SRISHTI
सृष्टि

Bilingual E-Magazine

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GREEN ENERGY

THE ENVIRONMENT SOCIETY
P.G.D.A.V. COLLEGE (EVENING)
(UNIVERSITY OF DELHI)

SRISHTI- BILINGUAL E-MAGAZINE
Volume I (Issue II)
October – December 2020

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SRISHTI

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P.G.D.A.V. College (Evening), University of Delhi
Ring Road, Nehru Nagar, Delhi – 110065
For Any Query, Mail us at srishtipgdave@gmail.com

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From Principal's Desk

With the core of my heart, I would like to congratulate 'Team *Srishti*', Editorial Board and entire Environment Society of the college for releasing the second issue of '*Srishti*'- the bilingual E-magazine. I would like to express my sincere appreciations for Mrs. Renuka Dhar Bajaj, the convener of the Environment Committee under whose dynamic guidance and support, the society is touching new milestones.

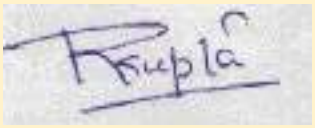
I am glad to see that the theme of the current issue is **'Green Energy'** which is one of the most important and indispensable dimensions of the Environment in the present times. In order to fight with global warming - climate change and its consequences, it is necessary to reduce the national and global carbon footprint. Transformation of energy sector is one of the biggest tools available globally which may significantly lower down the greenhouse gases emissions and protect the mother earth. We all know that our country is performing exceptionally well in renewable energy sector. The Govt. of India has taken many innovative initiatives (like International Solar Alliance, mega solar and hybrid parks, onshore and offshore wind farms, incentivizing biomass-based energy etc.) in the recent past which have gained global attraction and appreciations. I firmly believe that India is going to play an extremely vital role in transforming the energy sector which will in turn conserve the mother nature.

I am happy to share with the readers that in addition to other eco-friendly practices (like solid waste management, water conservation, plantation drive etc.), P.G.D.A.V. College (Evening) has been effectively implementing the energy conservation and efficiency practices within the college premises. Our college has completely checked the loss or leakage of energy. The college building is designed in a way to fully utilize the sunlight which sharply reduces energy consumption during the day. Old lightings and electrical appliances are being replaced with LED bulbs and Bureau of Energy Efficiency (BEE) rated appliances respectively. The college

has installed Solar Street Lights within its campus. Our college also frequently conducts various awareness programs on energy efficiency and conservation.

It is the matter of extreme happiness and satisfaction for me to see the contextual and rich articles contributed by our college students. Once more, I would like to congratulate entire 'Srishti Team' for releasing the second issue of the e-magazine having such an important theme. I am sure that the environment society of the college, led by dynamic and dedicated team of faculty members and students, will touch new heights in the near future.

Best wishes to the entire team.



Dr. R.K. Gupta

Principal

From Convener's Desk

Dear Readers,

Welcome to the second issue of '***SRISHTI***'- the bilingual E-magazine on environmental issues, proudly brought out by the Environment Society of the P.G.D.A.V. College (Evening). Our endeavour is to highlight current environmental issues so the current issue focusses on the theme of **'Green Energy'**.

This kind of energy, as we know, is derived from natural sources and thus has little or no environmental impact. The biggest benefit of Green Energy is that it doesn't dispense greenhouse gases and thus doesn't add to global warming.

India is rapidly moving towards becoming one of the largest Green Energy producers in the world. In the last six years, our country has witnessed the fastest growth in green energy capacity among all large economies. In this context, it is befitting that we should discuss and elaborate upon this form of energy.

Our compilation of articles is a step in that direction, we hope readers will find them informative as well as interesting.

With best wishes for the year ahead.

Renuka Dhar Bazaz
(Convener, Environment Committee)

Message from Society's President

It gives me immense pleasure to introduce to you all the second issue based on theme '**Green Energy**' of '***Srishti***'- bilingual e-magazine of the environment Society of the P.G.D.A.V. College (Evening). Under the expert guidance and motivation of revered principal Sir Dr. R.K. Gupta and convener of the society Mrs. Renuka Bajaj ma'am, we aim to create environmental awareness and promote green and sustainable activities in and around the college.

