

VOLUME 13 • JUNE 2022

EARTH ROOT

EFFECT OF HEATWAVE ON HUMANS AND THE ENVIRONMENT

-Sunanda Maurya

CAUSES AND CONSEQUENCES OF HEATWAVE

-Nimarpreet Kaur Kalsi

FUEL OF THE FUTURE: HYDROGEN GAS

-Aditi Avasthi



earthrootfoundation.org



Earth Root Foundation



Earth Root Foundation



@earthrootfoundation



EarthRootFound1

About E-magazine

“Earth Root” is an open access e-magazine in the discipline of Environmental sciences published by Earth Root Foundation. The aim of the e-magazine is to provide information and upgradation of knowledge about environmental issues on wider scale and to share ideas and resources to the readers. Using essential knowledge people can lead a healthy life, which is more sustainable and can connect with ongoing efforts for stopping catastrophically the climate change. E-magazine caters to all related environmental aspects ranging from big issues like climate change, renewable energy and pollutants in the atmosphere to the health of human and living beings on Earth. We also take topics of water resources and efforts and measurement to provide optimum use of it; including large scale atmospheric circulation linked with oceans and ecology.

Magazine Particulars

Title	Earth Root
Frequency	Monthly
ISSN	----
Publisher	Earth Root Foundation
Chief Editor	Dr. Vivek Panwar
Copyright	Earth Root Foundation
Starting Year	2021
Subject	Environment
Languages	English
Publication Format	Online
Phone No.	011 49064364
Email Id	info@earthrootfoundation.org ; vivekpanwar@earthrootfoundation.org
Mobile No.	+91 8766317774; +91 9990013202
Website	www.earthrootfoundation.org
Address	456, Pocket B, Sector-13, Dwarka, New Delhi-110078

Editorial Board



Dr. Vivek Panwar

Editor-in-Chief

Assistant Professor, Department of Physics & Electronics, Rajdhani College, University of Delhi, Ring Road, Raja Garden, New Delhi – 110015, India

Email: vivek.panwar@rajdhani.du.ac.in

Profile Link: <https://www.rajdhanicollege.ac.in/Base/faculty/173>

Prof. Surendra Kumar Dhaka

Editor

Professor, Department of Physics & Electronics, Rajdhani College, University of Delhi, Ring Road, Raja Garden, New Delhi – 110015, India

Email: skdhaka@rajdhani.du.ac.in

Profile Link: <https://www.rajdhanicollege.ac.in/Base/faculty/159>



Dr. Narendra Singh

Editor

Aryabhatta Research Institute of Observational Sciences (ARIES), Manora Peak, Nainital – 263001, Uttarakhand, India

Email: narendra@aries.res.in

Profile Link: <https://www.aries.res.in/people/user-profile/sci/76>

Dr. Deeksha Katyal

Editor

Assistant Professor, University School of Environment Management, Guru Gobind Singh Indraprastha University, Sec-16C, Dwarka, New Delhi – 110078, India

Email: deekshakatyal@ipu.ac.in

Profile Link: http://www.ipu.ac.in/usem/Assistant_Professors.php



Dr. Pawan kumar

Editor

Assistant Professor, Department of Chemistry, Rajdhani College, University of Delhi, Ring Road, Raja Garden, New Delhi – 110015, India

Email: drpkumar@rajdhani.du.ac.in

Profile Link: <https://www.rajdhanicollege.ac.in/Base/faculty/248>

TABLE OF CONTENTS

FUEL OF THE FUTURE: HYDROGEN GAS

4

**COAL SHORTAGE AND POWER CUTS-
GLOBAL ISSUES IN DIGITAL INDIA**

6

**CAUSES AND CONSEQUENCES OF
HEATWAVE**

8



**EFFECT OF HEATWAVE ON HUMANS AND
THE ENVIRONMENT**

11

**SCIENTIFIC FACTS ABOUT THE
HEATWAVE**

13

SUSTAINABLE AGRICULTURE PRACTICES

15

**IMPORTANCE OF ENVIRONMENTAL
SUSTAINABILITY**

16



**PLASTIC RECYCLING AND EXTENDED
PRODUCER RESPONSIBILITY**

18

MOVIE REVIEW - CARBON

20



FUEL OF THE FUTURE: HYDROGEN GAS

Aditi Avasthi
Shyama Prasad Mukherji College

"I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable."

