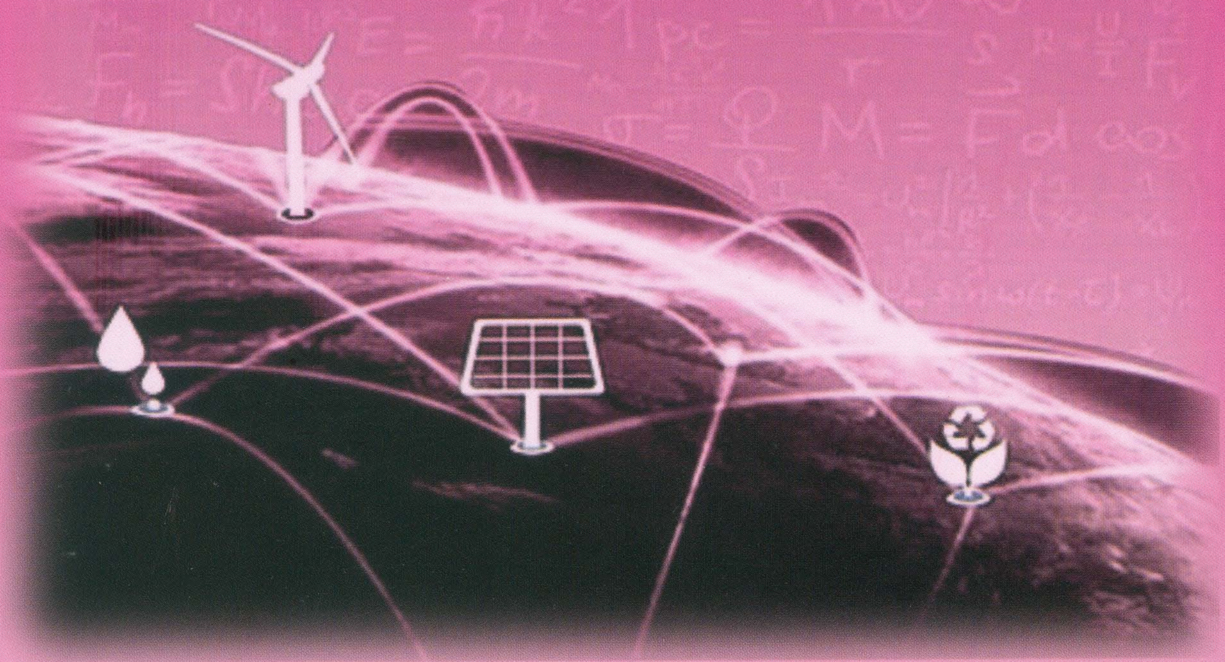
Physik

2013-2014



STELLA MARIS COLLEGE

DEPARTMENT OF PHYSICS

Funded by the Department of Biotechnology (Star College Scheme)

Ministry of Science and Technology, Govt. of India.

DEPARTMENT OF PHYSICS - STAFF

STUDENT EDITORS

TRUTH CHARITY

STELLA MARIS COLLEGE

(AUTONOMOUS), CHENNAI - INDIA

DEPARTMENT OF PHYSICS

Physik

2013-2014

FUNDED BY THE DEPARTMENT OF BIOTECHNOLOGY (STAR COLLEGE SCHEME)

MINISTRY OF SCIENCE AND TECHNOLOGY, GOVT. OF INDIA

Stella Maris College has always encouraged creative programmes and has endeavoured to keep pace with advances in the technological field. This year's magazine of the Department of Physics, 'Physik', is one such attempt to create awareness on the various possibilities that exist for 'renewable energy', such as solar, wind, biomass, nuclear and geothermal energy. With the fast depleting resources of fossil fuel, we need to explore and utilize renewable sources of energy that will lead to sustainable development. Our energy consumption is on the rise with the increasing use of electronic equipment. All over the world there is a growing awareness of the need for renewable energy and I am glad the students of the department of Physics are keeping pace with the global trend.

The faculty and students have also engaged in an energy audit that was conducted on campus and have detailed the usage of power in the various buildings. This has enabled the college to install solar panels to generate power, accounting for some part of our total energy consumption.

My congratulations to the faculty and the students of the Department of Physics in bringing out this publication. I wish the magazine all success.

Dr. Sr. Jasintha Quadras, fmm
Principal

STELLA MARIS COLLEGE
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CHENNAI - 600 086.

Foreword

I am extremely happy to go through the magazine prepared by the students of the Department of Physics titled 'Physik'. The theme 'renewable energy' is very relevant since it is the need of the hour. They have included articles on solar and wind energy, biomass and tidal energy. All the articles are of good quality and I am sure that the students have done a lot of study on the subject.

I congratulate them for their good work.

In fact the staff and students of the Physics Department were involved in the energy audit of the college prior to the installation of the solar panels for the purpose of tapping solar energy. Even now a group of students continue to monitor daily the flow of solar energy in the campus, under the direction of Sr. Nirmala and other staff.

Congratulations to the editorial board students and the staff adviser. I wish the students all the very best in their future career.

Sr. Susan Matheikal, fmm
Secretary

February 26, 2014

The Department of Physics publishes its magazine **PHYSIK** every year. This year the theme chosen was Renewable Energy. This magazine is the team work of students. The articles written by students are informative and futuristic.

The Department of Physics thanks DBT, Ministry of Science and Technology in helping to publish this magazine.

Dr. K. H. Rajini

Head, Department of Physics

EDITORS' DESK

"The more that you read, the more things you will know; the more that you learn, the more places you will go"

Yes…..to quench your thirst for knowledge we bring to you PHYSIK an annual publication by the Department of Physics, Stella Maris College.

As the world is marching towards the verge of depleting its natural resources, switching over to other sources of energy is the need of the hour. Indeed the only solution to this energy crisis is by tapping the renewable resources. We only hold the stewardship of these resources in our hands. So, as the runners of this marathon, it lies in our hands to awaken the world.

On behalf of the Department of Physics, Stella Maris College, the Editorial Board takes immense pleasure to thank our Principal Dr. Sr. Jasintha Quadras, fmm and Secretary of the College, Rev. Sr. Susan Matheikal, fmm for their encouragement and blessings. We also extend our gratitude to the Head of the Department, Dr. K.H. Rajini and all the faculty members for their guidance and support. We also thank Rev. Sr. Nirmala, fmm, Faculty of the Department of Physics for her constant help in bringing out this magazine.

We hereby present to you the 9th edition of PHYSIK. We hope you enjoy reading it, as much as we did, putting it together.

Belinda Damian

Christy Preetha. A

Kiruthika. M.A

Sadhana. B

Sivapriya Janani.A.R

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Our sincere thanks to Catherine Priya S and Prasanna T for helping us in designing the cover page.

RENEWABLE ENERGY

Renewable energy is energy that is generated from natural processes that are continuously replenished. This includes sunlight, geothermal heat, wind, tides, water, and various forms of biomass. This energy cannot be exhausted and is constantly renewed. To meet the Energy Crisis need has risen to strengthen the energy scenario. It is required that we depend on the Renewable Energy.

Renewable energy is more appropriate as the resources are diffused and decentralized

- The demand for energy in the country has been growing rapidly
- The current trends indicate clearly that the country would be facing constraints in indigenous availability of conventional energy resources.
- Inability of the conventional systems to meet growing energy demands in an equitable and sustainable manner.
- Need to efficiently and economically meet the energy needs of all the citizens, particularly the rural poor.
- In today's environment, there is a need for a broad variety of resource options:
    - Ranging from conventional fossil alternatives to renewable (low-risk) energy ones
    - Renewables have minimal operating cost risk
- India has abundant renewable energy resources, which can contribute towards reduction in dependency on imported fossil fuels.
    - Renewables assume special significance in India considering its geographic diversity and size, not to mention the size of its rural economy.
- India is endowed with good renewable energy resources like solar, wind, and biomass

- Even at village level, use of locally available resources is preferable than using fuels transported from the far-flung areas.

Different types of Renewable Energy available are:

BIOMASS: Biomass is a renewable energy source made of biological material from living, or recently living organisms. Energy is released by combustion (burning).

Advantages

- Produces less pollution than fossil fuels.
- Does not cause acid rain.
- Can be found locally.

Disadvantages

- Inefficient (only 30% efficiency).
- Releases harmful solid carbon particles into the atmosphere

NUCLEAR: Radiation is released from the nuclei of metal atoms. The radiation can be used to generate electricity.

Advantages

- Green House gases are not made.
- Only a small amount of fuel is needed to create a lot of energy.

Disadvantages

- Harmful radioactive waste is created.
- Uranium supplies may only last for another 50 years.
- Radiation may cause cancer

WIND: Wind turbines are used to generate electricity from the wind. The wind turns the large blades and the blades turn a generator.

Advantages

- Wind is renewable.
- Wind is free.
- No greenhouse gases are made.
- There are few safety risks.

Disadvantages

- Lots of wind turbines are needed to produce enough power.
- Turbines can only be put in windy areas.
- It is not always windy.

SOLAR: Solar power uses energy from the Sun. Solar panels are used to generate electrical energy

Advantages

- The energy from the Sun is free.
- The sun does not produce greenhouse gases.
- The sun will always be there during our lifetime

Disadvantages

- Solar panels are expensive.
- When it is cloudy or at night there is not enough light.

GEOTHERMAL: Rocks under the ground are hot. Water can be pumped through these hot rocks and warmed up.

Advantages

- Geothermal energy does not produce greenhouse gases.
- The energy source is free and will not run out

Disadvantages

- There are not many places where we can build geothermal power stations.
- Harmful gases and minerals may occasionally come up from the ground below.

HYDRO: Flowing water is used to turn a turbine which generates electricity.

Advantages

- When the electricity is generated, no greenhouse gases are made.
- The water used is free.

Disadvantages

- The dam is expensive to build.
- By building a dam, the nearby area has to be flooded and this could affect nearby habitats.
- If it does not rain much we may not have enough water to turn the turbines.

WAVE: Waves force air in and out of a chamber. The air causes a turbine to generate electricity.

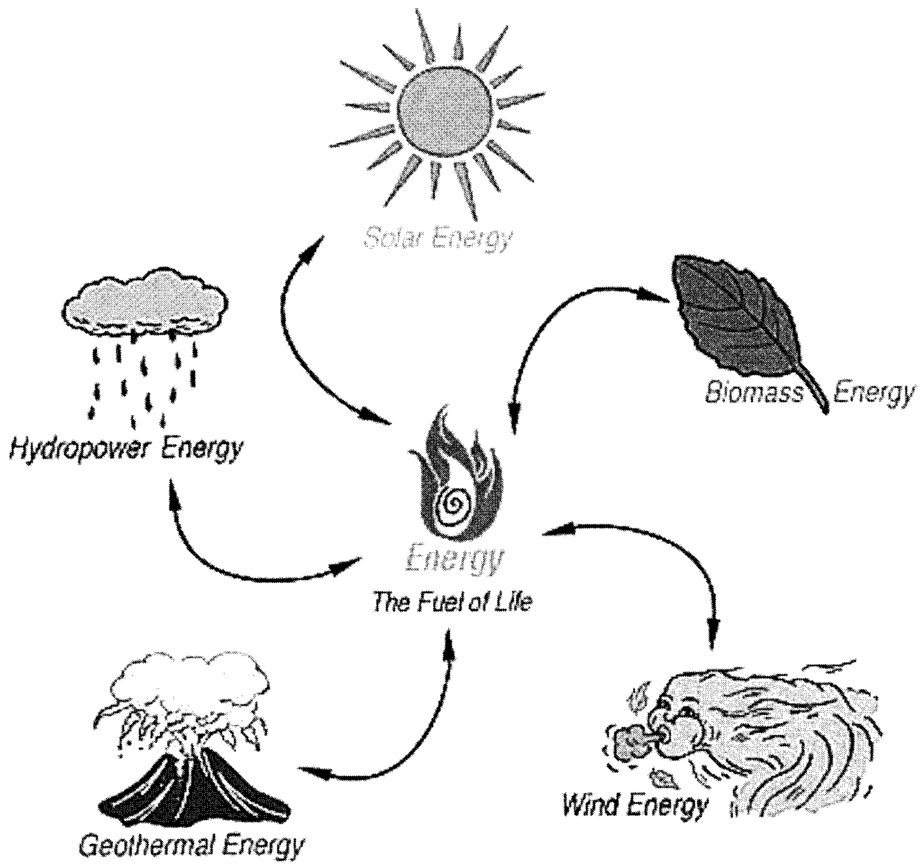
Advantages

- Waves are free and will not run out.
- Wave power does not produce greenhouse gases.
- There are very few safety risks.

