03	**11.32**
Reduce 1 bin liner/day. Reuse an old plastic bag instead	365	0.03	**11.32**
Reduce use of 1 paper bag a day	365	0.08	**27.74**

Annual CO_2 emission reduction of 11-28 kg is equivalent to 1-2 additional trees

Manage wastes in school - If you have a canteen or kitchen, start a food waste composting activity

Reduce annual CO_2 emissions by 10604 kg

	Waste / day (kg)*	No of working days	Waste / year (kg)	Emission factor (kg CO_2e/kg waste)*	Annual emissions (kg CO_2)
Organic waste sent to landfill	50	220	11000	1.29	14157
organic waste composted	50	220	11000	0.32	3553
Savings					10604

** Endnote 27 & 28*

Annual CO_2 emission reduction of 10604 kg is equivalent to 1060 additional trees

Start an aluminium can collection campaign in school

Reduce annual CO_2 emissions by 2534 kg

	Weight of 1 can (gm)*	Weight of cans collected per month (kg)	Weight of cans collected per year (kg)	Reduction in electricity consumption if these are recycled (kWh)*	Emission factor (kg CO_2/ kWh)	Reduction in Annual CO_2 emissions
1500 cans brought in for recycling per month	14.9	22.35	223.5	3090.82	0.82	2534.47

** Endnote 29*

Annual CO_2 emission reduction of 2534 kg is equivalent to 253 additional trees

Do not Waste Paper

Assumptions:

Emission factor of paper producing units[30]= 2.5 kg CO_2 / kg of dried product

Note: Calculations consider only carbon dioxide emissions at the paper manufacturing site and do not include emissions related to transportation and postage (where relevant) of paper.

Collect unused sheets from old notebooks to make new ones

Reduce annual CO_2 emissions by 750 kg

Activity	Weight/ sheet (gm)	sheets / student / year	No. of students	Weight of paper conserved /year (kg)	Emission factor (kg CO_2 / kg of product)	Annual CO_2 emissions reduction (kg)
1500 students collect 100 unused sheets from old notebooks to make new ones	2	100	1500	300	2.5	**750**

Reduce the use of fresh chart paper

Reduce annual CO_2 emissions by 150 kg

Activity	Weight/ sheet (gm)	sheets / student / year	No. of students	Weight of paper conserved /year (kg)	Emission factor (kg CO_2 / kg of product)	Annual CO_2 emissions reduction (kg)
Reduction in use of chart paper	20	2	1500	60	2.5	**150**

Send paper for recycling instead of disposing it in garbage

Reduce annual CO_2 emissions by 2700 kg

Activity	Weight/ sheet (gm)	sheets / student / year	No. of students	Weight of paper conserved /year (kg)	Emission factor (kg CO_2 / kg of product)	Annual CO_2 emissions reduction (kg)
Sending paper for recycling instead of disposing it in garbage	2	1500	1500	4500	0.6	**2700**

Maintain your textbooks well and hand them down to juniors.

Reduce annual CO_2 emissions by 11250 kg

Activity	Weight/ sheet (gm)	sheets / student / year	No. of students	Weight of paper conserved /year (kg)	Emission factor (kg CO_2 / kg of product)	Annual CO_2 emissions reduction (kg)
1500 students hand down 10 texts to juniors	300	10	1500	4500	2.5	**11250**

Annual CO_2 emission reduction of 150 - 11250 kg is equivalent to 15-1125 additional trees

Reduce Waste in Offices

Do not use bottled water for corporate events and in the office

Reduce the use of 100 crates of 500 ml bottles

Reduce annual CO_2 emissions by 74 kg *(excluding emissions for production process and transportation)*

	Number of bottles reduced	Weight of 1 bottle (g)	Total Weight (kg)	Emission factor for PET manufacture (kg CO_2/kg product)*	CO_2 Emissions Reduction from PET manufacture (kg)	Emission Factor for Water Extraction (kg CO_2/ kl)*	CO_2 Emissions Reduction from Water Extraction (kg)*	Total CO_2 Emissions Reduction (kg)
Reduce the use of 100 crates of 500 ml bottles (24 bottles /crate)	2400	10	24	3	72.00	2.01	2.41	74.41