A famous philosopher once said, "Inside all of us is a hidden dream" and in our society SRISHTI- our bilingual e-magazine gives the students the platform to showcase their creative abilities, hidden dreams, and aspirations for writing. Our magazine is aimed towards bringing out the latent talent of the students through articles, poems, quizzes, and experiences. We, 'The Team', encourage our students to put on their thinking cap.

SRISHTI- our environment society magazine kindles the imagination of our learners. Like our previous issued magazine, it also has articles in English and Hindi, facts and figures, nature's photography, maps, facts, etc. This issue of SRISHTI is dedicated to **'Green Energy'**.

Green energy, a clean source of the energy that have a much lower environmental impact than conventional energy sources which helps to reduce greenhouse gases emissions at a considerable rate. Release of the second issue could only be possible by excellent coordination and hard work of the 'Team Srishti'. The student editors have done their bit to give the magazine an appearing and youthful look.

With best Wishes,

Ayush Raj

Ayush Raj

FOREWORD

I feel privileged to introduce the second issue of '*Srishti*' – bilingual E-magazine of the Environment Society of P.G.D.A.V. College (Evening). The theme of the present issue is **'Green Energy'**. Renewable energy is gaining a big thrust globally and *Bharat* is no more exception. In fact, our country's growth in green energy sector has been unprecedented and has crossed many milestones which were believed to be unachievable till the recent past. Initiatives and incentives by the Govt. of India to minimize the greenhouse gas emissions have not only attracted the global attention but also reduced the carbon footprint like never before. Certainly, there is a vast scope of research & development in this sector and exponential growth in the non-conventional energy sector will create a large number of job opportunities in near future. We are glad that our students have contributed rich and contextual articles on 'Green Energy'. Also, from the current issue, we have included few more interactive sections like Know Our State/UT and Visit Our College. I hope that the readers will enjoy this issue and will give their suggestions to further improve the quality of this magazine.

I sincerely want to thank our Principal and Convener for their precious and consistent support and suggestions. My warm regards to all the faculty members of the society for their valuable cooperation. I would like to convey my sincere gratitude to Dr. P. Saxena, CEO, Skill Council for Green Jobs as he accepted my request and contributed a valuable article on Green Energy. My best wishes and heartiest congratulations to the 'Team *Srishti*' which is working really hard for the E-magazine.

With Best Wishes!!!

Dr. Mayank Pandey
(Editor-in-Chief)

GUEST ARTICLE

INDIAN RENEWABLE ENERGY FOR A SUSTAINABLE FUTURE – OPPORTUNITIES FOR GREEN JOBS

Dr. P. Saxena
CEO, Skill Council for Green Jobs
Former DG, National Institute of Solar Energy
& Advisor to Ministry of New and Renewable Energy, Govt. of India

India has been keen to attempt to work towards a low carbon emission pathway while simultaneously endeavouring to meet all the developmental challenges. The Nationally Determined Contribution (NDC) document was prepared with a view to taking forward the Prime Minister's vision of a sustainable lifestyle and climate justice to protect the poor and vulnerable from adverse impacts of climate change. India's NDC center around policies and programmes on the promotion of clean energy, especially renewable energy, enhancement of energy efficiency, development of less carbon-intensive and resilient urban centres among others.

India has adopted several ambitious measures for Sustainability, renewable energy, energy efficiency in various sectors of industries, achieving lower emission intensity in non-fossil-based electricity generation. Thrust on Renewable Energy, Promotion of Clean Energy, Enhancing Energy Efficiency, Developing Climate-resilient Urban Centres, and Sustainable Green transportation Network are some of the measures for achieving this goal.

It is recognized in the NDC that Renewable energy sources are a strategic national resource. Harnessing these sources will put India on the path to a cleaner environment, energy independence and, a stronger economy, and sustainability. India's share of non-fossil fuel in the total installed capacity is projected to change from 30% in 2015 to about 40% by 2030. The renewable power target of 175 GW by 2022 will result in an abatement of 326.22 million tons of CO_2 eq. /year. The ambitious solar expansion programme seeks to enhance the capacity to 100 GW by 2022, which is expected to be scaled up to 450 GW by 2030.