Disadvantages

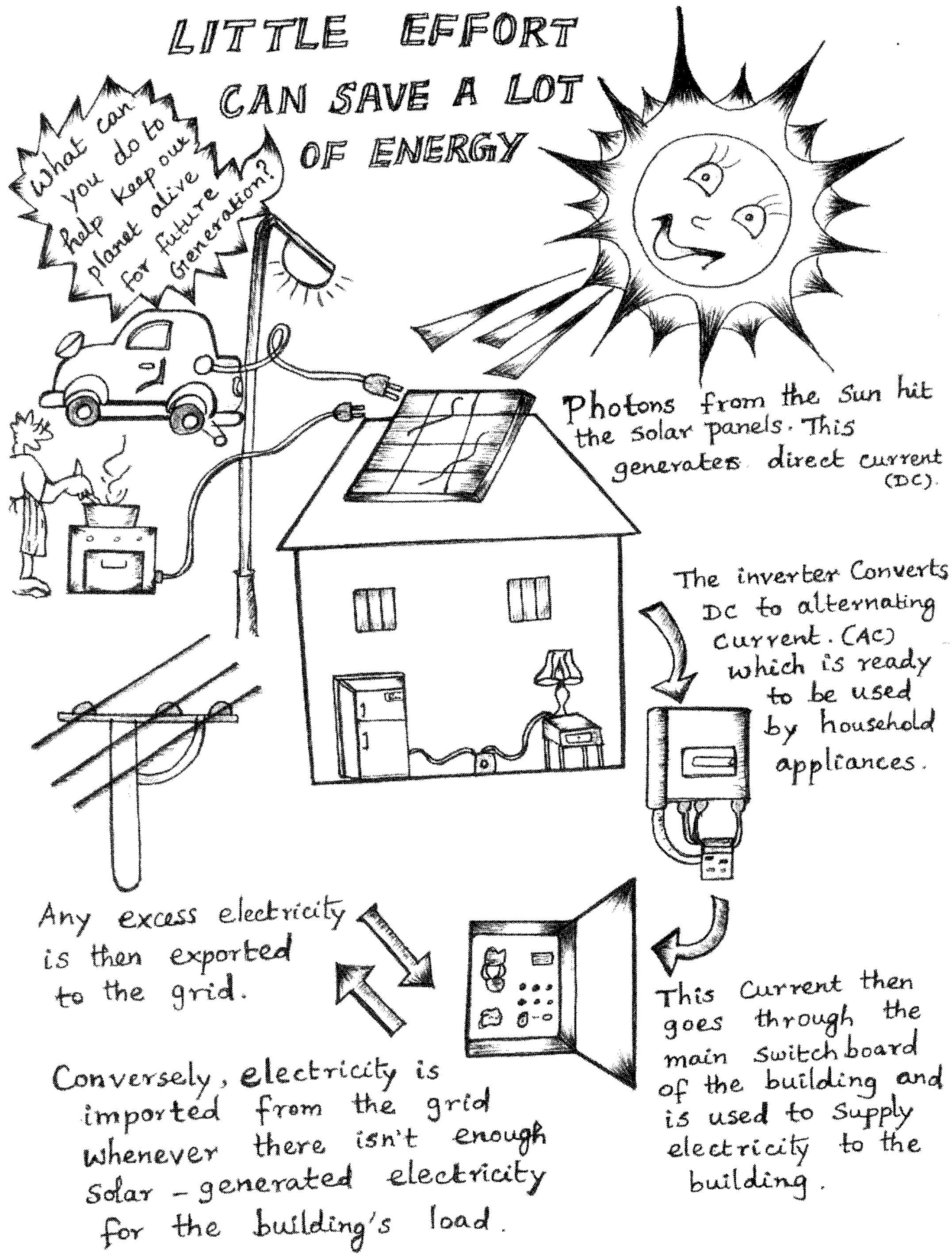
- Small waves generate small amounts of electricity.
- Electricity needs to be transported from the sea onto the land.
- The equipment is expensive

Renewable energy accounts for approximately 12% of a total 200 GW of power generation capacity installed in India.



Dr. K. H. Rajini

Head, Department of Physics.



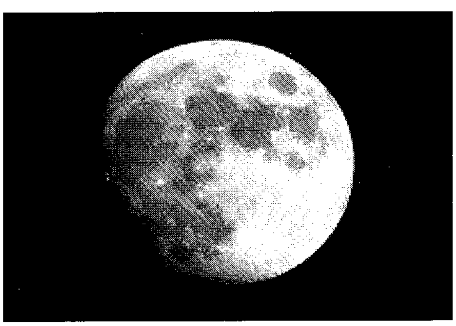
Sr. Vinodha C

III Year Physics

SOLAR POWER FROM MOON

Solar power is clean, abundant and becoming cheaper and more efficient all the time. Unfortunately, the sun isn't always there when you need it—like when it's cloudy, or it's raining, or, it's night time but as the world's population continues to grow, the need for low-cost, sustainable sources of energy grows along with it.

Scientists say that the answer to this dilemma might be found in space. They say building solar power stations on the moon could be a way to fulfil the energy needs of the whole world. It could provide a clean, emission-free, and unlimited source of energy and it could supply all needs of an energy-hungry world in the 21st century and beyond .We think of beaming power from the moon as exotic, but it have been done for at least 15 years.



The reason to collect solar power on moon is that all the factors that make life impossible on the moon (no atmosphere, wind, rain, fog, clouds, or weather of any kind) make it an ideal place to collect solar energy. The moon is exposed to sunlight constantly, except briefly during a rare lunar eclipse. If that energy could be harnessed and sent back to earth in microwave form, it could supply energy far more efficiently than solar panels in even the driest earth desert.

A Lunar Solar Power System (LSP) can be built using lunar materials to build bases on the moon to collect solar energy and convert it to low intensity microwaves, which would be beamed to a several thousand receivers around Earth. The microwaves would then be converted into electricity to be fed into local power grids. The proposed LSP System would consist of between 20 and 40 power bases located on the eastern and western edge of the moon, as seen from Earth.

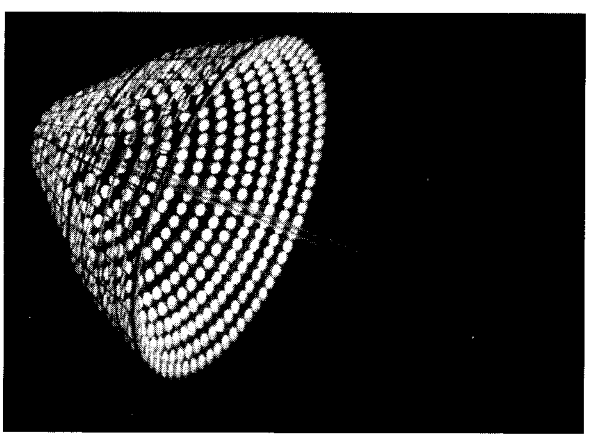
Though many other scientists says that this project will need a lot of people up there and which will be very costly, the scientist who proposed this, argues that in the long run, it will be cheaper than the power we use now. And it will definitely take some creative thinking to meet the world's energy demand of 20 terawatts (the amount of energy used by 200 billion bright light bulbs) by 2050 and also most of the necessary materials can actually be extracted from the lunar landscape, with help from some start-up equipment and supplementary supplies. (Analyses revealed an abundance of silicon, magnesium, aluminium, and titanium—the basic material required for building solar cells)

Thus the Lunar Solar Power project would not be a simple undertaking, but the technological knowledge is available to pull it off.

Shanthini.I

III Year Physics

SPACE SOLAR



Scientists around the world says harvesting sun's energy in space can turn out to be cost effective way of delivering the world's need of power in as little as 30 years. This is done by building up a satellite that could collect energy from the sun and beam it back down to the Earth, which is then added to the electrical grid.

Several groups of scientist across the world dreamed of building such a satellite over several decades, but no one came up with a design with all the constraints until last summer.

John Mankins, a NASA engineer, put forth this idea in reality. This idea is a bio-mimetic approach, meaning it is based on a way something in nature goes about handling a similar situation. His idea is this: there is something like flowers whose petals collect the solar energy and reflects into Earth. These petals are built up of an array of small mirrors that would direct the solar rays to solar cells and this energy is then converted to microwaves. These microwaves are collected in the receiving station on Earth, where electricity (about tens of thousands of megawatts) would be generated from the energy of microwaves. The mirrors and solar cells should be small and lightweight so that they could be easily transported into space using conventional transport vehicles.

Thin filmed mirrors are used to reduce weight which would be curved to take maximum advantage of the sunlight it takes. Also the satellite would sit far enough away from the planet Earth so that it would never be in the dark, allowing for a constant stream of microwaves.

NASA is working on the cheaper version of this project which will orbit closer to earth. It works out well; full-scale satellite would be built and sent up, which would, perhaps become a game changing theory of energy production.

It is said that, this idea could double amount of solar power collected, compared with the amount of earth-bound technology. Another advantage is that, space solar power can occur without worry about adverse weather conditions and cost of energy storage. Nevertheless, some resources point out the hurdles such as space debris, a lack of focused market studies and development costs.

Ashwini. K

III Year Physics

A NOUVELLE ENTRANT TO THE SOLAR WORLD

Researchers have discovered that a material can bring down the cost of solar power, which are twice as efficient as that of the best solar cells in market today. Though the material was known for about a century, no one ever thought of making solar cells out of them, until relatively recently. These materials are nothing but compounds called perovskites, which have a particular crystalline structure.

The perovskite material has properties that could lead to solar cells capable of converting 15% of the energy in sunlight directly into electricity. Although the potential of the material has not yet been understood completely, it has caught the attention of the world's leading solar researchers and several companies are already working to commercialize it.

Unlike the conventional solar cell materials, the new material doesn't require an electric field to produce an electrical current, which reduces the raw material needed and produces higher voltages, which can help increase power output. Though there are other materials that can produce current without the aid of an electric field, perovskite is the only one to also respond well to visible light, making it relevant for solar cells.

It has also been showed that it is relatively easy to modify the material so that it efficiently converts different wavelengths of light into electricity. It is possible to form a solar cell with different layers, each designed for a specific part of the solar spectrum. This could greatly improve the efficiency of these solar cells.

Perovskite solar cells can be made by spreading the pigment on a sheet of glass or metal foil, along with a few other layers of material that facilitate the movement of electrons through the cell. When perovskites were first tried in solar cells in 2009, they only converted about 3.5 percent of the energy in sunlight into electricity. The cells also didn't last very long, since a liquid electrolyte dissolved the perovskite. Later in 2012 a couple of technical innovations led to replace a liquid electrolyte with solid materials which could produce ever-more-efficient solar cells.

These high efficiency perovskite solar cells may cut down half the number of solar cells needed to produce the same power, thereby greatly reducing the installation charges. It is believed that the perovskite based technology could lead to solar panels that cost just 10 to 20 cents per watt while the solar panels now typically cost about 75 cents a watt.

It might be possible to paint perovskites onto conventional silicon solar cells to improve their efficiency, and thereby lowering the overall cost per watt rather than replacing the silicon solar cells. This might be an easier way to break into the solar market than trying to introduce an entirely new kind of solar cell.

Researchers are making new perovskites using combinations of elements and molecules not seen in nature; many researchers see the materials as the next great hope for making solar power cheap enough to compete with fossil fuels.

Michael McGehee, a materials science and engineering professor at Stanford University, recently wrote, "The fact that multiple teams are making such rapid progress suggests that the perovskites have extraordinary potential, and might elevate the solar cell industry to new heights."

But the cells in general have key challenges to overcome before they come to market. For example, the highest efficiency perovskite materials so far aren't durable enough. Another challenge it will have to face may be due to the small amount of lead that the material includes, which is toxic. Tests will be needed to show the toxicity of the perovskite material. Steps should also be taken to ensure that the solar cells are collected and recycled to prevent the materials from getting into the environment.

Alice Gnana Francita

III Year Physics

MATERIALS THAT COULD MAKE SOLAR POWER "DIRT CHEAP"

A material described in nature could help lead the way to high efficiency, inexpensive solar cell. When sophisticated technological and scientific advancement are made, the very next step scientist adopt is to make them cheap and affordable by the common men. It holds good in every field of science.

Even in the field of solar power there are numerous experiments occurring to find out techniques which could be applied to make solar power both cost effective and reliably effective. The cumulative world PV installation reached around **100GWp** (giga watts) by the end of **2012** some **85%** use crystalline Si with the rest being poly crystalline thin film cells mostly cadmium telluride /cadmium sulphide ones. In this thin film cells tend to be cheaper to make with a shorter energy payback time.

A new solar cell material called the perovskite has properties that might lead to cells which are twice as efficiency as the best on the market today. This new comer of the PV field is based on organic-inorganic pervoskite structured semiconductors [perovskite structure: the compounds having some crystal structure as $CaTiO3$]

What are perovskite?

Perovskite is a calcium-titanium oxide mineral species composed of calcium titanium with chemical formula **CaTiO3**. This mineral was discovered in Ural Mountain of Russia by Gustav Rose in **1839** and named after the Russian mineralogist '**Lev Perovski'.**

The researcher haven't yet demonstrated a high efficiency solar cell based on the material but their works adder to a growing body of evidence suggesting that perovskite material could change the face of solar power. Researches are making new perovskite using combination of elements and molecules not even in nature. Many researchers see the material as the next great hope for making solar power cheap enough to complete with fossil fuels.

Pervoskite base solar cells have been improving at a remarkable pace. It took a decade or more for the major solar cell material used today silicon and cadmium telluride to reach efficiency levels that have been demonstrated with perovskite in just four years. The rapid success of the material has when impressed the veteran solar researchers.

The perovskite material described in nature has properties that could lead to solar cells capable of converting over half the energy in sunlight directly into electricity. That is more than twice as efficiency could cut in half the number of solar cells needed to produce a given amount of power. Besides reducing the cost of solar panels, this would greatly reduce installation cost.

Unlike conventional solar cells material the new material does not require an electric field to produce an electric current. This reduces the amount of material needed and produces higher voltage which can help increase power output. They also are the first to respond well to visible light making it relevant for solar cells.

They also showed that it is relatively easy to modify the material so that it efficiency converts different wavelength of light into electricity. It could be possible to form a solar cell with different layers each designed for a scientific part of the solar spectrum, something that could greatly improve the efficiency compared to conventional solar cells.

While perovskite remain a promising solar material they also have to overcome general key challenges like less durability etc. before they come to the market. According to Ramamoorthy Ramesh Professor at Berkeley says about perovskite,

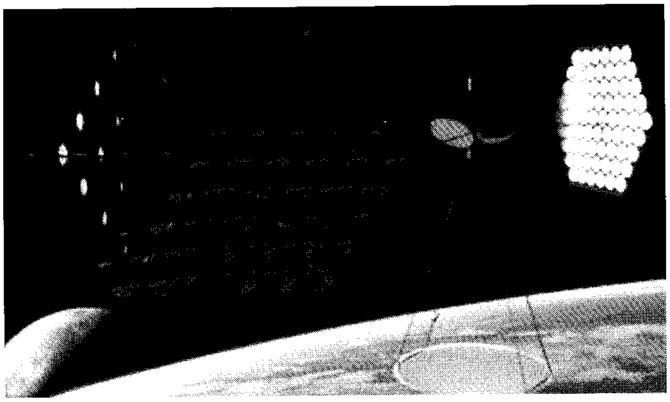
"This is nice, but really early stage. To make a solar cell a lot of other things are needed".

