सत्यमेव जयते

Govt. of India
Ministry of Environment, Forest
& Climate Change

LOW CARBON LIFESTYLES

gef
GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

UNDP
Empowered lives.
Resilient nations.

ENERGY IS LIFE
BEE
CONSERVE IT

SGP The GEF Small Grants Programme

CEE
Centre for Environment Education

Each of us needs to be responsible

Anthropogenic greenhouse gas emissions are mainly driven by population size, economic activity, lifestyle, energy use, land-use patterns, technology and climate policy (IPCC). As countries across the world take action towards a new international climate agreement,India's Intended Nationally Determined Contributions (INDCs) includes reduction in the emissions intensity of its GDP by 33 to 35% by 2030 from 2005 levels, and creation of an additional carbon sink of 2.5 to 3 billion tonnes of carbon dioxide (CO_2) equivalent through additional forest and tree cover by 2030.

The toolkit on Low Carbon Initiatives lays emphasis that each of us needs to play a strategic role to help the country achieve its targets. It seeks to demonstrate that **simple individual actions when adopted** can have a significant overall bearing. It arms **trainers and users with a wide range of climate friendly examples** and everyday actions, which when aggregated across a larger population will have significant impacts and contributions towards CO_2 reduction for countries and communities to meet their intended target commitments. It also provides a quantitative estimation of the reduction in CO_2 emissions at a micro-level and cost savings accrued by implementing the above-mentioned actions.

Contents

The toolkit contains a list of practical climate friendly initiatives that can be adopted by individuals, educational institutions, and workplaces with detailed calculations of annual CO_2 emissions reductions and cost savings from implementing these simple actions.

The enclosed CD contains:

- An MS Excel sheet with the formulae to arrive at the calculated quantified reductions in emissions. Users and trainers have the flexibility to change specific fields to arrive at quantification of CO_2 emissions reduction and cost savings. It can also accommodate country specific modifications.
- An MS PowerPoint presentation on climate change basics, how we are responsible, and its impacts on India. This presentation comes with speaker notes.
- Three MS PowerPoint presentations on actions that can be taken by individuals at home, educational institutions, and workplaces and the impacts of a larger population implementing these actions.

How to use the toolkit

Trainers and users are advised to first gain an understanding of the observed changes in climate and the science that explains it;the impacts on natural and human systems; and the underlying causes of global warming and climate change. The MS PowerPoint presentation on climate change basics can be used as a template and maybe change to suit specific requirements.

Trainers and users can pick anywhere between **3-5 action initiatives** that can be implemented by their target audience. These can be elaborated upon and the trainees can be given an idea of the magnitude of emissions reduction, if a larger population can implement each of them. Specific assumptions can be tweaked as necessary, using the MS Excel sheet and any of the three MS PowerPoint presentations can be modified and used to communicate relevant messages to the trainees.

Methodology

Government bodies and independent research organizations have shared their knowledge base and provided feedback in developing this toolkit. All data are relevant to the Indian context. The assumptions are provided in the referenced end-notes.

Emission factors used in this toolkit represent the weight of greenhouse gases, converted to and expressed as the weight of CO_2 released per unit of the activity that releases the greenhouse gases; such as kilograms of CO_2 emitted per unit consumption of electricity or kilograms of CO_2 emitted per litre of fuel used. Emission factors used in this training toolkit are referenced in the endnotes.

Cost savings calculated in this toolkit consider only annual running expenditure and do not include capital costs. All calculations are done using conservative estimates.

For each action, the reduction in annual **CO_2 emissions is translated into benefits from additional trees to illustrate the impact of that particular action.** This is computed on the basis that on an average a tree can sequester about 10 kg of CO_2 each year.

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[2] = ₹ 5.95/kWh

Homes

Switch to energy efficient devices

Lighting

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 tubelight changes					**41.90**		**304**

** Endnote 3*

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

Electrical Appliances
Buy BEE 5 star rated appliances

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

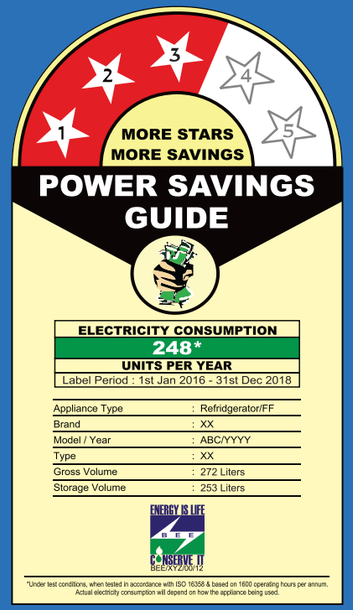
Use BEE 5 star rated split air conditioners (1.5 tons)