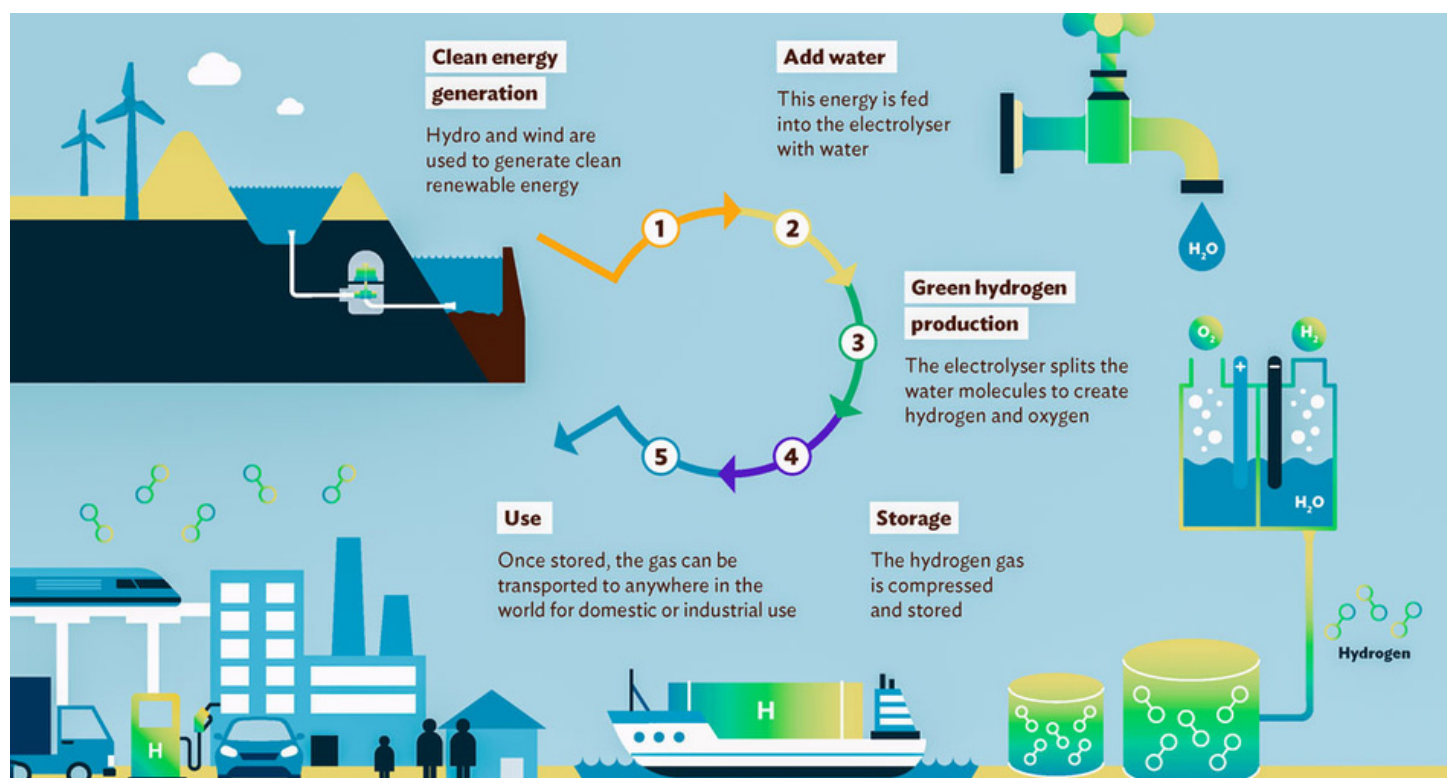
- Jules Verne

Hydrogen is a zero carbon-based fuel. When burnt with oxygen it produces just water as the end product, hence, it is considered to be a clean fuel. Presently, many commercial fuel cell vehicles and passenger cars utilize hydrogen in place of conventional fossil fuels.

It is popular rocket fuel, providing an impressive amount of impulse intensity. It's very light in weight and burns with incredible vigor. Hydrogen seems like the ideal fuel not only for the present but also for the future. It can aid us in tackling environmental issues. Air pollution due to vehicles as well as some industries can be reduced considerably as well as some industries. Hydrogen is very eco-friendly and is found in abundance on the earth. Hydrogen is a renewable source of energy.



Source: Google, Just love chemistry



Source: Google, Solarthermalworld.org

A few challenges, however themselves when it comes to making hydrogen the "go-to" fuel. The extraction of hydrogen is still dependent upon fossil fuels. Green hydrogen is obtained by a process called "electrolysis". The majority of hydrogen production is met by processes that involve the utilization of fossil fuels such as methane gas reforming. The process is also decently expensive which makes hydrogen a pretty luxurious fuel. The transportation and storage are costly as due to the low density of hydrogen it has to be stored under high pressure to maintain its efficiency. Hydrogen is highly volatile and flammable and odorless which makes it hard to detect a leak.

Despite all this, it's safe to say that with better strategies and technological advancements we'll be in a place to regard hydrogen as conventional fuel.

FUEL CELLS ARE A CLEAN WAY TO PRODUCE POWER.

Fuel cells are similar to batteries in that they produce electricity without combustion or emissions. Unlike batteries, fuel cells do not run down or need to recharge—as long as there's a constant source of fuel and oxygen. Compared to conventional gasoline vehicles, fuel cell vehicles can even reduce carbon dioxide by up to half if the hydrogen is produced by natural gas and by 90%, if the hydrogen is produced by renewable energy, such as wind and solar. There are also no pollutants emitted from the tailpipe—just water!

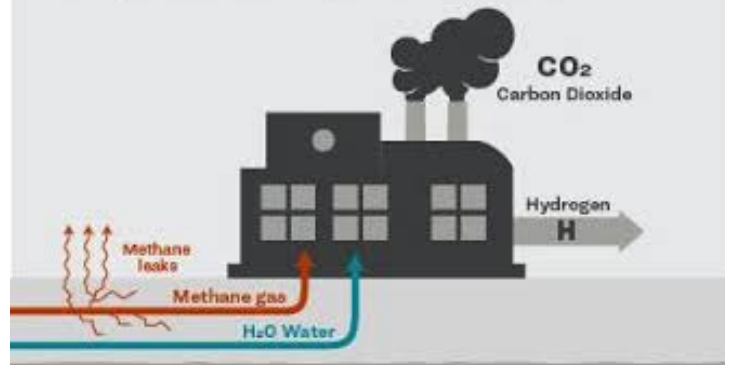


Source: Forbes

Three ways to make hydrogen

Gray hydrogen plant

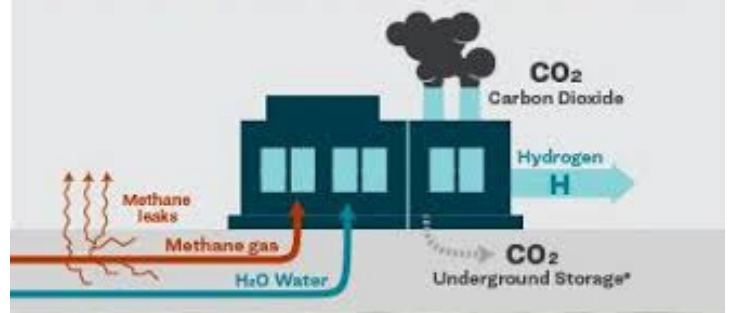
Steam methane reforming process uses methane gas and creates a reaction that results in hydrogen and carbon dioxide, which is released into the atmosphere.



Blue hydrogen plant

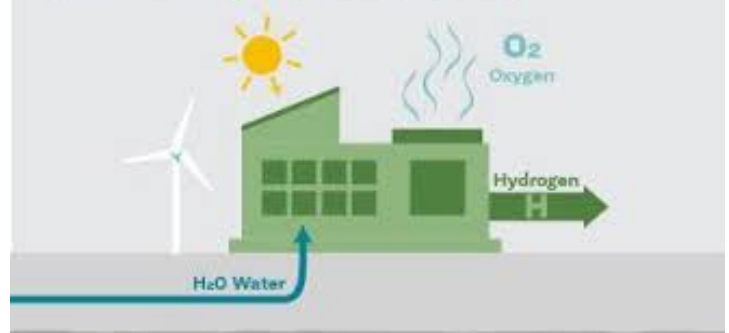
Steam methane reforming process uses methane gas and creates a reaction that results in hydrogen and carbon dioxide. Some of the carbon is captured and stored, while some is released into the atmosphere.

*Underground storage of carbon poses additional environmental issues



Green hydrogen plant

Process uses electrolysis to separate the hydrogen from oxygen in water and is powered with some form of renewable energy. No fossil fuels are used.