Sabitha Ann Jose

III Year Physics

SPACE SOLAR ENERGY

The world needs to find new sources of clean energy. Space Solar Power gathers energy from sunlight in space and transmits it wirelessly to Earth. Space solar power can solve our energy and greenhouse gas emissions problems. Not just help, not just take a step in the right direction, but solve. Space solar power can provide large quantities of energy to each and every person on Earth with very little environmental impact. The solar energy available in space is literally billions of times greater than we use today. The lifetime of the sun is an estimated 4-5 billion years, making space solar power a truly long-term energy solution. As Earth receives only one part in 2.3 billion of the Sun's output, space solar power is by far the largest potential energy source available, dwarfing all others combined.



Solar energy is routinely used on nearly all spacecraft today. This technology on a larger scale, combined with already demonstrated wireless power transmission can supply nearly all the electrical needs of our planet. Another need is to move away from fossil fuels for our transportation system. While electricity powers few vehicles today, hybrids will soon evolve into plug-in hybrids which can use electric energy from the grid. As batteries, super-capacitors, and fuel cells improve, the gasoline engine will gradually play a smaller and smaller role in transportation — but only if we can generate the enormous quantities of electrical energy we need. It doesn't help to remove fossil fuels from vehicles if you just turn around and use fossil fuels again to generate the electricity to power those vehicles. Space solar power can provide the needed clean power for any future electric transportation system. While all viable energy options should be pursued with vigor, space solar power has a number of substantial advantages over other energy sources. Current launch vehicles are too expensive, and at high launch rates may pose atmospheric pollution problems of their own. Cheaper, cleaner launch vehicles are needed. To gather massive quantities of energy, solar power satellites must be large, far larger than the International Space Station (ISS), the largest spacecraft built to date. Fortunately, solar power satellites will be simpler than the ISS as they will consist of many identical parts. A relatively small effort is also necessary to assess how to best transmit power from satellites to the Earth's surface with minimal environmental impact. Space solar power will not require dependence on unstable or hostile foreign oil providers to meet energy needs, enabling us to expend resources in other ways. It can be exported to virtually any place in the world, and its energy can be converted for local needs — such as manufacture of methanol for use in places like rural India where there are no electric power grid also be used for desalination of sea water. Space solar power can take advantage of our current and historic investment in aerospace expertise to expand employment opportunities in solving the difficult problems of energy security and climate change. It can provide a market large enough to develop the low-cost space transportation system that is required for its deployment. This, in turn, will also bring the resources of the solar system within economic reach.

Immaculate Nancy Mary

III Year Physics

NEW HEAT-RESISTANT MATERIALS COULD IMPROVE SOLAR CELL EFFICIENCY

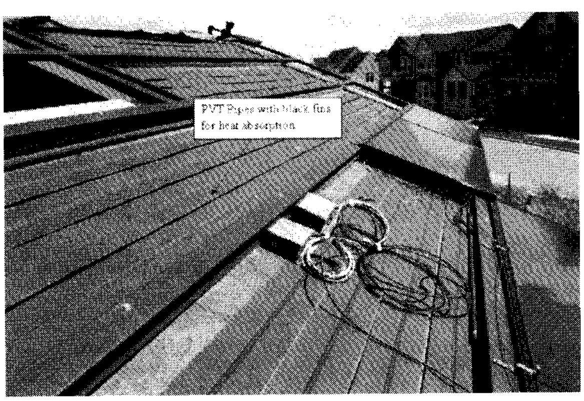
Scientists have created a heat-resistant thermal emitter that could significantly improve the efficiency of solar cells. The novel component is designed to convert heat from the sun into infrared light, which can then be absorbed by solar cells to make electricity—a technology known as thermo photo-voltaics. Unlike earlier prototypes that fell apart at temperatures below 2,200 F (1,200 C), the new thermal emitter remains stable at temperatures as high as 2,500 F (1,400 C). A typical solar cell has a silicon semiconductor that absorbs sunlight directly and converts it into electrical energy. But silicon semiconductors only respond to infrared light. Higher-energy light waves, including most of the visible light spectrum, are wasted as heat, while lower-energy waves simply pass through the solar panel. Conventional single-junction solar cells can only achieve an efficiency level of about 34%, but in practice they don't achieve that, that's because they throw away the majority of the sun's energy. Thermo photovoltaic devices are designed to overcome that limitation. Instead of sending sunlight directly to the solar cell, thermo photovoltaic systems have an intermediate component that consists of two parts: an absorber that heats up when exposed to sunlight, and an emitter that converts the heat to infrared light, which is then beamed to the solar cell. Essentially, we tailor the light to shorter wavelengths that are ideal for driving a solar cell that raises the theoretical efficiency of the cell to 80 percent, which is quite remarkable.

So far, thermo photovoltaic systems have only achieved an efficiency level of about 8%.The poor performance is largely due to problems with the intermediate component, which is typically made of tungsten—an abundant material also used in conventional light bulbs. Scientists coated tungsten emitters in a nano layer of a ceramic material called hafnium dioxide. It increased the efficiency of the system.

Jeevitha. T

III Year Physics

PHOTOVOLTAIC EFFICIENCY: THE TEMPERATURE EFFECT



The current and voltage output of a PV panel is affected by changing weather conditions, so it is important to characterize the response of the system to these changes such that the equipment associated with the PV panel can be sized appropriately. The average operating voltage and current of a PV system is important to consider for safety concerns, equipment capabilities and choices and minimizing the amount of wire required for construction. Using weather data, including historical temperature and solar irradiation information, engineers estimate how much energy a PV power plant might generate over its lifetime.

Have you ever noticed how an LCD display, such as your calculator or cell phone screen, changes color when exposed to extreme cold or hot temperatures? Temperature affects how electricity flows through an electrical circuit by changing the speed at which the electrons travel. This is due to an increase in resistance of the circuit that results from an increase in temperature. Likewise, resistance is decreased with decreasing temperatures.

Solar panels work best in a cold and sunny climate, but since the weather is always changing, most panels do not operating under ideal conditions. In some cases, they design cooling systems to keep the panels within certain temperatures.

Panels can be cooled actively or passively. An active system requires some external power source to run. A passive system requires no added power. An example of passive system might be an array of panels that are set off the roof 2 feet (61 cm), to allow air to naturally flow behind the panels and pull away some heat, or a white-colored roof that prevents the surfaces around the panels from heating up and causing additional heat gain. An active system might have fans to blow air over the panels, or pump water behind the panels to pull away heat. An active cooling system may be used in certain situations in which the added efficiency to the panels is greater than the energy needed to run the system, such as with a solar power plant in a desert. They also may be used in situations in which some additional purpose can be achieved, such as domestic water heating.

This combined solar PV and water heating system was installed on the roof of a student-designed solar home. The system runs cool water behind the panels to absorb heat from them, making them more efficient. The heated water is used in the home for showers or heating. Even when the outside temperature is less, the dark panels and rooftop become quite hot on sunny days because of all the solar radiation received, making a PVT system a practical solution to increase electrical power production from the PV panels and reduce the heating loads in the home.

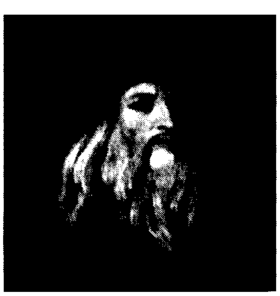
Joesna. G

III Year Physics

ELEVATIONS OF SOLAR ENERGY

It is interesting to look back and see how the sun has been often used for its power in the past. We could for instance imagine that Archimedes is the father of concentrated solar power. Indeed during the battle of Sycause (Italy 213-221 BC)

angle hexagonal mirror were used to destroy the roman fleet. Archimedes burned up the whole Roman fleet. For by tilting a kind of mirror toward the sun he concentrated the sun's beam upon it; and owing to the thickness and smoothness of the mirror he ignited the air from this beam and kindled a great flame, the whole of which he directed upon the ships that lay at anchor in the path of the fire, until he consumed them all. {when Marcellus withdrew his ship a bow-shot, the old Archimedes constructed a kind of hexagonal mirror, and at an interval proportionate to the size of mirror he set similar small mirrors with four edges, moved by links and by a form of hinge, and made it the centre of the sun's beams—its noon-tide beam, whether in summer or in mid-winter. Afterward, when the beams were reflected in the mirror, a fearful kindling of fire was raised in the ships, and at the distance of a bow-shot he turned them into ashes. In this way did the old Archimedes prevail over Marcellus with his weapons}



LEONARDO DA VINCI also thought of using the sun. He designed solar concentrator in 1515 already to use solar power. When we speak "solar power" today we are usually referring to making electricity from sunlight using photovoltaic cells. This would have been totally unknown in Leonardo's time. Leonardo wrote about optics and burning mirrors, their mathematical calculation and their manufacture –and he designed a machine to grind the surface for large burning mirrors unfortunately the way it is drawn in the notebooks of his that we have today, it could not worked ---- so, it was probably redesigned as he was being constructed----- If it was ever constructed at all. Even known geniuses can have a bad day or a poorly thought out idea.

Solar energy to heat things usually with "burning mirrors"- that is hyperbolic round mirror that concentrate the sun's light into a heat source this world sort of look like the satellite dishes for TV service, only made of brightly polished bronze or silver glass of the mirror in your bathroom. These can concentrate light at a specific focal distance, effectively as a lens for burning, shaped mirror can be used focused reflection, rather than the refraction of a glass lens, but their making must likewise be very precise. This is basic concept given by Leonardo Da Vinci.

Kowshigha. K. R

III Year Physics

FUTURE OF SOLAR ENERGY

The future of solar energy is brighter than ever before. As new solar products continue to become available, we will all find ways to benefit from this vast and renewable resource. Demand for solar energy items is currently greater than the supply. This won't be changing anytime soon. As technology continues to develop, here are a few things to look for. According to the U.S Department of Energy, the solar energy market is expected to grow by more than 30% every year for the next few decades. This boom is expected to create many solar energy jobs, particularly in the southwest. New solar energy products will appear on the market. From solar energy automobiles to solar powered clothing, expect to see all types of solar energy items in the future. Solar panels will become a standard addition to newly constructed homes. Tax incentives, easier access to solar panels, and DIY solar energy kits will encourage home owners to consider solar energy for home use.

Rosy Louis

III Year Physics

HOW DO SOLAR CELLS WORK?

Solar (or photovoltaic) cells convert the sun's energy into electricity. Whether they're adorning your calculator or orbiting our planet on satellites, they rely on the the photoelectric effect: the ability of matter to emit electrons when a light is shone on it.

Silicon is what is known as a semi-conductor, meaning that it shares some of the properties of metals and some of those of an electrical insulator, making it a key ingredient in solar cells. Let's take a closer look at what happens when the sun shines onto a solar cell.

Sunlight is composed of miniscule particles called photons, which radiate from the sun. As these hit the silicon atoms of the solar cell, they transfer their energy to loose electrons, knocking them clean off the atoms. The photons could be compared to the white ball in a game of pool, which passes on its energy to the coloured balls it strikes.

Freeing up electrons is however only half the work of a solar cell: it then needs to herd these stray electrons into an electric current. This involves creating an electrical imbalance within the cell, which acts a bit like a slope down which the electrons will flow in the same direction.

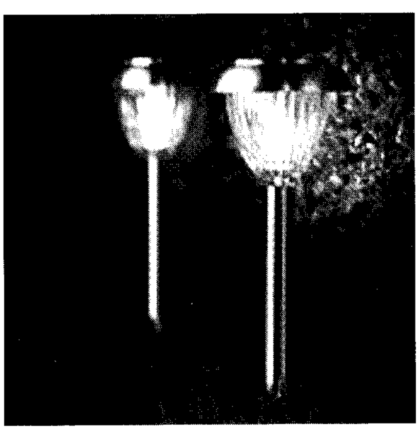
Creating this imbalance is made possible by the internal organisation of silicon. Silicon atoms are arranged together in a tightly bound structure. By squeezing small quantities of other elements into this structure, two different types of silicon are created: n-type, which has spare electrons, and p-type, which is missing electrons, leaving 'holes' in their place.

When these two materials are placed side by side inside a solar cell, the n-type silicon's spare electrons jump over to fill the gaps in the p-type silicon. This means that the n-type silicon becomes positively charged, and the p-type silicon is negatively charged, creating an electric field across the cell. Because silicon is a semi-conductor, it can act like an insulator, maintaining this imbalance. As the photons smash the electrons off the silicon atoms, this field drives them along in an orderly manner, providing the electric current to power calculators, satellites and everything in between.

Padma Priya. L

III Year Physics

SOLAR LIGHTS



With the popularity of solar garden lighting, homeowners are beginning to discover the beauty that this outdoor addition could bring. A lot of individuals simply rely on knowing how these lights convert the energy coming from the sun into electricity. But, it is also good to know how all the components of solar lights for the garden work in order to maximize the use of these equipments in one's home. Knowing in what conditions these lights would work best would maximize its life and use.

Every process in solar light begins with a switch that may be turned on manually or automatically to absorb the light coming from the rays of the sun. For many individuals, automatic controls are highly preferred because the solar lights begin collecting energy and stops when there is enough build up in the system ensuring that there is enough to power up the lights once it gets dark.