The Indian NDC brings a huge responsibility to the country and an equally big opportunity for green business and poses a skilled manpower requirement. The midyear 2020 ended with a Total Installed Capacity of 370.5 GW which includes 230 GW from Thermal, 0.457 GW from Hydro, 0.06 GW from Nuclear, and 87.38 GW from various Renewable Energy Sources. The 87 GW Installed Capacity from renewable energy includes 37.7 GW from wind energy, 35 GW from solar energy, and 15 GW from biomass, small hydro, and waste to energy.

The manufacturing sector has always been the biggest employment source for the country and to develop Renewable Energy (RE) manufacturing in India it is important to not only have skilled manpower but also invest in R&D which should be at par to compete in the global market. With the government´s pledge under the NDC to scale up renewables in the country, net employment (measured in full-time employees) can be expected to increase by an additional 30% by 2030.

Skills development is seen as the shared responsibility of the key stakeholders viz. Government, the entire spectrum of the corporate sector, community-based organizations, those outstanding, highly qualified, and dedicated individuals who have been working in the skilling and entrepreneurship space for many years, industry and trade organizations, and other stakeholders. The policy links skills development to improved employability and productivity in paving the way forward for inclusive growth in the country. The skill strategy is complemented by specific efforts to promote entrepreneurship to create ample opportunities for the skilled workforce.

In order to ensure that skill development efforts are being made by all stakeholders in the system are in accordance with the actual needs of the industry, Sector Skill Councils (SSCs) have been set up. SSCs are industry-led and industry-governed bodies, which will help link the requirements of industry with appropriately trained manpower. The Sector Skills Councils are set up to develop sector-specific competencies/skills, quality assurance through the accreditation of the skills acquired by trainees, curriculum development for the skills training, qualification framework and setting of standards and benchmarks, recruitment and placement of trained and skilled workforce, as well as a data collection, management, and provider to the industry. To address the skilled manpower issue associated with sustainable development, the Ministry of Skill Development and Entrepreneurship has set up a separate skill council, ‘Skill Council for Green Jobs (SCGJ)’, a Sector Skill Council set up to develop competencies/skills in the domain of renewable energy, sustainable development, and environmental issues.

A Green job is defined as the one that helps bring about and maintain a transition to environmentally sustainable forms of production and consumption. It cut across all the sectors, be it energy, materials, water conservation, waste management, pollution control, etc. The green skill can be divided into two categories vis developing green skills for the existing workforce and skilling workforce for green jobs. While the 'Skill Council for Green Jobs' proposes to target both, the immediate focus would be to skilling the workforce for green jobs for renewable energy, energy efficiency, and waste treatment. Training and skilling workforce in R&D and Manufacturing is the special focus of the council.

The focus of SCGJ has been to establish a strong industry connection in all its areas of work, talk to large industries to understand the manpower requirement, and establish long-term contacts to improve the employability of trained and skilled manpower. It has already established strategic alliances with about 500 Industries, organizations, and State skill missions. Skill Council for Green Jobs has affiliated about 340 training institutions, PAN India, to deliver training in its domain. These institutions have imparted training to over 4 lakh candidates on the 50 National Standards developed by SCGJ.

Skill Council for Green Jobs is building on its industry connect with a government-industry interface and partnership with stakeholders from industry, labour as well as academia. Its activities are linked to Skill India Mission, National Solar Mission, Swachh Bharat Mission, and the Make in India initiative of the Government of India. SCGJ is closely interacting with the Ministry of New and Renewable Energy, Ministry of Environment, Forest & Climate Change, Ministry of Urban Development, Ministry of Water Resources, and NITI Aayog to cater to the skilled manpower requirements for the changing scenario.