** Endnote 31*

Annual CO_2 emission reduction of 74 kg is equivalent to 7 additional trees

Conduct a department wise paper reduction campaign

Reduce the use of 1 ream of paper per department and set the printer to double-side printing

Reduce annual CO_2 emissions by 82.5 kg per department

	Number of sheets reduced per month	Weight of one sheet of paper (g)	Weight of paper conserved / year (kg)*	Emission Factor (kg CO_2/kg of paper)	Annual CO_2 Emissions Reduction(kg)
Requisition 1 ream less	500	5	30	2.5	75.00
Set printer to double side printing	50	5	3	2.5	7.50

Annual CO_2 emission reduction of 82.5 kg is equivalent to 8 additional trees

TRANSPORTATION

Assumptions:

Emission factors for vehicles[25]: 4 stroke motorcycles = 24.82 g CO_2/km, 4 stroke scooters: 42.06 g CO_2/km, car with engine capacity < 1200 cc = 126.37 g CO_2/km, car with engine capacity > 1200 cc = 172.95 g CO_2/km

Fuel efficiency of 2 wheelers[33]: 4 stroke motorcycles = 82.35 km/l, 4 stroke scooters: 62.75 km/l,

Fuel efficiency of 4 wheelers[34]: petrol car with engine capacity < 1200 cc = 17.6 km/l, petrol car with engine capacity > 1200 cc = 13.05 km/l

Cost of Petrol[35]: ₹61.2/l, Diesel = ₹44.95/l

Regularly inflate vehicle tyres

Reduce annual CO_2 emissions by 140 kg

Reduce annual fuel costs by ₹ 3864

	Daily Distance Travelled (km)	Annual Distance Travelled (km)	Fuel Efficiency (km/l)*	Fuel Used (l)	Additional Distance that can be travelled if tyres are well inflated (km)	Emission Factor (g CO_2/km)	CO_2 Emissions Reduction - well inflated tyres (kg)	Fuel Cost (₹ /l)	Cost Savings (₹)
Car, 25% under inflated tyres	40	10000	15.84	631.31					
Car, well inflated tyres	40	10000	17.6	568.18	1111	126.37	140.41	61.20	3864

** Endnote 36*

Annual CO_2 emission reduction of 140 kg is equivalent to 14 additional trees

Switch off the ignition at traffic red lights

Reduce annual CO_2 emissions by 85 - 122 kg

Reduce annual fuel costs by ₹ 2532 - 3351

	Reduction in Daily Idling Time (hr)	No. of days	Reduction in Annual Idling Time (hr)	Hourly Fuel Conserved (l)*	Annual Fuel Conserved (l)*	Fuel Efficiency (km/l)	Emission Factor (g CO2/ km)	Redn. in Annual CO_2 Emissions (kg)	Fuel Cost (₹/l)	Cost Savings (₹)
Two wheeler	0.333	365	121.67	0.34	41.37	82.35	24.82	**84.55**	61.2	**2532**
Small Car	0.333	365	121.67	0.45	54.75	17.6	126.37	**121.77**	61.2	**3351**

** Endnote 37*

Annual CO_2 emission reduction of 85-122 kg is equivalent to 8-12 additional trees

Driving at a steady 45 km/hr on highways gives you the best fuel economy

For a distance of 500 km of highway driving

Reduce annual CO_2 emissions by 32 kg

Reduce annual fuel costs by ₹ 356

	Fuel Consum-ption (kg/ hr)*	Distance covered (km)	Fuel consum-ed (kg)*	Distance that can be covered in the amount of fuel saved	Emission Factor (g CO2/ km)*	CO_2 Emissions Reduction (kg)	Fuel Cost (₹/l)	Cost Saving (₹)
Driving a Santro at 90 km/hr for 5 hrs to cover a distance of 90 km	3.08	90	3.08				61.20	188
Driving a Santro at 45 km/hr to cover a distance of 90 km	1.02	90	2.04	45.88	126.37		61.20	124
Savings for 90 km			1.04			**5.80**		**64**
Savings for 500 km						**32.2**		**356**

