Reducing Carbon Emission

SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be **University** u/s 3 of UGC Act, 1956)

How do we reduce our carbon foot Print?

REDUCING CARBON EMISSIONS

The SRMIST is working hard to reduce energy consumption, increase efficiencies, use more renewable energy sources, and reduce its carbon footprint. We have ambitious targets to reduce our carbon emissions from our activities to reduce our impact on the natural environment.

To adequately address global warming, SRMIST has significantly reduced the amount of heat-trapping emissions we are putting into the atmosphere. By taking action to reduce emissions of the greenhouse gas pollution that warms our planet, we can reduce the risks we will face from future climate change. SRMIST has expanded the use of renewable energy and transform our energy system into one that is cleaner and less dependent on coal and other fossil fuels.

Why reduce carbon?

Carbon dioxide (CO_2) is the main heat-trapping greenhouse gas associated with human-induced global warming and climate change. Consequently, extreme weather events, like floods and droughts, are likely to happen more often with varying local and national effects. Climate change is not just about another bad day of weather. If we do not reduce carbon emission and limit global temperature rises to 2 °C, the impacts of climate change on water, agriculture, infrastructures, and economies will severely affect our lifestyles. Carbon emissions are the main contributor to climate change, so cutting carbon emissions and moving to a low carbon society is the primary solution.

WE AIM TO:

- Deliver 30 % reduction in CO_2e by 2020 from 2012 levels;
- Compensate for remaining emissions by developing research and low carbon technology solutions.

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OUR PERFORMANCE

- We have reduced CO_2e emissions from gas and electricity by **18 %** since the base year 2012;
- We need to reduce our current emissions by a further **15 %**–based on our current consumption - to achieve our 2022 target.

WE' RE REDUCING CARBON EMISSIONS BY. . .

1. Generating our own energy from renewable sources such as
    - Solar panels;
    - Solar water heating and
    - Biogas Plants
2. Existing Lighting to be upgraded to LED lighting
3. Cutting down on the need for air conditioning
4. Increased utilization of Public Transport

The university spends over **100 Crores** per year on energy and is committed to reducing its energy consumption and carbon footprint.

SRMIST INITIATIVE TO REDUCE CARBON EMISSION

A 'carbon footprint' measures the total greenhouse gas emissions caused directly and indirectly by a person, organisation, event or product. At SRMIST, the most significant opportunities to reduce GHGs and demonstrate climate action leadership are in energy use, business travel, commuting, paper use and food. SRMIST has a vital role to play in reducing carbon (greenhouse gas) emissions not only through the management of its campus and operations but also through the engagement and education of its students and staff.

The following are some of the SRMIST initiatives to reduce the carbon emission.

Figure 1 : SRMIST initiative for carbon reduction

SOLAR PANELS AT SRMIST

Solar power can help reduce CO_2 emissions mainly by being a clean and renewable source of energy. Solar power is not dependent on burning fossil fuels or other products; instead, it uses electrons from captured from the sun's energy for energy creation. Therefore, solar energy does not create greenhouse gases for energy production.

The cost of energy resources has been on the rise from previous years. Now is the time to start looking into future technologies to make the SRM a more sustainable place. The implementation of a solar plan at the Institute of Science and Technology could be substantially beneficial for all parties involved. The large flat roof of a university building is a great place for solar panels to generate clean solar electricity to cut energy costs and make a lasting impression on students.

In 2016, SRM Institute of Science and Technology added 100 kilowatts (kW) of solar photovoltaics to Institute of Science and Technology. The installed solar arrays will produce an estimated kilowatt hour each year, enough emissions-free energy to power the electrical usage.

TABLE -1 LIST OF INSTALLED SOLAR PANELS AT SRMIST

Year of Installation	Place of Installation	Capacity (in kW)	Type	No of Solar Panels	Total Installed Area (Sq.Ft)
2013	SRMIST ESB Block	5	250 Wp / Monocrystalline	20	550
2014	SRMIST Administrative Block	100	160Wp/ Mono-Crystalline	36	11,000
			250 Wp/ Mono &poly-crystalline	319	
			285Wp/ Poly-Crystalline	54	
2016	SRM College of Pharmacy	10	250 Wp / Poly-Crystalline	80	1100
2017	SRM Arts & Science College–MBA Annexure Block (Dept. of Visual Communication)	20	250Wp / Poly-Crystalline	80	2200
	SRM Valliammai Engineering College	30	250Wp / Poly-Crystalline	120	3300
2018	SRM IST-Basic Engineering Laboratory	55	315Wp / Poly-Crystalline	176	5500
	SRM Dental College	95	315Wp / Poly-Crystalline	304	9500
	SRM Medical College Hospital	95	315Wp / Poly-Crystalline	200	9500
			325Wp / Poly-Crystalline	100	

Overall, the arrays provide less than 5% of SRM Institute of Science and Technology 's total electricity use. At the end of 2022, SRM Institute of Science and Technology targets to increase the solar array to double the SRM Institute of Science and Technology 's total electricity use.