RE Sector	Manufacturing / Service	QPs Developed	Training Conducted
Solar PV	Manufacturing	8	3340
	Service	12	69774
Solar Thermal	Service	3	63
Wind	Manufacturing	4	250
	Service	4	350
Clean Cooking	Manufacturing	4	272
Bio Mass/ Bio fuels		4	230
Total		**39**	**74279**

Skill Council for Green Jobs is working towards introducing environmentally friendly and sustainable in existing job roles as well. This translates into a huge opportunity for additional job creation and impetus for Skilling & Entrepreneurs Development. Currently, the Green

Business sector generates about 22 lakh Jobs, it is estimated that about 2 crore additional jobs will be created by 2030 due to the strategic shift of India towards sustainable development and climate justice.

R&D and advanced technologies in manufacturing are the backbones for sustaining the growth of any sector. MNRE has been extremely focussed on giving impetus to Renewable Energy R&D through various initiatives. Research and Development efforts in renewable energy continued to make advances in making such technologies affordable and sturdy with assured quality. Skill Council for Green Jobs has systematically planned to meet the skilled manpower requirement and is geared to supplement the national efforts of moving towards sustainability. The training centers of SCGJ are strategically co-located with on-going or existing Solar PV or Wind Power Plant sites and manufacturing units so that local manpower can be skilled and a sustainable employment cycle is established.

The success of any technology or technological shift is greatly dependent on its proper execution on the ground through trained manpower. It may not be possible to achieve the desired results of any strategic shift unless our human resource and skill development policies are aligned to address the needs. Ministry of Skill Development and Entrepreneurship (MSDE) skill initiatives are comprehensive in meeting the skilled workforce for R&D, manufacturing, and project development. It will be further strengthened with Industry participation and up-gradation of skills to meet all future challenges.

To address the skilled manpower issue associated with Renewable Energy and sustainable development, the Ministry of Skill Development and Entrepreneurship has set up a separate skill council, **"Skill Council for Green Jobs"**, in October 2015 just before COP21. The purpose is to develop competencies /skills in the domain of renewable energy, sustainable development, and environmental issues addressing both the Manufacturing and Service sectors.

- Skill Gap study for all subsectors of renewable Energy was first carried out during 2016-17. Renewable Energy sector skill Gap study was revisited in April 2019 in collaboration with CEEW and NRDC.
- RE sector is at present employing about 22 lakh workforces at different levels. It is expected that this will increase by 10-fold by 2030 taking to about 2 crore jobs.

- 39 Job roles (QPs) have been developed for most required jobs in the Renewable Energy Sector both in the Manufacturing and Service sectors.
- Total training in the RE Sector are over 74,000 with Solar PV accounting for 73,000
- 330 Training Centers across 24 States and over 1810 Certified Trainers with 278 Certified Assessors and over 400 Industry members
- Four Skills Competitions/ Challenges organized in Solar Expos
- Gold Medal in 2019 World Skills Competition for Water Technology

BIOFUELS- INDIA'S HIDDEN POTENTIAL

Hardik Arora
B.A. (Prog.)

Will India be able to unlock her hidden potential for biofuels?

Energy, a word which we hear daily and holds enormous importance in the present times. Everything on earth in some way or other depends upon it. From turning on the electric kettle while waking up in the morning to switching off lights at night, our lives completely revolve around energy. With so much prominence attached to it, it has got a prodigious worth in the social development and economic growth of the country. We are using various sources of energy for the development of mankind but the fastest-growing source of energy in the world today is green energy and a lot of research is going on to use it to benefit the climate, environment, economy, and social cohesion. Bioenergy is one of the green energies that can change the socioeconomic impacts on the economy and environment by providing power through renewable sources instead of conventional generation technologies. The energy derived from the conversion of biomass (biodegradable fraction of products from the biological origin) directly, or after transformation, into liquid or gases is called bioenergy. For a long, we have been using fossil fuels for our energy requirements and in the twentieth-century major research, the emphasis was given to the development of petroleum, coal, and natural gas-based refinery to exploit the cheaply available fossil feedstock. Currently, fossil resources are not regarded as sustainable and questionable from the economic, ecological, and environmental point of view. The time has come when we have to look for more clean sources of energy and should start taking bold steps to substitute fossil fuels with biofuels.