** Endnote 38*

Annual CO_2 emission reduction of 32 kg is equivalent to 3 additional trees

Walk if you need to go short distance. Do not drive

Reduce annual CO_2 emissions by 9 - 63 kg

Reduce annual fuel costs by ₹ 271 - 1712

Vehicle	Reduction in km travelled /year	Emission Factor (g/km)	Annual CO_2 Emissions Reduction (kg)	Fuel efficiency (km/l)	Fuel saved (l)	Fuel cost (₹/l)	Cost Savings (₹)
4 stroke Motorcycle	365	24.82	**9.06**	82.35	4.43	61.2	**271**
4 stroke scooters	365	42.06	**15.35**	62.75	5.82	61.2	**356**
Car	365	126.37	**46.13**	17.6	20.74	61.2	**1269**
Large car	365	172.95	**63.13**	13.05	27.97	61.2	**1712**

Annual CO_2 emission reduction of 9-63 kg is equivalent to 1-6 additional trees

Conserve fuel in school transportation

Assumptions:

Fuel efficiency of bus[39] *= 4.3 km/l*

Conduct a transport audit. Identify safe and energy efficient transport options

Use transport provided by the school

Reduce annual CO_2 emissions by 24565 kg if a bus replaces 50 cars

Vehicle	Daily distance covered (km)*	Annual distance covered (km/person)*	Mileage (km/l)	Annual fuel spent (l)	Emission factor (g CO_2/km)	Annual CO_2 emissions (kg)	Fuel cost (₹/l)	Annual cost (₹)
Car (5 kms one way)	20	4400	17.6	250.00	126.37	556.03	61.20	15300
Bus to School	20	88	4.3	20.47	735.51	64.72	44.95	920
Savings per car off the road						**491.30**		**14380**
Savings-50 cars off the road						**24565.16**		

** Endnote 40*

Annual CO_2 emission reduction of 24565 kg, if a bus replaces 50 cars, is equivalent to 2456 additional trees

If you cannot take a school bus, try a car-pool

Reduce annual CO_2 emissions by 1112 kg

Vehicle	Daily distance covered (km)	Annual distance covered (km/person)	Mileage (km/l)	Annual fuel spent (l)	Emission factor (g CO_2/km)	Annual CO_2 emissions (kg)	Fuel Cost (₹/l)	Annual cost (₹)
Three cars for 3 children (5 km one way)	60	13200	17.6	750.00	126.37	1668.08	61.20	45900
One car for 3 children (5 km one way)	20	4400	17.6	250.00	126.37	556.03	61.20	15300
Savings						**1112.06**		**30600**

Annual CO_2 emission reduction of 1112 kg, if a car transports 3 students, is equivalent to 111 additional trees

Walk / cycle to school if you live less than a km away

Reduce annual CO_2 emissions by 111 kg

Vehicle	Daily distance covered (km)	Annual distance covered (km/person)	Mileage (km/l)	Annual fuel spent (l)	Emission factor (g CO_2/km)	Annual CO_2 emissions (kg)	Fuel Cost (₹/l)	Annual cost (₹)
Car (1 km one way)	4	880	17.6	50.00	126.37	111.21	61.20	3060
Walking	4	880	0	0	0	0	0	0
Savings						**111.21**		**3060**

Annual CO_2 emission reduction of 111 kg is equivalent to 11 additional trees

Reduce air travel. Take a train or bus

Take the train or bus between Delhi and Jaipur

Reduce annual CO_2 emissions by 1865 - 2430 kg over 20 trips

Activity	One way Distance (km)	Round trip Distance (km)	Emission Factor (kg CO2/pkm)*	CO_2 Emissions per round trip (kg)	Number of passenger trips / year	Annual CO_2 Emissions (kg)
Short haul flight	250	500	0.26	130	20	2600
Bus	250	500	0.073	36.75	20	735
Savings				93.25		1865
Short haul flight	250	500	0.26	130	20	2600
Train	250	500	0.017	8.5	20	170
Savings				121.50		2430

