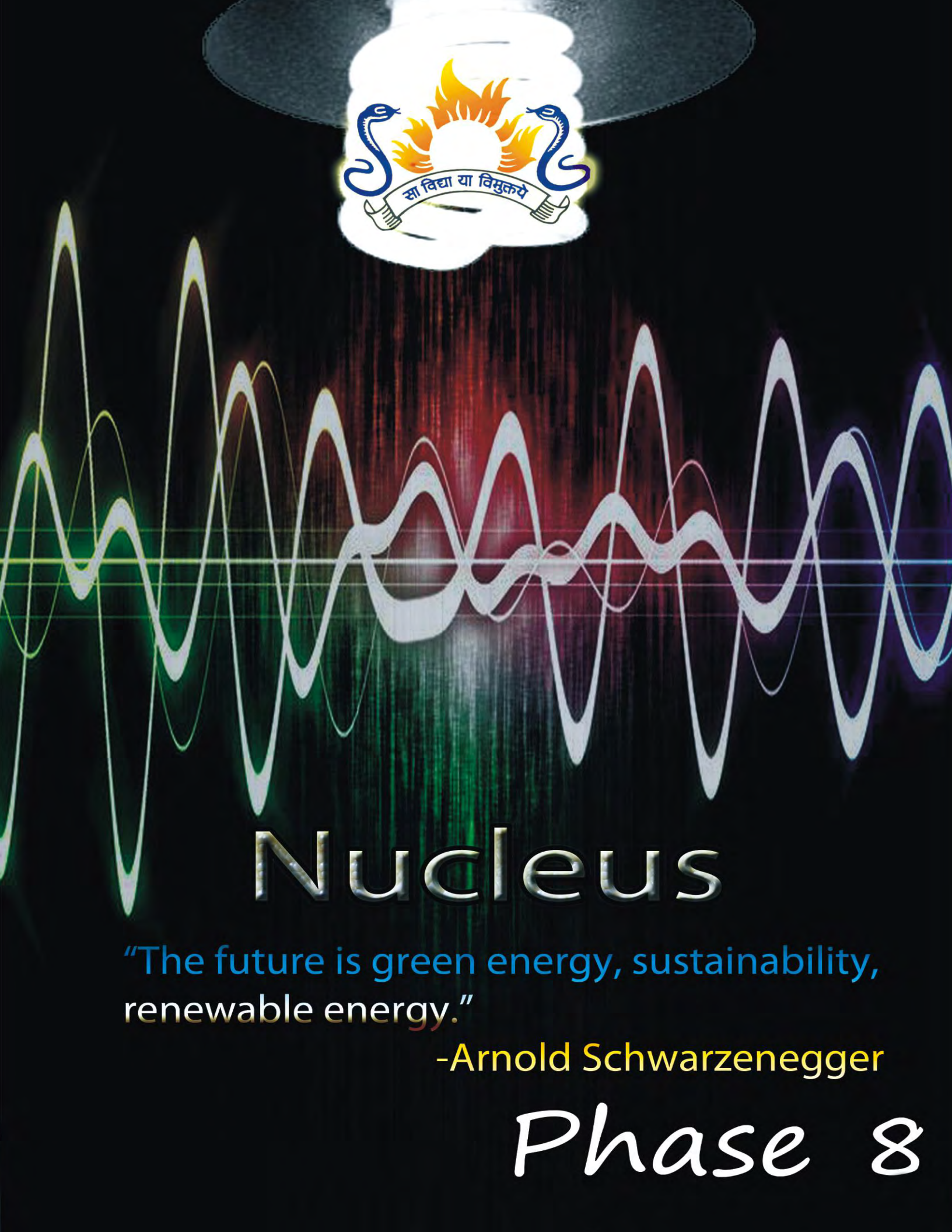


Nucleus

"The future is green energy, sustainability, renewable energy."

-Arnold Schwarzenegger

Phase 8

NUCLEUS EDITORIAL BOARD

Sitting On Chairs (Left To Right): Sankalp Agarwal, Utsav Akhaury, Dr. I.P. Dubey (Chief Staff Editor), Shiv Bajpai (Senior Editor), Mr. Samik Ghosh (Principal), Ankush Agarwal (Senior Editor), Dr. Geeta Shukla (Staff Editor), Anirudh Gangwal, Archit Verma

Standing Behind (Left To Right) : Ayush Barya, Priyansh Jain, Atul Korkoo, Hrithik Malhotra, Shailesh Bhagat, Rahul Mahnot

LETTER FROM THE PRINCIPAL'S DESK

At a time when wars are fought over sources of energy, devastating accidents happen in power plants, possible crisis of energy worries all and certain ways of using energy create serious threat to our environment, it is but natural that students will be engaged in debates and discussions on this issue.

Efforts, like we shall see in this magazine, are the seeds from which an important solution may emerge.

I congratulate the entire team that worked on this highly relevant issue.

Samik Ghosh

(Principal)

LETTER FROM THE VICE-PRINCIPAL'S DESK

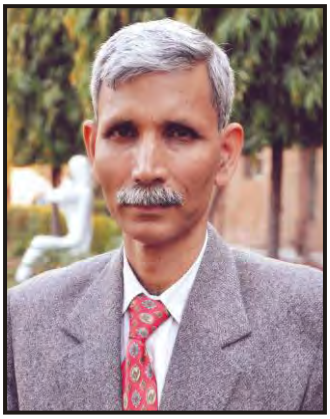
This is that time of year when everyone exhibits high energy levels! Founder's invigorates every Scindian to be at the best. All the energy that the boys conserve during the academic hours, round the year is employed during Founders'!

Energy is the theme of this year's edition of Nucleus and, I am sure it will interest our readers as the term 'energy' is not limited to the concept of Science, but is the most fundamental property of the universe. The composition of energy has puzzled physicists round the world for centuries and young Scindians, this time round, have been successful in bringing forth many interesting facts and articles in this edition of Nucleus.

My compliments to team 'Nucleus' for their enthusiasm and for producing yet another quality edition!

Shalini Mehrotra
(Vice Principal)

LETTER FROM THE CHIEF STAFF EDITOR'S DESK



Dear All,

This year has been a year of great achievements and prosperity. I feel proud to see Nucleus prosper and reach great heights. Energy is required to do any kind of work and therefore, this year's Editorial Board has worked very hard to produce a great outcome. Science has given us all its reactions, all its results. But moreover, it has given us hope and a possibility to think beyond every large or small thing. Science has its advantages, as well as disadvantages. But indirectly, it depends on how we use it. Without us, the knowledge of science is nothing because it is us who ultimately have the command over it. It is us who invent anything either by mistake or using our logic and assumptions about those things that are there in the environment.

Dr. I.P. Dubey

LETTER FROM THE SENIOR EDITOR'S DESK

Greetings to all my readers!

It makes me feel proud to be a part of this prestigious magazine's editorial board. ENERGY, as we all know of it, is a very vast topic to talk about and therefore we present before you this year's issue of Nucleus, with the theme being ENERGY. The knowledge of science can never be complete; it can only be extended and so again, we take a step forward and try to add some facts and figures to your knowledge of science. Science is such a discipline where inventions never end. My special credits go to Science for making our world a better place to live. I would like to thank the entire Nucleus Editorial board for putting in their constant effort without which, this would have not been possible. I Hope you enjoy your scientific tour.

HAPPY READING!

Shiv Bajpai
(Senior Editor)

CONTENTS

ENERGY

The term 'Energy' appears for the first time in the work Nicomachean Ethics of Aristotle in the 4th century BC. The concept of energy emerged out of the idea of living force, which Leibnitz defined as the product of the mass of an object and its velocity squared; he believed that total living force was conserved.

Emilie Marquise du Châtelet in her book 'Institutions Lessons in Physics', incorporated the idea of Leibnitz with practical observations of Gravesande to show that the "Quantity of motion" of a moving object is proportional to its mass and the square of its velocity (not the velocity itself as Newton taught what was later called momentum).

In 1802 lectures to the Royal Society, Thomas Young was the first one to use the term "Energy" in its modern sense, instead of living force. The product of the mass of a body into the square of its velocity may properly be termed its Energy. Gustavo-Gaspard Coriolis described "Kinetic Energy" in 1829 in its modern sense, and in 1853, William Rankine coined the term "Potential Energy. It was argued for some years whether Energy was a substance or merely a physical quantity.

Rahul Mahnot

IX

The Term Energy in different languages

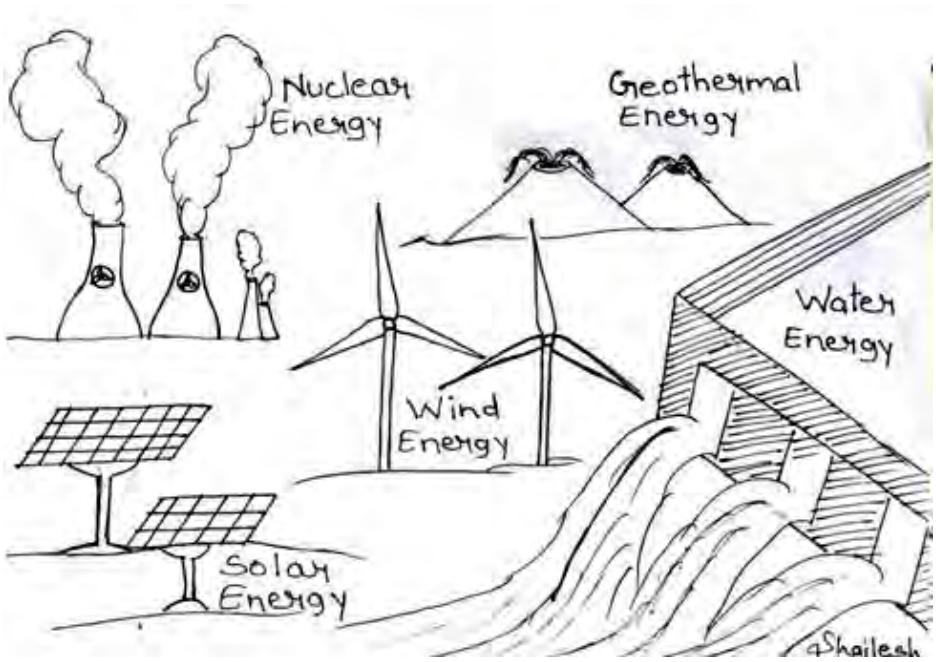
energie	- Afrikaans, Czech, Dutch, Romanian, Slovak, German
energji	- Albanian
pronounced 'energiya'	- энергія (Belorussian), енергия (Bulgarian), ενέργεια (Greek), enerġija (Latvian), енергија (Macedonian, Serbian), enerġija (Maltese), энергия (Russian), енергія (Ukrainian)
energia	- Catalan, Estonian, Finnish, Hungarian, Italian, Portuguese ,Spanish
energija	- Croatian, Lithuanian
energije	- Slovenian
energi	- Danish, Indonesian, Norwegian, Swedish
energii	- Polish
Urja	- Hindi
enerhiya	- Filipino

Sukanya Shukla
X

ENERGY AND ITS SOURCES

In terms of science, what do we call energy? Mostly, it is the ability to do work - Right, but I refer to energy as the very basic source for living in any living object. Energy has many sources:

- Wind
- Sun (Solar)
- Water (Hydro)
- Heat (Thermal)
- Bio Mass
- Nuclear
- Geothermal



These are the major sources of energy. Solar, Wind and Geothermal are very often used since these are totally dependent on the geographical factors; since solar uses sun energy, wind energy can only be used when wind is blowing, and geothermal can only be found in the places where hot springs are found. Hydro, Nuclear, Thermal and Bio Mass are basically used since they produce a lot of energy which is required to run factories and industries. Also, these are the sources that are the major cause of pollution, since they are produced with a lot of smoke. These resources are also non-renewable resources, except Hydro. Since in thermal energy, fossils of dead animals are used, which will take millions of years to be formed again, another substitute i.e. Bio Mass is used, which burns wood or cow-dung to produce energy. In Nuclear energy, nuclear fission is carried out to break an atom in order to release energy which is enough to destroy a country. Wind, Solar and Geothermal are a little expensive because solar panels, wind mills and geothermal power stations cost a lot. Also, solar energy is totally dependent on sun's light; and if there are clouds, then the solar panels won't work. Similarly, the turbines of the wind mills won't move if there is no wind blowing.

Still there are a lot more ways by which energy can be produced, but these are yet to be discovered; and these will change the history of Energy.

Akshat Soni

X

Nuclear energy is being used in more than 30 countries around the world, and even powers Mars rovers.

WIND ENERGY

Resources are a vital part of our lives. Humans have been exploiting them since ages and they are soon going to be over. But god has blessed us with something called renewable resource which can be used over and over again without getting finished. One of them is wind energy.

Wind power has been used as long as humans have installed sails in their boats. Wind power was widely available and not confined to the banks of fast-flowing streams. Wind-powered pumps used to drain the polders of the Netherlands, and in arid regions such as the American mid-west or the Australian outback, wind pumps provided water for livestock and steam engines.

During the Second World War, small wind generators were used on German U-boats to recharge submarine batteries as a fuel-conserving measure. In 1946 the lighthouse and residences on the island Insel Neuwerk were partly powered by an 18 kW wind turbine 15 metres in diameter, to economize on diesel fuel. This installation ran for around 20 years before being replaced by a submarine cable to the mainland.

By late 2011, Japan announced plans to build a multiple-unit floating wind farm, with six 2-megawatt turbines off the Fukushima coast of northeast Japan, where the 2011 tsunami and nuclear disaster have created a scarcity of electric power. After the evaluation phase is complete in 2016, Japan plans to build as many as 80 floating wind turbines off Fukushima by 2020 at a cost of some 10-20 billion Yen.