The light from the sun is converted to energy by the solar panel device that is attached to the rest of the lighting fixture. Depending on the size of the solar panels, the amount of electricity produced varies. In the beginning of solar garden lighting, it relied significantly on the direct rays of the sun. But these days, these solar panels have the capacity to absorb and convert any form of light and heat into electricity which is stored through the accumulators. Accumulators are also known as rechargeable batteries that store the energy during the day.

The solar lights may either be made with a light bulb, fluorescent, or LED. LEDs are being utilized more in the recent years because of its lower energy consumption and requirement to assure that there is enough solar energy to last the entire night. These bulbs may need to be replaced from time to time but will not require much technical knowledge since it is very simple to do.

Queen Cinderella. J

III Year Physics

WHY GO SOLAR?

1. Solar PV or solar hot water systems reduce or can completely eliminate the amount of electricity you have to purchase from your utility or electric service provider to power your home using solar helps reduces the reliance up on fossil fuels.

2. The electricity generated by your solar power system is clean, renewable and reliable. It will help reduce the amount of greenhouses gasses.

3. Solar PV or hot water systems save you money on your electricity or natural gas bill and act as hedge against future price increases. Solar power systems can provide owners with fixed energy costs.

4. A growing solar industry provides local jobs and economic development opportunities for states and regions.

5. Using solar PV power helps your community by reducing electricity demand and providing additional electricity for the grid when you generate more than you use during the day.

Why is solar energy important?

Solar energy can be effective economic driver. The U.S PV market increased by 57% in the year 2007. In 2006 the cumulative installed OV power in the US was 624MW (IEA photovoltaic power system programmer). The energy information administration forecasts the long term growth of PV in the US to reach nearly 3000 MW, by 2030, not including off grid installations. The PV industry generated over $17 billion in global revenues in 2007 and worldwide PV installations increased to 2,826 mw in 2007 up from 1,744 MW installed during 2006

What can solar do for you?

Solar energy can also play an important part in lowering the greenhouse gas emission by replacing coal powered energy sources with clean renewable solar PV technologies. These GHG emissions reductions will in turn improve air quality and lessen the harmful impacts that contribute to climate change.

Sindhuja. M

III Year Physics

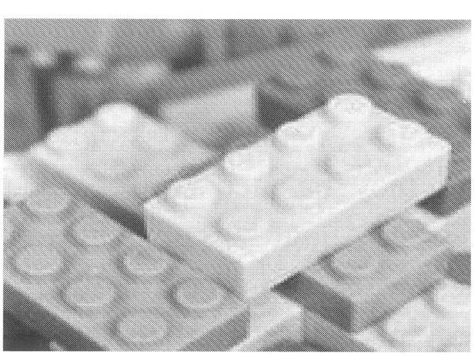
SOLAR CELLS AND BATTERIES

In Germany one kilowatt hour (kwh) of solar energy cost is about euro , 0.15 while electricity from an plug socket costs euro0.25. So clearly it makes sense for home owners to supply much energy from their photo voltaic system as possible. As more photo voltaic cells get connected to the grid they balance between the generation and consumption will be increasingly skewed. About 50 companies in Germany now sell system solar panels and batteries. Most use modern lithium batteries than lead batteries since they take up more space they can store more solar electricity and because their electrode are more electrochemically stable have a longer service life but lithium technology is significantly more expensive but can last up to 10,000 charge cycles. It is easier to store solar electricity in a lithium ion battery. The cost of these is a big hindrance other than that the production is bigger and the advantages are to the highest. Electricity price continuously rise higher by 5% each year. Hence lithium ion batteries will make a good financial sense bridging the gap. Companies are also developing electrodes materials that are robust and powerful. In most standard batteries, the anode is made up of graphite and the cathode of lithium graphite are a part of a chemical reaction that occur in the battery. Lechlanche is now planning to use anodes made of lithium titanium's as they are quicker to charge and also withstand more charge than graphite .As study prevails batteries are not the only way to store excess energy if you have photovoltaic system you could also make it simpler and store it in water. In theory all you need to do is to put an immersion heater in your hot water cylinder. At mid day when panels produce high electricity at full capacity and little being used in the house the excess energy will be stored up in the water tank which is already available at home and the grid gets respite.

Maria Vinita. A

III Year Physics

TINY "LEGO BRICK"- STYLE STUDS MAKE SOLAR PANELS A QUARTER MORE EFFICIENT



Most solar cells used in homes and industry are made using thick layers of material to absorb sunlight, but have been limited in the past by relatively high costs. Many new, lower cost designs are limited as their layer of light-absorbing material is too thin to extract enough energy. In new research, scientists have demonstrated that the efficiency of all solar panel designs could be improved by up to 22% by covering their surface with aluminium studs that bend and trap light inside the absorbing layer. At the microscopic level, the studs make the surface of the solar panels look similar to the interlocking building bricks played with by children across the world.

In recent years both the efficiency and cost of commercial solar panels have improved but they remain expensive compared to fossil fuels. As the absorbing material alone can make up half the cost of a solar panel our aim has been to reduce to a minimum the amount that is needed. so they attached rows of aluminium cylinders just 100 nanometers across to the top of the solar panel, where they interact with passing light, causing individual light rays to change course. More energy is extracted from the light as the rays become effectively trapped inside the solar panel and travel for longer distances through its absorbing layer. In the past scientists have tried to achieve the light bending effect using silver and gold studs because those materials are known to strongly interact with light, however these precious metals actually reduce the efficiency as they absorb some of the light before it enters the solar panel. The key to understanding these new results is in the way the internal structures of these metals interact with light. Gold and silver both have a strong effect on passing light rays, which can penetrate into the tiny studs and be absorbed, whereas aluminium has a different interaction and merely bends and scatters light as it travels past them into the solar cells. An additional advantage to this solution is that aluminium is cheaper and far more abundant than silver and gold.

ACTIVITIES OF THE DEPARTMENT (2013-2014)

The academic year 2013-2014 was a momentous year for the Department of Physics. The dynamic involvement of the Staff and Students helped in organizing plentiful activities.

A workshop on "Determination of protein crystal structure" was organized for the III year students on 30th January 2014. The resource person was Dr. Velmurugan, Head of the Department, CAS in Crystallography and Biophysics, University of Madras.

The annual event of the Department of Physics, "Electra-13", the intercollegiate fest, was held on October 10th 2013.

Another significant event of the Department "The Popular Lecture Series" was well planned and the series of lectures happened on three different days of the semester. The first lecture was on 28th November 2013. The topic was centred on "Smart Materials" and it was delivered by Dr. M Mahendran, Boyscast Fellow (MIT, USA), Associate Professor of Physics, Thiagarajar College of Engineering, Madurai. The lecture revealed the significance of smart materials in the field of material science. The second lecture on "Experiments in Physics" was conducted by Dr. S Natarajan, Professor of Physics, IIT Madras on 12th December 2013. Principles like Hall Effect, Mapping equipotential lines, Ultrasonic Interferometer studies for liquids were well explained with practical demonstration. The popular lecture series was culminated on 10th March 2014 with guest lectures delivered by Mr. Barnabas Tiburtius, Dr. Prem B Bisht and Dr.Sunethra Ramanan. On the same day the, the annual department magazine "Physik", which saw an enthusiastic contribution from the students, was released.

The II year students were taken on a field trip to "Irula Tribal Women Welfare Society", Chengelpet, as a part of the Social Awareness Program. The III year students visited "Precision Diagnostics on 7th October 2013 and learnt the working of machinery associated with Medical Physics.

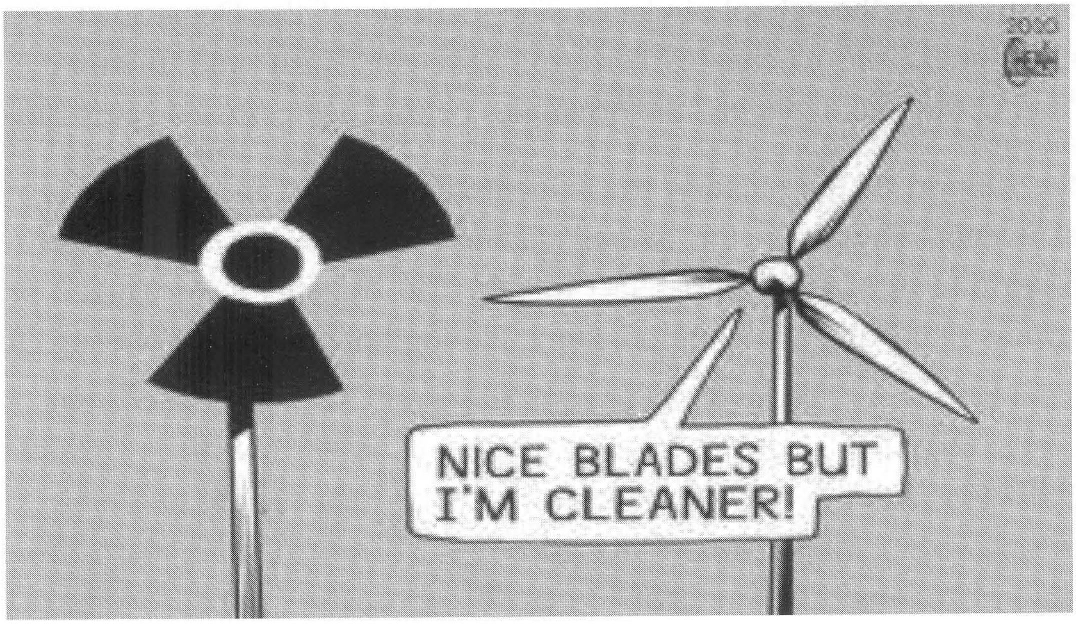
A Guest Lecture on "Microprocessors and Microcontrollers" was arranged for the III year students on 8th October 2013. It was delivered by Dr. G Kumar Sathian, Retired Professor of Physics, Madras Christian College. It helped the students master the architecture and application of microprocessors.

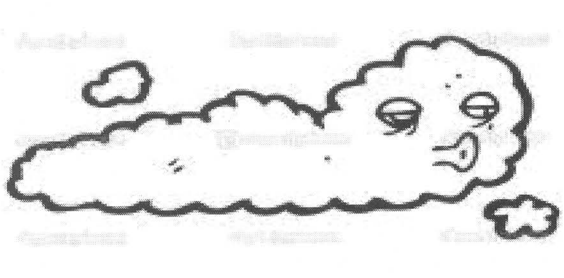
The Department of Physics actively took part in the "Science Exhibition", held on 4th February 2014. It was presented by the College, to emphasize the importance of basic sciences, to the school students. The students of the Department displayed working models on mechanics, electromagnetism, heat and thermodynamics, sound and optics and explained the principles behind devices used every day.

With the support of the Faculty, the students participated in many intercollegiate cultural events. They won the overall championship in Loyola College and the runners-up title in Madras Christian College. The students have bagged prizes in many events like Paper Presentation, Quiz, Photography, Creative writing etc.

Christy Preetha A and Kiruthika M A

WIND POWER





WIND ENERGY

The term might strike you as boring and dull as it had occurred to me when I found out an article was to be prepared on it.

But on a deeper note, many questions popped into my mind??

No energy is created or destroyed; Energy can only be conserved. So, what's the source or root of Wind energy?

So what causes wind?

Wind is the flow of air from high to low pressure areas. Wind is air in motion. Its due to the uneven heating of earth's surface. So it could be the heat energy that is carried by the wind which is in turn harvested as wind energy.

The ever-blowing, never ceasing wind is often associated with unpredictability and devastation. As the poem "Ode to the West Wind "suggests, I was taken up by the mere notion that the wind can be a creator and destroyer; a purgatory and a catastrophe.

So how does human race benefit from this phenomenon?

Well, to start with, we would be able to harvest an energy that is not only renewable but al so environment friendly .It produces no toxic emissions that contribute to global warming. This is what makes it a viable alternative to the fossil fuels that harm our health and threaten the environment.

Wind energy is "the fastest" source of electricity in the world. In 2012, nearly 45000 MW of new capacity were installed worldwide. Thanks, to its many benefits and significantly reduced costs, Wind energy is poised to play a major role as we move toward a sustainable future.

The wind resource-how fast it blows, how often and when plays a significant role in its power generation cost. The power output from a wind turbine rises as a cube of wind speed. For instance if wind speed is doubled, the power increases by eight times. Thus higher the speed of the wind, it is easier and less expensive to capture it.

So with increasingly competitive prices, growing environmental concerns and the call to reduce dependence on foreign energy sources, a strong future for wind power seems certain. The global Wind energy Council projects global wind capacity will reach 536000 MW by 2017 almost double its current size, with growth especially concentrated in Asia and Europe.

Turbines are getting larger and more sophisticated, with land based turbines now commonly in the 1-2 MW range and offshore turbines in the 3-5 MW range. The next frontiers for Wind industries are deep-water offshore and land based systems capable of operating at lower wind speeds. Both technological advances will provide larger areas for new development.

Development of Wind energy in the future would not only improve the air and water quality for future generations but also lessen the vulnerability to fluctuations in fossil fuel prices. Getting to that level requires a very determined global effort but Wind energy is more than ready to meet the CHANGE.

Elizebeth Jacob

I Year Physics

HOW IT ALL STARTED

It was the year 1939. USA was just preparing to go into a war. The country was hoping to secure the nation's facilities for when the war starts. They wanted an energy source that will be less expensive than coal and less vulnerable to air attacks than the localized energy stations. It was around this time that a man by the name Palmer Putnam wondered if he could harness the abundant ocean breeze near his summer home in Cape Cod to generate electricity. He was displeased at the high electric costs there and wanted to look for a cheaper alternative. He immediately began working hard, trying to build such a machine. Finally, on October 19, 1941, the world's first megawatt-size wind turbine was born. It was a joint venture between Putnam, S. Morgan Smith Company and Central Vermont Public Service Corporation.