On August 10, 1893, **Sir Rudolf Christian Karl Diesel** demonstrated the diesel engine running on peanut oil. His work on peanut oil anticipated the growing popularity of modern biofuels. Therefore, **August 10** is observed every year as **World Biofuel Day**. Diesel's name has become synonymous with a crude oil derivative, but he designed his engine to use a variety of fuels, from coal dust to vegetable oils. Thus in 1893 itself, he set the bar to use various fuels made from vegetables or peanuts, and the term bio-fuel gained prominence. However, with the discovery of oil wells in different parts of the world, biofuels' production could not attract the global community. However, after more than a century, now the world is facing double threats as the reserves of fossil fuels are depleting at an unprecedented rate and catastrophic effects are being caused by the production and consumption of non-renewable sources of energy. Also,

after the oil shock (the 1970s), the importance of non-fossil fuels as an alternative to conventional fossil fuels needs to be understood applied in our lifestyle as the societal challenges such as waste management, climate change, and environmental concerns regarding pollution and human health as well as diminishing fossil resources represent some of the most important issues to be tackled by our civilization now and in the (near) future.

Sir Rudolf Christian Karl Diesel (March 18, 1858 – September 29, 1913)

(Source: http://www.tesla-institute.com/index.php/electrical-engineering-articles/431-rudolf-diesel)

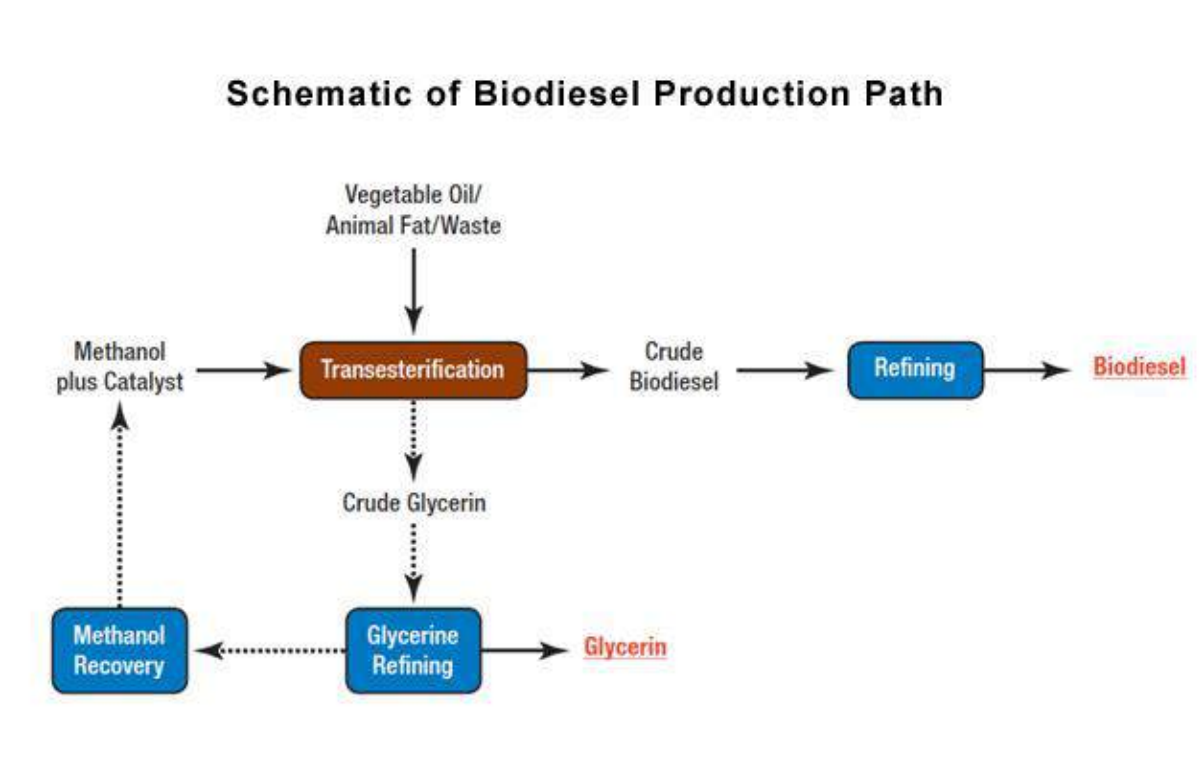
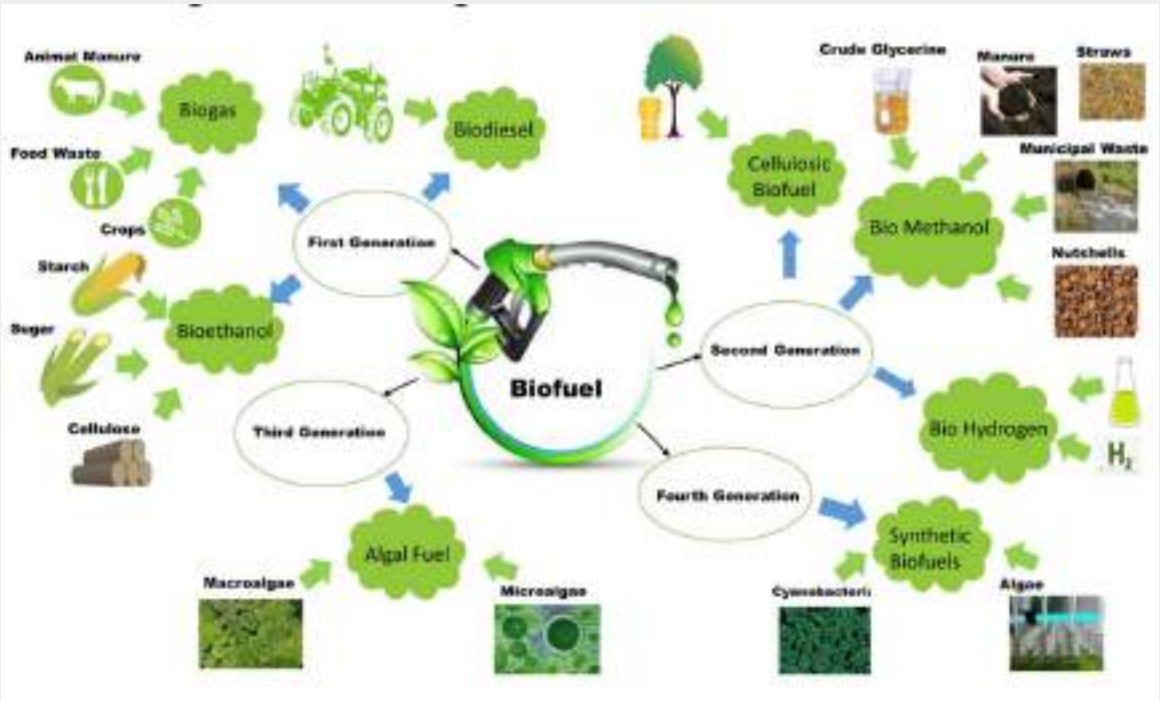