Source: Sierra Club

COAL SHORTAGE AND POWER CUTS- GLOBAL ISSUES IN DIGITAL INDIA

Mehak Tiwari

*Shyama Prasad Mukherji College for Women
University of Delhi*

On which planet are we living? Of Course on the planet Earth and not on papaya or Mars and the reason why we live is that this is the only planet which can tolerate human beings and still being and showering love selflessly by providing us the humans, basic resources to sustain our lives. To sustain human needs the resources were broadly classified in two categories i.e. first Renewable resources which are those resources which can be renewed or replaced naturally and will never run out, for e.g. Oxygen and Sunlight. On the other hand we have Non renewable resources which once used up can't be replaced or renewed within a reasonable period of time. For e.g. fuels like petroleum, natural gas or coal which take millions of years to form.

We can't imagine a day without our A.Cs in these hot summers but on which they are running, the simple answer is electricity, and no wonder India is also dependent on thermal energy which is solely based on coal.

WHY DO WE NEED TO BE CONCERNED?

Coal is a fossil fuel. It has formed over a period of millions of years, by the gradual decay and compression of buried remains of ancient forests involving a process of carbonization. Most of the Indian states are staring at blackouts and long power cuts, especially in states of Uttarakhand and the northeast. This is and will bring massive difficulty for common citizens and businesses across the country.



Source: Google, Boston.com

HOW DID INDIA LAND IN THE COAL CRISIS?

There was a steep rise in demand with a temperature rising to historic levels to which the country's electricity consumption soared. Secondly, post-COVID recovery has also increased power demand. And thirdly India's supply was hit by the Russian War on Ukraine. 108/173 thermal power plants have critically low levels of stock and could only meet the demand for a few days. Being the second biggest importer of coal, India's supply is hit. Passenger trains also saw cancellation to have faster movement of coal carriages.





Source: Google, Duluth News Tribune

CONCLUSION:

Sensing the crisis, the central government has stepped in, the government has assured us that the situation will be handled. The stock is replenished on a rolling basis but it can't be denied that millions of people across the country have difficult days ahead. What can be done in these troubling times is that we realize it's a matter of pride that we are adopting sustainable architecture and the idea of a smart city but also emphasizing more solar energy, wind, and biogas. As a part of a progressive nation, by following the path of conscience we as a citizen must adopt and according to the basic conservation of energy. If we remove I from illness and add us in illness even illness can become wellness thus by having a positive outlook and together working healthily we can make the change.

DID YOU KNOW?



It takes roughly 1 million years to form coal. Now you see why it's classified as a non-renewable energy source.

FUN FACTS

- The Romans used to wear coal as jet jewellery, use it in blacksmiths' forges, for heating their soldiers' forts and maintaining a perpetual fire at Minerva's shrine in the city of Bath



Source: Google, The spruce crafts

- The Titanic's coal stores had been burning for weeks before she set sail, damaging the starboard side of the ship where the iceberg hit. The fire damaged the hull enough to be a large contributing factor in why the iceberg caused such damage



Source: Google, Nicholas Rosses

CAUSES AND CONSEQUENCES OF HEATWAVE

Nimarpreet Kaur Kalsi
Mata Sundri College For Women, New Delhi

The 21st-century witnesses the abnormal increase of atmospheric temperature due to the overexploitation of the environment through deforestation, high consumption of fossil fuel, etc. The heatwave has great potential and is more dangerous as compared to another natural phenomena like hurricanes, lightning, and tornadoes. In this article, we are given a short note on the concept, definition, causes, and impact of heatwaves.

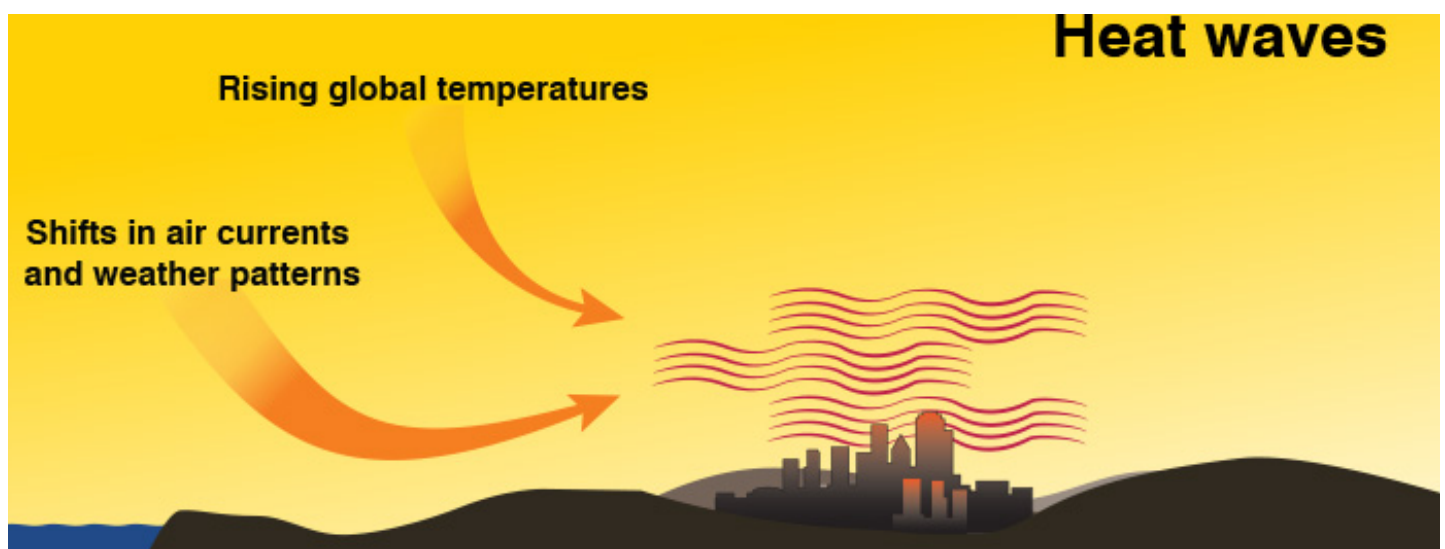
The variation of temperature and light is equally important because without heat and light the Earth would be a lifeless ball of ice-coated rocks. Earth is the only planet that uses the Sun's light as useful as a source of energy. It has a suitable climate for the existence of all forms of life because of the moderate amount of carbon dioxide, which is the driving factor for the survival of life forms.

A heatwave is a hot weather phenomenon that is accompanied by a high temperature and high humidity that causes a prolonged period of abnormally hot weather. It can be measured by comparing the usual weather in the area relative to normal temperatures for the season.

Rapid rises in heat gain due to exposure to hotter than average conditions compromises the body's ability to regulate temperature and can result in a cascade of illnesses, including heat cramps, heat exhaustion, heatstroke, and hyperthermia.