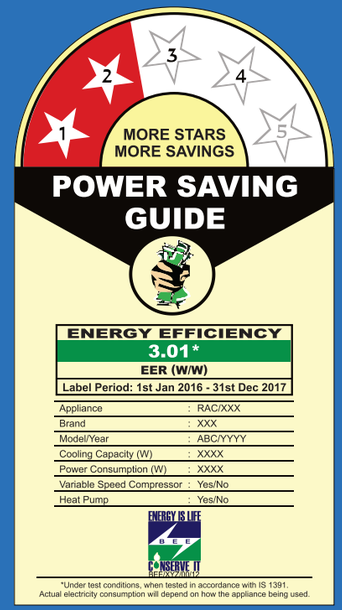
- Reduce annual CO_2 emissions by 197 kg per air conditioner
- Reduce annual electricity bills by ₹ 1428 per air conditioner

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

Go Solar

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 Rs 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 mains electricity	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

Practice Energy Efficiency

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

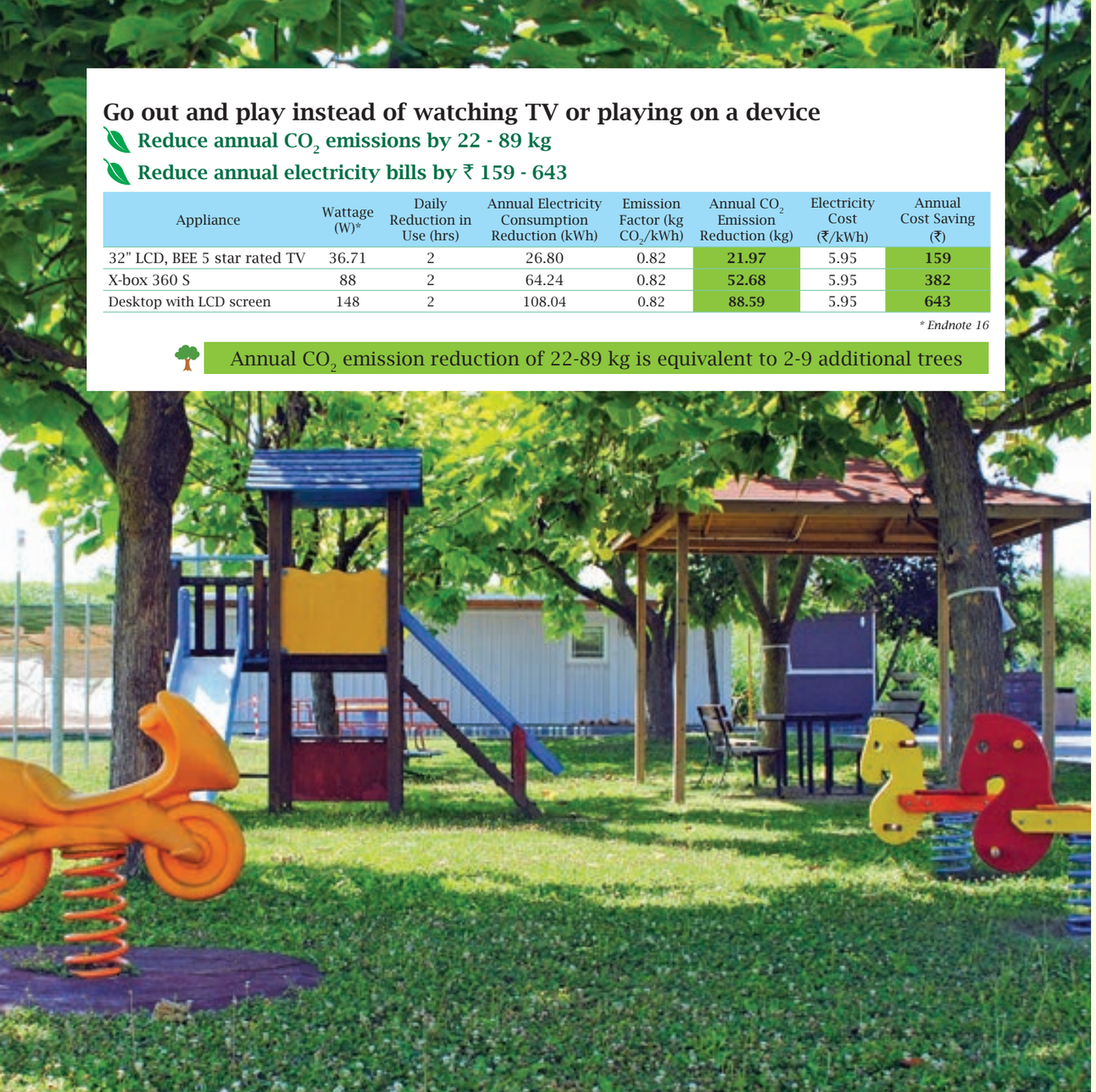
Reduce annual CO_2 emissions by 135 kg

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 CO2 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:

Electricity required to pump 1000 lts of groundwater from a depth of 150 mts[20] = 0.82 kWh
Emission Factor - Borewell supply (kg/kl)[21] = 0.67
Electricity required to pump 1000 lts of water by municipal authorities[22] = 2.06 kWh
Emission Factor - Municipal supply (kg/kl)[23] = 1.69

Conserve Water

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 24*

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

Change flush tanks in the bathrooms

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 lts	5	250	91.25	0.67	1.69	61.14	154.21
Dual flush tank of 3 and 6 lts	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 lts 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

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[26]: 4 stroke motorcycles = 82.35 km/l, 4 stroke scooters: 62.75 km/l,

Fuel efficiency of 4 wheelers[27]: 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[28]: ₹61.2/l

Be Fuel Efficient

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 29*

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 30*

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 kms of highway driving

Reduce annual CO_2 emissions by 32 kg

Reduce annual fuel costs by ₹ 356

	Fuel Consumption (kg/hr)*	Distance covered (km)	Fuel consumed (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 kms	3.08	90	3.08				61.20	188
Driving a Santro at 45 km/hr to cover a distance of 90 kms	1.02	90	2.04	45.88	126.37		61.20	124
Savings for 90 kms			1.04			**5.80**		**64**
Savings for 500 kms						**32.2**		**356**

** Endnote 31*

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

Assumptions
Emission Factor - Composting of organic waste[32] = 0.32 kg CO_2e /kg waste
Emission Factor - Land filling of organic waste[32] = 1.29 kg CO_2e /kg waste
Emission Factor - Production of plastic bag[33] = 0.03 kg CO_2e /bag
Emission Factor - Production of paper bag[33] = 0.08 kg CO_2e /bag

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

Reduce Waste

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

Fuel efficient cooking techniques:

- Cover cooking pots and pans with lids
- Reduce the flame once food starts boiling
- Use optimum quantity of water for cooking