Figure: Synthesis Path of Biofuels

(Source: https://afdc.energy.gov/fuels/biodiesel_production.html)

The term **'Biofuels'** refers to a liquid or gaseous fuel derived from some biomass such as plants, starch, or sugar crop plants, and the organic fraction of municipal and industrial waste. For example- ethanol, biodiesel, hydro processed vegetable oils and lipids, upgraded bio-pyrolysis oil (bio-oil), or biogas-derived biomethane. Biofuels are classified into primary and secondary biofuels. The primary biofuels, like wood chips and pellets, are used in an unprocessed form, whereas the secondary biofuels, like ethanol and biodiesel, are produced by processing the biomass and can be used in vehicles and various industrial processes. Secondary biofuels are further classified as first, second, third, and fourth-generation biofuels. This classification may depend on the types of feedstocks, production technology, greenhouse gas (GHG) emissions, as well as on the end-user.

First-generation biofuels: First-generation biofuels also known as conventional biofuels are made from feedstocks that can also be consumed as human food. First-generation biofuels are produced through well-understood technologies and processes, like fermentation, distillation, and transesterification. Sugars and starches are fermented to produce primarily ethanol, and in smaller quantities, butanol and propanol. Biodiesel or Ethanol are obtained through these processes. It is clean and is widely used in Brazil to run vehicles. These biofuels also support agricultural industries and rural communities through increased demand for crops. First-generation biofuels symbolize a step towards energy independence and weaning off fossil fuels for energy demands however, these have some disadvantages too.