According to the World Meteorological Organization, the term 'heat wave' refers to the situation when the daily maximum temperature of more than five consecutive days exceeds the average maximum temperature by 5 °C. A heatwave is formed when static high pressure is generated in the upper atmosphere over a region for several days up to several weeks. This static high pressure generates a hot mass of air, which is stagnant for many days and a week, which resulted in the trapping of more heat that also reduces the convection currents.



IMPACT OF HEAT WAVE

- If the body temperature of a living creature is lower than external temperature or atmospheric temperature, then it is very often to get heatstroke, and heat cramps. During this situation, the body is not able to regulate and maintain the optimal temperature.

Under this condition static hot mass of air trapped all the pollutants and harmful chemicals below the layer of the hot air which decreases the air quality that causes airborne diseases.

- The abnormal hot temperature causes a drought-like situation. It drains the vegetation's moisture content, which causes bushfires and forest fires. The excessive hotness of the atmosphere also affects the infrastructure.

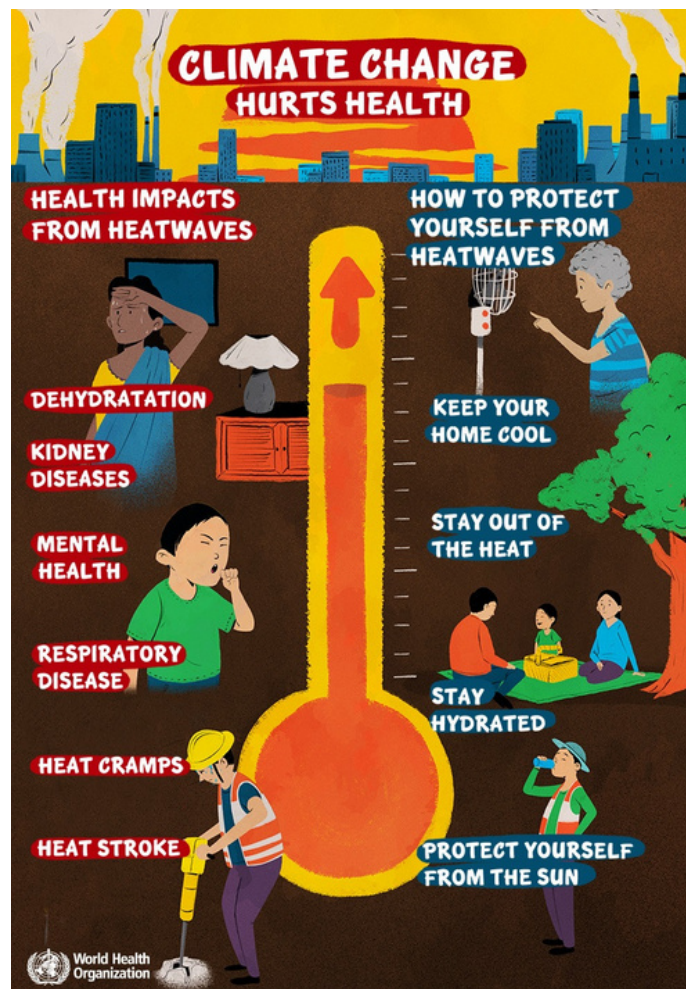
For example- Hot atmospheric temperatures can crack the roads, and burst the waterlines, Rapid rises in heat gain due to exposure to hotter than average conditions compromise the body's ability to regulate temperature and can result in a cascade of illnesses, including heat cramps, heat exhaustion, heatstroke, and hyperthermia.

- Deaths and hospitalizations from the heart can occur extremely rapidly (same day), or have a lagged effect (several days later) and result in accelerating death or illness in the already frail, particularly observed in the first days of heatwaves.

Even small differences from seasonal average temperatures are associated with increased illness and death.

- Temperature extremes can also worsen chronic conditions, including cardiovascular, respiratory, and cerebrovascular disease and diabetes-related conditions and led to the explosion of a transformer. Aircraft performance decreases at high temperatures.

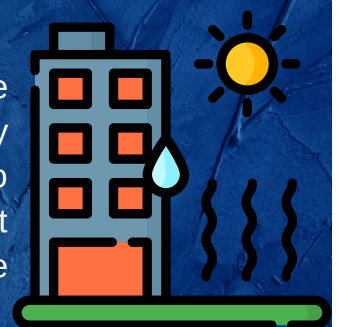
- The high temperature can damage the ground surface of the airport.



source: who.int

FACTS

A heat wave is a period of abnormally hot weather generally lasting more than two days. Heat waves can occur with or without high humidity. They have potential to cover a large area, exposing a high number of people to hazardous heat. A heat wave is a period of unusually hot weather that typically lasts two or more days. To be considered a heat wave, the temperatures have to be outside the historical averages for a given area.



- The excessive heat stresses the vehicle cooling systems which could hurt ground operations, etc.
- The excessive hotness of atmosphere reduces the human productivity and performance. It will also increase the stress level that endorses the conflict.
- Heat also has important indirect health effects. Heat conditions can alter human behavior, the transmission of diseases, health service delivery, air quality, and critical social infrastructures such as energy, transport, and water.





Throughout a **HEATWAVE, try to keep out of heat**

Stay in the shade 

Avoid going outside during the hottest time of the day 

Avoid strenuous physical activities if you can 

Do not leave children or animals in parked vehicles 





Keep your home cool during a **HEATWAVE**


During the day, close windows and shutters especially those facing the sun 


At night, keep all windows and shutters open to air the rooms 


Turn off lights and electricity 






If you feel unwell during a **HEATWAVE**

Get help if you feel dizzy, weak, anxious or have intense thirst and headache 

Move to a cool place as soon as possible 


Drink some water to rehydrate 

Keep medicines below 25°C or in the refrigerator 





Throughout a **HEATWAVE, keep yourself cool and hydrated**

Drink water regularly. Avoid alcohol and too much caffeine and sugar 

Eat small meals and eat more often 

Wear light, loose-fitting clothes 

Wear a hat or cap and sunglasses. 

Take cool showers or baths 



EFFECT OF HEATWAVE ON HUMANS AND THE ENVIRONMENT

Sunanda Maurya
IIMT college of management, Greater noida

Climate change can affect human health and the Environment. Temperature extreme related to heat could damage the entire environment. Global climate change promises to bring with it longer, hotter summers to many places on the planet. A heatwave can be dangerous, causing illnesses such as Heat cramps and Heatstroke or even death.