Figure 2 : 100 kW solar panel installed at University Building

Using electricity from a solar panel system on your roof can be cheaper than buying it from your electricity company, and it is one of the most significant activities your household can do to reduce your carbon footprint.

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Figure 3 : 55 kW solar panel at Basic Engineering Block

TABLE -2 : SOLAR PANEL INSTALLED CAPACITY

Year	Installed capacity (KW)	Total electricity generation-annually (kWh)	Carbon dioxide emissions mitigated (In tons)	Equivalent Planting Teak trees
2013	5	7500	154	264
2014	100	150,000	3075	4920
2016	10	15000	308	492
2017	50	75,000	1538	2460
2018 (till June)	245	367,500	7534	12,054
Total	**410**	**615,000**	**12,609**	**20,190**

Note: Average solar irradiation in TAMIL NADU state is 1266.52 W / sq.m. 1kWp solar rooftop plant will generate on an average over the year 5.0 kWh of electricity per day (considering 5.5 sunshine hours)

TABLE 3: SOLAR PANEL CAPACITY AND ITS EQUIVALENT PLANTING

Installed Solar Panel Capacity (in the Year 2018)	440 kW
Approximate units per kW per day:	3.5 kWh
Total Electricity Generation from Solar Plant	615,000 kWh/Year
Financial Savings	Rs. 4920000 / Year
Carbon dioxide emissions mitigated is	12,609 tons
This installation will be equivalent to planting (Data from IISc)	**20190 Teak trees over the lifetime.**