The wind turbine was located on a 2000-foot mountain in southern Vermont in a place called Grandpa's Knob. This twin bladed turbine generated enough electricity to light 12,500 100-watt bulbs at full capacity. It was indeed a major leap in the development of renewable and clean energy sources. Although the wind mill was shut down after 4 years, on March 26, 1945, due to blade failure and high blade replacement charges, it paved the way to a cleaner and greener electricity source.

Hridya V Varma

I Year Physics

GONE WITH THE WIND

Wind powered vehicles are not something that developed in the 21st century, they are not something that came out of a desperate attempt to save fuel but are those vehicles that have been used since immemorial times. They were traditionally associated with seafaring vehicles like ships and boats that were dependent on the wind and hence their sail majorly. Nowadays, wind powered vehicles are majorly used for leisure activities like sailing, yachting, windsurfing, etc. As most of us are aware of the use of wind power in seafaring vehicles, here we'll see their mechanical use in terrestrial vehicles. Wind-powered mechanical vehicles primarily use wind turbines installed at a strategic point of the vehicle. The wind power, which is converted into mechanical energy through gears, belts or chains, causes the vehicle to propel forward. While they are not in mainstream use yet, they are widely encouraged and largely invested upon, especially in universities, so as to make a change in the automobile industry and save fuel.

Terrestrial wind-powered mechanicals include Ventomobile and Spirit of Amsterdam (1 & 2), Mercedes-Benz Formula Zero, The Greenbird, which currently holds a world record for fastest wind powered vehicle, is sail powered. The **Blackbird** is an experimental land yacht, built to demonstrate that it is possible to sail directly downwind faster than the wind.

As a proof against the ethical belief that, the machines and instruments built to use the alternate energy sources are expensive and hard to maintain, a wind powered rickshaw is being used by a lay man in Nepal. A rickshaw driver made life easier for himself by installing a windmill on his rickshaw. Built by a professor in the next town, the windmill was made of a metal drum that adapts wind power to help provide extra thrust to the pedals. Dubbed the wind-human hybrid vehicle, the windmill is connected via a side-mounted gear to the drive wheel, making it easier to pedal in a tailwind. This above example clearly tells us how we can use the abundant wind power to our advantage and hence contribute towards sustainable development. At the end of the day, you can go along with the wind at a faster pace than wind itself.

Dravina. S

I Year Physics

WIND POWER CONSERVATION

Wind power is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electric power, windmills for mechanical power wind pumps for water pumping or drainage or sails to propel ships .Large wind farms consist of hundreds of individual wind turbines which are connected to the electric power transmission network. For new constructions, onshore wind is an inexpensive source of electricity, competitive with or in many places cheaper than fossil fuel plants. Small onshore wind farms provide electricity to isolated locations. Utility companies increasingly buy surplus electricity produced by small domestic wind turbines. Offshore wind is steadier and stronger than on land, and offshore farms have less visual impact, but construction and maintenance costs are considerably higher.

Wind power, as an alternative to fossil fuels, is plentiful, renewable widely distributed, clean produces no greenhouse gas emissions during operation and uses little land. As of 2011, Denmark is generating more than a quarter of its electricity from wind and 83 countries around the world are using wind power to supply the electricity grid. In 2010 wind energy production was over 2.5% of total worldwide electricity usage, and growing rapidly at more than 25% per annum.

Wind power is very consistent from year to year but has significant variation over shorter time scales. As the proportion of wind power in a region increases, a need to upgrade the grid and a lowered ability to supplant conventional production can occur. Power management techniques such as having excess capacity storage, geographically distributed turbines, storage such as pumped-storage and importing power to neighbouring areas or reducing demand when wind production is low, can greatly mitigate these problems. In addition, weather forecasting permits the electricity network to be readied for the predictable variations in production that occur.

A. Bruntha

I Year Physics

ELECTRA 2013-2014

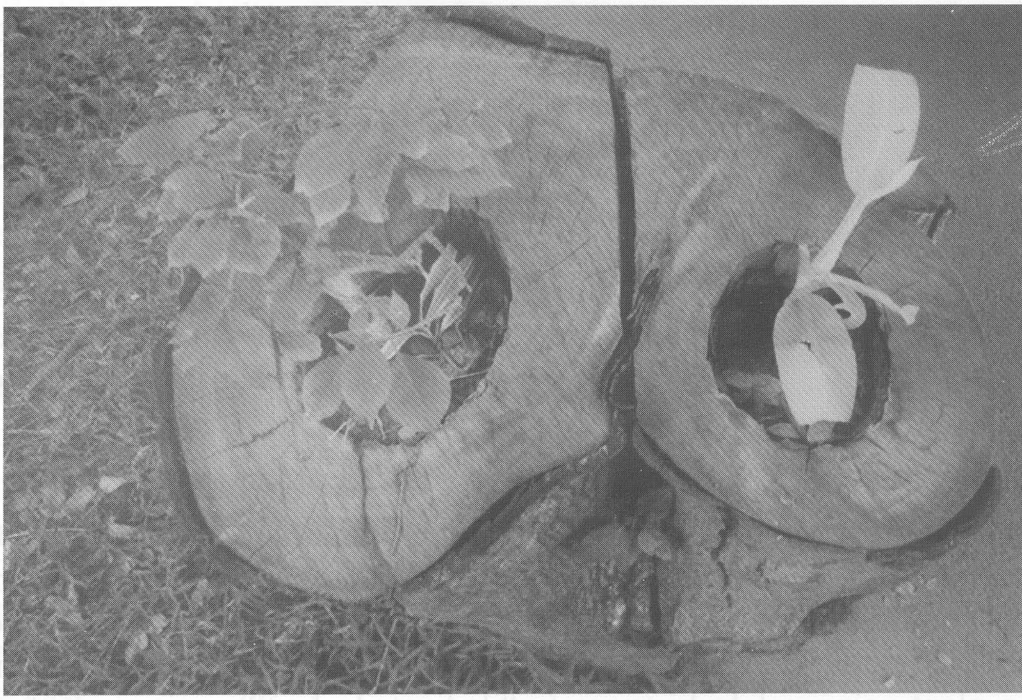
The students from the Department of Physics conduct various activities to enrich their knowledge. One among them was the long awaited ELECTRA '13 '14 an intercollegiate physics fest remains an awakening memory. The event was a great success by each ones unremitted hard work. All our strenuous arrangement for ELECTRA got staged on 10th October 2013 by the dignitaries of the college, the faculty and the emerging physicists from Stella Maris College and all other city colleges. The program was presided over by the renowned scientist Dr. Somnath Chandha Roy from IIT, Madras. The event witnessed active participation of students from different colleges. Students from about 10 colleges took part in events like Paper Presentation, Quiz, Loquacious, Variety Entertainment (Mime), Photo Hunt, Sci-fi (Creative Writing), Experimental Physics, etc., and staged their talents. Madras Christian College won the Overall Champions' Trophy. The event turned out to be a great success.

Sr. Vinodha.C

III Year Physics

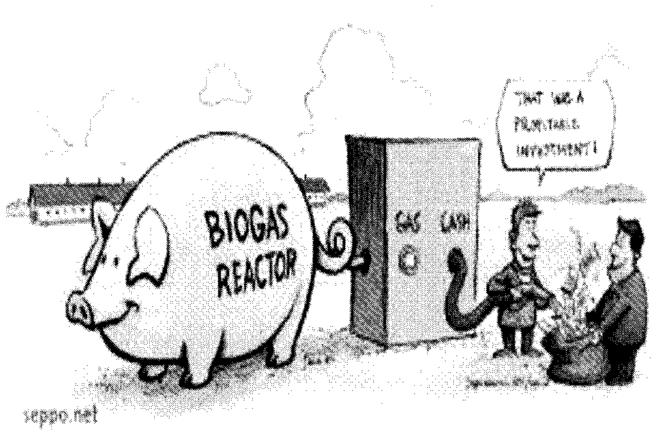
Pictures contributed by Divina, Junita and Sadhana

GREEN EFFORTS ON CAMPUS



Pictures contributed by Divina, Junita and Sadhana

GENERATION OF BIO-POWER



Converting Biomass to Bio-power

From the time of Prometheus to the present, the most common way to capture the energy from biomass was to burn it to produce heat. Since the industrial revolution this biomass fired heat has produced steam power, and more recently this biomass fired steam power has been used to generate electricity. Conversion of biomass to biofuel happens through the following methods.

Direct combustion

The oldest and most common way of converting biomass to electricity is to burn it to produce steam, which turns a turbine that produces electricity. The problems with direct combustion of biomass are that much of the energy is wasted and that it can cause some pollution if it is not carefully controlled. Direct combustion can be done in a plant using solely biomass (a "dedicated plant") or in a plant made to burn another fuel, usually coal.

Co-firing

An approach that may increase the use of biomass energy in the short term is to mix it with coal and burn it at a power plant designed for coal through a process known as "co-firing."

The benefits associated with biomass co-firing can include lower operating costs, reductions of harmful emissions like sulfur and mercury, greater energy security and, with the use of beneficial biomass, lower carbon emissions. Co-firing is also one of the more economically viable ways to increase biomass power generation today, since it can be done with modifications to existing facilities.

Repowering

Coal plants can also be converted to run entirely on biomass, known as "re-powering."

Combined heat and power (CHP)

Direct combustion of biomass produces heat that can be used to heat buildings or for other industrial processes. Because they use heat energy that would otherwise be wasted, CHP facilities can be significantly more efficient than direct combustion systems.

Biomass gasification

By heating biomass in the presence of a carefully controlled amount of oxygen and under pressure, it can be converted into a mixture of hydrogen and carbon monoxide called "syngas". The syngas can then be run directly through a gas turbine or burned and run through a steam turbine to produce electricity. It can also be further processed to form liquid biofuels or other useful chemicals. Biomass gasification is generally cleaner and more efficient that direct combustion of biomass.

Anaerobic digestion

Micro-organisms break down biomass to produce methane and carbon dioxide. This can occur in a carefully controlled way in anaerobic digesters used to process sewage or animal manure. Related processes happen in a less-controlled manner in landfills, as biomass in the garbage breaks down. A portion of this methane can be captured and burned for heat and power. In addition to generating biogas, which displaces natural gas from fossil fuel sources, such collection processes keep the methane from escaping to the atmosphere, reducing emissions of a powerful global warming gas.

Energy density

An important consideration with biomass energy systems is that unprocessed biomass contains less energy per pound than fossil fuels—it has less "energy density." Green woody biomass contains as much as 50% water by weight. This means that unprocessed biomass typically can't be cost-effectively shipped before it is converted into fuel or energy.

However, there are ways to increase the energy density of biomass and to decrease its shipping costs. Drying, grinding and pressing biomass into "pellets" increases its energy density. Compared to raw logs or wood chips, biomass pellets can also be more efficiently handled with augers and conveyers used in power plants. In addition, shipping biomass by water greatly reduces transportation costs compared to hauling it by truck. And thus, has made it economical to transport biomass much greater distances—even thousands of miles, across the Atlantic and Pacific, to markets in Japan and Europe.

In the last few years, the international trade in pelletized biomass has been growing rapidly, largely serving European utilities that need to meet renewable energy requirements and carbon-reduction mandates. Several large pellet manufacturers are locating in the Southern US, with its prodigious forest plantation resource, to serve such markets.

J.Rinita
II Year Physics

BIOMASS

Biomass is biological material derived from living, or recently living organisms. As a renewable energy source, biomass can either be used directly via combustion to produce heat, or indirectly after converting it to various forms of biofuel. Historically, humans have harnessed biomass-derived energy since the time when people began burning wood to make fire. Even in today's modern era, biomass is the only source of fuel for domestic use in many developing countries.

Based on the source of biomass, biofuels are classified broadly into two major categories namely first generation biofuels and second generation biofuels. First generation biofuels are derived from sources such as sugarcane and cornstarch etc. Sugars present in this biomass are fermented to produce bioethanol, an alcohol fuel which can be used directly in a fuel cell to produce electricity or to serve as an additive to gasoline. However, utilizing food based resource for fuel production aggravates food shortage problem. Second generation biofuels on the other hand utilize nonfood based biomass sources such as agriculture and municipal wastes. It mostly consists of lignocellulosic biomass which is not edible and is a low value waste for many industries. Despite being the favored alternative, economical production of second generation biofuel is not yet achieved due to technological issues. These issues arise mainly due to chemical inertness and structural rigidity of lignocellulosic biomass.

Jenisha
II Year Physics

FROM WASTE.........BIO MASS

Biomass is matter usually thought of as garbage. Some of it is just stuff lying around like dead trees, tree branches, yard clippings, left-over crops, wood chips and bark and sawdust from lumber mills. It can even include used tires and livestock manure. Paper products that can't be recycled and other household wastes sent to the trash, contain some types of biomass that can be reused. Recycling biomass for fuel and other uses cuts down on the need for "landfills" to hold garbage.

Biomass can also be tapped right at the landfill with burning waste products. When garbage decomposes, it gives off methane gas. Pipelines are put into the landfills and the methane gas can be collected. It is then used in power plants to make electricity. This type of biomass is called as landfill gas.

A similar thing can be done at animal feed lots. In places where lots of animals are raised, the animals - like cattle, cows and even chickens - produce manure. When manure decomposes, it also gives off methane gas similar to garbage. This gas can be burned right at the farm to make energy to run the farm.

How biomass works is very simple. The waste wood, tree branches and other scraps are gathered together in big trucks. The trucks bring the waste from factories and from farms to a biomass power plant. Here the biomass is dumped into huge hoppers. This is then fed into a furnace where it is burned. The heat is used to boil water in the boiler, and the energy in the steam is used to turn turbines and generators

Using biomass can help reduce global warming compared to a fossil fuel-powered plant. Plants use, and store carbon dioxide (CO_2) when they grow. CO_2 stored in the plant is released when the plant material is burned or decayed. By replanting the crops, the new plants can use the CO_2 produced by the burned plants. So using biomass and replanting helps close the carbon dioxide cycle. However, if the crops are not replanted, then biomass can emit carbon dioxide that will contribute to global warming.