EFFECTS OF HEAT WAVE ON HUMAN HEALTH

HEATSTROKE:

The human body's normal temperature is about 98.7degree Fahrenheit: For the body to stay within safe limits of this temperature, it must get rid of its excess heat. When your body is faced with internal or external factors that raise its temperature, like a streaming hot day, the brain sends signals that begin cooling mechanisms such as sweating.

HEAT EXHAUSTED: Heat exhaustion is milder in severity than a heat stroke but the cause is similar. This due to your body's temperature is rising, and it's often associated with dehydration. Symptoms of heat exhaustion include vomiting, muscle cramps, headache, nausea, fainting, extreme thirst, rapid heartbeat, and dizziness.

Temperature extremes related to heat also affect the oceans, weather patterns, plants and animals, and ice or snow.

HEAT HIVES:

Heat hives also known as cholinergic urticaria (CU) are a type of hives that occur when the body's temperature is raised, they tend to break out when you sweaty from a workout, nervous, or just plain hot. It's one of the most common types of hives and occurs in at least 15% of the population. CU hives can appear anywhere on your body but usually show up on your face, chest, arms, and upper back.

They can occur very quickly after a person begins to sweat or gets overheated and usually it goes away on their own often the person can cool themselves down.

HEALTH TIPS

To secure yourself from heatwave you should drink plenty of water, take a cool shower and avoid tight clothes.



EFFECTS OF HEAT WAVE ON ENVIRONMENT

WATER:

Shortage of water increases at high temperatures. Many parts of the world already have very little water, and climate change could make this problem worse. Rising temperature, changing precipitation patterns, and increasing droughts will affect the amount of water in lakes, rivers, and streams, as well as the amount of groundwater that seeps into the ground to replenish groundwater.

AGRICULTURE:

Crops also need the right temperature to end enough water to grow properly. Changing climate could have both positive and negative effects on crops. More heat could hurt crop growth. The extreme temperature will also affect agriculture and food supply in many other ways.

PLANTS, ANIMALS, AND ECOSYSTEM:

Most plants and animals live in areas with very specific climate conditions. Any change in the climate of an area can affect the plants and animals living there, as well as the To secure yourself from heatwave you should drink plenty of water, take a cool shower, avoid tight clothes makeup of the entire ecosystem. The extreme temperature will also change the lifecycle of the plants and animals.

ENERGY:

In extreme temperatures, people want to keep themselves cool by using air conditioning, which uses a lot of electricity. Climate change could also make it harder to produce certain types of electricity, such as hydropower.



SCIENTIFIC FACTS ABOUT THE HEATWAVE

Kaushiki Ishwar
Miranda College, Delhi University

A Heatwave is a period of extreme heat that is often accompanied by high humidity. Heat Index Values are used to determine excessive heat. The heat index, commonly known as the apparent temperature, is the temperature that the human body perceives when relative humidity and air temperature are combined.

In comparison to the expected conditions, a heatwave is defined as an extended stretch of hot weather. A heatwave is declared when a location's maximum air temperature is recorded for three consecutive days. The heatwave threshold differs by location.

A heatwave does not have a recognized definition. To compare and declare a Heatwave, a location's average air temperature is required. When there is high pressure in the atmosphere, warm air is pushed towards the ground, resulting in hot spells. It gets warmer as it compresses, and the heat builds up, causing severe heat. A heatwave is a period of intense heat that is frequently accompanied by high humidity.

CLIMATE CHANGE AND THE HEAT WAVE

The world's hot days are becoming much hotter as air temperatures rise, and the world's cool days are becoming fewer. Over the last decade, daily record high temperatures have become more common.

If greenhouse gas emissions are not reduced, daily high and low temperatures in most locations will climb by at least 5°C (9°F) by mid-century, and even more by the end of the century. It has the potential to blow transformers, overwhelm electricity grids, and cause havoc.

Quick Facts

- Over 75 per cent of British workers say a heat wave hampers their ability to work effectively and more than half admitted to taking "sun-bathing days".
Studies have also shown that more boys than girls are likely to be conceived during a heat wave.
- A 1988 New York heat wave saw the murder rate increase by 75 per cent.
- Philadelphia, Pennsylvania, is one of many US cities that operate a "buddy system" during a heat wave. A designated person in each street checks on elderly and vulnerable people.
- Following the British drought of 1976, the birth rate dropped to a record low, proving that the advice of the most popular car sticker of the year was not being followed: "Save Water, Take a Bath with a Friend".
- A 1986 US study also showed reports of Domestic Violence peaked at the same time each year as maximum temperatures in five locations around the nation.
- In 1842 a Belgian mathematician concluded "Crimes against property reach a maximum in winter months, and crimes against the person and against morals, in the summer months."

Heat exhaustion can build over time, and if not treated, heatstroke can occur.

Heatstroke is most common in the elderly, children under the age of four, those living in homes without air conditioning, and persons with chronic diseases, which can harm the brain, heart, kidneys, and other muscles.

According to NOAA, more people die from heat than any other meteorological danger on average over 30 years from 1987 to 2016. There were an average of 131 deaths per year over the 30 years, with the majority of them occurring during heat waves.