The first windmill used for the production of electricity was built in Scotland in July 1887 by Prof James Blyth of Anderson's College, Glasgow. Blyth's 33-foot (10 m) high, cloth-sailed wind turbine was installed in the garden of his holiday cottage at Marykirk in Kincardineshire and was used to charge accumulators developed by the Frenchman Camille Alphonse Faure, to power the lighting in the cottage, thus making it the first house in the world to have its electricity supplied by wind power.

India ranks fifth amongst the wind-energy-producing countries of the world after USA, China, Germany and Spain. Estimated potential is around 49130 MW at 50 m above ground level and 102788 MW at 80 m above ground level. Wind farms have been installed in Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu & West Bengal. Majority of installed capacity belongs to Private Sector in seven states.

Instead of using too much of fossil fuels and polluting the environment which is being done on a large scale now, we should be inspired by the countries and people who have put this form of energy into “actual” work. Wind power plants are efficient and are renewable. And so for the countries which are putting up many more such plants we can say that they have a long way to go on the path of progress, and the future generations will not suffer from scarcity of energy resources.

-Ayush Barya

IX

GOING SOLAR!

Solar energy is a non-conventional source of energy, which is being used in many ways worldwide. Mostly it is being used by industries for a good supply of energy. Lots of gadgets are being manufactured which need solar energy to operate. However, most of the people are not aware of the fact that it cannot only be used in industries and for commercial purposes, but also in our daily lives.

First of all, what exactly is solar energy? It is a source of energy which can be used without any fear of them getting finished, the kind which we term as renewable source of energy. Energy is acquired from the Sun and is stored or used straight away. Solar energy is the most readily available source of energy. It does not belong to anybody and is, therefore, free. It is also the most important of the non-conventional sources of energy because it is non-polluting and, therefore, helps in lessening the greenhouse effect. After the dramatic rise in oil prices in the 1970s, several countries began to formulate extensive research and development programmes to exploit solar energy.

Daily Lives and Household Applications:

In the next few years it is expected that millions of households in the world will be using solar energy, as the trends in USA and Japan show. In India too, the Indian Renewable Energy Development Agency and the Ministry of Non-Conventional Energy Sources are formulating a programme to have solar energy in more than a million households in the next few years. India is one of the few countries with long days and plenty of sunshine, especially in the Thar Desert region. This zone, having abundant solar energy available, is suitable for harnessing solar energy for a number of applications. Through Solar Photovoltaic (PV) cells, solar radiation gets converted into DC electricity directly. This electricity can either be used as it is or can be stored in the battery. Few handy solar powered gadgets include:

- Solar cooker,
- Concentrating collectors,
- Solar calculators,
- Solar Dryers

Solar cooker

Solar dryer

Solar calculator

Industrial Applications:

For many years, solar energy has been the power supply choice for industrial applications, especially where power is required at remote locations. Because solar power systems are highly reliable and require little maintenance, they are ideal in distant or isolated places. Solar energy is also frequently used for transportation signaling, such as offshore navigation buoys, lighthouses, aircraft warning light structures, and increasingly in road traffic warning signals. Solar energy is used to power environmental monitoring equipment and corrosion protection systems for pipelines, well-heads, bridges, and other structures. For larger electrical loads, it can be cost-effective to configure a hybrid power system that links the PV with a small diesel generator.

Commercial Applications:

On an office building, roof areas can be covered with glass PV modules which can be semi-transparent to provide shaded light. If the roof is flat, then arrays can be mounted using techniques that do not breach the weatherproof roof membrane. Also, skylights can be partially covered with PV. The vertical walls of office buildings provide several opportunities for PV incorporation, as well as sunshades or balconies incorporating a PV system. Sunshades may have the PV system mounted externally to the building or have PV cells specially mounted between glass sheets comprising the window.

Other Applications:

Remote buildings, such as schools, community halls, and clinics can benefit from solar energy. In developing regions, central power plants can provide electricity to homes via a local wired network, or act as a battery charging station where members of the community can bring batteries to be recharged. Holiday or vacation homes can use solar systems more cost-effectively without access to the electricity grid than if the grid was extended to reach the location. Remote homes in sunny locations can obtain reliable electricity to meet basic needs with a simple system comprising of a PV panel, a rechargeable battery to store the energy captured during daylight hours, a regulator (or charge controller) and the necessary wiring and switches. Such systems are often called solar home systems (SHS).

So, it could rightly be said that if better means to make efficient use of solar energy could be found, it would reduce our dependence on non-renewable sources of energy and make our environment cleaner!

- Utsav Akhaury, XI

Did you know?

India receives solar energy equivalent to over 5000 trillion kWh/year, which is far more than the total energy consumption of the country.

GEOTHERMAL ENERGY

Geothermal energy is a type of renewable thermal energy generated and stored in the Earth. 20% of the geothermal energy present in earth's crust has originated from the formation of earth and the rest from radioactive decay of minerals. The word *geothermal* originates from the Greek words, *γη* (geo) meaning earth, and *θερμος (thermos),* meaning hot. The difference between the temperature of earth's core and surface transfers the thermal energy in form of heat from core to the top surface. It is created by radioactive decay at the core of the earth and temperatures may reach over 5000 °C. The high temperature and pressure at the core results in the rising of magma (mixture of molten or semi molten rock) to the crust as it is lighter than the solid rock. The magma heats rock and water at crust.

Steam rising from the **Nesjavellir** Geothermal Power Station in **Iceland**

However, fluids drawn from the deep earth carry a mixture of gases, notably carbon dioxide (CO_2), hydrogen sulfide (H_2S), methane (CH_2) and ammonia (NH_2). These pollutants contribute to global warming, acid rain, and noxious smells if released. Hot water from geothermal sources may also contain toxic elements such as mercury, arsenic, boron, and antimony. These chemicals precipitate as the water cools, and can cause environmental damage if released.

Geothermal energy from hot springs has been used for bathing since Paleolithic (early phase of the Stone age) times and for space heating since ancient Roman times, but is now better known for electricity generation. The oldest known spa is a stone pool on China's Lisan mountain built in the Qin dynasty in the 3rd century BC, at the same site where the Huaqing Chi palace was later built About **10,715 megawatts** (MW) of geothermal power is online in 24 countries worldwide. An additional **28 gigawatts** of direct geothermal heating capacity was installed for district heating, space heating, spas, industrial processes, desalination and agricultural applications in 2010.

The Earth has more geothermal resources than needed to supply humans' energy needs, but only a very small number may be profitably used. Drilling and exploration for deep resources is very expensive. The future use of geothermal power depends on assumptions about technology, energy prices, subsidies, and interest rates. Pilot programs show that customers will be willing to pay a little more for a renewable energy source like geothermal. But as a result of government assisted research and industry experience, the cost of generating geothermal power has decreased by 25% over the past two decades.

Geothermal power is cost effective, reliable, sustainable, and environmental friendly, but has been limited to areas near tectonic plate boundaries since old times. Recent technological advancements have expanded the range and size of viable resources, especially for household applications. Geothermal wells release greenhouse gases trapped deep within the earth, but these emissions are much lower per energy unit than those of fossil fuels. The present generations of humans will not endanger the future of earth if they use geothermal energy. Further, geothermal energy is considered to have excellent potential to reduce global warming because of its less polluting nature. As a result, geothermal power can help reduce global warming if widely used in place of fossil fuels.

- Lovedeep Gahlawat

XI

Nuclear power facilities can produce energy at a 91 percent efficiency rate 24/7, while maintaining the method with the lowest emissions.

For every 100 meters you go below ground, the temperature of the rock increases about 3 degrees Celsius. Or for every 328 feet below ground, the temperature increases 5.4 degrees Fahrenheit.

SHOULD WE SPEND ON GEOTHERMAL ENERGY?

For the motion

Geothermal energy is beneficial to us. Geothermal energy is overall reliable and eco-friendly unlike some other types of energies which harm the environment. We should invest in geothermal energy as almost all of the other resources will exhaust in future, but geothermal energy being a renewable source of energy, will last forever. It also allow us to make use of useless and barren land for setting up geothermal power stations in the areas like deserts which will light the dark houses. As nowadays the earth's temperature is rising due to global warming the geothermal energy resource could be used in large quantity to make use of a phenomenon that is harmful to us into a beneficial thing. We are living in a world which rapidly running out of resources. Surely, we should welcome any new form of energy? Geothermal energy is clean and uses up no resources, like burning fossil fuels, and should be utilised wherever possible. Of course, it wouldn't be available anywhere, but having cleaner energy in at least one place benefits us all!

-Hrithik Malhotra

VIII

Against the motion

Geothermal energy also has disadvantages. The main problem with geothermal energy is that we can't get to it. The deepest oil wells go down to 5-7 miles. Another problem is that geothermal plants can only be setup at specific places. To get to magma, you need to drill down to 20 miles or more. Geothermal heat pumps are expensive, and your home needs to be on a one-quarter to three-quarter acre, most homes are not on that big of a lot. They say you need a vertical pump, but then you have to drill down 150 to 450 feet, and you must not interfere with any utility companies. You still need a bigger lot than most homes are on, especially in the big cities. And, you still need electricity to run the heat pumps and you need an electric heater to heat the air in the winter, because the temperature of the earth is from 55 to 65 degrees Fahrenheit. Some chemicals from deep wells if released in water bodies can harm the earth on a large scale.

- Tanmay Shandilya

VIII

Out of the 232 million cattle in the country, if one-third of the dung produced annually from these is available for biogas production and for recycling as farm manure, 12 million biogas plants can be installed! Each plant could save about 1260 kg of fuel wood per year.

BIOGAS

Eco friendly gases are one of the main requirements of today's world. World is experiencing Global warming which is killing the Earth every second. Well, it's not that late as scientists say. Minimising the use of fuels which produce excessive amounts of greenhouse gases can prevent our earth from dying young.

First of all, let's be introduced by the most common eco-friendly gas: Biogas. Biogas typically refers to the gas produced by the biological breakdown of organic matter in the absence of oxygen.

Biogas

Heating

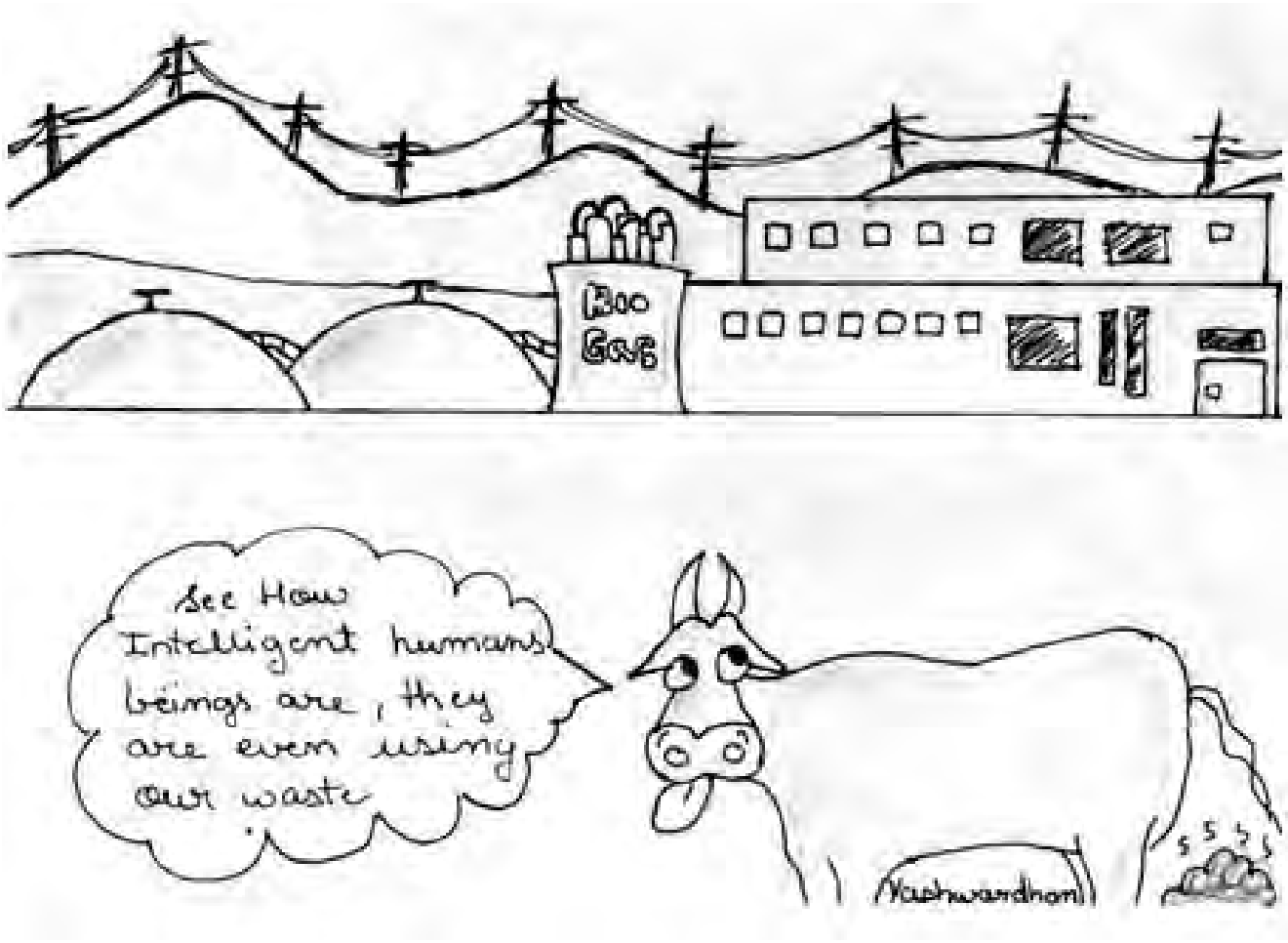
Biogas is energy rich and is well suited as a source of energy within many areas. The easiest use of biogas is for heating. This is because, for this purpose, no pre-treatment other than the removal of water is required. Biogas is usually used for heating buildings in conjunction with a biogas plant.