Annual CO_2 emission reduction of 1865-2430 kg is equivalent to 186-243 additional trees

Take the train between Delhi and Mumbai

Reduce annual CO_2 emissions by 7406 kg over 20 trips

Activity	One way Distance (kms)	Round trip Distance (kms)	Emission Factor (kg CO_2/pkm)*	CO_2 Emissions per round trip (kg)	Number of passenger trips / year	Annual CO_2 Emissions (kg)
Flight over a distance > 463 km	1150	2300	0.178	409.4	20	8188
Train	1150	2300	0.017	39.1	20	782
Savings				370.30		7406

Annual CO_2 emission reduction of 7406 kg is equivalent to 740 additional trees

Avoid long haul flights for work. Video-conference instead

Reduce long haul flights between Delhi and New York

Reduce annual CO_2 emissions by 26904 kg over 10 trips

Activity	One way Distance (kms)	Round trip Distance (kms)	Emission Factor (kg CO_2/pkm)*	CO_2 Emissions per round trip (kg)	Number of passenger trips / year	Annual CO_2 Emissions (kg)
Reduce long haul flights between Delhi & New York	11800	23600	0.114	2690.40	10	26904

** Endnote 41*

Annual CO_2 emission reduction of 26904 kg is equivalent to 2690 additional trees

WATER

Assumptions:
Electricity required to pump 1000 lts of groundwater from a depth of 150 mts[42] = 0.82 kWh
Emission Factor - Borewell supply (kg/kl)[43] = 0.67
Electricity required to pump 1000 lts of water by municipal authorities[44] = 2.06 kWh
Emission Factor - Municipal supply (kg/kl)[45] = 1.69

Install water efficient showers and faucets. Use water carefully

Reduce annual CO_2 emissions by 75 - 189 kg

	Water conserved / household / day (l)*	Water conserved / household / year (l)	Emission Factor- borewell supply (kg/kl)	Emission Factor - municipal supply (kg/kl)	Annual CO_2 emissions reduction - borewell supply (kg)	Annual CO_2 emissions reduction - municipal supply (kg)
Better shower fittings and reduced time under shower	200	73000	0.67	1.69	48.91	123.37
Using aerator faucets and changing dish washing habits	106	38690	0.67	1.69	25.92	65.39
Total	306	111690			74.83	188.76

** Endnote 46*

Annual CO_2 emission reduction of 75-189 kg is equivalent to 7-19 additional trees

Change flush tanks in the washrooms

Reduce annual CO_2 emissions by 39 - 99 kg

	times flushed / capita / day	Daily water consumption per household (l)	Annual water consumption (kl)	Emission Factor- borewell supply (kg/kl)	Emission Factor - municipal supply (kg/kl)	Annual CO_2 emissions reduction - borewell supply (kg)	Annual CO_2 emissions reduction - municipal supply (kg)
Flush tank 10 l	5	250	91.25	0.67	1.69	61.14	154.21
Dual flush tank of 3 and 6 l	5	90	32.85	0.67	1.69	22.01	55.52
Savings						**39.13**	**98.70**

Annual CO_2 emission reduction of 39-99 kg is equivalent to 4-10 additional trees

Harvest rainwater

Harvest 1000 litres per household per day over 40 days of rainfall

In half an hour, a rooftop of 100 m^2 can harvest 1000 litres in a downpour of 25 mm/hr

Reduce annual CO_2 emissions by 27 - 68 kg

	Water conserved/ household/ year (l)	Emission Factor - borewell supply (kg/kl)	Emission Factor - municipal supply (kg/kl)	Annual CO_2 emissions reduction - borewell supply (kg)	Annual CO_2 emissions reduction - municipal supply (kg)
1000 l harvested per day for 40 days	40000	0.67	1.69	**26.80**	**68**