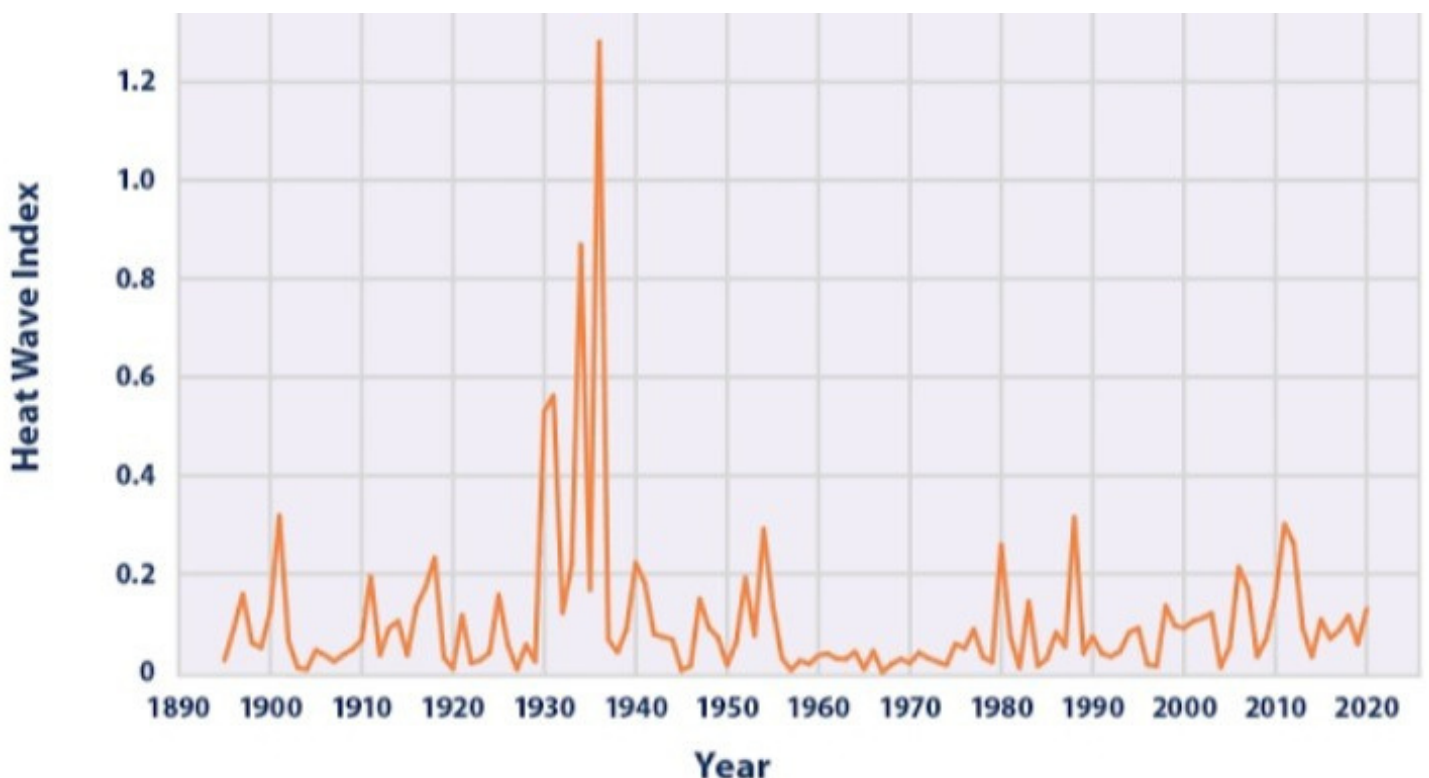
Overnight temperatures may not decrease as quickly as they normally would if blazing heat LINGERS for several days. Warm nighttime temperatures, especially those of 80 degrees or above, prevent people from recovering from the heat of the day. The effects can be worsened when warm low temperatures are paired with excessive humidity. June 2019 was the hottest month on record worldwide, the effects of this were especially prominent in Europe. The effects of climate change have been projected to make heat waves in places such as Europe up to five times more likely to occur. Among other effects, increased wildfires in places such as Spain can also be attributed to heat waves.

Dew points and relative humidity indicate how much moisture is present in the air. The dew point temperature indicates how much cooler the air temperature must be to get saturated.

This indicates that once the dew point climbs over 60 degrees, the air becomes humid. It becomes uncomfortable when the dew point reaches 70 degrees, and most people consider anything above 75 degrees oppressive.

They are more prevalent in cities. The urban heat island effect, which refers to a metropolitan area that is warmer than the surrounding areas, can exacerbate the effects of heat waves in cities.

According to the EPA, temperatures in cities with a population of one million or more people can be 1.8 to 5.4 degrees warmer than nearby locations. Because rural areas cool down faster after sunset, the temperature difference can be as high as 22 degrees. A study that investigated 13,115 cities found that extreme heat exposure of a wet bulb globe temperature above 30 °C tripled between 1983 and 2016. It increased by ~50% when the population growth in these cities is not taken into account. Urban areas and living spaces are often significantly warmer than surrounding rural areas, partly due to the urban heat wave effects.



SOURCE- US Environmental Protection Agency

SUSTAINABLE AGRICULTURE PRACTICES

Ritika Sen
Freelance content writer

Sustainable Agriculture Practices are referred to as those farming practices in which sustainable ways are used for meeting today's food and textile needs, without negotiating the ability of current or future generations to meet their needs.

It is using farming practices considering the ecological cycles. This method is also delicate towards the microorganisms and their equations with the environment on a large expansion.

This kind of farming practice mainly focuses on: -

1. Building healthy soil and preventing erosion
2. Managing water wisely
3. Minimizing air and water pollution
4. Storing carbon on farms
5. Increasing resilience to extreme weather
6. Promoting biodiversity

The various methods or practices of Sustainable Farming in detail: -

1. Making use of Renewable Energy Sources- Solar panels can be used to store solar energy and further used for electrical fencing and running of pumps and heaters. Flowing river water can be a source of hydroelectric power which can be used to run various machines on farms. Similarly, geothermal heat pumps dig beneath the earth and can take advantage of earth's heat.

2. Integrated pest management-Integrated pest management is a combination of pest control techniques for identifying and observing pests in the initial stages.

3. Hydroponics and Aquaponics In hydroponic systems the crops are grown with the roots dipped in a mineral solution or with the roots in an inert medium like gravel or perlite.

4. Crop Rotation- IT is an ancient method used for keeping the soil rich with nutrients.

5. Polyculture Farming-It comprises growing multiple crop species in one particular area. These species go well with each other and greater diversity of products can be made possible at one plot while fully utilizing the available resources.

6. Permaculture-Permaculture is a food production system involving smart farming to reduce waste of resources and create increased production efficiency.

7. Natural Pest Eliminators- Natural pest eliminators include Bats, birds, insects, etc. In this method insects such as ladybugs, beetles, green lacewing larvae, and fly parasites all are fed on pests, including aphids, mites, and pest flies.