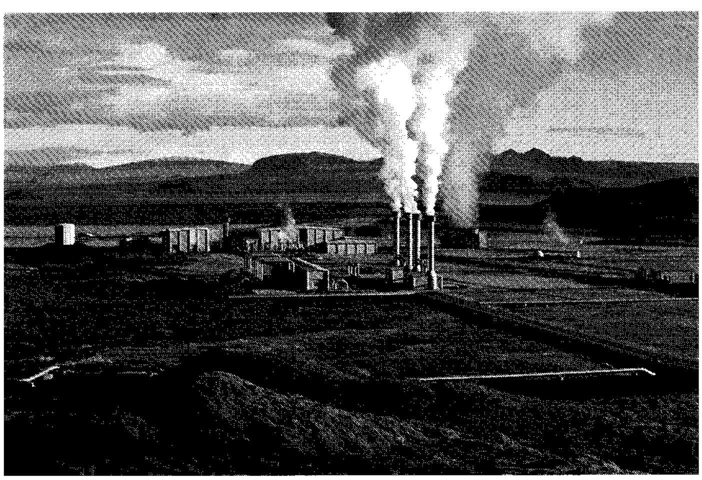
California produces more than 60 million bone dry tons of biomass each year. Of this total, five million bone dry tons is now burned to make electricity. This is biomass from lumber mill wastes, urban wood waste, forest and agricultural residues and other feed stocks. If all of it was used, the 60 million tons of biomass in California could make close to 2,000 megawatts of electricity for California's growing population and economy. That's enough energy to make electricity for about two million homes!

So, the use of biomass can be environmentally friendly as the biomass is reduced, recycled and then reused. It is also a renewable resource.

Sr.Sophi

II Year Physics

GEOTHERMAL ENERGY



Geothermal energy is thermal energy generated and stored in the Earth. Thermal energy is the energy that determines the temperature of matter. The geothermal energy of the Earth's crust originates from the original formation of the planet and from radioactive decay of minerals. The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface. Earth's internal heat is thermal energy generated from radioactive decay and continual heat loss from Earth's formation. Temperatures at the core-mantle boundary may reach over 4000 °C .The high temperature and pressure in Earth's interior cause some rock to melt and solid mantle to behave plastically, resulting in portions of mantle convicting upward since it is lighter than the surrounding rock. Rock and water is heated in the crust, sometimes up to 370 °C .From hot springs, geothermal energy has been used for bathing since Paleolithic times and for space heating since ancient Roman times, but it is now better known for electricity generation. Worldwide, 11,400 MW of geothermal power is online in 24 countries in 2012. An additional 28 GW of direct geothermal heating capacity is installed for district heating, space heating, spas, industrial processes, desalination and agricultural applications in 2010.Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation. Geothermal wells release greenhouse gases trapped deep within the earth, but these emissions are much lower per energy unit than those of fossil fuels. As a result, geothermal power has the potential to help mitigate global warming if widely deployed in place of fossil fuels.

The Earth's geothermal resources are theoretically more than adequate to supply humanity's energy needs, but only a very small fraction may be profitably exploited. Drilling and exploration for deep resources is very expensive. Forecasts for the future of geothermal power depend on assumptions about technology, energy prices, subsidies, and interest rates.

Padmapriya. L

III Year Physics

NUCLEAR REACTORS USED IN SPACE EXPLORATION

While Russia has used over 30 fission reactors in space, the USA has flown only one - the SNAP-10A (System for Nuclear Auxiliary Power) in 1965.

Early on, from 1959-73 there was a US nuclear rocket program – Nuclear Engine for Rocket Vehicle Applications (NERVA) – which was focused on nuclear power replacing chemical rockets for the latter stages of launches. NERVA used graphite-core reactors heating hydrogen and expelling it through a nozzle. Some 20 engines were tested in Nevada and yielded thrust up to more than half that of the space shuttle launchers. Since then, "nuclear rockets" have been about space propulsion, not launches. The successor to NERVA is today's nuclear thermal rocket (NTR).

Another early idea was the US Project Orion, which would launch a substantial spacecraft - about 1000 tonnes - from the earth using a series of small nuclear explosions to propel it. The project was commenced in 1958 by General Atomics and was aborted in 1963 when the Atmospheric Test Ban Treaty made it illegal, but radioactive fallout could have been a major problem. The Orion idea is still alive, as other means of generating the propulsive pulses are considered.

Radioisotope systems – RTGs

So far, radioisotope thermoelectric generators (RTGs) have been the main power source for US space work over nearly 50 years high decay heat of Plutonium-238 (0.56 W/g) enables its use as an electricity source in the RTGs of spacecraft, satellites, navigation beacons, etc and its alpha decay process calls for minimal shielding. Heat from the oxide fuel is converted to electricity through static thermoelectric elements (solid-state thermocouples), with no moving parts. RTGs are safe, reliable and maintenance-free and can provide heat or electricity for decades under very harsh conditions, particularly where solar power is not feasible.

So far 45 RTGs have powered 25 US space vehicles including Apollo, Pioneer, Viking, Voyager, Galileo, Ulysses and New Horizons space missions as well as many civil and military satellites. The Cassini spacecraft carries three RTGs providing 870 watts of power as it explores Saturn.

The latest RTG is a 290-watt system known as the GPHS RTG. The thermal power for this system is from 18 General Purpose Heat Source (GPHS) units. Each GPHS contains four iridium-clad ceramic Pu-238 fuel pellets, stands 5 cm tall, 10 cm square and weighs 1.44 kg.

The Stirling Radioisotope Generator (SRG)

It is based on a 55-watt electric converter powered by one GPHS unit. The hot end of the Stirling converter reaches 650°C and heated helium drives a free piston reciprocating in a linear alternator, heat being rejected at the cold end of the engine. The AC is then converted to 55 watts DC. This Stirling engine produces about four times as much electric power from the plutonium fuel, than an RTG. Thus each SRG will utilise two Stirling converter units with about 500 watts of thermal power supplied by two GPHS units and will deliver 130-140 watts of electric power from about 1 kg Pu-238. The SRG and Advanced SRG (ASRG) have been extensively tested but have not yet flown. NASA plans to use two ASRGs for its probe to Saturn's moon Titan.

Fission systems – space propulsion

For spacecraft propulsion, once launched, some experience has been gained with nuclear thermal propulsion systems (NTR) which are said to be well developed and proven. Nuclear fission heats a hydrogen propellant which is stored as liquid in cooled tanks. The hot gas (about 2500°C) is expelled through a nozzle to give thrust (which may be augmented by injection of liquid oxygen into the supersonic hydrogen exhaust). This is more efficient than chemical reactions. Bimodal versions will run electrical systems on board a spacecraft, including powerful radars, as well as providing propulsion. Compared with nuclear electric plasma systems, these have much more thrust for shorter periods and can be used for launches and landings.

However, attention is now turning to nuclear electric systems, where nuclear reactors are a heat source for electric ion drives expelling plasma out of a nozzle to propel spacecraft already in space. Superconducting magnetic cells ionise hydrogen or xenon, heat it to extremely high temperatures (millions °C), accelerate it and expel it at very high velocity (eg 30 km/sec) to provide thrust.

Research for one version, the Variable Specific Impulse Magnetoplasma Rocket (VASIMR) draws on that for magnetically-confined fusion power for electricity generation, but here the plasma is deliberately leaked to give thrust. The system works most efficiently at low thrust (which can be sustained), with small plasma flow, but high thrust operation is possible. It is very efficient, with 99% conversion of electric to kinetic energy.

Heat-pipe Power System (HPS)

These reactors are compact fast reactors producing up to 100 kW for about ten years to power a spacecraft or planetary surface vehicle. They have been developed since 1994 at the Los Alamos National Laboratory as a robust and low technical risk system with an emphasis on high reliability and safety. They employ heat-pipes to transfer energy from the reactor core to make electricity using Stirling or Brayton cycle converters.

The reactor itself contains a number of heat-pipe modules with the fuel. Each module has its central heat-pipe with rhenium-clad fuel sleeves arranged around it. They are the same diameter and contain 97% enriched uranium nitride fuel, all within the cladding of the module. The modules form a compact hexagonal core.

Control is by six stainless steel clad beryllium drums each 11 or 13 cm diameter with boron carbide forming a 120 degree arc on each. The drums fit within the six sections of the beryllium radial neutron reflector surrounding the core, and rotate to effect control, moving the boron carbide in or out.

Shielding is dependent on the mission or application, but lithium hydride in stainless steel cans is the main neutron shielding.

HOMER-15 – the Heat-pipe-Operated Mars Exploration Reactor. It is a15 kW thermal unit similar to the larger SAFE model, and stands 2.4 metres tall including its heat exchanger and 3 kWeStirling engine (see above). It operates at only 600°C and is therefore able to use stainless steel for fuel pins and heat-pipes, which are 1.6 cm diameter. It has 19 sodium heat-pipe modules with 102 fuel pins bonded to them, 4 or 6 per pipe, and holding a total of 72 kg of fuel. The heat-pipes are 106 cm long and fuel height 36 cm. The core is hexagonal (18 cm across) with six BeO pins in the corners. Total mass of reactor system is 214 kg, and diameter is 41 cm.

Project Prometheus 2003

In 2002 NASA announced its Nuclear Systems Initiative for space projects, and in 2003 this was renamed Project Prometheus . Nuclear-powered space travel will be much faster than is now possible, and will enable manned missions to Mars. One part of Prometheus, which is a NASA project with substantial involvement by DOE in the nuclear area, was to develop the Multi-Mission Thermoelectric Generator and the Stirling Radioisotope Generator described in the RTG section above.

A more radical objective of Prometheus was to produce a space fission reactor system such as those described above for both power and propulsion that would be safe to launch and which would operate for many years with much greater power than RTGs. Power of 100 kW is envisaged for a nuclear electric propulsion system driven by plasma.

In 2003 Project Prometheus successfully tested a High Power Electric Propulsion (HiPEP) ion engine. This operates by ionizing xenon with microwaves. At the rear of the engine is a pair of rectangular metal grids that are charged with 6,000 volts of electric potential. The force of this electric field exerts a strong electrostatic pull on the xenon ions, accelerating them and producing the thrust that propels the spacecraft. The test was at up to 12 kW, though twice that is envisaged. The thruster is designed for a 7 to 10-year lifetime with high fuel efficiency, and to be powered by a small nuclear reactor.

Radiation in space

The 2011-12 space mission bearing the Mars Science Laboratory - the rover Curiosity, measured radiation en route. The spacecraft was exposed to an average of 1.8 mSv/day on its 36-week journey to Mars. This means that astronauts would be exposed to about 660 mSv on a round trip. Two forms of radiation pose potential health risks to astronauts in deep space. One is galactic cosmic rays (GCRs), particles caused by supernova explosions and other high-energy events outside the solar system. The other, of less concern, is solar energetic particles (SEPs) associated with solar flares and coronal mass ejections from the sun. One way to reduce the crew exposure would be to use nuclear propulsion, reducing the transit time considerably.

The radiation dose on the International Space Station orbiting Earth is about 100 mSv over six months.

Sadhana.B

II Year Physics

RADIOACTIVE WASTE MANAGEMENT

All the debates on nuclear energy focus on the waste products created and the hazardous nature of them. All over the world there is an equally vigorous debate on global warming and proponents of nuclear energy claim that the wastes produced during the production of nuclear energy are far less dangerous than the air pollution caused due to the burning of fossil fuels.

Generation of radioactive wastes

One of the main disadvantages of the generation of nuclear energy is the generation of radioactive wastes. Most of the radioactive wastes decay very slowly and the wastes generated stays in the biosphere for a long time and affect generations of living beings. Every aspect of nuclear energy generation results in the production of radioactive wastes.

In the front end of the cycle the radioactivity in the waste consists only of the naturally occurring elements in the original ore body due to the extraction of uranium. The wastes are often radium and its decay products. The back end of the nuclear fuel cycle (spent fuel rods) contains fission products that emit beta and gamma radiation, and actinides that emit alpha particles, such as uranium-234, neptunium-237, plutonium-238 and americium-241.It also sometimes includes neutron emitters such as californium (Cf). Used fuel contains highly radioactive products of fission. Many of these products are neutron absorbers often called neutron poisons due to their ability to absorb a large number of neutrons. They stop the nuclear process and necessitate the replacement of fuel. The water circulated to cool the reactor also contains radioactivity.

Sometimes when a reactor completes its lifetime the nuclear power plant is often decommissioned. The decommissioning of the nuclear plant also generates a lot of radioactive wastes.

Classification of radioactive wastes:

Exempt waste & very low level waste

Exempt waste and very low level waste (VLLW) contains radioactive materials at a level which is not considered harmful to people or the surrounding environment. It consists mainly of demolished material produced during rehabilitation or dismantling operations on nuclear industrial sites.

Low-level waste

Low-level waste includes paper, rags, tools, clothing, filters, and other materials which contain small amounts of short-lived radioactivity. Materials that originate from any region of an Active Area are commonly designated as LLW as a precautionary measure even if there is only a remote possibility of being contaminated with radioactive materials. Some high-activity LLW require shielding during handling and transport but most LLW are suitable for shallow land burial. To reduce their volume, they are often compacted or incinerated before disposal. Low-level waste is further divided into four classes: class A, class B, class C, and Greater Than Class C (GTCC).