- Keep all ingredients ready and at hand before turning on the gas
- Use broad bottom vessels
- Allow refrigerated food to come to room temperature before heating it
- Clean the burners regularly
- Soak rice, dal etc. for some time before cooking
- Eat together so that food is not heated multiple times

Assumptions:
Emission factor for LPG[34] = 3.13 kg CO_2/ kg of LPG
Rate of use of LPG (big burner, high flame)[35] = 177 g/hr
Cost of 14.2 kg LPG cylinder[36] ₹ 417.82

Practice fuel efficiency in the kitchen

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 mins 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 37*

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 38*

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[39] = ₹ 8.5/kWh
Number of working days of a school[40] = 220
Number of students = 1500

Educational Institutions

Conduct An Energy Audit

Switch to energy efficient lighting

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

Become more Energy Efficient

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 CO2 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 41*

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 41*

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

Conserve Water

Conduct a water audit.

Conserve 10000 l per day

Reduce annual CO_2 emissions by 1474 - 3718 kg

	Water conserved/ institution/ day (l)	Water conserved/ institution/ 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)
Invest in rainwater harvesting, dual flush toilets, low flow tap fixtures and drip irrigation for the garden	10000	2200000	0.67	1.69	1474	3718

** Endnotes 21 & 23*

Annual CO_2 emission reduction of 1474-3718 kg is equivalent to 147-371 additional trees

Manage Wastes

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 32 & 42*

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

Start an Aluminium can collection campaign

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 43*

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

Assumptions:

Emission factors for vehicles[25]: bus = 735.51 g CO_2/km, car with engine capacity < 1200 cc = 126.37 g CO_2/km

Fuel efficiency of bus[44] = 4.3 km/l

Fuel efficiency of petrol car with engine capacity < 1200 cc[27] = 17.6 km/l,

Cost of Fuels[28]: Petrol = ₹61.2/l, Diesel = ₹44.95/l

Conserve Fuel

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 45*

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 to 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 kms one way)	60	13200	17.6	750.00	126.37	1668.08	61.20	45900
One car for 3 children (5 kms 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 kms 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

Do not Waste 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

Assumptions:

Emission factor of paper producing units[46]= 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.