Annual CO_2 emission reduction of 27-68 kg is equivalent to 2-7 additional trees

FUEL EFFICIENCY IN THE KITCHEN

Assumptions:
Emission factor for LPG[47] = 3.13 kg CO_2/ kg of LPG
Rate of use of LPG (big burner, high flame)[48] = 177 g/hr

Cost of 14.2 kg LPG cylinder[49] ₹ 417.82

Use the pressure cooker daily

Reduce annual CO_2 emissions by 135 kg

Reduce annual fuel costs by ₹ 1265

Activity	Time (mins)	Time (hr)	Annual Time taken (hr)	Annual LPG Consumption (kg)	Emission Factor - LPG (kg CO_2/kg LPG)	Annual CO_2 Emissions (kg)	Annual Cost (₹)
Cooking pots & pans with lids							
Cooking rice - 2 cups	25	0.42	395.42	69.99	3.13	219.06	2055
Cooking dal - 1 cup	40	0.67					
Pressure cooker							
Cooking rice - 2 cups and dal - 1 cup	25	0.42	152.08	26.92	3.13	84.26	790
Savings				43.07 Approx. three cylinders		**134.81**	**1265**

Annual CO_2 emission reduction of 135 kg is equivalent to 13 additional trees

Use fuel efficient cooking methods

Reduce gas usage by 20 min a day per household

Reduce annual CO_2 emissions by 67 kg

Reduce annual fuel costs by ₹ 632

Activity	Cooking Time Reduced (hr)	Annual Time Reduced (hr)	Annual LPG Reduction (kg)*	Emission factor for LPG (kg CO_2/kg LPG)	Annual CO_2 Emissions Reduction (kg)	Annual Cost Saving (₹)
Use fuel efficient cooking techniques	0.33	121.67	21.54 Approx. 1.5 cylinders	3.13	67.40	632

** Endnote 50*

Annual CO_2 emission reduction of 67 kg is equivalent to 6 additional trees

Use fuel efficient biomass cookstoves. Reduce usage of wood and time

Reduce annual CO_2 equivalent emissions by 1220 kg per household

Activity	Time required for cooking (hrs/day)*	Annual Wood Consumption/capita (kg)*	Annual Wood Consumption/ household (kg)*	Annual CO_2 equivalent Emissions/household (kg)*
Traditional Cookstove	3.5	892	4460	1440
Improved Cookstove	2.8	641	3205	220
Savings	0.7	251	1255	1220

** Endnote 51*

ENDNOTES FOR ANNEXURE

1 CO_2 baseline database for the Indian Power Sector, User Guide, Version 10, December 2014. Emissions are considered at the power generation point only since estimation of emissions at end-use point depends on a number of variable factors. This also gives us the most conservative estimate of emissions.

2 Middle slab of residential electricity tariff in Delhi October 2015. http://tatapower-ddl.com/UploadedFiles/107_1105_2013_8_1_41_27_364.pdf. Last accessed 5 November 2015.

3 The lumen output of a 60 W Incandescent bulb, 14W Compact Fluorescent Lamp and a 7W Light Emitting Diode are comparable. The lumen output of the T5 and T8 tubelights are comparable. Hours of use per day as assumed by DSM based Efficient Lighting Programme (DELP) = 3.5. http://www.eeslindia.org/writereaddata/DELP%20Toolkit%20finalpdf. Last accessed 5 November 2015.

4 Highest selling volume of frost free refrigerator = 280L. Annual electricity consumption of 2 star and 5 star fridges calculated from Section 2.4 and Table 2.3 of Schedule 1, Revision 3 of the Standards and Labelling document, Bureau of Energy Efficiency. http://beestarlabel.com/. Last accessed 5 November 2015.