Intermediate-level waste

Intermediate-level waste (ILW) contains higher amounts of radioactivity and in some cases requires shielding. It typically comprises resins, chemical sludge and metal fuel cladding, as well as contaminated materials from reactor decommissioning.

High-level waste

High-level waste arises from the 'burning' of uranium fuel in a nuclear reactor. HLW contain the fission products generated in the reactor core. It is highly radioactive and hot, so requires cooling and shielding. HLW has both long-lived and short-lived components and generally short-lived fission products can be separated from long-lived actinides.HLW account for over 95% of the total radioactivity produced in the process of electricity generation.

Transuranic waste

Transuranic waste (TRUW) waste is contaminated with alpha-emitting transuranic radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g (3.7 MBq/kg), excluding high-level waste. TRUW is disposed more cautiously than either low- or intermediate-level waste because of their long half-lives.

Treatment of radioactive wastes

Nuclear waste requires sophisticated treatment and management to successfully isolate it from interacting with the biosphere. This usually necessitates treatment, followed by a long-term management strategy involving storage, disposal or transformation of the waste into a non-toxic form.

Management of low level and intermediate level wastes

All disposal concepts for LL/ILW rely on isolation from the biosphere initially. Multi-barrier containment systems are used for this purpose and most countries have already defined and sometimes implemented disposal practices and policies. LL/ILW is normally conditioned and packaged in drums or other containers at the site where it is generated and are transported to a central treatment facility. They are often incinerated before their treatment to reduce their volume. A surface or near-surface disposal facility is usually suitable for the disposal of short-lived, low-level waste. In contrast, deep geologic isolation as a totally passive system is considered necessary for long-lived waste. Geologic disposal removes the need for isolation of short term and long term radioactive waste.

It is common for medium active wastes in the nuclear industry to be treated with ion exchange or other means to concentrate the radioactivity into a small volume. The radioactive bulk after treatment is then discharged.

Management of HLW

HLW comprises highly-radioactive fission products and some transuranic elements with long-lived radio-activity. Most of the HLW is obtained from the used fuel in the nuclear reactor.

The HLW obtained from the used fuel contains high amounts of radioactivity that cannot be handled directly. Therefore the HLW is firstly stored in the surface for 40-50 years after which the amount of radioactivity falls to a level which can be handled. The HLW is vitrified into borosilicate (Pyrex) glass, encapsulated into heavy stainless steel cylinders about 1.3 metres high and stored for eventual disposal deep underground after the period of initial storage. This process is called direct disposal. Often the HLW is stored in ponds called STORAGE PONDS within the nuclear facility which ensure storage of used fuel and provide a means for the management of radioactive wastes. There is an ongoing debate in many countries against the disposal of HLW irretrievably. In most of the cases if the HLW are made accessible to future generations after underground disposal, it will prove very beneficial since radioactivity would have fallen to levels of normal radioactive mining ores. Methods for retrievable disposal of HLW after surface storage are being researched all over the world.

In a theoretical approach called Remix and Return, high-level waste is blended with uranium mine and mill tailings down to the level of the original radioactivity of the uranium ore, then replaced in inactive uranium mines. If adopted, this approach will provide jobs for miners who will double as disposal staff, and will facilitate a cradle-to-grave cycle for radioactive materials, Multi Barrier geological disposal process is also planned for the long term disposal of radioactive wastes.

Few other methods of disposing radioactive wastes are described below:-

Above-ground disposal (Dry cask storage): Dry cask storage typically involves taking waste from a spent fuel pool and sealing it (along with an inert gas) in a steel cylinder, which is placed in a concrete cylinder that acts as a radiation shield. It is a relatively inexpensive method which can be done at a central facility or adjacent to the source reactor.

Land based subductive waste disposal: The land-based subductive waste disposal method involves the disposal of nuclear waste in a subduction zone accessed from land. This method is considered as the most viable means of disposing of radioactive waste.

Re-use of waste: Nuclear wastes can be reduced by finding uses for nuclear isotopes produced as wastes in other industries. Caesium-137, Strontium-90 and a few other isotopes extracted from nuclear wastes are used in certain industrial applications such as food irradiation and radioisotope thermoelectric generators.

Regulation of disposal of radioactive wastes

The nuclear and radioactive waste management industries work in accordance to well-established safety standards for the management of radioactive wastes.

International and regional organisations such as the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD), the European Commission (EC) and the International Commission on Radiological Protection (ICRP) develop standards, guidelines and recommendations to assist countries in establishing and maintaining national standards. National policies, legislation and regulations are all developed from these internationally agreed standards, guidelines and recommendations. These safety standards aim to ensure the protection of the public and the environment both in the present and the future.

Emerging technologies

A lot of discussion is going on in the field of radioactive waste management and a lot of new technologies are being proposed. Some of these will definitely dominate the arena of radioactive waste management.

Space disposal of radioactive waste is being proposed by a lot of researchers because it ensures removal of harmful radioactive wastes from the earth's biosphere. But the technique has significant disadvantages including the risk of failure of the launch vehicle containing the radioactive waste. In addition, high number of launches would be required because no individual rocket would be able to carry much of the material relative to the total amount that needs to be disposed of. Though non-rocket launches can be considered, the cost of such missions would be very high. Still rapid advances in space technologies can render this possible in the future. There have been proposals for reactors that consume nuclear waste and transmute it to other, less-harmful nuclear waste. The Integral Fast Reactor was a proposed nuclear reactor with a nuclear fuel cycle that produced no transuranic waste and could consume transuranic waste. But the research activity was stopped and the idea still remains theoretical. Proposals for sub-critical reactors that transfer transuranic waste into non- transuranic wastes have also been put forward. A practical nuclear research reactor called Myrrha in which transmutation is possible has been developed and is operational in EU. Additionally, a new research program called ACTINET has been started in the EU to make transmutation possible on a large, industrial scale.

A new innovation called Australian Synroc has been proposed by Prof. Ted Ringwood which aims to immobilize radioactive waste. Synroc has been developed specifically for liquid high level waste obtained from light water reactor. The Synroc rock contains pyrochlore and cryptomelane type minerals..

It can be said without doubt that there will be more innovations for safe disposal of all classes of radioactive wastes in the future that would make nuclear energy a clean energy.

Problems and concerns

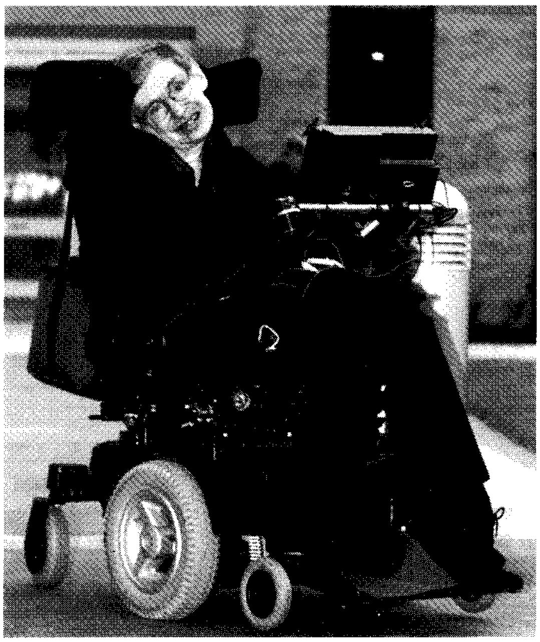
Though the amount of radioactive waste produced is less than the total amount of toxic wastes produced by oil producing and oil consuming industries, the leakage of radioactive material is much feared. The destructive capacity of nuclear energy has been showcased in several examples of nuclear accidents such as Chernobyl and Fukushima. The amount of HLW produced in nuclear power generation plants is also increasing by leaps and bounds every year. There are also cases of disputes between countries and the international community in case of nuclear power generation. Nuclear power generation can also be used a mask to hide the production of high – grade nuclear weapons. Further, high-level waste is full of highly radioactive fission products, most of which are relatively short-lived. If the waste is stored, perhaps in deep geological storage, over many years the fission products decay, decreasing the radioactivity of the waste and making the plutonium easier to access. Thus, some researchers argue that as time passes, these deep storage areas have the potential to become "plutonium mines", from which material for nuclear weapons can be acquired with relatively little difficulty.

The debate whether nuclear energy is better than other non- renewable sources of energy will continue. If methods for the safe disposal of radioactive wastes are discovered or invented, nuclear energy will emerge as the clear winner.

Krithika Raman

II Year Physics

WILL POWER SPEAKS



"Quiet people have the loudest minds"

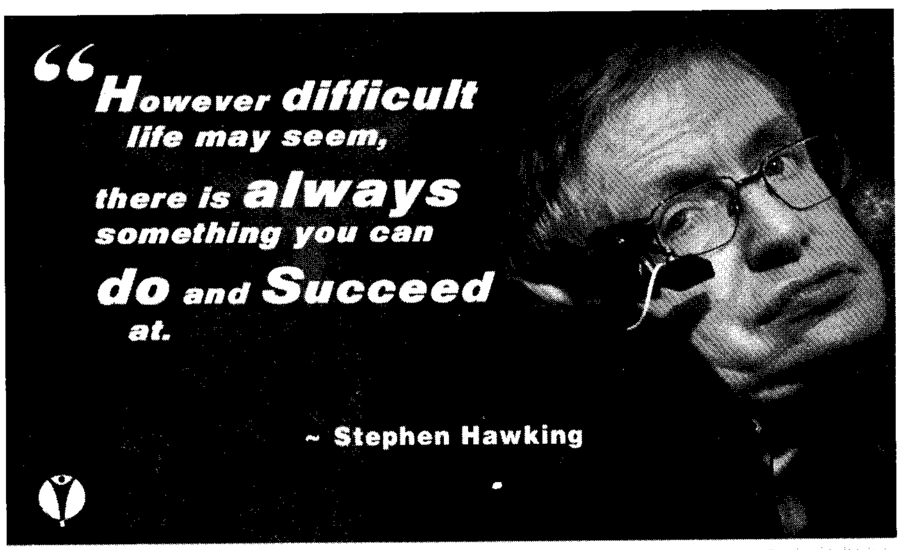
True to his word Stephen Hawking is a brilliant mind whose theories are difficult for a nonscientific mind to grasp. That is why it may come as a shock to learn that Hawking was a slacker when it came to his school studies. Despite his poor grades, both his teachers and his peers seemed to understand that they had a future genius amongst them, evidenced by the fact that his nickname was "Einstein". He went to Oxford University and majored in physics. As a student, Hawking gradually started showing symptoms of tripping and general clumsiness. His family became concerned when he was home during his Christmas break and they insisted him on visiting a doctor. Before seeing a specialist, however, he attended a New Year's party where he met his future wife, Jane Wilde.

Later he was diagnosed with amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, which is a neurological disease that causes patients to lose control of their voluntary muscles. He was told that he'd probably have only a few years to live. Hawking remembers being shocked and wondering why this happened to him. However, seeing a boy dying of leukemia in the hospital made him realize that there were others worse than him. Hawking became more optimistic and he was soon engaged to Jane. He cites his engagement as giving him "something to live for".

"I have had (Lou Gehrig's disease) for practically all my adult life. Yet it has not prevented me from having a family and being successful in my work," he writes. "I try to lead as normal a life as possible and not think about my condition or regret the things it prevents me from doing, which are not that many."

One of Hawking's major achievements was to come up with the theory that the universe has no boundaries. In his long career in physics, Hawking has racked up an incredibly impressive array of awards and distinctions. In 1974, he was inducted into the Royal Society, and a year later, Pope Paul VI awarded him the Pius XI

Gold Medal for Science. He also went on to receive the Albert Einstein Award and Hughes Medal from the Royal Society. He attained at least 12 honorary degrees; however the Nobel Prize continues to elude him. Hawking achieved all this despite being paralyzed in a wheelchair almost his entire life. He now communicates only by twitching his right cheek. Since 1985 with the attack of pneumonia, Hawking needed round-the-clock care and relies on a computer and voice synthesizer to speak. Thus Stephen Hawking is a living example and an inspiration to people that nothing in life can constrain one from achieving great heights.



Belinda Damian

III Year physics

POTENTIAL CAREERS IN PHYSICS

Want to put your knowledge of physics to use and learn new ideas and breakthroughs in Physics at the same time? Here's a list of careers you can make your own

1) Physicists are in demand for jobs in the **petroleum industry**. Till recently, Shell and British Petroleum were headed by Physics graduates. A good knowledge of the fundamentals of physics and the ability to apply basic concepts for environmental management are the only pre-requisites.

2) **Nuclear sector**: A variety of jobs are available in nuclear power plants. Waste management, recycling of wastes, etc. are growing avenues which are creating a lot of challenging job opportunities for physicists. This is besides the never ending research programmes to generate energy through nuclear fusion and fission

3) **Jobs in the renewable energy sector:** All the sectors of renewable energy are on lookout for fresh graduates in Physics. Wind energy plants, geothermal plants and companies manufacturing solar panels are recruiting in large numbers. An application oriented mind and out of the box innovative ideas are the requirements for success in this field. A specialised master's degree in applied physics or energy physics will be a significant value addition.

4) **Science communication**: This field is for those who have the knack to communicate physics to non- physicists and for those who devour all the latest magazines in physics and thoroughly enjoy the experience. Science communication comprises an entire variety of jobs from science journalist to science magazine reviewer. A master's in science communication or equivalent will land you a dream job in this field.

5) **Academician:** Good physics teachers and professors are in demand all over the world. If you have the thirst for knowledge and want to share your knowledge with others, then this will be a suitable job for you. This is a very rewarding career in which you can touch hundreds of lives. You can be instrumental in moulding the future scientists like Raman, Saha and Bose.

6) **Scientist**: Are you always building stuff, imagining theories, dreaming about equations and experimental set-ups or do you simply want to discover new things?

Then this is the field for you. This profession is for those who want to push the human race forward and whose thirst for knowledge is never quenched.