Sustainable Agriculture

Advances in Technological Interventions



Source- Amazon.in

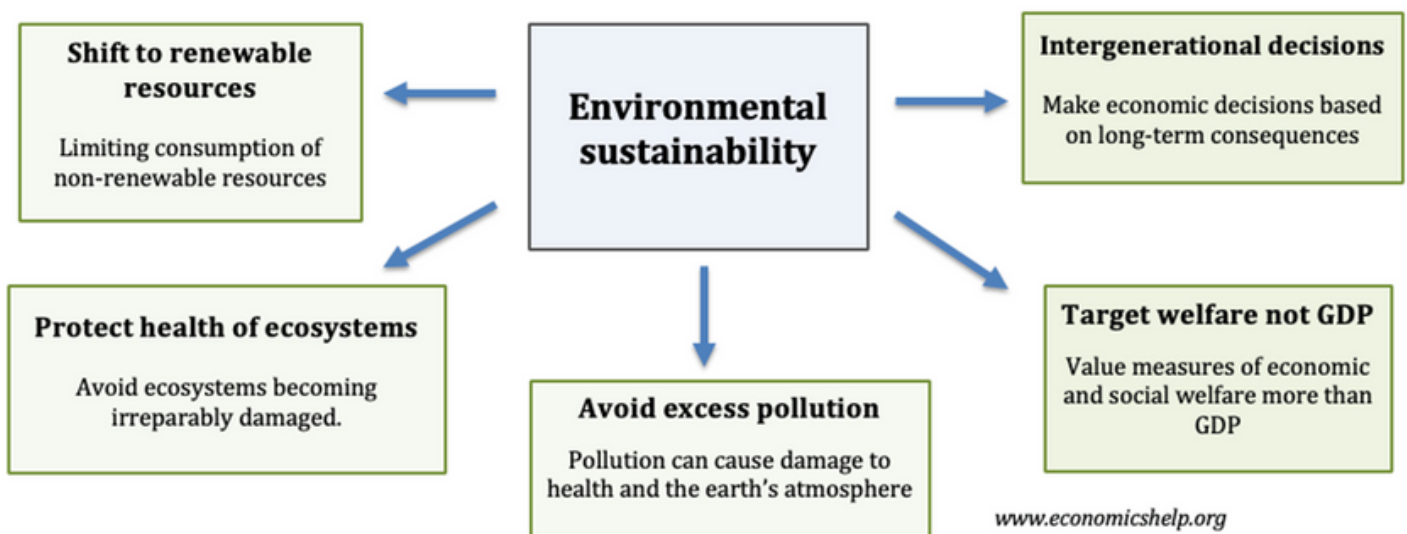
IMPORTANCE OF ENVIRONMENTAL SUSTAINABILITY

Dolly

Guru Gobind Singh Indraprastha University, New Delhi

Environmental sustainability is the need to conserve natural resources and maintain global ecosystems for current and future health and well-being. We may do this by not wasting or depleting natural resources unnecessarily. The increasing population, along with a massive increase in anthropogenic activity, has prompted various concerns about the sustainability of our planet's natural resources. Human activity and pollution have now affected every corner of the planet. It is critical to regularly examine the impact of human activities on local ecosystems and the world.

Individuals, companies, and government agencies may all work together to achieve environmental sustainability. Individuals may take little but significant steps toward a more sustainable lifestyle, such as using less water, eating less meat, and converting to reusable items to minimize our reliance on single-use plastics. Environmental sustainability may entail converting to renewable energy in warehouses, factories, and offices, or reducing the use of single-use plastics in production.



To maintain environmental sustainability, a balance must be struck between the conservation of natural systems, economic progress, and the preservation of communities' cultural and social well-being. Environmental sustainability may greatly benefit business companies. It will not only lessen detrimental effects on air, water, and land, but it will also assist them in meeting legislative duties. Both developed and developing nations are addressing future environmental problems and climate change, making it critical for businesses to include this notion in sustainability programs.



Thus, environmental sustainability is the most significant challenge and goal. It is a key focus for academics, academicians, scholars, governments, and non-governmental organizations worldwide, including individuals, communities, countries, continents, and the entire planet. Environmental sustainability is the primary approach in the face of human population expansion and widespread ecological abuse. While today's people enjoy the benefits of economic development, future generations will face scarce natural resources and a polluted environment, and it is our most important responsibility to leave the planet as a self-sustaining system that provides equal opportunities for survival not only to our future generations but also to all other species co-habiting with us.

Quick Facts

Exponential population growth has led to increased farming, which leads to greater greenhouse gas emissions and deforestation. Industrial and technological growth means we need more power than ever. Yet our planet is reaching a breaking point. We are beginning to see the consequences of global warming on ecosystems and communities. That's why now more than ever businesses need to invest in environmentally sustainable and socially responsible practices, like using clean energy and paying living wages, to secure a livable future.

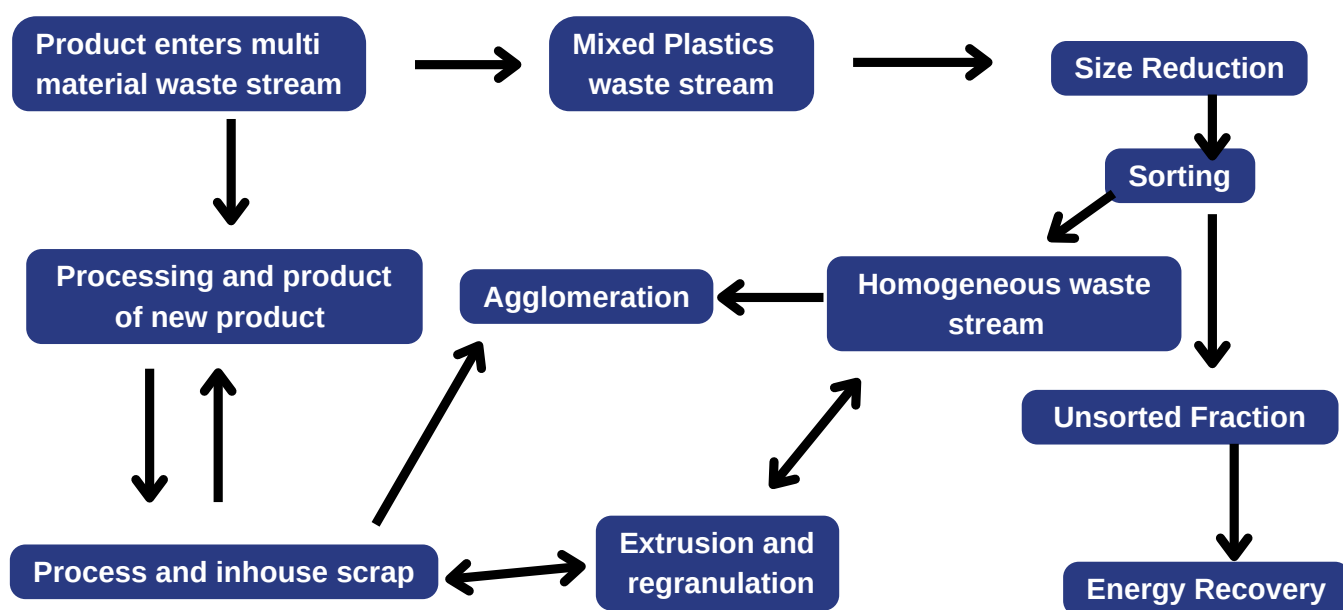


PLASTIC RECYCLING AND EXTENDED PRODUCER RESPONSIBILITY

Manisha Mani
Packaging technologist

Plastics are materials derived from petrochemicals and gases that have substantial benefits in terms of their low weight, durability, and lower cost relative to many other material types. Molding and processing of plastics help produce various products for daily use like furniture, and household items of which major contribution is towards plastics as a packaging material. The majority of the plastic waste generated either end up in landfills or is further processed using a recycling system. This plastic waste may enter water bodies affecting the flora and fauna using microplastics and can have a drastic ecological impact on wildlife, wildlife habitat, and humans. This indicates that plastic production and use are not sustainable throughout the value chain of the natural environment.