Power Generation

Biogas energy can also be used to generate power. Both electricity and heat can be produced with the help of a gas powered generator. The proportions of heat and power generated depend on the design of the plant, but are usually in the region of 35 per cent electricity and 65 per cent heat.

Fuel

Relatively speaking, biogas requires considerable processing if it is to be used as vehicle fuel. The energy value has to be raised by separating carbon dioxide in order to achieve a methane content of between 95 and 99 per cent. Water, impurities and particles must be removed to avoid mechanical as well as environmental damage. Finally, the gas has to be compressed. Although significant work is needed to upgrade methane gas to biogas fuel, the environmental benefits are so great that an increasing number of filling stations are opening throughout the country.



Industries

Many industries such as sugar refineries, distilleries, dairies and paper mills generate processing and waste water that can be digested directly on site. Biogas can thus be used for heating premises, district heating power production, heating ovens etc. This is a gas which reduces the risk of global warming as it produces very low amount, or no greenhouse gas. If biogas is brought into daily use by each individual, we can save ourselves and the earth from going into graves.

- Anirudh Gangwal, XI

The traditional chulha, which is used in Indian villages, is an inefficient way of using energy. Ninety per cent of the energy in the fuel is lost into the atmosphere; only ten per cent of the energy goes to actually heat the pot.

NUCLEAR ENERGY

With every passing minute, the resources are depleting at a faster rate. We need to find some alternative for these exhaustible resources.

The sun and stars are seemingly inexhaustible sources of energy. That energy is the result of nuclear reactions, in which matter is converted to energy. We have been able to harness this mechanism and regularly use it to generate power. Presently, nuclear energy provides for approximately 16% of the world's electricity.

The home of more than one billion people, India has had one of the world's fastest-growing economies over the past decade. During this same time frame, the country has made big strides in increasing its capacity for nuclear generation of electricity. India now ranks sixth in terms of production of nuclear energy, behind US., France, Japan, Russia, and South Korea.

Changes can occur in the structure of the nuclei of atoms. These changes are called nuclear reactions. Energy created in a nuclear reaction is called nuclear energy, or atomic energy. Some nuclear reactions occur naturally, while others are man accompanied.

- **Naturally:** The Sun and other stars make heat and light by nuclear reactions.
- **Man Accompanied:** Machines called nuclear reactors, parts of nuclear power plants, provide electricity for many cities. Man-made nuclear reactions also occur in the explosion of atomic and hydrogen bombs.

Nuclear energy is produced in two different ways:

- Large nuclei are split to release energy (Nuclear Fission)
- Small nuclei are combined to release energy (Nuclear Fusion)

Nuclear Fission: In nuclear fission, the nuclei of atoms are split, causing energy to be released. The element uranium is the main fuel used to undergo nuclear fission to produce energy, since it has many favourable properties.

Nuclear Fusion: In nuclear fusion, the nuclei of atoms are joined together, or fused. This happens only under very hot conditions. The Sun, like all other stars, creates heat and light through nuclear fusion. In the Sun, hydrogen nuclei fuse to make helium. The heat required to start the fusion reaction is so great that an atomic bomb is used to provide it. Hydrogen nuclei fuse to form helium, and in the process, release huge amounts of energy, thus producing a huge explosion.

Unlike the stars, the nuclear reactors that we have today work on the principle of nuclear fission. Scientists are working like madmen to make fusion reactors which have the potential of providing more energy with fewer disadvantages than fission reactors.

- Shiv Bajpai, XII

Quiz

1. Which area of the world consumes the most energy?
   - Asia Pacific
   - North America
   - Europe and Eurasia
   - Africa

NUCLEAR WASTE

What clicks in your mind by hearing "nuclear waste"? Something you have never seen! Or let me make it simpler, something you cannot imagine. But have you ever thought what it is or how this hyped "nuclear waste" is disposed.

Nuclear waste epitomizes the double-edged sword of modern technology. It's a toxic and radioactive byproduct of nuclear medicine, nuclear weapons manufacturing and nuclear power plants. In short, it's the type of waste that reflects one of humankind's greatest leaps in technology, but it also demonstrates our inability to deal with our own advances.

All parts of the nuclear fuel cycle produce some radioactive waste (radwaste). At each stage of the fuel cycle there are proven technologies to dispose off the radioactive wastes safely. Radioactive waste can take the form of different states of matter, including gas, solids and liquids. Depending on the waste's source, the radioactivity can last from a few hours to hundreds of thousands of years. If disposed of improperly, radioactive waste can devastate the environment, ruining air, water and soil quality. What's more, these materials can have long-term negative effects on human health, and can be fatal.

The greatest bulk of nuclear waste is related to the generation of nuclear power. There are two primary byproducts, including spent nuclear fuel from nuclear reactors and high-level waste (HLW) from the reprocessing of spent nuclear fuel.

The reactors in nuclear power plants use fuel in the form of ceramic Uranium dioxide pellets that are sealed within metal rods. After the usable Uranium is gone from the rods, the rods must be disposed off. But first, the rods are often processed with chemicals to draw out any unused Uranium; this results in HLW, which is liquid waste. Then the rods are usually stored in pools of water near the reactor until a permanent location is prepared.

Low-level waste (often from hospitals or labs) can often be compacted or incinerated in a container that is subsequently buried a landfill. Intermediate-level waste (reactor components, chemicals and similar wastes), which have higher levels of radioactivity, may be solidified in concrete or bitumen and then buried deep underground.

HLW comprises only a tiny percentage of all nuclear waste but accounts for 95 percent of the radioactivity given off by nuclear waste. For storage, it may be transformed into a glass, which is then sealed inside stainless-steel containers that are entombed far below the Earth's surface at government-approved sites. Sometimes HLW is stored in underground tanks or silos too.

Finding suitable locations for radioactive waste is no easy task. In short, no one wants nuclear waste near their communities, even if it's buried many miles away in a vault in the desert. But thanks to technology, we have sorted out all the problems regarding the hyped "nuclear waste".

- Archit Verma, XI

Storage pond for used fuel at the Thermal Oxide Reprocessing Plant at the UK's Sellafield site

NUCLEAR DISASTERS AND ACCIDENTS

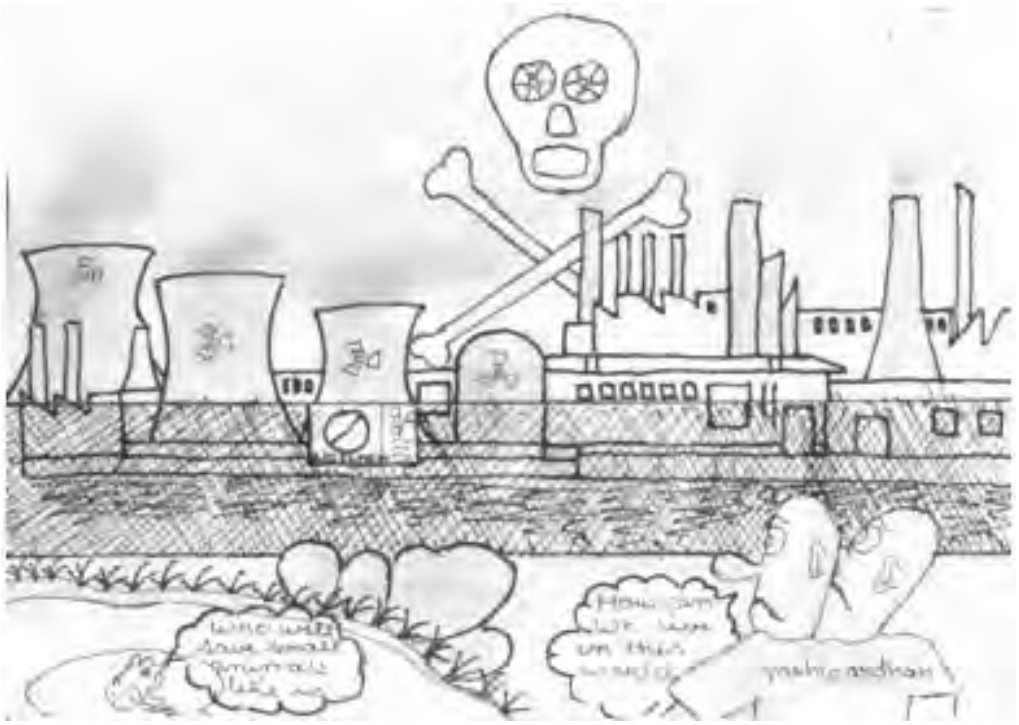
One of the scariest things about nuclear power is when something goes wrong and an accident occurs. Radiation is released into the environment and people get hurt. Two of the most famous nuclear accidents occurred at the Three Mile Island reactor 2 in the United States and the Chernobyl reactor 4 in the former Soviet Union. In this text we will discuss these two disasters, along with correcting a few common misconceptions about nuclear accidents.

The Myth of a Reactor Explosion:

It is impossible for any PWR(Pressurized water reactor) or LWR (light water reactor) nuclear reactor to explode like an atomic bomb. This is because in order for an uncontrolled chain reaction to occur that is similar to an atom bomb, the uranium fuel must be extremely enriched, much more than the 4% 235U that is present in regular commercial nuclear reactor fuel. So, if it can't explode, what does happen in a nuclear reactor?

The answer is what is called a meltdown. When a meltdown occurs in a reactor, the reactor "melts". That is, the temperature rises in the core so much that the fuel rods actually turn to liquid, like ice turns into water when heated. If the core continued to heat, the reactor would get so hot that the steel walls of the core would also melt. In a complete reactor meltdown, the extremely hot (about 2700 Celsius) molten uranium fuel rods would melt through the bottom of the reactor and actually sink about 50 feet into the earth beneath the power plant. The molten uranium would react with groundwater, producing large explosions of radioactive steam and debris that would affect nearby towns and population centres.

You may be wondering, "Why can't they just drop the control rods in the reactor if it starts to get out of control?" The answer is that they can. The problem is that, even if the control rods are completely dropped in and the nuclear chain reaction stops, the reactor is still extremely hot and will not cool down unless coolant is put back in. The residual heat and the heat produced from the decay of the fission products are enough to drive the core's temperature up even if the nuclear chain reaction stops.



- Rahul Mahnot, IX

DEBATE

Topic- the nuclear reactor at Fukushima should be restored

For

The Fukushima disaster that took place in Japan is the second most disastrous nuclear event of all time but due to Japans efficient working, the amount of causalities are close to zero. This, my dear friends is something nearly impossible. That is why Japan should restore the reactor as they have planned to spend 3 trillion yen to restore and improve the Fukushima power plant, which means that it will be working and it will also be more secure than before. They have already spent 720 million yen to build an ice wall so that the radiated water can be stopped from entering the sea. The Japanese government is working on increasing the height of the ocean wall up to 15 feet so as to prevent further causalities from natural catastrophes. They have also removed the radiation from the air using hydro bombing. They have taken good care of the damaged reactors as well as those which were not functional. These events prove that Japan will not take any chance with the power plant and so, they should restore their power plants as no further problems will occur. And even if it does, Japan has taken all the precautions to face the disaster.

- Prabhav Pachauri, IX

AGAINST

The second most powerful nuclear disaster can't be taken lightly and should be shut down so as to prevent further problems. Thinking about restoring that plant is simply madness.

The plant still is radioactive and instead of stopping the problems if someone rebuilds the plant it only leads to more destruction and who knows that Japan that nearly missed a nuclear calamity may not miss it the next time and lead to its self-destruction.

This is what Japan is looking forward - to the end. The Fukushima power plant won't take a minute to become a nuclear bomb which will finish Japan and make it uninhabitable for the next 100 years or more. Many of us think that there is only one power plant in Fukushima. But the truth is that there are six reactors inside it. The disaster that took place in 2011 was only due to one reactor. Even then, it was the second biggest disaster of the world. Imagine what would be the result if two or more reactors exploded at the same time Japan would be removed from the map of the earth but no one knows why Japan wants that to happen. The only thing that we know is that we can only tell them what to do, but it is for them to choose what to do.

- Archit Verma, XI

TIDAL ENERGY

Tidal power is one of the forms of renewable energy, and this technology is also known as hydropower. Hydro power technology or tidal energy uses tidal strength of water and back and forth movement in seas, rivers or oceans. Tidal power exploits kinetic energy of water that power water turbines with its movement between the wings, which rotate the turbine to produce electricity.

How does it work?

When water levels are high in oceans, and tides are being produced rushing to and fro, there is a potential to produce electricity out of it. For producing electricity out of such wild potential oceans, barrage is installed around, and then water turbines are installed inside the barrage. When water rushes through these turbines, they turn and their kinetic energy is converted into electrical energy.

For significant amount of energy to be produced out of tidal water turbines, range of tides should be high, and substantial amount of water should be there for pushing water through the turbine.

It is important to spot the appropriate place which provides suitable and sustainable conditions to produce tidal energy. There are plenty of places around the globe which provide good conditions for installing water turbines and then producing electricity using tidal power of oceans in the location. For instance in Canada, there is a place named Bay of Fundy, which produces highest and largest tide ranges in the world. Its average range is 10.8 meters

This image shows water turbines installed inside the barrage, and wings rotating with the flow of water to produce electricity

Working Tidal energy projects:

There are many ongoing tidal power projects worldwide out of which, the largest tidal energy station is in Europe in Rance estuary in North France. It was developed in 1966. This tidal station is the only one in the entire Europe.