Figure 4 : Solar Panels at the School of Pharmacy, SRMIST

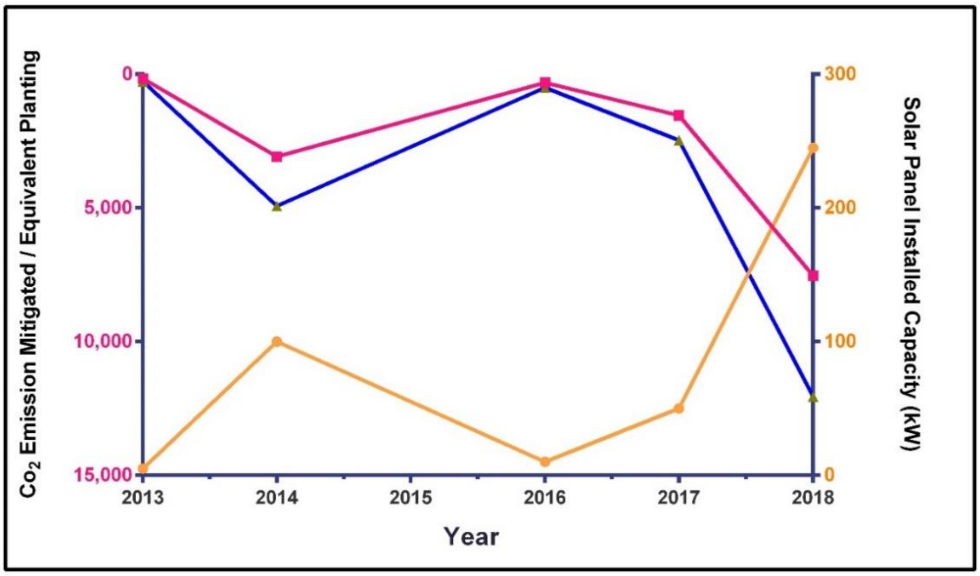

Figure 5 : Year wise solar panel installed and its carbon emission mitigation

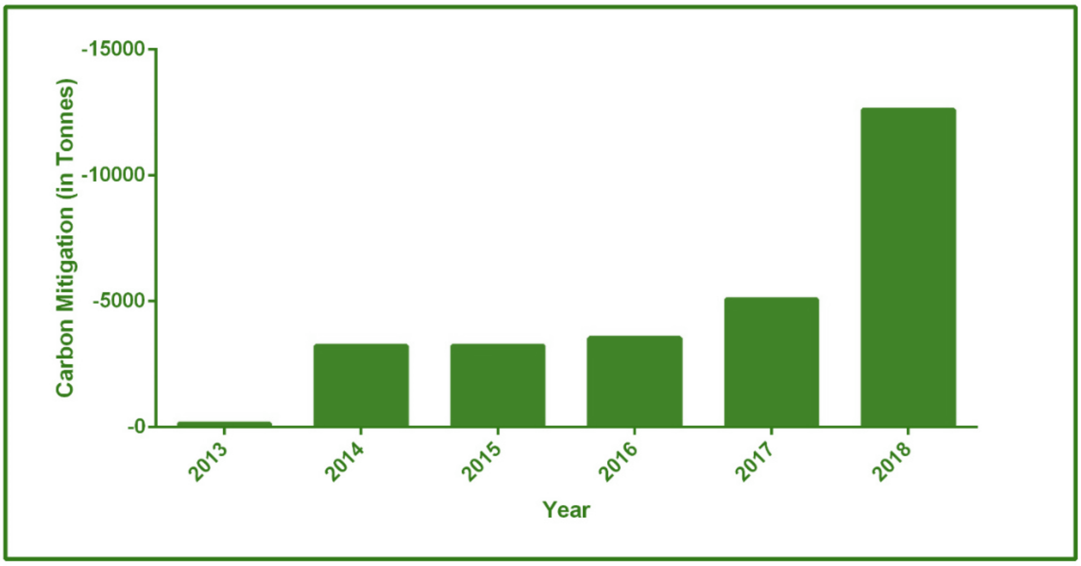

Figure 6: Carbon mitigation due to solar panel installation

By installing solar panels at SRMIST, we have mitigated 12k tons of carbon dioxide and which is equivalent to planting 20,190 teak trees over the lifetime

SOLAR STEAM GENERATORS

A solar steam generating system based on this technology comprises elliptically shaped parabolic solar concentrators arranged in pairs of sleeping and standing dishes in parallel modules, aligned in a perfect east-west direction. Receivers (heat exchangers painted black) are placed in the focus of each pair of dishes. SRM IST has implemented the Scheffler based system for the purpose of cooking application in the campus. The total system has 37 Nos of concentrators of each 16m2 area. The system was commissioned in February 2012 by M/s Thermax Limited, Pune. Prior to the implementation of the CST system our University was using LPG for cooking purpose. The system is integrated with CST & LPG.

The project is set up at a cost of Rs. 1.15 Crore Rupees with grant availed from MNRE of the order of Rs. 29.99 Lakh Rupees. (Subsidy excludes civil works cost). Above the receiver is a header pipe half-filled with water. Cold water enters the receiver through the inner pipe coming from the header. Solar rays falling onto the dishes are reflected and concentrated onto the receivers. Due to the high temperatures achieved, the water within the receiver is converted into steam.

The steam generated in the system is stored in the upper half (empty portion) of the header pipe, and if the steam is not drawn, the pressure of steam keeps on increasing. The steam is then drawn / sent to the kitchen for cooking food or to other units for a variety of applications including laundry, process heat, sterilization, air conditioning etc.

Configuration	: 37 Nos of scheffler dishes of 16 m^2 reflector area
Application	: Cooking
Year of Commissioning	: 2012
Steam Generation	: 1500 kg/day (maximum)
Operating Temperature	: 130°C to 140°C
Operating pressure	: 2.5 bar
System type	: Scheffler type solar parabolic concentrator
Location	: Hostel mess block, SRM IST, Chennai.
Total plant area	: 1800 m^2

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Figure 7 : Solar Steam Generators at SRMIST

A solar steam system comprising of 96 sq.m of dish area of this technology (6 dishes each of 16 sq. m) may generate around 150 to 200 kg of steam in a day depending on location, and various other features can save approximately 4,500 liters of diesel in a year.

Figure 8 : Solar Steam generator disk

SRM Institute of Science and Technology has installed solar powered lights, solar cooking system, Biogas plant, and a sewage treatment plant. From gardening to cooking, only non-conventional sources of energy are now being used in the Kattankulathur campus. The fundamental principle is the conversion of water into steam energy, i.e. converting the solar energy into steam energy. The water flows through the pipes and the solar dishes concentrate the solar power on the concentrators. In the concentrators, the water is converted into steam, and that steam is utilized for cooking.

A large portion of the LPG consumption has been reduced because of solar steam. As per the present performance report, monthly saving possible through LPG reduction is around Rs 2 lakhs. The payback period came around 5 years.


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UNDP
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Government of India
Ministry of New & Renewable Energy

CERTIFICATE OF MERIT

This **Certificate of Merit** is awarded to ***SRM University, Tamilnadu*** for using the largest Solar Steam Cooking System in the Institutional Sector during **2013-14** on the occasion of 2nd National Workshop on Solar Thermal Systems organized under UNDP-GEF project of the Ministry.

New Delhi
17th December, 2013

(Tarun Kapoor)
Joint Secretary, MNRE

Figure 9 : MNRE certificate for largest solar steam cooking system

Awarded for being the largest steam cooking system in the institutional sector during the year 2013 by MNRE, Govt. of India. Ministry of New and Renewable Energy, Govt. of India has awarded our SRM Institute for using the largest steam cooking system in the institutional sector. The prestigious award was received by Dean, School of Mechanical Engineering from the then Hon'ble Minister of New and Renewable Energy, Dr. Farooq Abdulla during a National Workshop on Solar Thermal Systems conducted by MNRE. The workshop and award ceremony was held at Hotel Ashok, New Delhi on 17th of December 2013. Various stakeholders of solar water heating systems and concentrating solar technologies attended the national workshop and award presentation ceremony.