Highest selling volume of direct cool refrigerator = 180L. Annual electricity consumption of 2 star and 5 star fridges calculated from Table 2.2 of Schedule 5, of the Standards and Labelling document, Bureau of Energy Efficiency. http://beestarlabel.com/. Last accessed 5 November 2015.

5 Highest selling split AC = 1.5 tons
1 ton of refrigeration (R_T) = 3516 W
Cooling capacity of a 1.5 ton AC = 1.5 * 3516 W = 5265 W
Energy efficiency ratio (EER) for a 2 star AC = 3.09; Energy efficiency ratio (EER) for a 5 star AC = 3.5
Power consumption (W) = cooling capacity / EER
Reference: Table 2.3 of Annexe 1 to Schedule 3, Revision No. 2 of the Standards and Labelling document, Bureau of Energy Efficiency.
It is assumed that an AC is used on average for 1200 hours in a year in both homes and offices.

6 Service delivery (air delivery / power input) of 1 star fans = 3.2; Service delivery (air delivery / power input) of 5 star fans = 4
Minimum wattage of 1 star fans of 210 cum air delivery = 210/3.2 = 65W
Minimum wattage of 5 star fans of 210 cum air delivery = 210/4 = 52W
Reference: http://beestarlabel.com/. Last accessed 5 November 2015.
It is assumed that a fan is used for 24 hours a day for 6 months of the year.

7 5 tubelights of 28W each used for 4 hours and 3 fans of 65W used for10 hours, require 2.51 kWh of electricity. This can be powered by a 640Wp panel, which produces 2.56 units of electricity if exposed to sunshine for 5 hours of the day.It is assumed that 5 hours of sunshine is available over 300 days of the year.

8 A 1kW_p photovoltaic panel generates 4 kWh power if exposed to sunshine for 5 hours. 4 units of electricity in a day are adequate to handle daily electricity requirements of 5 lights, 3 fans, a TV, a refrigerator and a computer.It is assumed that 5 hours of sunshine is available over 300 days of the year.

9 Energy (Q) = Specific heat capacity of water at constant pressure (Cp)*mass (m)* difference in temperature (dT). It is assumed that 25 lts of water is heated from 20°C to 60°C; Cp of water = 4.19 kJ/kg°C and 1 kJ = 3600 kWh.
It is assumed that the geyser is turned on 4 times a day.
It is assumed that the geyser is required only for an average of 6 months in a year.

10 https://www.bijlibachao.com/appliances/voltage-stabilizers-working-sizing-and-power-consumption.html. Last accessed 5th November 2015

11 Electricity required to heat the water is as in Endnote 7
For a bucket bath of 15 lts / person, it is assumed that the geyser needs to be turned on twice if 4 people have their baths in quick succession and 4 times if they do not. It is assumed that the geyser is required only for an average of 6 months in a year.

12 Operating manual of 20 l IFB microwave oven.

13 Operating manual of IFB washing machine Serena

14 Operating manual of IFB dryer. http://www.ifbappliances.com/laundry/clothes-dryer/maxi-dry-550.html last accessed 5th November 2015

15 https://www.bijlibachao.com/appliances/television-set-top-box-can-hog-power.html last accessed 5th November 2015.The set-top box is assumed to be in use for 6 hrs and on stand-by mode for the rest of the day.

16 https://www.bijlibachao.com/appliances/power-consumption-gaming-consoles-ps4-ps3-xbox-360-wii-nintendo.html; http://beestarlabel.com/; https://www.bijlibachao.com/appliances/laptop-and-desktop-energy-comparison.html. Last accessed 5th November 2015

17 BPL's StudyLite Light Emitting Diode (LED) table lamp consumes 5W when connected to the mains. This is compared with a 100W ICL since a higher wattage bulb is usually used for reading.

18 60W is the wattage of the most commonly used ICL. 65 W is the wattage of a commonly used 1200 mm sweep fan.

19 1 hp = 0.7457 kW

20 https://cp.tatapower.com/irj/go/km/docs/documents/Public%20Documents/CustomerPortal/pdf/MYT%20Direct%20Tariff%20FY16.pdf . Last accessed 5th Nov 2015.