Proposed Tidal energy projects worldwide

There is a proposed project with the name Severn Barrage, in Wales. This project had been proposed earlier, but it never got initiated. This project's estimated cost is about £15 million. It is also stated that it will produce about 8000 MW of energy, which is more than the energy produced by 12 nuclear power stations.

Other projects which are yet to be completed:

In Canada, CORE Project

In South Korea, Wando Hoenggan Waterway,

In New Zealand, Kaipara Harbour

In Scotland, Pentland Firth Tidal Energy Project

In Scotland, Islay Project

AnkushAgrawal, XII

A hurricane releases 50 trillion to 200 trillion watts of heat energy. This is as much energy as a 10-megaton nuclear bomb exploding every 20 minutes

A PlayStation 3 uses more energy than a refrigerator. In the average home, 75% of the electricity used to power home electronics is consumed while the products are turned off.

WAYS TO SAVE ENERGY

Lighting

- Don't leave lights on when no one is in the room. If you are going to be out of the room for more than five minutes, turn off the light
- Where possible, use compact fluorescent light bulbs. They last for years and years without burning out
- Maximize the use of daylight

Fridge

- Refridgerator not to be installed in areas where temperature is comparatively high or where there is no proper ventilation to carry away the heat from the condenser coils
- Switch off your refrigerator when you go on holidays
- Periodically clean the freezer
- Do not leave the door open for a long time
- Cover the cooked meals when you put them in the refrigerator

Computers

- Do not turn on your computer until you need to use it, and turn it off when you are finished
- Set your computer to go into "sleep" mode when not in use
- Computer peripherals such as scanners and printers also consume electricity; turn them off when they are not being used
- Take advantage of the energy saving features like an energy saving screen saver that will automatically put the monitor into sleep mode after a specified period of inactivity
- Activate your computer's power management features - configuring a computer to save electricity is easy to do

In the Bathroom

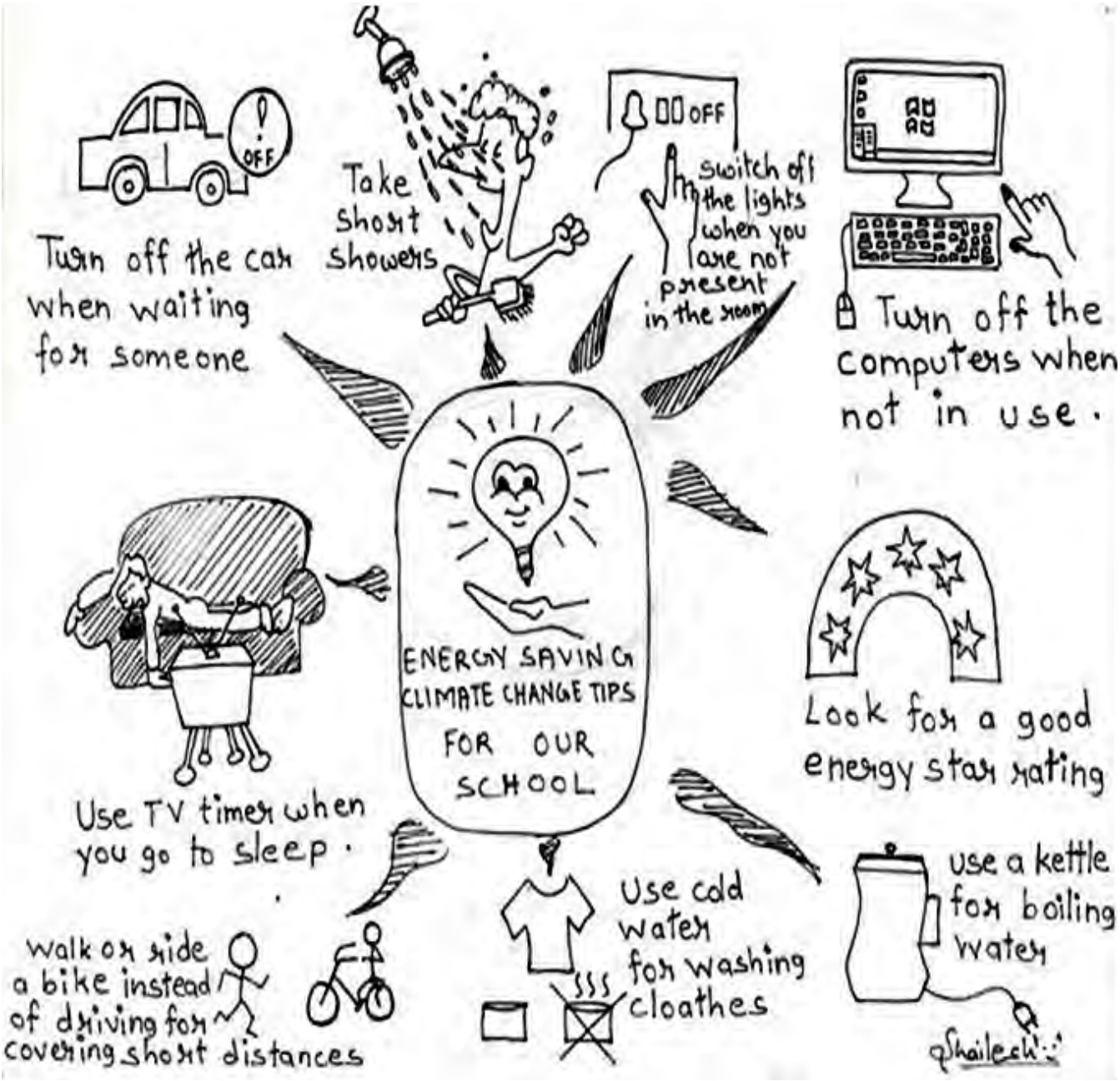
- Wasting water wastes electricity. Why? Because the biggest use of electricity in most cities is supplying water
- About 75% of the water we use in our homes is used in the bathroom. Unless you have a low flush toilet, for example, you use about 15 litres to 25 litres of water with every flush! A leaky toilet can waste more than 40000 litres of water a year
- Another simple way to save water AND energy is to take shorter showers.

In the Kitchen

- If you need to warm up or defrost small amounts of food, use a microwave instead of the stove to save energy. Microwave ovens use around 50% less energy than conventional ovens do. For large meals, however, the stove is usually more efficient.
- Don't keep the refrigerator door open any longer than you need to. Close it to keep the cold air inside! Also, make sure the door closes securely
- Is there an old refrigerator sitting in someplace at home? Old refrigerators are real energy hogs! Replace it if you don't need it. One large refrigerator is cheaper to run than two smaller ones

- Hrithik Pankaj, X

ENERGY AUDIT MIND MAP



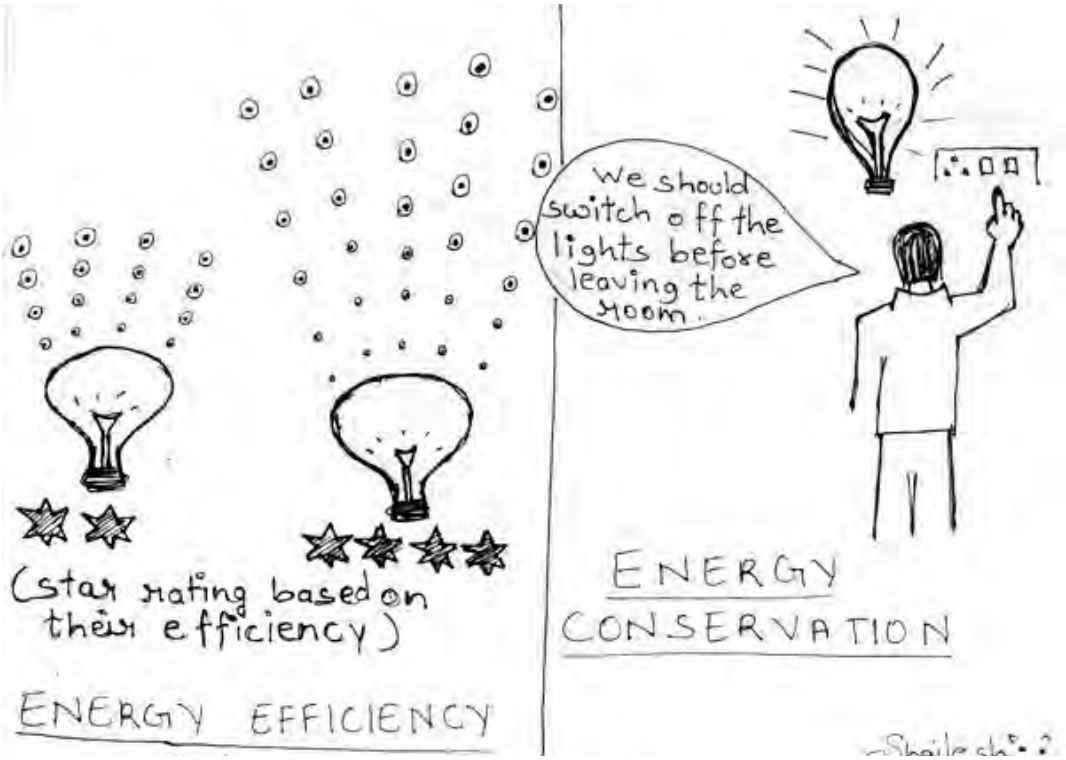
- Shailesh Bhagat, IX

ENERGY EFFICIENCY VS ENERGY CONSERVATION

Are energy efficiency and energy conservation different???

All of us use energy every day for transportation, cooking, heating and cooling rooms, manufacturing, lighting and entertainment. The choices we make about how we use energy i.e. turning machines off when we're not using them or choosing to buy energy efficient appliances, impact our environment and our lives. Many times when we study about energy there are two terms we generally come across, those are energy efficiency and conservation, which we suppose are similar but the truth is they are quite different. Let us study about these terms and we only make the distinction between the two.

Energy conservation is any behaviour that results in the use of less energy. Turning the lights off when you leave the room and recycling aluminium cans are both ways of conserving energy.



Energy efficiency is the use of technology that requires less energy to perform the same function. A compact fluorescent light bulb that uses less energy than an incandescent bulb to produce the same amount of light is an example of energy efficiency. However, the decision to replace an incandescent light bulb with a compact fluorescent is an act of energy conservation.

So, you can see from the above salient points these two terms are quite different but are interrelated.

- HrithikPankaj, X

NEW ENERGY SOURCES AND INVENTIONS

In the late 1880's, trade journals in the electrical sciences were predicting "free electricity" in the near future. Incredible discoveries about the nature of electricity were becoming common. Within 20 years, there would be automobiles, airplanes, movies, recorded music, telephones, radio, and practical cameras. For the first time in history, common people were encouraged to envision a utopian future filled with abundant modern transportation and communication, as well as jobs, housing and food for everyone. So what happened? Where did the new energy breakthroughs go? Was this excitement about free electricity all just wishful thinking that science eventually disproved?

Current State of Technology:

The answer is no. Spectacular new energy technologies were developed right along with other breakthroughs. Since then, multiple methods for producing vast amounts of energy at extremely low cost have been developed. None of these technologies have made it to the open consumer market, however. Why this is true will be discussed shortly. First, here is a short list of new energy technologies. The common feature connecting all of these discoveries is that they use a small amount of one form of energy to control or release a large amount of a different kind of energy.

There are dozens of other systems. Many are viable and well tested. But this short list is sufficient to make the point: new energy technology is here. It offers the world pollution-free energy in abundance for everyone, everywhere. It is now possible to stop the production of "greenhouse gases" and shut down the nuclear power plants. Transportation and production costs for just about everything can drop dramatically. Yet all these wonderful benefits that can make life on this planet so much easier and better for everyone have been postponed for decades. Why? Whose purposes are served by this postponement?

On the periphery of the extraordinary scientific breakthroughs that constitute real new energy technologies, lies a shadow world of unexplained anomalies, marginal inventions and unscrupulous promoters. The first two forces have constantly used the media to promote the worst examples of this group, to distract the public's attention, and to discredit real breakthroughs by associating them with the frauds. So, the third force is delusion and dishonesty. The motivations are self-aggrandizement, greed, want of power over others, and a false sense of self-importance. The weapons used are lying, cheating, self-delusion and arrogance combined with bad science.

Western society is in many ways spiralling toward self-destruction due to the accumulated effects of greed and corruption. New energy technologies cannot stop this trend. If however, you have a new energy device, you may be better positioned to support the transition that is underway. The question is who will ultimately control the emerging world government, the first force, or the fourth force? Those who choose the fourth force may live to see the dawn of the world of new energy. I challenge you to be among the ones who do so.