Figure 10 : MNRE certificate for effective use of CST system for cooking

Awarded for effective utilization of the steam cooking plant by MNRE, Govt. of India during the excellence award 2016 held at New Delhi. Ministry of New and Renewable Energy, Govt. of India has awarded our SRM Institute for using the largest steam cooking system in the institutional sector. The prestigious award was received by Dean, School of Mechanical Engineering from the then Hon'ble Minister of Power, Shri Piyush Goyal during a National Workshop on Concentrating Solar Technologies and Solar Cookers. The workshop and award ceremony was held at Hotel Ashok, New Delhi on 29th of April 2016.The installation of this system not only serves the purpose of catering our 5000 students with solar food but also gives an added advantage for our engineering students to have hands on experience for working and experimenting on this technical marvel.

TABLE 4: SOLAR STEAM GENERATORS AND ITS REDUCTION IN LPG CYLINDERS

Year	LPG Cylinder Utilization (19 kg)	The capacity of Solar Steam Generator (converted in terms of number of cylinders each with 19 kgs)	% reduction in LPG cylinder
2012	9500	635	6.7 %
2013	10,800	1203	12.0 %
2014	11,600	746	7.0 %
2015	13,700	780	6.0 %
2016	15,300	679	5.0 %
2017	15,427	596	4.0 %
2018 (till June)	7399	314	5.0 %

TABLE 5: REDUCTION IN LPG DUE TO SOLAR STEAM GENERATOR

Year	Total LPG Utilization (KG/Year)	CO_2 Emission Due to LPG Utilization (in Tons)	Reduction in LPG due to Solar Steam Generator (in KG/Year)	% Reduction in CO_2 Emission
2012	180500	538	12065	6.68
2013	205200	612	22857	11.13
2014	220400	657	14174	6.43
2015	260300	776	14820	5.69
2016	290700	867	12901	4.43
2017	293113	874	11324	3.86
2018 (till June)	140581	419	5966	4.24

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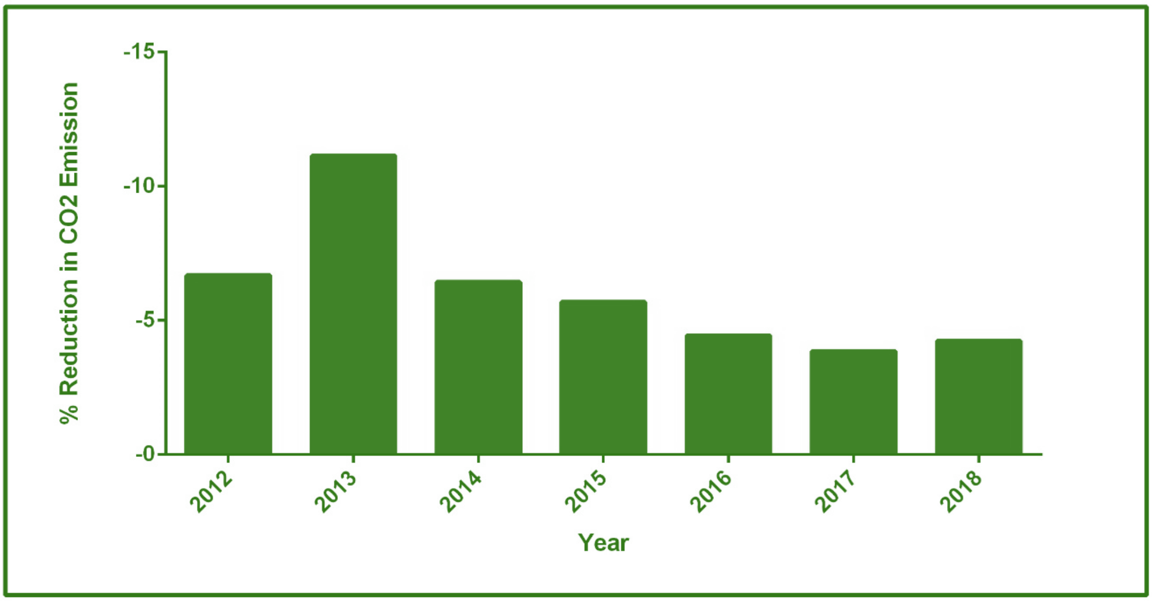

Figure 11: Reduction in Carbon Emission due to solar steam generators

CO²e
Carbon Mitigation

By installing solar steam generators at SRMIST, we have reduced the 5% of the total LPG consumption in the university hostels.

SOLAR WATER HEATERS

Solar water heating is one of the most common and cost-effective uses of solar energy. Solar heating systems, convert the heat energy from the sun into useful energy by heating water or any thermic fluid for use in multiple applications as given below. Solar water heating systems use collector panels to capture the sun's radiation and convert it into useful heat in the form of hot water. A solar collector coupled with solar water storage reduces the fuel needed. The heated liquid is stored in an insulated storage unit made of stainless steel or low carbon steel with glass lining or directly transferred to process during the daytime without storage. Solar hot water collectors heat water for washing, showers, and other domestic uses.