21 Yadav S K. (2011). National Study On Ten Year School Curriculum Implementation. Available: http://ncert.nic.in/rightside/links/national_curriculum.pdf. Last accessed 5th November 2015

22 http://h20331.www2.hp.com/hpsub/downloads/hp_workstation_powerusageestimator.pdf. Last accessed 5th November 2015

23 https://www.bijlibachao.com/appliances/laptop-and-desktop-energy-comparison.html. Last accessed 5th November 2015

24 8W occupancy sensors lights are available in the market and their lumen output is the same as a 14W CFL.

25 www.greenbuildingcongress.com/site/mmbase/attachments/375534/kone. Last accessed 5th November 2015

26 Nair, J. (Feb 2009). The impact of landfilling and composting on greenhouse gas emissions - A review. Bioresource Technology. 100 (16), 3792-8.

27 http://use-less-stuff.com/Paper-and-Plastic-Grocery-Bag-LCA-Summary-3-28-08.pdf. Last accessed 5 November 2015.

28 Apte A et.al.. (August 2013). Potential of Using Kitchen Waste in a Biogas Plant. International Journal of Environmental Science and Development. 4 (4), 370-374.

29 http://metalworld.co.in/focus0508.pdf. Last accessed 5th November 2015

30 http://www.cseindia.org/userfiles/91-104%20Paper(1).pdf. Last accessed 5th November 2015

31 http://pacinst.org/publication/bottled-water-and-energy-a-fact-sheet/. Last accessed 5th November 2015. The CO_2 emissions for water extraction is calculated based on extraction of groundwater, as per endnote 21

32 ARAI, Pune. (2008). Draft report on "Emission Factor development for Indian Vehicles " as a part of Ambient Air Quality Monitoring and Emission Source Apportionment Studies. Available: http://www.cpcb.nic.in/Emission_Factors_Vehicles.pdf. Last accessed 5th Nov 2015. Average of emission factors of relevant variants of vehicles have been considered.

33 Society of Indian Automobile Manufacturers. (January 2010). Fuel Economy Data. Available: http://www.team-bhp.com/forum/indian-car-scene/64622-siam-arai-fuel-efficiency-figures-now-jan-2011-data-pg6.html. Last accessed 5th Nov 2015. Average of variants of relevant 2 wheelers have been considered.

34 Society of Indian Automobile Manufacturers. (2014). SIAM 6th Fuel Efficiency Declaration. Available: http://www.siamindia.com/uploads/filemanager/256th-4W-FE-Data-Declaration.pdf. Last accessed 5th Nov 2015. Average of fuel efficiency of 17 variants (of cars manufactured by all major manufacturers) have been considered for cars with engine capacity less than 1200 cc. Average of fuel efficiency of 14 variants (of cars manufactured by all major manufacturers) have been considered for cars with engine capacity more than 1200 cc.

35 Fuel cost in Delhi as on 1st October 2015

36 25% reduction in tyre pressure assumed to cause 10% reduction in fuel efficiency as per http://pcra.org/English/transport/CRRIstudy.htm. Last accessed 5 November 2015.

37 http://pcra.org/English/transport/Central Road Research Institute (CRRI) study.htm. Last accessed November 2015

38 Fuel efficiency in Transport Sector. Booklet by Petroleum Conservation Research Association, December 2014

39 http://in.pegaad.com/automotive-services-tata-starbus-lp-1512-tc-54-seater-4nos.31000.html. Last accessed 5th November 2015

40 50 students/bus. Distance between home and school assumed to be 5 kms

41 http://lipasto.vtt.fi/yksikkopaastot/henkiloliikennee/raideliikennee/junat_henkiloe.htm, http://planningcommission.nic.in/sectors/NTDPC/volume3_p1/railways_v3_p1.pdf. Last accessed 5th November 2015.