There are a million more jobs related to physics that one can choose from. Working in any of these fields will make the world a better place for the human race.

Krithika Raman

II Year Physics

STELLA GOES 'GREEN'

As a part of energy developmental scheme that was suggested by the government of Tamil Nadu, Stella Maris College, under the guidance of the Department of Physics, laid out a plan to install solar panels in the campus. There were many workshops conducted by the department to enlighten the student community about the renewable sources of energy especially solar energy which is the need of the hour.

The Department of Physics conducted various workshops that enhanced our basic knowledge on photovoltaic power.

There were three workshops out of which the first workshop was held on 31st Jan 2013. It gave us an overview regarding the fabrication and initial set-up of the solar panel. We were given hands-on training and illustrations on the power generation from solar panels. We also learnt the methods to calculate energy efficiency of the system.

The second workshop was conducted on 10th July 2013, in which Mr.Maruthu and Dr.John gave lectures on thin film solar panels and the future of solar energy, including the Building Integrated Photovoltaic (BIPV). We got an insight on the world statistics on the usage of solar energy. Different hazardous raw materials used in the fabrication technique of solar panels were detailed and the need to reduce and avoid those materials for a completely eco-friendly solar panel system was insisted. Based on this information, we prepared questionnaires and conducted a survey on the usage of solar power in different city institutions under the guidance of the staff.

The solar power plant in the college was inaugurated on the 22nd of January 2014 by our Principal Dr. Sr. Jasintha Quadras, fmm. A total of 200 solar panels were successfully installed in the college campus by Omega Natural Polarity Private Limited which will generate over 50kW of electricity contributing to 6% of the total power consumption on campus.

Sabitha Ann Jose and Sruthi Mirium Sam

III Year Physics

GUESS THE HIDDEN SCIENTISTS INSIDE!!!

R	E	H	C	S	I	F	L	I	M	E	J	J
N	E	E	D	R	A	D	N	H	O	J	A	O
M	I	J	J	T	H	O	M	S	O	N	M	H
M	E	D	W	I	N	H	U	B	B	L	E	A
A	A	A	R	C	H	I	M	E	D	E	S	N
X	V	E	L	T	O	T	S	I	R	A	P	N
P	I	U	C	F	H	S	C	I	R	E	R	E
L	C	C	B	A	R	O	I	A	A	Y	E	S
A	E	L	O	E	R	E	M	U	Y	N	S	K
N	N	I	H	L	N	O	D	A	O	L	C	E
C	N	D	R	L	S	J	L	N	S	L	O	P
K	A	T	R	E	B	L	A	N	O	I	T	L
G	E	O	R	G	E	O	H	M	H	B	T	E
S	T	E	V	E	N	C	H	U	I	O	E	R
R	O	B	E	R	T	K	O	C	H	N	J	L

J.J.Thomson	Aristotle	Eric	Albert
Avicenna	Edwin Hubble	Johannes Kepler	Gell
Mae Carol	Alfred Noble	Archimedes	Steven Chu
Euclid	Ray	Bohr	Robert Koch
John	John Bardeen	Max Planck	Benjamin
Bill Nye	Emil Fischer	Jim	George Ohm
Omar	James Prescott	Thomas	Louis

Mary Margaret. S
III Year Physics

Solar Energy Word Search Puzzle

E	U	C	L	E	D	H	M	W	V	S	Z	S	L	Z	H	D	G	C	U
E	N	O	I	T	A	M	R	O	F	S	N	A	R	T	T	N	R	F	P
O	U	A	G	F	A	B	H	D	M	W	N	S	R	J	O	U	A	Q	E
J	K	P	H	O	T	O	V	O	L	T	A	I	C	I	X	D	L	B	H
T	N	C	T	S	Q	J	K	U	E	X	D	I	T	E	P	Y	T	F	G
W	N	T	E	S	D	L	E	N	A	P	R	A	L	O	S	O	E	S	V
W	G	T	N	I	O	E	Y	F	D	G	V	N	V	S	N	M	R	B	W
M	N	K	E	L	V	B	Q	S	Q	R	T	O	M	Q	W	W	N	H	T
O	I	P	R	F	K	F	O	N	E	E	C	I	H	E	N	N	A	I	A
D	T	M	G	U	X	Y	A	S	E	G	R	S	D	D	R	I	T	F	O
G	A	S	Y	E	U	E	N	H	L	C	F	U	I	F	U	Z	I	D	E
H	E	V	E	L	G	O	U	X	E	R	I	F	U	G	E	S	V	J	I
F	H	Z	V	H	C	T	P	Y	C	A	U	R	E	M	V	L	E	P	Y
T	R	T	S	F	T	C	Y	F	T	O	T	A	P	T	S	Q	E	Y	F
C	E	I	O	T	C	R	Y	G	R	E	N	E	C	I	T	E	N	I	K
D	T	W	C	R	U	N	O	M	I	Z	W	L	N	A	M	V	E	C	D
J	A	Z	O	T	P	S	E	T	C	S	T	C	B	E	C	S	R	R	G
L	W	S	P	A	I	L	H	C	A	L	C	U	H	T	R	L	G	N	H
X	M	O	Y	P	H	O	G	I	L	H	Q	N	G	W	V	G	Y	S	F
D	T	M	E	C	H	A	N	I	C	A	L	E	N	E	R	G	Y	L	Y

1. Solar Panel
2. Nuclear Fusion
3. Photovoltaic
4. Mechanical Energy
5. Kinetic Energy
6. Transformation
7. Law of Conservation
8. Friction
9. Light Energy
10. Alternative Energy
11. Water Heating
12. Electrical
13. Fossil Fuel
14. Heat Energy

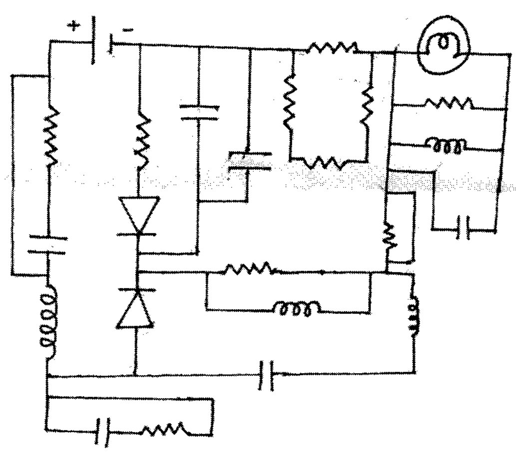
Lousiya Dayana. F

III Year Physics

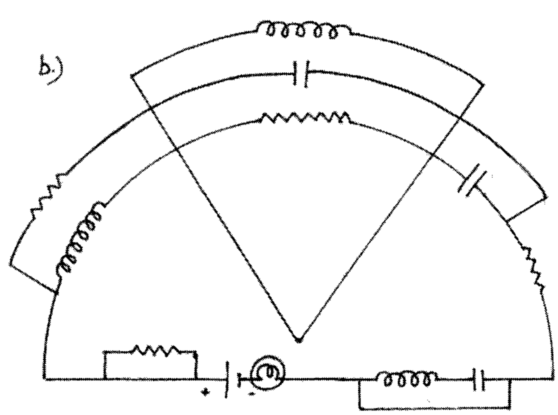
CIRCUIT MAZE

Find the easiest path followed by current to make the bulb glow.

a.)



b.)



A WORLD OF ENERGY

It's a world of energy,
energy, energy,
The world's full of energy
Everywhere you look.

A crane uses energy,
To operate a hook.
A scientist uses energy,
To open a book.

The sun gives off energy,
energy, energy,
The sun gives off energy,
It keeps the world alive!

Green plants uses sunlight
To make and store our food.
Their chemical energy
Brightens up our mood.

The world of energy,
energy, energy,
The world full of energy,
All around the house.

Gas, electricity
Run a washing machine.
But it takes human force,
To cut a magazine.

So look around this world
of ours with responsibility!
It's you and I that really care,
We"ll save our energy.

Energy, energy,
We"ll save our energy
Energy, energy,
The world for you and me

Shweta Tanwar

II Year Physics

Energy Fun!

Q. Why did the gardener plant a light bulb?
A. He wanted to grow a power plant!

Q. How did Benjamin Franklin feel when he discovered electricity?
A. Shocked!

Q. What is a renewable energy source that is used every day at your school?
A. Brain power!

Q. How many smart energy students does it take to change a light bulb?
A. None! They're smart enough to have found energy-efficient compact fluorescent bulbs fueled by green renewable energy sources; hardly ever in need of replacement.

Q. What did the light bulb say to the generator?

A. *"I really get a chance out of you!"*

Q. Why do transformers hum?

A. *They don't know the words!*

Q. What did the baby light say to the mommy light bulb

A. *"I love you watts and watts!"*

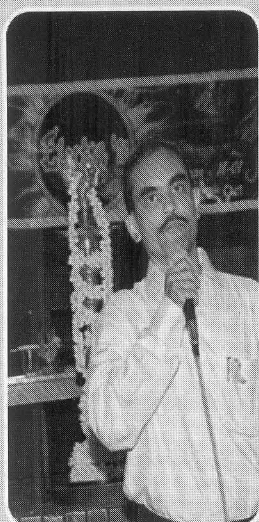
Q. What would a barefooted man get if he steps on an electric wire?

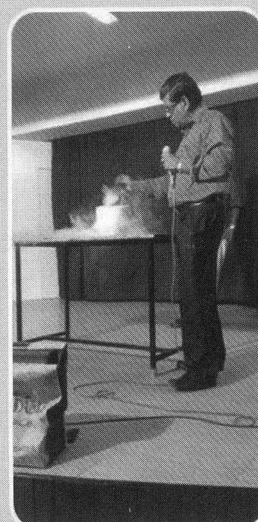
A. *A pair of shocks!*

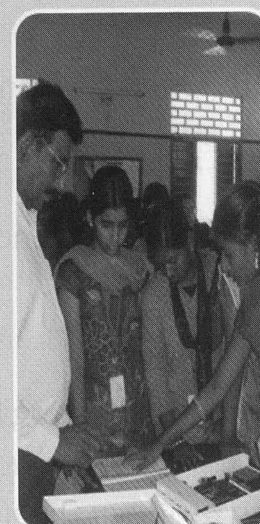
Shweta Tanwar

II Year Physics

DEPARTMENTAL ACTIVITIES UNDER THE STAR COLLEGE SCHEME







Electra-13-- Annual Fest, 10th Oct 2013. Inaugral address was delivered by Dr. Somnath Chandha Roy, IIT-M

Participation in the Science Exhibition hosted by Stella Maris College on 4th Feb 2014.

Popular Lecture Series and release of the Magazine:

Lecture on "Smart Materials" by Dr. M. Mahendran, Boyscast Fellow(MIT, USA), Associate Professor of Physics, Thiagarajar College of Engineering on 28 Nov 2013.

Workshop on "Experiments in Physics" by Dr. S. Natarajan, Professor of Physics, IIT-M on 12th Dec 2013.

Lecture on "Quantum nature of consciousness" on 10th March 2013 by Mr. Barnabas Tiburtius

Release of the Department Magazine- 10th March 2013

Workshop on Protein Crystal Structure Determination for III years by Dr. Velmurugan, HOD, CAS in Crystallography and Biophysics, University of Madras on 30th Jan 2014.

Guest Lecture on Microprocessors and Microcontrollers for III years by Dr Kumar Sathian, Retd Professor, MCC on 8th Oct 2013

Field Vist to Irula Tribal Women Welfare Society by II years.

III years visited Precision Diagnostics on 7th Oct 2013.

ACHIEVEMENT LIST: 2013-2014

III Year Physics

Belinda Damian	Loyola College	II place Sci-fi Writing
Christy Preetha. A	National Graduate Physics Examination 2013	One among the state toppers
	Ethiraj College for Women	III place Digital Photography
	Madras Christian College	II place Collage
Jeevitha. T	Loyola College	I place Quiz
Konsiliya Jenifer. S	Women's Christian College	I place Street Play
Kowshigha. K. R	Anna Adarsh College for Women	II place Mish Mash
Mary Margaret. S	Anna Adarsh College for Women	II place Mish Mash
	Loyola College	I place Collage
Priyanka. T	Madras Christian College	III place Junk Art
Rosy Louis	Madras Christian College	I place Treasure Hunt
	Loyola College	III place Variety Entertainment

Sabitha Ann Jose	Loyola College	I place Paper Presentation
ShankariDhevi. S. R	Ethiraj College for Women	III place Digital Photography
Shanthini. I	Pacchaiyappa's College	Won the Vivekananda Best NSS Student Award
	NSS Bhavan, Bangalore University	Attended the National NSS Mega Camp
	Anna Adarsh College for Women	II place Mish Mash
	Madras Christian College	II place Debate
	Loyola College	III place Variety Entertainment
	University of Madras	Arivu Thalir Award Oratorical Competition
	Women's Christian College (Rapport NSS)	Runner up Debate
SruthiMirium Sam	Madras Christian College	I place Treasure Hunt
Suganya. B	Stella Maris College	I place Baton Relay

I Year Physics

Ashreya. J	Anna Adarsh college	I place Quiz
Niveditha. R	Anna Adarsh college	I place Quiz

Internships were arranged for students, so as to develop research interests in them. Belinda Damian, Christy Preetha A, Alice Gnana Francita A and Suganya B of the Department took up an internship on "Synthesis of Nanomaterials" in Loyola College. Kiruthika M A and Ashwini K did a project on "Chaos and Fractals" in IIT-M. In addition, Sabitha Ann Jose, Kiruthika M A, Ashwini K and Alice Gnana Francita of the Department were selected to attend a workshop in IIT-M. Few meritorious students were given a chance to do research on "Nano materials" in the Centre for Research In Science and Technology, Stella Maris College.

III B.Sc. Physics (2011-2014)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