Figure 12: Solar Water Heaters at SRM Hostels

SRM Institute of Science and Technology set up solar steam generation plant over the Terrace of Sannasi U.G. mess hostel in 2012 and the steam energy generated is utilized for cooking foods for hostel students. The plant is successfully functioning between 2.30 p.m. to 5.00 p.m. daily.

TABLE 6: SOLAR WATER HEATERS INSTALLED AT SRMIST HOSTELS

Year	Electricity Utilization for Water Heaters (kW)	The capacity of Solar water heaters Installed (kW)	Place of Installation	% Reduction in Electricity Consumption
2012	2050	300	All Hostels	14.63
2013	2100	350	,,	16.67
2014	2500	334	,,	13.36
2015	2750	334	,,	12.15
2016	3000	334	,,	11.13
2017	3500	307	,,	8.77
2018 (till June)	3500	206	,,	5.89

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Figure 13 : Hot Water reservoir installed at SRM Hostel.

Figure 14 : Solar Water Heaters at SRM Medical College.

TABLE 7: SOLAR WATER HEATERS CARBON EMISSION MITIGATES AND ITS EQUIVALENT PLANTING

Year	Capacity (k.W)	Total Power Saving (kWh)	Financial Saving (in Lakhs)	Co_2 Emission Mitigated (in tons)	Equivalent to Planting
2012	300	450,000	36	9225	14,760
2013	350	525,000	42	10,763	17,220
2014	334	501,000	40.08	10,271	16,433
2015	334	501,000	40.08	10,271	16,433
2016	334	501,000	40.08	10,271	16,433
2017	307	460,500	36.84	9440	15,104
2018 (till June)	206	309,000	24.72	6335	10,135