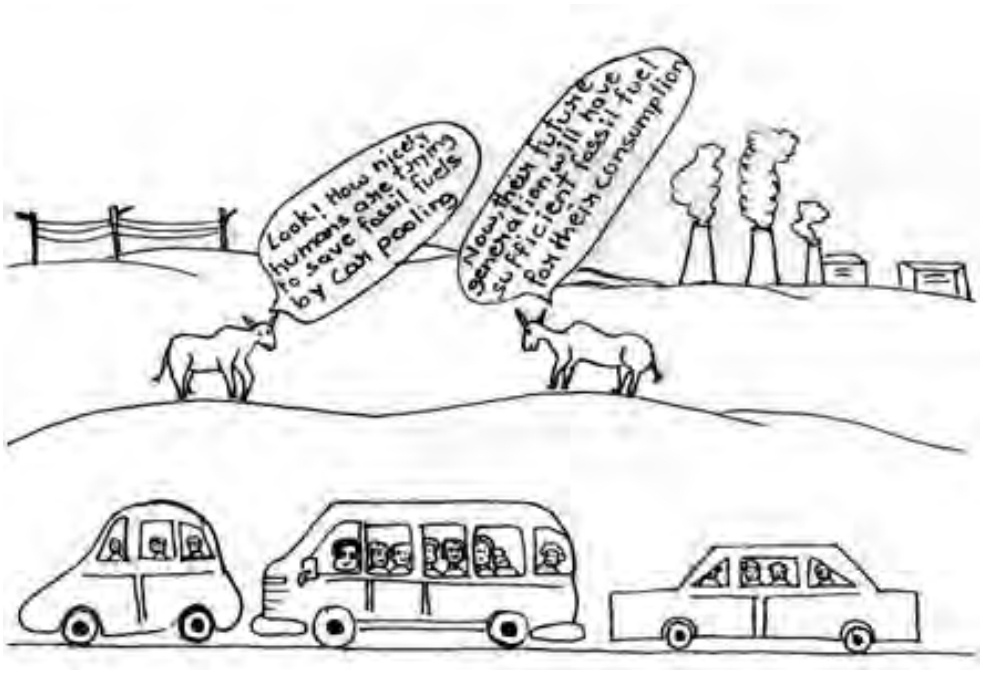
- Pulkit Agarwal, X

CONSERVATION OF FOSSIL FUELS

Fossil fuels are non-renewable energy sources that formed more than 300 million years ago during the Carboniferous Period - long before dinosaurs roamed the Earth. Fossil fuels are made up of plant and animal matter. When plants and animals died, their bodies decomposed, and were buried under layers of earth. Millions of years later, we have the three forms of fossil fuels: Oil, Natural gas and Coal.

Fossil fuels are resources that take millions of years to form. Natural gas forms in oil deposits. Coal is made from pressurized dead body of plants and animals. These are important to us because it helps us in everyday life. We need to conserve these because removing them from the Earth will wreck the environment. Using them will also create pollution. Pollution in the air will ruin the air quality, making it harder to breathe.

If resources were to run out in a pitiable condition, what would happen then? When we burn fossil fuels in cars, we release toxic chemicals in the air. Such pollutants include Carbon dioxide and Carbon Monoxide. Other chemicals that get released from factories and other utilities are Sulphur Dioxide and Nitrogen Oxide. Carbon monoxide is poisonous to our health. Huge loads of carbon dioxide will trap the heat that reaches the earth. This is known as the greenhouse effect. Too much heat will result in global warming. This will melt the polar ice caps, thus flooding coastal regions of the earth. Sulphur dioxide and Nitrogen oxide can fuse with water vapour in presence of sunlight to create two harmful acids; Sulphuric acid and Nitric acid. These chemicals are part of acid rain. Acid rain can destroy trees, and wildlife. It can poison lakes as well, killing fishes in it. Pollution, a result of burning fossil fuels, can really harm the environment.



Open pit and deep shaft mining leave holes in the Earth. Open pit Mining can reck the landscapes. Deep shaft mining holes can collapse, making it dangerous for workers. That's why mining isn't a great method to use. If we were to use them continuously for years, they will run out sooner or later. Oil will run out in the next 35 years due to increase in demand. Later, more oil deposits might be discovered, but even they won't last long. It is predicted that Natural gas will run out in the next 40 years. The fact that it is cleaner might make it run out. Coal, due to its inefficiency, will run out in 2100. If these sources were to run out, anything can happen. The result, in our opinion, could be unpredictable. So please think about this.

- Prateek Bansal, X

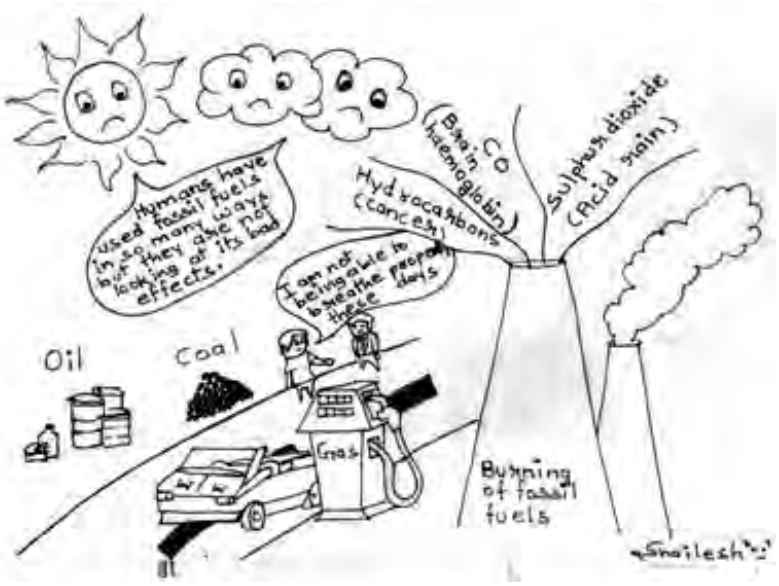
FOSSIL FUELS ARE A CURSE TO THE MANKIND -DEBATE

For the motion.

Nowadays, the most important thing in the world is any country's economy. To run the economy, there are many key factors that make each and every person of a country think, "Would our country progress and would it be able to cope up with the needs of the present and the foreseeable future generation?"

One of those key factors is also the health and wealth of the citizens of the country. But does investing huge amount of money on something which harms the citizens help to grow the economy? That 'something' which I'm talking about is Fossil Fuel. Yes, that fuel which you use in your cars, factories and probably in many more places.

To elaborate on the topic I should probably tell you what basically fossil fuels are. When animals or plants die their 'corpses' form fossil fuels & due to the pressure of the Earth, after millions of years, fossil fuels like coal, petroleum, petrol etc. are formed. They have a high calorific value and are easy to transport to different places. Due to the time taken for them to form, they are very expensive.



Factories, cars and many other day to day services or service providers use fossil fuels to power their systems. But what they emit is totally disastrous for our health. The fumes emitted from these fossil fuels have increased the amount of CO_2 in the atmosphere so much that the world is experiencing Global Warming.

CO (Carbon monoxide) is one of those harmful fumes which are emitted from fossil fuels. CO takes the place of oxygen in haemoglobin, thus, resulting in brain haemorrhage or in worst cases, death. So, instead of using fossil fuels we have many alternatives like wind energy, solar energy, tidal energy, geothermal energy etc. Sulphur dioxide causes acid rain, nitrogen oxide causes haze over populous cities and hydrocarbons cause cancer. These chemicals and fumes are all products that are formed when fossil fuel is burnt. New cleaner and eco friendlier alternatives have already been introduced to mankind but they are used in only few metropolitan cities. The fossil fuel may provide enough energy after burning. But what about the fact that it also burns our earth every time it is consumed? With this I think I have made my point clear and have explained you that how using fossil fuels may give you so many problems free with some amount of energy.

- Hrithik Malhotra, VIII

AGAINST THE MOTION

People have been blindly accusing fossil fuels for every problem that is being faced by earth for quite a long time now, say 30 years.

But it is quiet strange how people are not able to recognise this great boon because of which the mankind has come this far. Yes, ladies and gentlemen it is impossible for humans to ignore the fact that it is because of these resources that we have progressed this much in the field of technology. The industrial revolution which is said to be the biggest step towards the progress was brought about only when fossil resources like coal were exploited in England and in other parts of the world. During this period of time, many new inventions took place without which modern life was impossible to imagine.

Now we'll look at some reasons why fossil fuels are a great boon to the mankind.

- Fossil fuel sources are easy to find, extract and process compared to the amount of energy they produce when you burn them. They are low in cost and easy to use.
- Energy produced by fossil fuels costs less considering the huge amounts of energy they are capable of generating. Low energy costs reduce the cost of manufacturing, electricity production and transportation industries. Fossil fuels generate huge amounts of power from relatively compact fuel sources and power generation equipment.
- Fossil fuel-powered installations can be built in almost any location that can be serviced by pipelines, sea routes, roads or rail lines. Huge amounts of power can be generated anywhere and you can deliver large amounts of fuel.
- Fossil fuel is an extremely compact, reliable, practical and portable energy source for powering cars, ships, aircraft, trains and other motor vehicles

With this I would like to conclude by saying that accusing only fossil fuels and such resources is not the solution as they have been providing us everything that we have needed since hundreds of years. There are other reasons for global warming which I strongly feel should be looked upon to make this world a safer place to live in!

- Sankalp Agrawal, X

Quiz

2 Iceland gets 99 percent of its electricity from which of the following?

- Volcanism and hydropower
- Nuclear plants
- Coal
- Petroleum

CAREER OPTIONS IN ENERGY SECTOR

What is the Energy Sector?

The energy sector is the total of all of the industries involved in the production and sale of energy. Modern society consumes large amounts of fuel and the energy industry is a crucial part of the country's infrastructure. A large company is defined as having more than 1000 employees and can be international.

In particular, the energy industry comprises of:

- Petroleum industry
- Gas industry, including natural gas extraction as well as distribution and sales
- Electrical power industry, including generation, distribution and sales
- Coal industry
- Nuclear power industry
- Renewable energy industry, comprising of alternative energy and sustainable energy companies
- Supplying and looking after the appliances that use fuel
- A plethora of jobs around the support functions to ensure the continuing success of the industry

Range of roles

There are many disciplines offered, which include,

- Finance Looking after all aspects of finance, including accounting
- IT Developing and implementing innovative information systems for staff and customers, including software development, hardware, testing, quality and help desk support
- Human Resources All areas of Human resources from recruitment to generalist HR roles
- Production Involved in all the aspects of energy production from rigs to power stations
- Servicing Looking after energy and energy appliances and associated products, by servicing and undertaking breakdown work in premises
- Procurement Undertaking the buying and supplying of goods and services for the business
- Customer Service Providing support to customers, usually via the telephone in call centers
- Marketing Designing and implementing the marketing strategy across the business
- Sales A fast moving area covering sales of energy and energy related products to customers either over the phone or face to face

- Archit Verma, XI

WHO PAYS FOR SCIENCE?

Today, as we are the citizens of the world, we all have to pay for science. Most scientific research is funded by government grants, companies doing research and development, and non-profit foundations. As a society, we reap the rewards from this science in the form of technological innovations and advanced knowledge. But we also help to pay for it. You indirectly support science everyday through taxes you pay, products and services you purchase from companies, and donations you make to charities. Something as simple as buying a bottle of aspirin may help foot the bill for multiple sclerosis research.

Funding for science has changed with the times. Historically, science has been largely supported through private patronage, church sponsorship, or simply paying for the research yourself. Galileo's work in the 16th and 17th centuries was supported mainly by wealthy individuals, including the Pope. Darwin's *Beagle* voyage in the 19th century was funded by the British government the vessel was testing clocks and drawing maps for the navy and his family's private assets financed the rest of his scientific work. Today, researchers are likely to be funded by a mix of grants from various government agencies, institutions, and foundations. A 2007 study of the movement of carbon in the ocean was funded by the National Science Foundation, the U.S. Department of Energy, the Australian Cooperative Research Centre, and the Australian Antarctic Division. Other researches are funded by private companies, such as the pharmaceutical company that financed a recent study comparing different drugs administered after heart failure. Such corporate sponsorship is widespread in some fields. Almost 75% of U.S. clinical trials in medicine are paid for by private companies. Some researchers today still fund small-scale studies out of their own pockets. Most of us can't afford to do cyclotron research as a private hobby, but birdwatchers, scuba divers, rockhounds, and others can do real research on a limited budget.

- Priyansh Jain , X

ENERGY AND MOVIES

WALL-E:

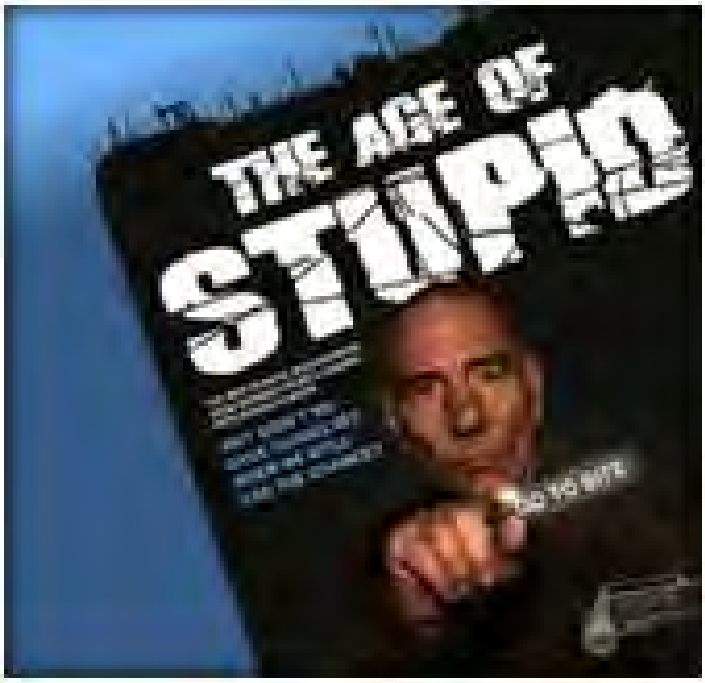
A Walt Disney animated movie which was released worldwide in the year 2008, is a mixture of three things:an enthralling animated film, a visual wonderment and a decent science-fiction story. From a scientific point of view, it tries to visualise the conditions of mankind and the earth after 700 years where nothing is left of the earth but a vast desert. All the energy resources are drained out, there's no water left and no sign of life is to be seen because of which humans left earth and started living in gigantic spaceships. The story is about how wall-e gets into the spaceship and finds himself between lazy and extremely fat people (which is because they have lived in low gravity space for years now). His only objective is to see what has become of his “girlfriend robo” Eva, who met him when the spaceship landed and spent some time with him, and also find the only ”plant” which Eva took away from him to the spaceship, as it was a part of her mission- Find signs of life on planet earth. Havoc is created as wall-e enters the spaceship and the Captain gets to know that this plant is the only thing that can lead the mankind back home!