Workplaces

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 47*

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

Instal occupancy sensor lights in conference rooms, bathrooms & passageways

Change 200 lamps to occupancy sensor based LED lamps

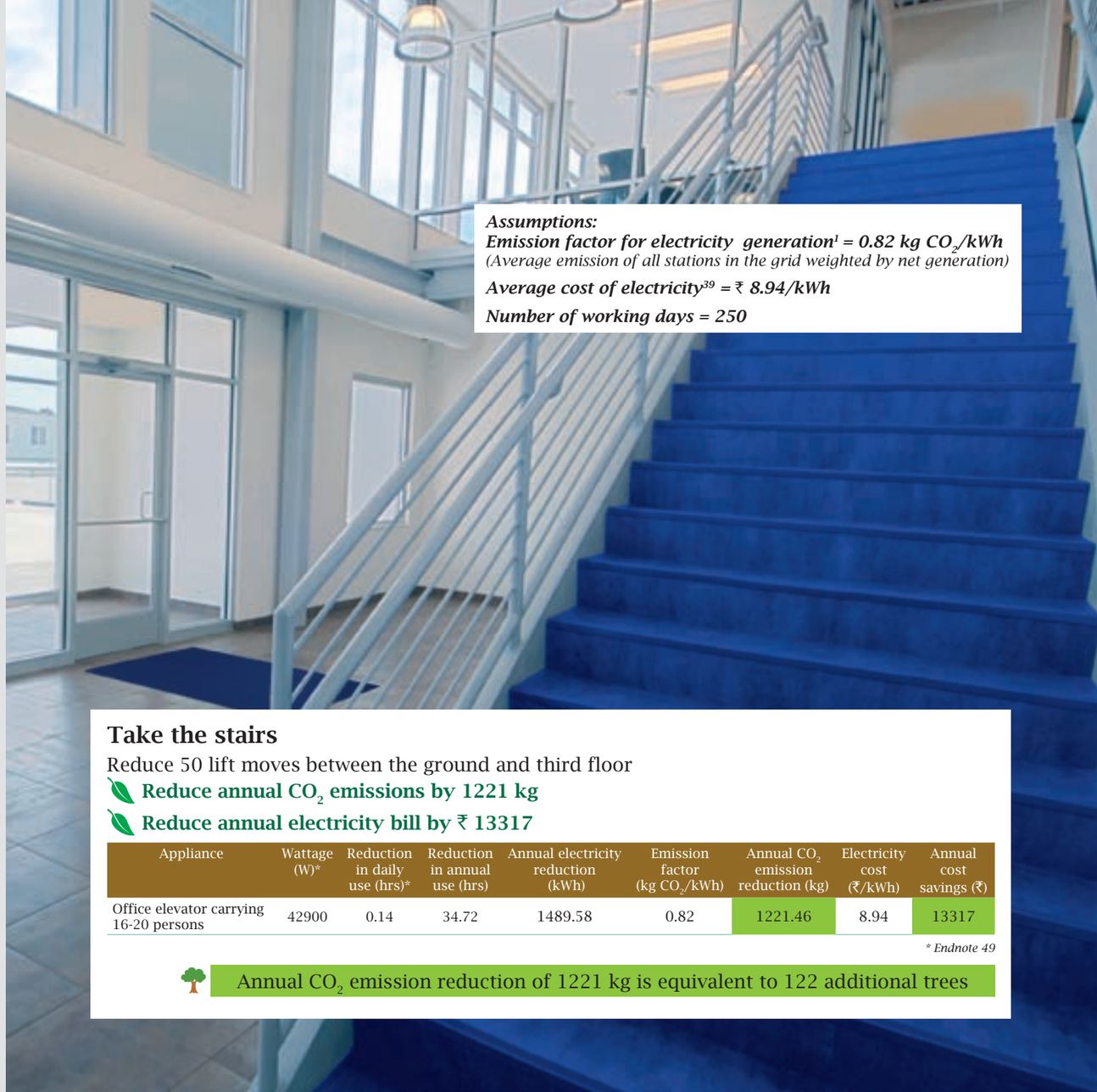
Reduce annual CO_2 emissions by 2542 kg

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 48*

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



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[39] = ₹ 8.94/kWh

Number of working days = 250

Take the stairs

Reduce 50 lift moves between the ground and third floor

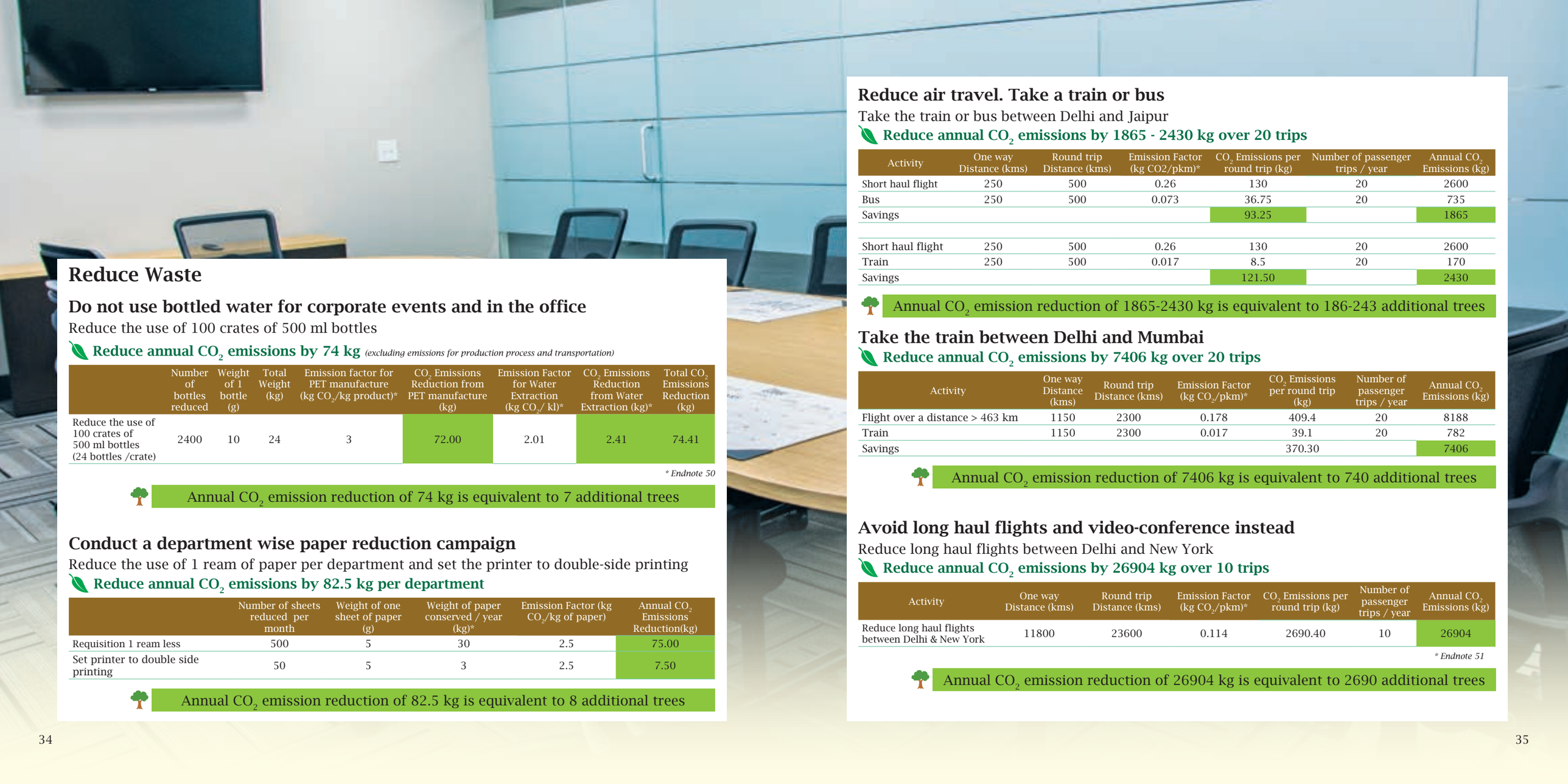
Reduce annual CO_2 emissions by 1221 kg

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 elevator carrying 16-20 persons	42900	0.14	34.72	1489.58	0.82	1221.46	8.94	13317

** Endnote 49*

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



Reduce Waste

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 50*

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

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 (kms)	Round trip Distance (kms)	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 and 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 51*

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

Endnotes

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 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

21 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

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

23 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

24 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.