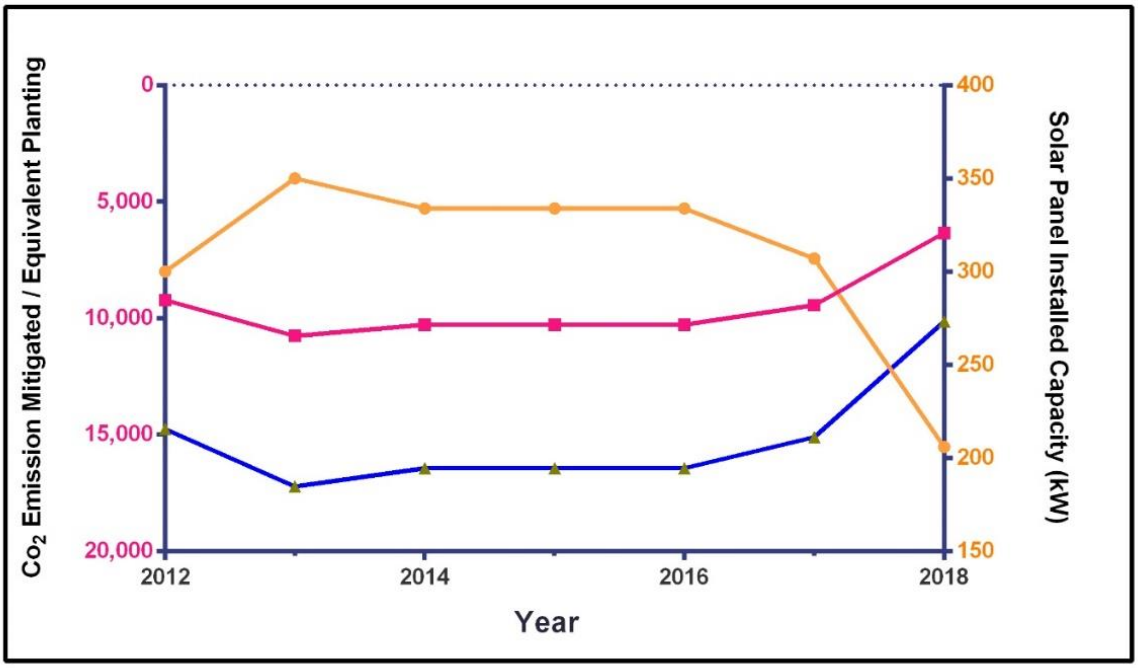

Figure 15 : Solar Water Heaters installed and its carbon mitigation at SRMIST

Reducing Carbon Emission

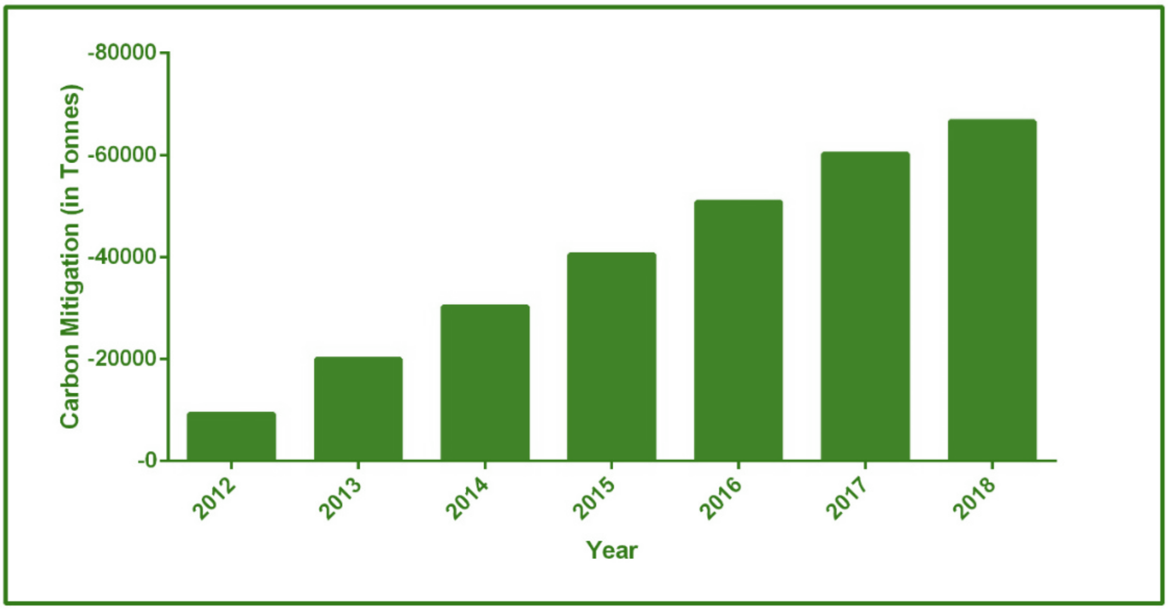

Figure 16 : Carbon Mitigation due to Solar Water Heaters

By installing solar water heaters at SRMIST, we have mitigated 66k tons of carbon dioxide and which is equivalent to planting 100k teak trees over the lifetime

BIOGAS PLANTS

The purpose of the project is to contribute to the reduction of carbon dioxide and methane emissions into the atmosphere through the promotion of the use of biogas for cooking instead of LPG. Five biogas plants have been constructed and are operational.

A prototype anaerobic model of 90 m^3 was developed for the study of biogas production and biogas manure from the mixed kitchen waste generated from SRM Institute of Science and Technology hostels. SRM hostels consist of 12 Block with four kitchens cooking food for more than 9000 students. It was estimated that an average food waste (cooked and uncooked) per person was 200 gm.

TABLE 8 : BIOGAS PLANT INSTALLED AT SRMIST

Year	The capacity of Biogas plant installed (in M^3)	The total capacity of installed Biogas plant (in M^3)	Biogas generated (in M^3)
2009	90	90	65
2010	0	90	68
2011	165	255	130
2012	0	255	145
2013	0	255	138
2014	0	255	155
2015	0	255	169
2016	150	405	321
2017	0	405	316
2018	0	405	355

The option available for management of this enormous kitchen waste was open land disposal and as animal feed. The reactor was filled with 2/3 rd of its capacity with mixed kitchen waste, cow dung and sewage in definite proportional. The retention period was maintained for 40 days. The study was mainly based on biogas manure quality which was produced after the digestion of kitchen waste. The biogas manure which produced by kitchen waste is good of fertilizer.