Gas land:

As American energy firms look for new sources of petroleum, natural gas has become an increasingly important part of their portfolios, especially after the 2005 Energy Policy Act removed environmental protection restrictions against hydraulic fracturing drilling (known in the trade as "fracking"). When Josh Fox, a theatrical director and filmmaker, was offered $100,000 for the gas rights to family property on the Delaware River Basis in Pennsylvania, he was curious about the possible effects of drilling. Fox set out to talk to other property owners about what he could expect, and their answers startled him -- fracking taints water sources near drilling sites, and many households have discovered their water is not only undrinkable after gas drilling, it's even flammable! It turns out this is just the tip of the iceberg of the environmental damage done by reckless gas drilling, and in his documentary Gas land, Fox travels to 34 states and talks to dozens of property owners and environmental experts on the under-reported menace of fracking and the truth about the dangers of natural gas.

The Age of Stupid:

The film is mostly documentary-style summarizing some of the issues of climate change (especially statistics about emissions), including using clever animations. The setup of the film is a man composing a cautionary tale to be transmitted into space form the world's archive (a station in the Arctic) in 2055 about how we destroyed our world. Even though we knew it was coming and we knew what to do to avoid it. The film powerfully pulls you into the human stories, explores issues of personal choice, current hypocrisies, vividly depicts how we already are seeing the effects of climate change and presents a strong call for action (mainly mass protest) in support of international action to reduce emissions.



- Sankalp Agrawal, X

India receives solar energy equivalent to over 5000 trillion kWh/year which is far more than total energy consumption in the country.

13 percent of the world's electricity comes from nuclear power plants that emit little to no greenhouse gases.

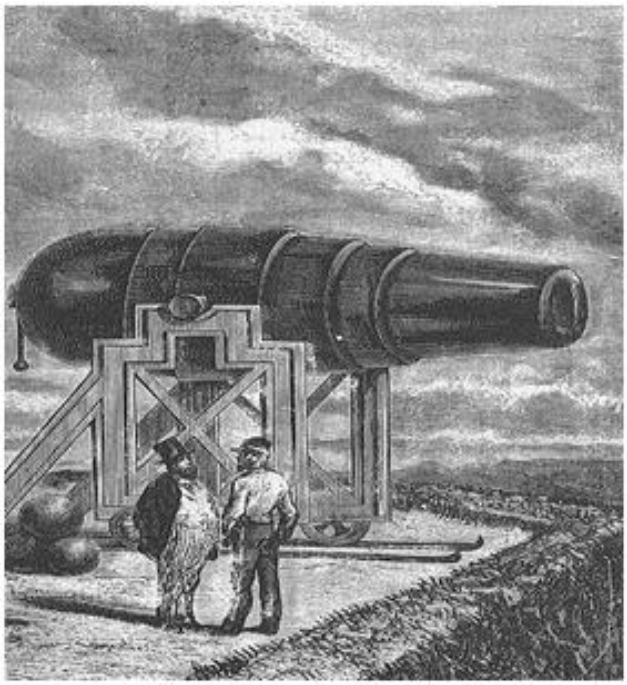
SCIENCE FICTION AND ENERGY

Virtual worlds; Terraforming complexes; Star-spanning generation ships; Science fiction is chock-full of massive technological artefacts born of humankind's desire to create, to explore. What do they all have in common? They all consume energy like black holes swallow stars. Computation, mechanization, acceleration. If the future's getting faster, it's certainly getting more energy intensive.

Even after Kelvin and others developed the theory of thermodynamics in the mid-19th century, early works of Science Fiction paid little heed to the energetic considerations of their invented worlds. Although Copernicus and Newton had ushered in enlightenment thinking centuries earlierand the heavens were no longer thought of as a Platonic realm of a different category of nature to that found on Earthwriters of this period struggled (or perhaps chose not) to engage with mechanical realities.

In Charles Curtis Dail's*Willmoth the Wanderer, or The Man from Saturn* (1890), the alien protagonist traverses the solar system with the aid of an antigravity ointment smeared over his body.

One of the earliest fictionalizations of the seeds of a workable route off-world appeared in AchilleEyraud's*Voyage à Vénus* (1865). Unlike Jules Verne's *From the Earth to the Moon,* published in the same year, where astronauts were fired into space from giant cannon, Eyraud had his adventurers lifted from the Earth by a water-based rocket propulsion system.



[An early vision of astronaut transport; Courtesy of Jules Verne.]

Despite Verne's oversight on cannon as a launching means, he carefully researched the scientific possibilities of the day, inventing many plausible technologies, and coming to understandings that were often remarkably prophetic.

Arthur C. Clarke, arguably the greatest exponent of creating great *sensawunda* moments underpinned by scientific rationale, used the solar windthe faint pressure of innumerable photons flung from the sunto power solar yachts in his story "Sunjammer."

In *Red Mars,* the terraforming of the red planet is kick-started by "mohole" drilling to release subsurface heat, the detonation of nuclear explosions deep in the permafrost to release carbon-dioxide and other heat-trapping atmospheric gases, and the insertion of a geosynchronous asteroid to which a space elevator cable is tethered.

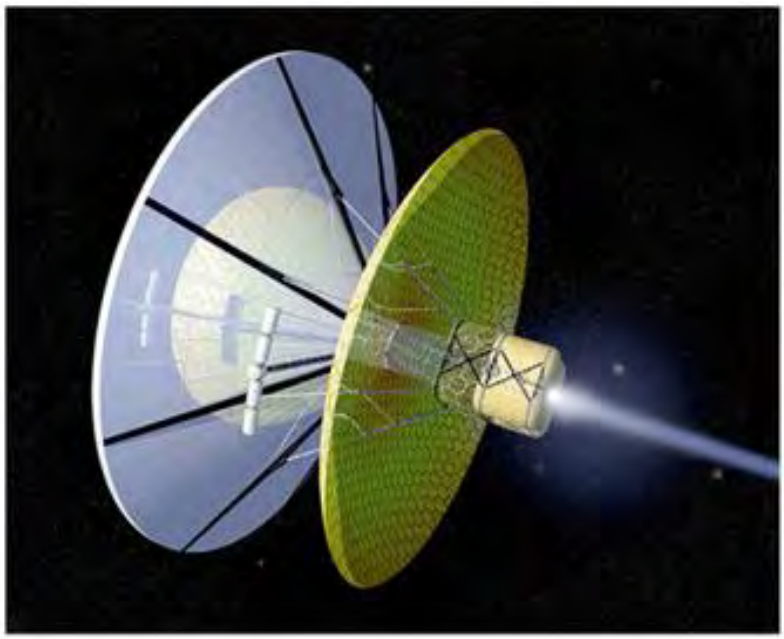
Duncan Jones' film *Moon,* Jeff Carlson's novella *The Frozen Sky,* and Joan Slonczewski's novel *The Highest Frontier*continue this tradition of scientifically informed, near-Earth exploration. In both *Moon* and *The Frozen Sky,* Jones and Carlson envision the off-world mining of fuels for nuclear fusion.

Modern Science fiction, of course, hasn't only concerned itself with the exploration and colonization of places within our own solar system. Overlapping with the declining popularity of "space-race" Science fiction through the latter part of the 20th century, new-wave space opera married the pulp adventures of the subgenre's early days with extensive knowledge of the wider cosmos gleaned from astronomer's increasingly powerful telescopes.

Seeing deeper and more up-close than ever before, writers such as Alistair Reynolds, Nancy Kress, Greg Egan, and Justina Robson have utilized the exotic playground of dark energy, pulsars, binary stars, exoplanets, nebulae, and black holes to depict human stories against the widest, most awe-inspiring backdrops. And the energy sources have often been equally spectacular.

Adam Roberts, in his first novel, *Salt,* begins with a 37-year star ship journey powered by a captured comet: "Our comet, fuel and buffer, building speed slowly. US strung out along the cable behind, eleven little homes like seashells on a child's necklace-string."

But why take any fuel at all when the interstellar medium is chock-full of ionized hydrogen anyhow? That was the astronomical fact that inspired an American physicist to conceive of the Bussard ramjet, a space drive powered by scooping up protons using powerful electromagnetic fields, fusing those protons in a fusion reactor, and using the exhaust like a conventional rocket.



In the *Halo* universe, zero-point generators harvest energy from *slip space*, while in Arthur C. Clarke's *Songs of Distant Earth,* humanity's last chance resides with the star ship *Magellan,* which is powered by a quantum drive that taps the vacuum energy.

- Shivam Agrawal, XI

STARDUST

I look at the fingers on my right,
And it seems that they are all alike.
I look at the fingers on my left,
And I inhale a wondering deep breath.

I just look and stare,
Thinking over the questions I bare,
The planets were made from stardust;
And it might be hard to believe but so were us.

The atoms in my hair
Might have come from the star 'ALTAIR'
The atoms in my ear
Might come from the stardust, as of a deer.

We all carry the 'Stars' in us
And are not just mere dust;
We look different and unique
But maybe we all carry the part of 'SABIR'

They may some light years away
But they are a part of you
So, don't feel stray
Cause you are a part of this crew

You can wonder about it all day,
And the facts would take your breath away
So, spare the brainstorm and know
That stardust is where we came from
Stardust is where we belong.

- Kunal Singh, XI

SOWEP: A NEW WORLD CREATED

This isn't one of those ordinary stories about the human civilization. It is about a major breakthrough in the history of mankind. The year is 2405 AD and most of the energy resources on Earth are finished.

"It is indeed a pleasure for me to tell you that scientists all around the world have created an energy resource that can power the whole world for three millenniums. A major contribution was done by Late Dr.SowepRamakrishnan, an Anglo-Indian who lives in Flomenasia. The presidents from various countries in the world have decided to name this substance on the leader who made it - Solution of Worldwide Energy Problems or 'SOWEP'

"So my dear students, has everyone understood this speech?"

"What is so difficult to understand in this speech? We had problems - Scientists fixed it. It was their duty to do it. Right guys?" said Max

"Yeah; what is so special in that?" followed Robert.

"It was a great discovery and we should respect these people" I replied. "It was a very difficult task to perform. And we people would otherwise still be living underground if these guys hadn't made it to this level"

"So why don't you tell us about the difficulties they faced?" argued Jake.

"It started when I was in my mother's womb and the world was still in darkness. A team of Scientists led by SowepRamakrishnan decided to give gift to humanity by creating an inexhaustible energy resource".

"'Sir, I have brought penicillin as you wished, but may I kindly ask what is it for?" Louis asked.

"My friend, I have already discovered a way that will help mankind for eternity but I am scared to reveal it to the whole world. I Have Created LIFE." replied Sowep'

As soon as the words from Sowep's mouth came out, they shocked Louis as if he was struck by lightning.

'"What do you…? What do you mean sir?"

"I have created an element which when mixed by penicillin increases the production of live cells than dead cells by a thousand forth. Thus, one would NEVER DIE"

"That is amazing news. We should spread it to the whole world!"

"No my friend. If we will do so, then the population of the world would be increased by at least 10 times, and I'm sure we don't want that. Plus, I used up all the energy in The Large Hadron Collider and just still managed to make 2 grams of it. So, I think we should proceed for the greatest scientific breakthrough in the history of mankind."

"It is ready sir!"

"Launch it!" Sowep commanded.

Louis started the machine but suddenly the machine stopped and the mixture went to half its capacity.

"No! No! No! No! No! No! All the hard work, all the calculations, just… gone…" cried Sowep

"There must be a mistake, sir" consoled Louis

"I know this mistake now. For the mixture to work and create energy, it would require a living medium to travel through, and the medium would be ME!"

"No sir! It will kill you!"

"But, imagine how many lives it would help to flourish. *Kuch pane keliyekuchkhonapadtahai*…."

"With this, Sowep went to the machine, changed its commands and then went inside it.

"…. That great man sacrificed his life for us. He sacrificed it so that we would be able to live in the world of light, and here we are disrespecting him!"

"How do you know so much about this project and Sowep?" enquired Max.

"Dr.SowepRamakrishnan, the man who made better world for us to live in was…… my FATHER!"

On hearing this, each and every student had tears in his eyes.

- Hrithik Malhotra, VIII

Quiz

3. Which country produced the most coal in 2011?

- Australia
- Burundi
- China
- U.S.

4. In 1990, which source of energy had the maximum usage ?

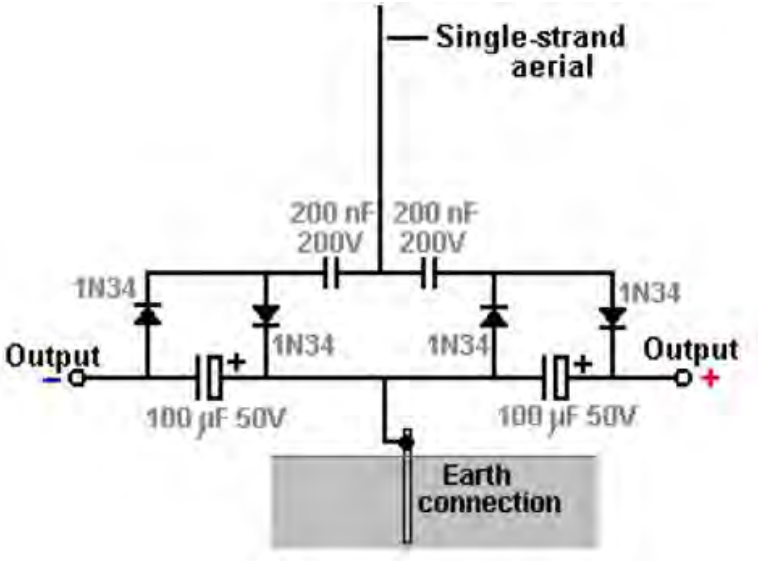
- Nuclear
- Coal
- Natural gas
- Oil

SAM PITRODA AWARD

Last date for the project submission was approaching rapidly. Sam Pitroda is a coveted award given to the budding scientists of the school. I was working with one of my friend on artificial intelligence and the project failed. We switched to back-up model, which would trap energies present in air (radio waves etc.) using receptors and convert it into electricity. We toiled very hard but could produce only 0.06volts, small but very big to be free energy. Although we won the award for the year 2010-11but the hunger to know more was not satisfied. The next year, we being unconventional, chose the same project and made some major changes in the antenna, circuit etc. After a lot of experimenting with different circuits, we managed to get 6.56V which was almost 100 times more than what we started with. There is an increasing need of cheaper and dependable source of free energy. The next objective of the scientific field is to reduce the cost and increase the efficiency. Nikola Tesla using some experiments showed that the air possesses a potential to provide energy for years. One can create electricity by using a metal sheet and a very good earthing. People say that this phenomenon is due to charging of the plates because of possibly two sources of energy that is Radiant energy and Zero-point energy. It is believed that there are more than two hundred lightning strikes every second on earth, people generally do not understand is that they are radiant energy events and their effects are felt instantly everywhere on earth as transmissions through the Zero-point energy field are instantaneous at any distance.