42 Electricity required for pumping 1cu m (1000l of ground water over a height of 150 m (kWh) = Q (qty)*h (head)*9.81/3600*efficiency of pump = 1*150*9.81/3600*0.5

43 Emission factor – Borewell supply (kg CO_2/kl) = Electricity required to pump 1kl of water (kWh/kl)* Emission factor of electricity generation (kg CO_2/kWh) = Electricity required to pump 1kl of water (kWh/kl)* 0.82 kg CO_2/kWh

44 Electricity required to pump 1000 l of water by Bengaluru Water Supply and Sewerage Board = 2.06 units. Discussions with officials

45 Emission factor – Municipal supply (kg CO_2/kl) = Electricity required to pump 1kl of water by municipality (kWh/kl)* Emission factor of electricity generation (kg CO_2/kWh) = Electricity required to pump 1kl of water by municipality (kWh/kl)* 0.82 kg CO_2/kWh

46 Shah, S. et.al. (2009). Water Audit - Need of the hour. Available: ttp://www.tce.co.in/Water_Audit_Need_of_hour.pdf. Last accessed 5th Nov 2015.

47 Emission Factor for LPG = Calorific value of LPG sold in India (TJ/kg) * Emission Factor for LPG (kg CO_2/TJ) = 0.000049538 TJ/kg LPG * 63100 kg CO_2/TJ = 3.13 kg CO_2/kg LPG. References: http://www.gasindia.in/technical-specification.html. Last accessed 5 November 2015.

48 User Manual of Sunflame Spectra DX Quadra gas stove.

49 Costof 14.2 kg cylinder in Delhi. Reference: https://www.iocl.com/products/indanegas.aspx. Last accessed 5th November 2015

50 Assuming the use of only 1 big burner at high flame.

51 Practical Action Consulting. (2015). Gender and Livelihoods Impacts of Clean Cookstoves in South Asia. Available: http://cleancookstoves.org/resources/357.html. Last accessed 5th Nov 2015.

Jain A et. al. (2015). Clean, Affordable and Sustainable Cooking Energy for India. New Delhi: Council on Energy, Environment and Water. 45.

Notes

ACKNOWLEDGEMENTS

Low Carbon Lifestyles – Right Choices For Our Planet has been made possible by the contributions of many organizations and individuals. Conscious of the long list and the fact that in such an exercise we may miss some names, we express our gratitude to all who are directly and indirectly associated with this publication.

The guidance of the Honourable Minister has played a vital role in ideating this book.

Quantitative estimations have been taken from UNDP-GEF document on 'Low Carbon Lifestyles' and are provided in the Annexure. WWF-India, Ashoka Trust for Research in Ecology and the Environment, and Central Research Institute for Dryland Agriculture provided case studies based on their experience in different sectors.

This document has been compiled under a consultancy assignment from UNDP India by Ms Rashmi Gopal with contributions from Mr Lokesh Chandra Dube and Dr Himangana Gupta. Illustrations are by Ms Thara Thomas.

Inputs were also received from Dr Kavita Iyengar, Ms Swati Prasad Siddharth, Ms Aashwina Mouli, Ms Mona Sogal, Dr A K Bhatnagar, Dr Sujata Arora, Dr P C Maithani, Dr J V N S Prasad and Mr Shantanu Goel.

Overall editing, review and collation carried out by Dr J R Bhatt.

Low Carbon Lifestyles - Right Choices For Our Planet, is a practical guide that shows how simple lifestyle changes will help the planet and our pocket. It quantifies emissions reduction that can be achieved by an action as effortless as turning off an unnecessary light or fan, and expresses it in a format that people can understand – as the number of additional trees that specific action is equivalent to and the amount of money that we save. Its bottom-up approach seeks to address the climate challenge by inspiring individuals to start small, get satisfaction from knowing how much a simple action has helped, and get motivated to do more.

This book is the outcome of the vision of honorable Minister on Lifestyle issues. Operationalizing the intended role of sustainable lifestyles as enshrined in the Paris Agreement is the need of the hour. This book is a step in that direction.

ISBN: 978-81-933131-0-7