Plastic recycling started late in the 1970s, although many recycling units are working towards the production of sustainable plastics with advanced technologies of, sorting and reprocessing recyclable plastics a need for consumer responsibility towards strategic use and disposal of plastics is still felt. As the threat of more regulation from the environmental movement grew, the plastics industry responded with lobbying to preserve their business interests. An increase in globalization has led to cheaper and more effective means of the recycling process with increased awareness. As the difficulty in global trading became eminent, local recyclers and processing took birth. Extended producer responsibility schemes have been proposed which would tax plastic producers to subsidize recyclers.



WASTE PROCESS
CYCLE OF PLASTIC

Plastic waste is categorized as Industrial scrap and Post-Consumer waste. Plastic waste majorly consists of thermoplastic polymers which can be remelted and reprocessed again and usually enter the recycling stream. Thermosets are a little difficult to recycle though there are recent advancements in the mechanical recycling of thermoset polymers to produce a composite with binding agents. Polyolefins like HDPE (19.8%), LDPE (13.9%), PP (19.1%), PET (10.8%) constitute to nearly 50% of the total plastic waste. Multilayer structure with fibers (15.7%) is more difficult to recycle hence it is mainly recycled into composites.

Collection and sorting are the main crucial steps in plastic waste recycling. Plastic waste after collection is sent to a material recovery facility where this waste is cleaned and sorted to form bales for further processing after its sale to the convertors. Density separation, electrostatic separation, and sensor-based separation are used to segregate plastic waste distinguishing it on parameters like density, color, and material of construction.

In closed-loop, or primary recycling, used plastic is endlessly recycled back into new items of the same quality and sort and it contributes to a circular economy. Closed-loop recycling is usually adopted in case of recycling PET bottles again into PET bottles where material identification and sorting are much easier. In open-loop recycling the plastic. In open-loop recycling, also known as secondary recycling, or downcycling, the quality of the plastic is reduced each time it is recycled, so that the material is not recycled indefinitely and eventually becomes waste. It is the most common type of plastic recycling. The recycling of PET bottles into fleece or other fibers is a common example and accounts for the majority of PET recycling. In feedstock recycling, also called chemical recycling or tertiary recycling, polymers are reduced to their chemical building blocks (monomers), which can then be polymerized back into fresh plastics. In theory, this allows for near-infinite recycling; as impurities, additives, dyes, and chemical defects are completely removed with each cycle. Thermal depolymerization and chemical depolymerization are the two types of Feedstock recycling. Plastic that does not make a

systematic way to the recycling chain is used to produce synthetic fuels using means of incineration and pyrolysis process. Life-cycle analysis shows that plastic-to-fuel can displace the production of fossil fuels and result in lower net greenhouse gas emissions (~15% reduction).

Extended Producer Responsibility (EPR) is key to solving this problem and transitioning towards a circular economy. It supports waste management and incentivizes changes in packaging design. It is a strategy to add all of the environmental costs associated with a product throughout the product life cycle to the market price of that product. EPR is based on the principle that manufacturers (usually brand owners) have the greatest control over product design and marketing and have the greatest ability and responsibility to reduce toxicity and waste. EPR may take the form of reuse, buyback, or recycling program. EPR may be implemented in many forms of which the rules can be mandatory, negotiated or voluntary. Circular plastics economy has remained elusive despite decades of concerted advocacy and public outcry. Despite all efforts voluntary contribution from industry is highly encouraged to drive the circular plastic economy.



MOVIE RECOMMENDATION

CARBON: A STORY OF TOMORROW

Yashita Arora
IIM Shillong



Carbon, starring Nawazuddin Siddiqui, Jackky Bhagnani, and Prachi Desai, is a 25 mins short film that focuses on the subject of prime national importance, environmental issues. The film's plot tries to analyze and foresee the impacts of high levels of pollution in Delhi. The movie is further set in a dystopian 2067 world, where it tackles the issues of environmental pollution and increasing carbon footprint.

The film starts with the year 2067, wherein a voiceover introduction of Jackky speaks about the earth a few years ago. He tells us about the harmful effects of carbon and uses of oxygen.

Jackky who lives in the pollution capital New Delhi, has an artificial heart and smuggles illegal oxygen. Prachi Desai is a robot named Pari, who is supposedly more humane because she doesn't know she is a robot. Meanwhile, Nawazuddin, a contract killer, poses as an NRI from Mars.

This plot sounds interesting. Isn't?. It further gets interesting when, Jackky uses his license to legally carry natural oxygen in the dystopian scenario where oxygen has become a commodity.

The conceptualization of the universe is fascinating, despite the doom it spells on humanity. Overall, Carbon is an important film as well as a good attempt at science fiction, trying to draw attention to our environment.



QUAD FELLOWSHIP

Quad Fellowship is a first-of-its kind program announced by Australia, India, Japan, and the United States on September 24 2021 and is designed to build ties among the next generation of scientists and technologists. 100 exceptional master's and doctoral students of the quad nations in the field of STEM will be sponsored to study in the United States.

This program offers a combination of financial benefits, cross-cultural exchange, net working and content programming. A one- time personal award of \$50,000 will be received by quad fellows for study in STEM master's and doctoral programmes in the united states.

Fellows can apply separately for additional need-based funding up to \$25000 to support the completion of their academic study subject to conditions.



ELIGIBILITY

- 18 years of age at the time of submission of application.
- Legal permanent resident of any one Quad country.
- Bachelor degree or equivalent in STEM field by August 2023.
- Demonstrated record of superior academic achievement at the UG level.

CREDITS

EDITOR-IN-CHIEF

: DR. VIVEK PANWAR

EDITORS

: PROF. S K DHAKA, DR. NARENDRA SINGH,
DR. DEEKSHA KATYAL, DR. PAWAN KUMAR

ASSOCIATE EDITOR

: SHREYANSHI CHAUDHARY

GRAPHIC DESIGNERS

: MEHAK TIWARI, NIMARPREET KAUR KALSI, CHARU,
VAIBHAV VERMA, KAMALDEEP

Publisher

Earth Root Foundation

456, Pocket B, Sector-13, Dwarka, New Delhi-110078

www.earthrootfoundation.org | info@earthrootfoundation.org | +91 8766317774



@earthrootfoundation



@EarthRootFound1



Earth Root Foundation



Earth Root Foundation