With increasing consumption of energy and increasing demand to reduce its cost, it is very important for us to find a viable and permanent source of free energy. Nikola Tesla in his patent, Patent No-685,957 and Patent No-649,621 has explained Apparatus for the utilization of radiant energy and Apparatus for the transmission of electrical energy respectively. He showed how radiant energy can be trapped using antenna and a good earthing. He got satisfactory results but still there has not been any special research done on this topic, other than a scientist, T. Henry Moray who produced a huge amount of electricity as big as 100 watts but stopped his research on this topic after some threats and murder attempt. The basic purpose of our project is to see whether this system is really cost effective, unlimited source and why this energy have not yet been harvested for real life use. We are using a project by a Danish developer who prepared apparatus to research in a small scale. We started with a very primary model and developing it step by step by inferring its results.

We are using a very primary model consisting of some capacitors, diodes, aluminium plate/sheet, copper earthing and heavy duty wires.



The judge was very impressed by seeing our effort and we have been asked to make research paper in our research and take it to the next level. It feels great to be a winner of the Sam Pitroda twice consecutively. I would like to thank Mr. Mukesh Tiwari for his constant help and support, he would always push us whenever we felt low and I would also like to thank my friend and partner for this project, Asad Khan Chowdhary for helping me all through the project. I would also like to thank my housemates for bearing all the pain I gave regarding my project, for allowing me to work with the lights on till 2am in the night and helping me with the same. This project would not have been a success without the Bursar, and my house master. I hope we would take this project further in future. I would urge all the readers to "Keep inventing and keep researching" because this is how we the humans have evolved.

Neelav Agarwala, Asad Khan Choudhary

Ex- SH, 2013

INNOVATION EN ROUTE FOR SCIENCE

Aryabhat Astronomy quiz

Hritik Meherotra, Utsav Akhaury, Anustup Garai and Archit Verma got through the prelims of Aryabhat Astronomy quiz and gave the secondary level examination at ITM Gwalior. Archit Verma and Utsav Akhaury stood 4th and 1st in Madhya Pradesh respectively.

Tele Mars-2013

The Cybo-Scindians Parijat Naithani, Monish Choudhary and Aishwary Agarwal participated in the national level robotics competition 'Tele Mars-2013'. They made it to the Final round.

National Conference of Space

Nine boys went to Chandigarh to attend the National conference of Space. The boys attended lectures from the leading scientists and researchers like Dr. H.P. Singh, Dr. Jayant Narlikar and many more. It was a very rich learning experience for the students.


National Conference of Space

Junior Science Fest

"Science Fest" for the classes 6th and 7th was organized from 18th March to 20th March 2013. During this period, various activities like Science quiz, Science skit competition, Poster making, Story writing, Science exhibition etc. were conducted. Students created things like Jaltarang, Solar Powered Bulb, Wind Powered Crane and Solar Water Distillatory.

Workshop on "Teaching Science by Enquiry through activities"

On 2nd April 2013, the workshop was inaugurated and the first activity conducted was a science quiz, which was thoroughly enjoyed by the students of other schools as well as our school. In the afternoon, a session was conducted for teachers of various school where they were guided how to conduct various activities in Physics and Chemistry. There were briefings by Prof. Samar Bagchi (80 years), Dr. B.N. Das (73 years) and Prof. Santosh Mitra (75 years).


Teacher's Workshop


Junior Science Fest

Visit to Observatories

Archit Verma and Utsav Akhaury were rewarded a trip to the Kodaikanal and Kavalur observatories respectively from 2nd May-10th May for performing exceptionally well in the secondary level of Aryabhat Astronomy Quiz. They both also got a chance to visit the Raman research Institute and the controlling centre of Himalayan Chandra Telescope (located at Leh) at Bengaluru and Hoskote respectively.

Educational Trip to Bharatpur Bird Sanctury

1st December 2012 was a memorable day for students of class 6th as they went to Bharatpur Bird sanctuary for an Educational Trip. This bird sanctuary is a part of Keoladeo National Park and was created 250 years ago. It is popular as it is a home of 230 species of bird and highly endangered birds such as Siberian Crane come here during winter season. Students watched some of the birds such as Bulbul, painted stork, spotted eagle etc.


Bharatpur Bird sanctury

Workshop on Teaching in Methods and Approaches

Dr. Raka Ray Mandal was on the campus for 14 days to conduct workshops on Interdisciplinary teaching in middle school, inclusive education for SEN students, improvising lesson plans to incorporate activity based teaching and experiential method of learning.

Guided by her, the Science teachers conducted experiments in their classes for which an immediate feedback was provided on ways of making the lesson more effective. A discussion would ensue after each session where all aspects of teaching were covered- the non-verbal behaviours, the introduction to a lesson, the greeting words etc.


Bhopal trip

Trip to Bhopal

The students of class 8th went on an educational trip to Bhopal from 7th September to 10th September. The students visited the Manav Sangrahalaya, Bhimbetka, Darul Uloom Tajulmasjid, Science Centre and the Bhopal Lake.

Workshop by Prof. H.C. Verma

Ms Niharika Kulshrestha attended a National Workshop of Utsahi Physics Teachers (NWUPT) From 25th to 30th May. This workshop was conducted under Science Communication Programme of National Academy of Sciences India (NASI). The resource person was Professor HC Verma Department of Physics, IIT Kanpur. The 6-day workshop was attended by 36 participants from 10 different states.

Initiative of Scienstein

Scienstein is the newly launched monthly newsletter which will deal exclusively with Science. The newsletter has started under the guidance of Dr. Geeta Shukla and the enthusiastic and creative editorial Board comprising students of Classes VII- XI. It aims to include the details of the latest science activities, breakthroughs, inventions and discoveries from all around the world. The aim is to inculcate a spirit of scientific inquiry and to foster the habit of asking questions and finding their answers. The main idea is to make Science more enjoyable and a way of life rather than just a subject to study.

Robotics workshop by Technido

A workshop on robotics by Technido started on 3rd October 2013. Students learnt a lot about robotics and made many robots like manual control robot, line follower robot, light sensing robot and an obstacle avoider. They also had race and sumo wrestling competition of the robots they made.


Robotics workshop

Quiz

5 What energy is projected to be the most used in 2030?

- Nuclear
- Coal
- Natural gas
- Oil

6 Japan turns which of the following into renewable energy?

- Crowd noise at sumo wrestling matches
- Stationary bikes in spinning classes
- Footsteps at Tokyo train stations
- Leftover sushi rice

WHAT PEOPLE FEEL ABOUT ENERGY…

Q) What comes to your mind on hearing the word ENERGY?

- Life — **Mr. Soumick Bagchi**
- Photon — **Mrs. Shalini Mehrotra**
- Alive — **Ms. Sangeeta Jain**
- It is something without which there would be no life on earth — **Mr. Ashok Shivraman**
- Energy is the prime source of everything in this universe, may it be in the form of science, geography, Philosophy or spiritually — **Mrs. Tanu Tewari**
- Something that is essentially required to do anything that comes to our mind — **Mr. Vijay Bhawani**
- Big bang - it is the only thing which comes into my mind after hearing the word ENERGY — **Mr. Arghya Das**
- It is the strength and vitality required for sustained physical or mental activity — **Mr. Jason Mazumdar**
- Young children playing in the compound — **Mrs. Anita Pandey**
- I need loads of it to get through the day — **Mrs. Niharika Kulshreshtha**
- Controlled and safe nuclear fusion because that is the ultimate quest — **Mrs. Vinita Pandey**
- Energy for me is the strength that allows us or any machine to function or work. — **Mrs. Raksha Siriah**

Q) "Save Energy" which is the first thing you adopt in your daily life?'

- Save Water — **Mr.SoumickBagchi**
- Save water, electricity and fuel — **Mrs. Shalini Mehrotra**
- Switching off equipment when not used — **Ms. Sangeeta Jain**
- Switching off the fans and lights when not required and using natural light as far as possible — **Mr. Ashok Shivraman**
- To stop the wastage of electricity and water — **Mrs. Tanu Tewari**
- I try not to waste food and water — **Mr. Vijay Bhawani**
- I sleep a lot in my house to save the energy which is present inside me!. Actually I minimize the usage of electricity by a lot of means in my house — **Mr. Arghya Das**
- By changing to compact fluorescent light bulbs (CFLs), reducing air conditioning usage in the summers, by setting the thermostat higher will use less energy — **Mr. Jason Mazumdar**
- Switch off the lights that are not required — **Mrs. Anita Pandey**

- Do least amount of cooking **Mrs. Niharika Kulshreshtha**
- I get up after sunrise so that I don't have to switch on the lights **Mrs. Vinita Pandey**
- The first thing I adopt in my daily life is to make sure that no unwanted wastage of electricity or fuel for vehicles and water at home takes place. **Mrs. Raksha Siriah**

Q) What is it composed of?

- Oxygen and Hydrogen **Mr.SoumickBagchi**
- What? Energy!? Not sure if anyone really knows. However, the easiest explanation may be that it is a property of a physical system which determines it's potential **Mrs.ShaliniMehrotra**
- Infectious material **Ms.Sangeeta Jain**
- Life sustaining particles/elements **Mr. Ashok Shivraman**
- WHAT??? **Mrs. Tanu Tewari**
- I believe energy is composed of energy itself **Mr. Vijay Bhawani**
- Light (which is a type of energy) is composed of small packets called 'Quanta' **Mr.Arghya Das**
- [Ma'am, I can't think of an answer for this. Please help] **Mr. Jason Mazumdar**
- **….?** **Mrs. Anita Pandey**
- Saving fossil fuel (LPG) **Mrs. Niharika Kulshreshtha**
- It is composed of the pleasure of extended sleep and my contribution to lessening the world's carbon footprint **Mrs. Vinita Pandey**

Q) What are types of energies you know?

- Sound energy, Visual energy, Light energy, etc **Mr. Soumick Bagchi**
- Thermal, mechanical, nuclear, electrical, chemical, electromagnetic. (Do I name all!?.....won't fit in the pages of Nucleus) **Mrs. Shalini Mehrotra**
- Positive **Ms.Sangeeta Jain**
- Potential energy, kinetic energy etc. **Mr. Ashok Shivraman**
- In terms of science there many types but the most required for life and soul is POSITIVE ENERGY of thoughts **Mrs. Tanu Tewari**
- Solar, Kinetic, Muscular, Wind, Water, Electrical, Nuclear, Atomic etc. **Mr. Vijay Bhawani**
- Scientifically, there are several types of energy like light, sound, heat, mechanical, electrical, nuclear, etc. But to me, energy is of only two types: Positive and Negative. Positive energy is the thing which keeps us happy; it enables us to perform all our duties with full devotion; it makes us feel that everything around us is good. Negative energy causes anger, greed and envy in us **Mr. Arghya Das**
- Sound energy, heat energy, light energy **Mr. Jason Mazumdar**

- Spiritual energy, getting positive vibes from the ones who care for you, being able to face adversities of life and still going strong **Mrs. Anita Pandey**
- Wind, nuclear, kinetic, potential, sound, light, chemical, solar, ocean thermal energy, biomass energy, hydel etc. **Mrs. Niharika Kulshreshtha**
- I know about kinetic energy, potential energy, latent energy, renewable energy, geo thermal energy, nuclear energy, physical energy, mental energy and vocal energy **Mrs. Vinita Pandey**
- Food gives energy, electricenergy, fuel gives energy, wind energy and solar.

Mrs. Raksha Siriah

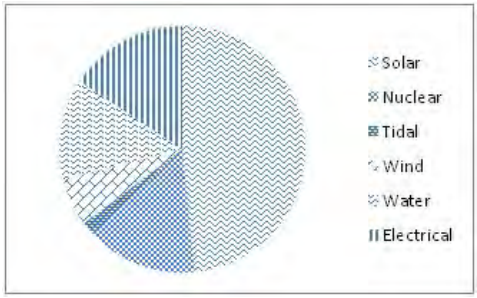
Q) What energizes you?