Food Waste Collected in SRM Hostels

Food Waste Collected in SRM Hostels

Processing of Food Waste

Processing of Food Waste

Figure 17 : Collection, Segregation and processing of food waste

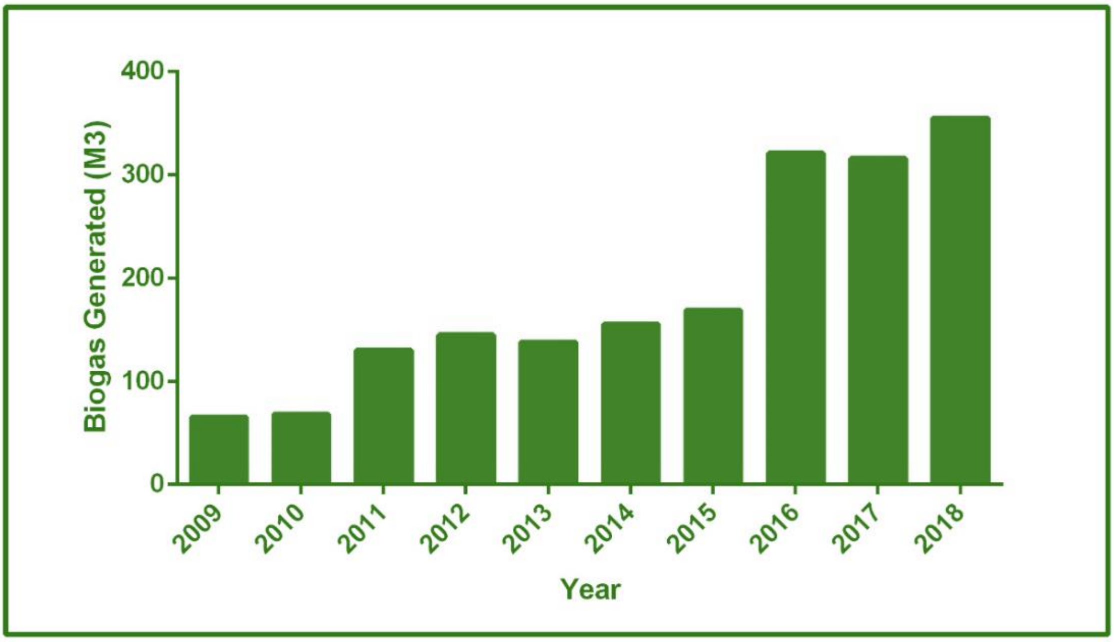

Figure 18: Biogas Generated from Food Waste

Sannasi Hostel Bio Gas Plant

Figure 18 : Biogas plant at Sannasi Hostel

Description and Specification

Location	=	Sannasi Hostel
Capacity	=	90 Cubie meter
Dia of Digestion Chamber	=	11.00 M
Depth of chamber	=	6.00 M
Structural walls	=	R.C.C Encased with Brick work.
Inlet chamber size	=	0.60 M X 0.60M
Outlet Chamber size	=	6.00 M X 6.50 M
Depth of outlet chamber	=	3.00 M
Feeding	=	Food Waste
Gas generated	=	Methane
Gas used by	=	Sannasi hostel mess
Year of commissioning	=	2009

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Medical Bio Gas Plant No.01

Figure 19 : Biogas plant at Nursing College

Description and Specification

Location	=	Nursing College
Capacity	=	90 Cubie meter
Dia of Digestion chamber	=	7.00 M
Depth of chamber	=	5.00 M
Structural walls	=	R.C.C Encased with Brick work.
Inlet chamber size	=	0.75 M X 0.75M
Outlet chamber size	=	5.50 M X 5.00 M
Depth ofoutlet chamber	=	3.00 M
Feeding	=	Food waste
Gas generated	=	Methane
Gas used by	=	Nursing Ladies Hostel
Year of commissioning	=	2011

Medical Bio Gas Plant No.02

Figure 20 : Biogas plant at Nursing College -2

Description and Specification

Location	=	Nursing College-2
Capacity	=	75 M^3
Dia of Digestion Chamber	=	4.50 M
Depth of chamber	=	5.00 M
Structural Walls	=	R.C.C Encased with Brick work.
Inlet chamber size	=	0.75 M X 0.75M
Outlet chamber size	=	5.50 M X 3.60 M
Depth of outlet chamber	=	3.00 M
Feeding	=	Food waste
Gas generated	=	Methane
Gas used by	=	Nursing ladies hostel
Year of commissioning	=	2011

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Bio Gas Plant behind Manoranjitham hostel

Figure 21 : Biogas plant at Manoranjitham Block

Description and Specification

Capacity	=	75 M^3
Dia of Digestion chamber	=	6.00 M
The depth of digestion chamber	=	5.00 M
Structural walls	=	R.C.C Encased with Brickwork.
Inlet chamber size	=	0.90 M X 0.90 M
Outlet chamber size	=	4.20 M X 4.20 M
Depth of outlet chamber	=	2.10 M
Feeding	=	Food Waste
Gas generated	=	Methane (Cooking Gas)
Gas to be used by	=	Agasthiyar mess
Year of construction	=	2016

Bio Gas Plant–Shenbagam hostel

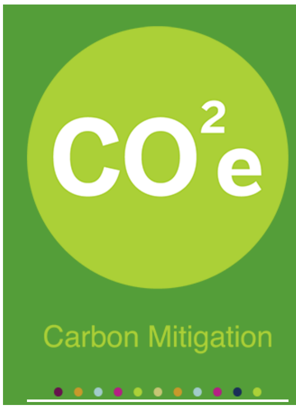
Figure 22 : Biogas plant at Shenbagam hostel

Description and Specification

Capacity	=	75 M^3
Dia of Digestion chamber	=	7.20 M
Depth of digestion chamber	=	4.50 M
Structural walls	=	R.C.C Encased with Brick work.
Inlet chamber size	=	0.60 M X 0.70 M
Outlet chamber size	=	5.00 M X 4.00 M
Depth of outlet chamber	=	2.10 M
Feeding	=	Food Waste
Gas generated	=	Methane (Cooking Gas)
Gas to be used by	=	Shenbagam hostel mess
Year of construction	=	2016