25 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.

26 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.

27 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.

28 Fuel cost in Delhi as on 1st October 2015

29 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.

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Authors

- Prabhjot Sodhi, Country Program Manager, GEF-UNDP Small Grants Program, CEE-New Delhi
- Rashmi Gopal, Consultant, Bangalore
- S.N. Srinivas, Program Officer, Climate Change, UNDP, New Delhi
- Ramesh Jalan, Resource Person and Moderator, Climate Change Community of Practice, UN Solution Exchange, New Delhi
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- M.M. Kutty, Additional Secretary, Ministry of Environment, Forest & Climate Change, New Delhi
- Ajay Mathur, Director General, Bureau of Energy Efficiency, New Delhi
- A.K. Mehta, Joint Secretary, Ministry of Environment, Forest & Climate Change, New Delhi
- S Sathpathy, Director, Ministry of Environment, Forest & Climate Change
- Arun K Tripathi, Director, Ministry of New and Renewable Energy
- Jaco Cilliers, Country Director, United Nations Development Programme, New Delhi
- Marina Walter, Deputy Resident Representative, UNDP, New Delhi
- Preeti Soni, Advisor-Climate Change, United Nations Development Programme, New Delhi
- Anil Arora, Senior Project Officer, GEF-UNDP Small Grants Program, CEE-New Delhi
- Saurabh Diddi, Energy Economist, Bureau of Energy Efficiency, New Delhi
- Ashish Saraswat, Bureau of Energy Efficiency, New Delhi
- Praveen Gupta, Central Electricity Authority, New Delhi
- Sandeep Garg, Chief Technical Specialist, Energy Efficiency Centre, SIDBI, New Delhi
- Gayrajan Kohli, Senior Manager - Consulting, BRIDGE TO INDIA
- Vernie Sannoo, Managing Director, Barefoot Power Pvt. Limited, Bangalore
- Chairman, Bangalore Water Supply and Sewerage Board, Bangalore
- Chief Engineer, Bangalore Water Supply and Sewerage Board, Bangalore
- R.K. Arya, Additional Director, Petroleum Conservation Research Association, New Delhi
- Chandra Bhushan,Deputy Director General, Centre for Science and Environment, New Delhi
- Swati Sambhyal, Programme Officer, Centre for Science and Environment, New Delhi
- Prof. R. Sukumar, Centre for Ecological Sciences, Indian Institute of Science, Bangalore
- H.S. Suresh, Centre for Ecological Sciences, Indian Institute of Science, Bangalore
- Pooja Vijay Ramamurthi, Research Engineer, Centre for Study of Science, Technology and Policy
- Bhaskar Goswami, Policy Specialist, Food and Agriculture Organization of the United Nations
- Karan Mangotra, Assistant Project Manager, United Nations Development Programme
- Arupendra Nath Mullick, Fellow, The Energy and Resources Institute, New Delhi
- Rekha Krishnan, Consultant
- Radhika Khosla, Fellow, Centre for Policy Research
- Abhishek Kumar, Ministry of New and Renewable Energy

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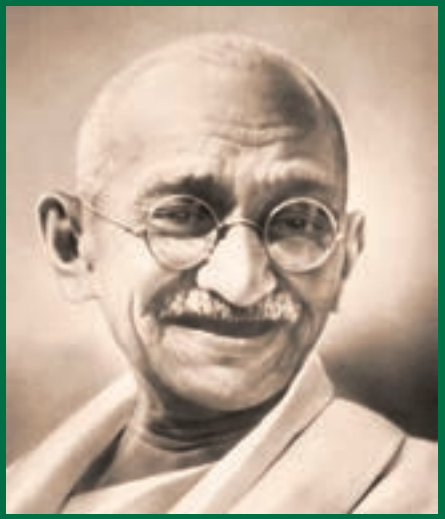

The difference between what we do
and what we are capable of doing
would suffice to solve
most of the world's problems.

–Mahatma Gandhi

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Centre for Environment Education
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GEF UNDP Small Grants Programme
Centre for Environment Education, Delhi
C-40 South Extension-II,
New Delhi-110049
Ph.: 011-26262878-80
e-mail : prabhjot.sodhi@ceeindia.org
www.sgpindia.org www.ceeindia.org

United Nations Development Programme (UNDP)
Post Box No. 3059, 55 Lodhi Estate
New Delhi-110 003
Ph.: 011-46532333
Fax: 011-24627612
e-mail : sn.srinivas@undp.org
www.undp.org.in