- Nature, music and good movies **Mr. Soumick Bagchi**
- A cup of hot coffee with *Moongdalpakoras* **Mrs. Shalini Mehrotra**
- Others' smile and laughter **Ms. Sangeeta Jain**
- A calm mind and a bright sunny day **Mr. Ashok Shivraman**
- Music, Dance ,Yoga, Time spent with my family **Mrs. Tanu Tewari**
- A glass of fresh fruit juice **Mr. Vijay Bhawani**
- 'Hope' is the only thing which can provide immense energy to anyone. Sometimes, 'sweet memory' also does it to some extent. Scientifically, in the process of 'Respiration' in which energy is liberated from the food we eat **Mr. Arghya Das**
- After playing a long game of tennis, I get exhausted. And then, I prefer to drink 2 glasses of chilled water, which energizes me **Mr. Jason Mazumdar**
- Being surrounded by cheerful and positive people **Mrs. Anita Pandey**
- A good book **Mrs. Niharika Kulshreshtha**
- The whistle of cool mountain breeze playing with the tree tops **Mrs. Vinita Pandey**
- My students and adventure activities. **Mrs.RakshaSiriah**

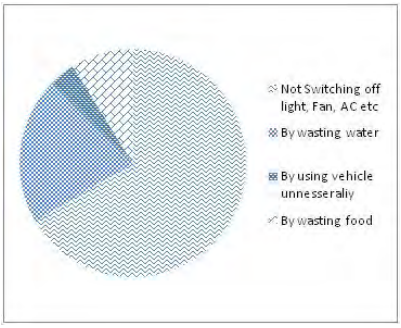
Nuclear power plants use nuclear fission (the process of splitting an atom in two). Nuclear fusion (the process of combining atoms into one) has the potential to be safer energy because it is produced at a much lower temperature. However, nuclear fusion technology has not yet been developed to operate within a large power plant.

OPINION POLL FOR STUDENT

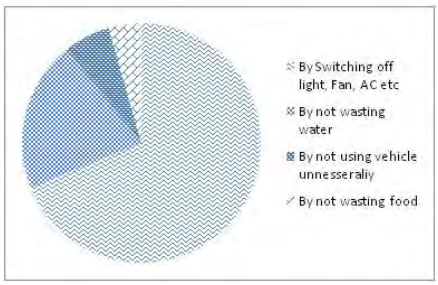
A survey was conducted by the Nucleus across the students of The Scindia School to know their opinion on how they think they are wasting energy and what alternatives can they take to save energy or how can they be good at saving energy. The results of the survey are as follows:



Given choice which energy source will you prefer?



How do you think that you waste energy most in school?



How do you think that you can save energy most in school?

Needless to say, students are always encouraged to take initiatives on how can they minimise the use of energy or prevent energy from getting wasted. Also most of them are aware what alternatives can they take in order to stop excessive usage of some sources of energy. Most of the children feel that solar energy is the most effective and efficient source of energy according to the poll. It may simply be because they are aware of how solar gadgets work and what wonders can solar energy do!

Realisation of a mistake is the first step towards improvement. Here children realise that most of the wastage takes place when they knowingly or unknowingly leave the lights and fans switched on. These mistakes result in vast amounts of wastage every day; this is what the students feel. What initiatives have they taken to stop the wastage of energy? Well, the answer is quiet simple; switching off lights and fans when not in use. They feel that a little more alertness and responsibility can save lots of energy from getting wasted. These small initiatives are not really small if practiced on daily basis; after all it is our Earth where we have been living for thousands of years and it should be our sacred duty to look after it and its gifts!

QUIZ

7 Which country generated the largest percentage of its electricity from nuclear energy in 2011?

- US.
- Slovenia
- Finland
- France

8 Which of these is not a renewable energy source?

- Natural gas
- Wind power
- Solar electricity
- All of the above

9 Which of these areas has the fewest natural gas reserves?

- Africa
- Middle East
- Asia Pacific
- South and Central America

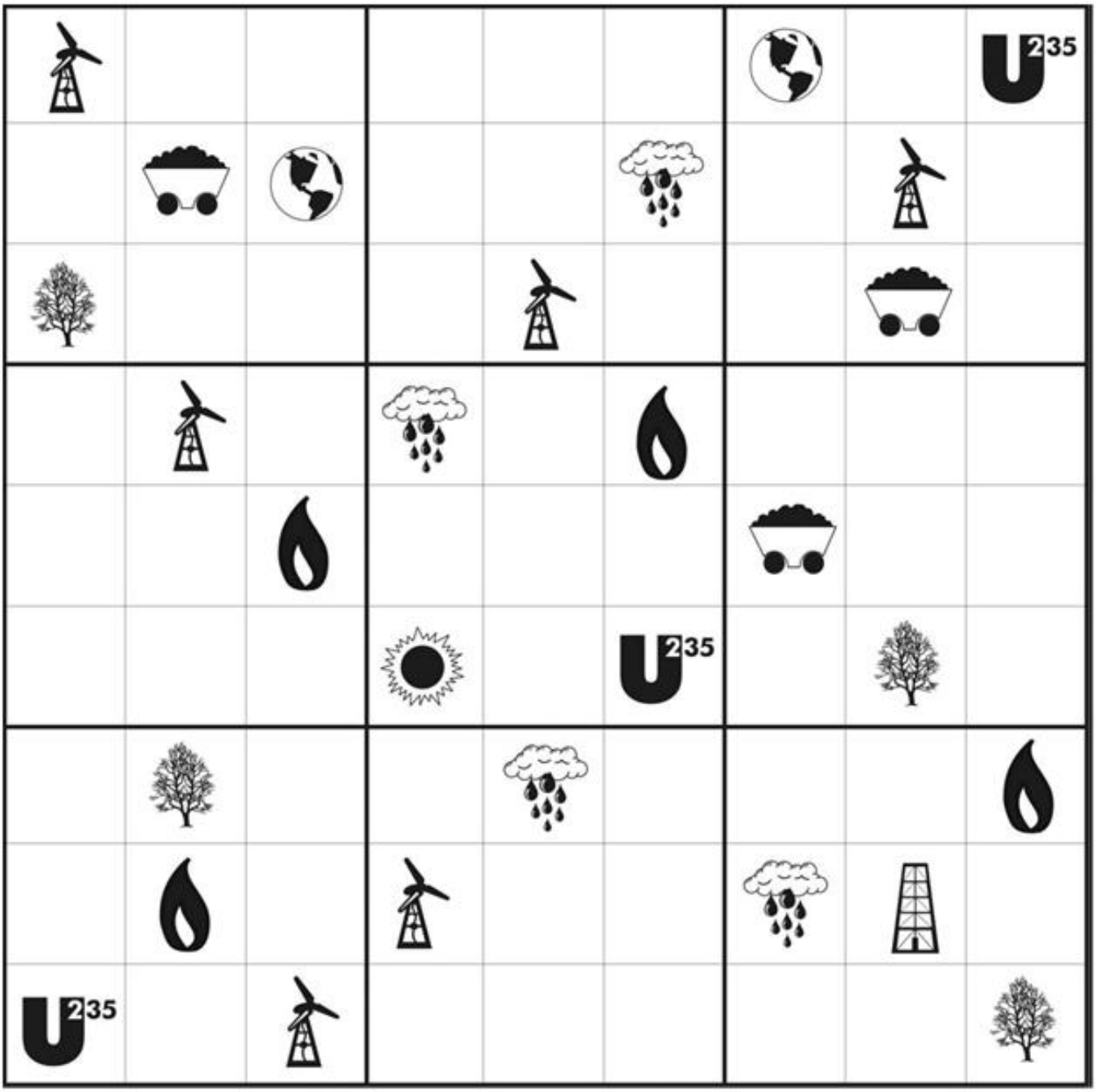
10 What country contains the world's largest proven oil reserves?

- Kuwait
- Saudi Arabia
- Russia
- Canada

ENERGY SOURCE SUDOKU

Sudoku is a logic-based placement puzzle consisting of a 9x9 grid of cells. Typically using numbers, this puzzle uses energy source symbols for biomass, coal, geothermal, hydropower, natural gas, petroleum, solar, uranium and wind.

To solve the puzzle, each 3x3 region of the grid must contain only one source symbol. Each row and each column of the puzzle must contain only one energy source symbol. There is only one solution. Good luck!




SAVE WATER
Let's play with Water
AT NIGHT IN THE DREAM...
STOP Wasting Water or I Will take you to God of Water.
I am God of Water I will Kill you
I will have to do Something to say Sorry
I will not waste water, I will use it for good purposes.
Now, Its so much fun watering plants
SAVE WATER,
SAVE LIFE
Made by :- Jatin Rai and Satyam Malik...

WORD SEARCH

There are twenty energy related words are hidden in the grid below. Find them. Answers are given in this issue itself.

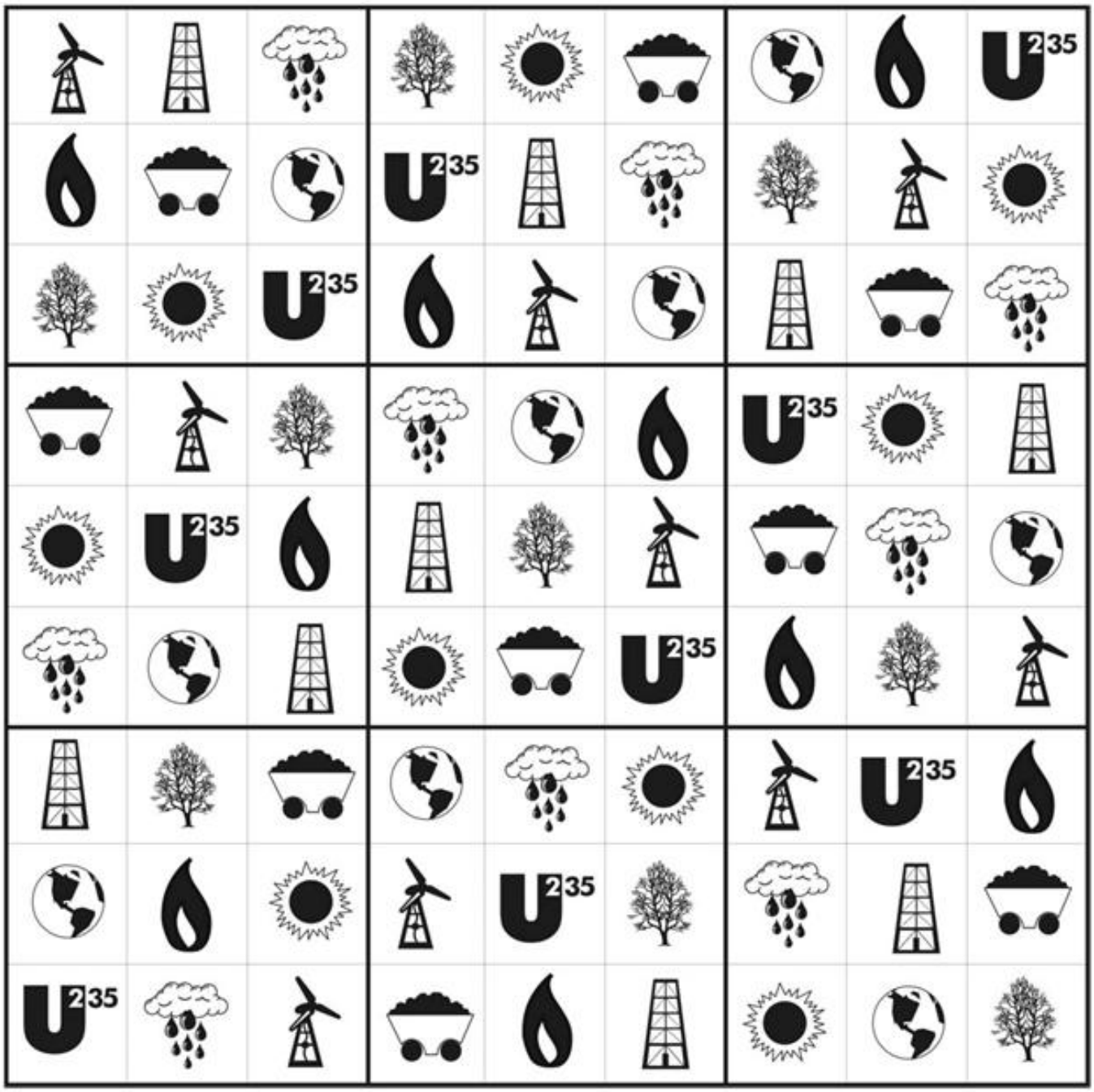
G	S	O	L	A	R	P	A	N	E	L	H	H	H	N
E	E	V	G	E	N	E	R	A	T	E	Y	Y	E	U
N	A	O	F	G	W	I	N	D	N	W	D	D	A	Y
E	B	L	T	B	N	H	J	L	U	I	R	R	T	T
R	D	T	Q	H	K	M	P	L	C	N	O	O	L	F
A	S	A	W	J	E	F	H	S	L	D	T	E	K	U
T	A	G	E	K	L	R	K	O	E	M	H	L	J	S
I	D	E	R	L	E	G	M	L	A	I	E	E	H	I
O	F	J	Y	S	C	H	G	A	R	L	R	C	G	O
N	G	K	T	D	T	H	V	R	L	L	M	T	F	N
T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

Answers of the WORD SEARCH

1. GEOTHERMAL
2. ELECTRON
3. HYDROELECTRIC
4. SOLAR
5. GENERATION
6. PLASMA
7. VOLTAGE
8. CURRENT
9. FUSION
10. FLOW
11. SOLAR PANEL
12. GENERATE
13. HYDROTHERMAL
14. WIND
15. TIDAL
16. WINDMILL
17. HEAT
18. RENEWABLE
19. POWER
20. NUCLEAR

- AyushBarya, Class IX

Facts- Collected by TridibeshGogoi, X



Source: http://www.suntechnics.com/in/bioenergy_biomass.htm

Quiz

Answers

1. Asia Pacific, 2.Volcanism and hydropower, 3.China, 4.Oil, 5.Natural gas
6.Footsteps at Tokyo train stations,7.France, 8.Natural gas,
9.South and Central America, 10.Saudi Arabia

-Hritikpankaj

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