TABLE 9 : DETAILS OF THE BIOGAS PLANT

Year	Location	Capacity	Dia of digestion chamber (in M)	Depth of chamber	Structural walls	Inlet chamber size	Outlet Chamber size	The depth of outlet chamber (in M)	Feeding	Gas generated
2009	Sannasi Hostel	90	11	6.0	R.C.C Encased with Brickwork.	0.60 M X 0.60M	6.00 M X 6.50 M	3.0	Food Waste	Methane
2011	Medical Bio Gas Plant No.01	90	7	5.0		0.75 M X 0.75M	5.50 M X 5.00 M	3.0		
	Medical Bio Gas Plant No.02	75	4.5	5.0		0.75 M X 0.75M	5.50 M X 3.60 M	3.0		
2016	Manoranjitham hostel	75	6.0	5.0		0.90 M X 0.90 M	4.20 M X 4.20 M	2.1		
	Shenbagam hostel	75	7.2	4.5		0.60 M X 0.70 M	5.00 M X 4.00 M	2.1		



By installing Biogas at SRMIST, in 2018 we have generated 355 m^3 of Biogas our goal is to generate 500 m3 of biogas by the year 2022

REPLACING CFL LAMPS WITH LED

LEDs are well known for their efficiency, which translates to energy savings for the consumer energy savings for the consumer. Nevertheless, they have many other characteristics that make them the best choice from a sustainability perspective too. The replacement of these lights is part of a more significant energy saving initiative that also includes the retrofitting of interior light fixtures with more efficient bulbs across campus to create a unified standard of lighting. All the compact fluorescent (CFL) bulbs are planned to be replaced with LED's

Figure 23 : LED Solar Street Lamps at SRMIST

Figure 24 : 2x2 Drop Ceiling LED Light Fixtures

TABLE 10 : YEAR WISE LED LIGHT REPLACEMENT AT SRMIST

Year	Total CFL Lamps Installed	Replaced LED Lights	Power Utilized for CFL Maps (in KW)	% Reduction	Reduction in Carbon Emission (in Tons)
2013	15,400	1500	616	4	756
2014	13,900	1500	556	10	1891
2015	12,400	1500	496	16	3025
2016	10,900	1500	436	25	4727
2017	9400	1500	376	36	6807
2018	7900	1500	316	51	9644

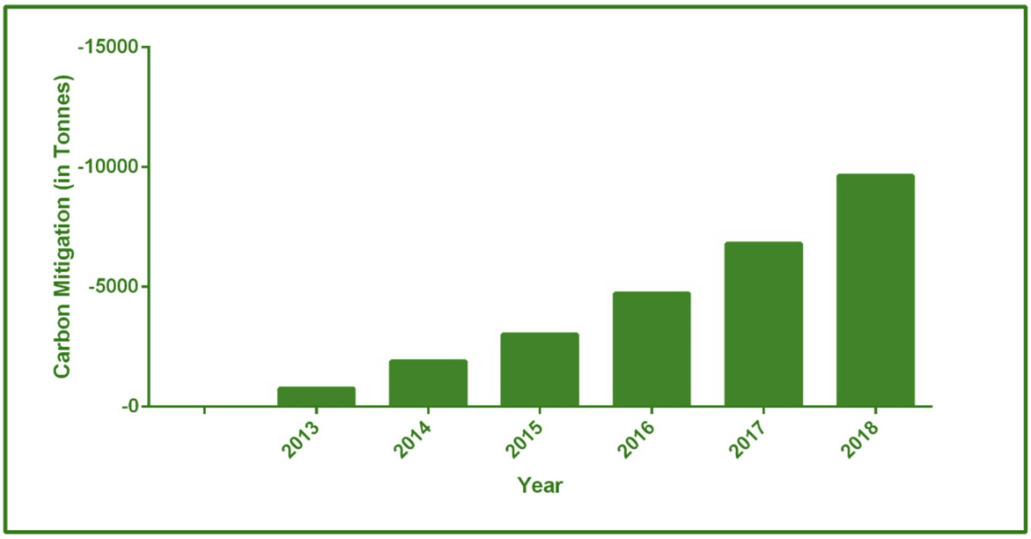


Figure 25: Carbon Mitigation due to the replacement of CFL to LED Lamps

By replacing the CFL lamps with LED lamps at SRMIST, we have mitigated 26k tons of carbon dioxide from the base year 2012

PASSIVE INFRARED MOTION SENSOR FOR LIGHTS

To optimize energy savings further, PIR (passive infrared) motion sensors are used in the faculty of engineering and technology, so the lights only operate when the presence of people is detected. The built-in Passive Infrared (PIR) Motion Sensor turns on the connected lighting system when it detects motion in its coverage area. You can reduce your electricity bills by using PIR Motion Sensors & Occupancy Sensors.

Figure 26 : Passive infrared Motion Sensors

GUIDE TO ENERGY SAVING IN THE OFFICE

- Encourage staff to adopt energy efficient behaviors;
- Schedule regular maintenance sessions, including reporting broken equipment;
- Turn off non-essential equipment at mains;
- Install timers on equipment like photocopiers, printers and scanners;
- Turn monitor screens off when not in use (few minutes and end of the day);
- Avoid unnecessary lighting, like in an unoccupied room or when there is sufficient sunlight;
- Make sure lights are switched off at the end of the day;
- Light personal desks/working space rather than the whole room where possible.