Different Generations of Biofuels (Source: https://en.wikipedia.org/wiki/Biofuel)

Second-generation biofuels: These are produced from sustainable feedstock like agro-waste and specific biomass crops. The sustainability of a feedstock is defined by its availability, its impact on greenhouse gas emissions, its impact on land use, and its potential to threaten the food supply. Certain food products can become second-generation fuels when they are no longer useful for consumption. Second-generation biofuels, especially alcohols (such as ethanol), are generally produced through either the thermochemical or the biological process, the latter involving the utilization of microorganisms. Second-generation biofuels are often called "advanced biofuels."

Third-generation biofuels: Third generation biofuels use specially engineered crops such as algae as the energy source. These algae are grown and harvested to extract oil within them. The oil produces from algae can be used to produce biodiesel, but algae can be genetically manipulated to produce other fuels such as ethanol, butanol, and methane. Biofuels derived from algae are under extensive research to maximize yields and lower production costs.

Fourth-generation biofuels: Fourth-generation biofuels are carbon negative ones and are still in the research and development stage for direct conversion of solar energy into fuel using cheap and widely available raw materials. These are aimed at producing sustainable energy along with finding a way of capturing and storing carbon dioxide (CO_2). Crops are genetically engineered to take in high amounts of carbon are grown and harvested as biomass and biomass materials, which have absorbed CO_2 while growing, are converted into fuel using the same processes as second-generation biofuels.

India is deficient in the production of fossil fuel and depends on imported crude oil to serve its needs. We can leverage India's potential in green energy because of our huge agricultural base. The future of biofuels in India is promising as biofuels are renewable sources of energy and can be manufactured from a wide range of materials like crop residue, manure, and other by-products. The importance of biofuels in greening the transport sector is huge as according to the International energy agency (IEA) the petroleum resources will be depleted around 2060. Currently, bioenergy accounts for 2% of the transportation sector that is far below its potential that it can serve. Besides incorporating biofuels in the transportation sector will help us to build a clean and peaceful environment as biofuels do not release as much carbon as fossil fuels do and it going to fulfil our international agreements such as the Paris climate pact, UN sustainable development goals, etc.

This being said, we haven't still been able to augment the share of biofuels in our energy requirements. There are many drawbacks of using biofuels as a substitute for normal fuels that scientists are realizing and the future role of liquid biofuel in the transport sector is still uncertain. There are concerns regarding their sustainability, second-generation biofuels are still far from being commercially produced, the issue of cost is still the biggest important factor that we haven't been able to address as first-generation biofuels produced from corn, oilseeds, etc are approaching current prices of petroleum. Besides, first-generation biofuels can pose threat to food prices since the biomass used are food crops such as corn and sugar beet and they also have the potential to harm biodiversity and competition for water in some regions as biomass requires more land to grow and need a lot of water. They also only provide a small benefit over fossil fuels in regards to greenhouse gases since they still require high amounts of energy to grow, collect, and process. There is also the issue of technology that needs to be addressed. The vast majority of biofuels today are produced using relatively simple technology that has major land-use concerns.

Still, in India, the evolution of biofuels started in the year 1975 when we began examining the feasibility of blending ethanol with petrol. Since then, we have had undertaken many commendable steps towards making India a hub of green energy. The National Policy on Biofuels (2018) approved by the Government of India envisages an indicative target of 20% blending of ethanol in petrol and 5% blending of biodiesel in a diesel by 2030. The policy has tried to address issues such as protection is being given to farmers under the policy. The scope of raw material is expanded as now multiple crop options have been given to produce ethanol. The policy gives thrust to biodiesel production from non-edible oilseeds, Used Cooking Oil, short gestation crops. The expected benefits coming from it seem to be truly interesting. If the policy becomes successful it will help us to reduce our import dependency on fuels, a better cleaner environment will wait for us, employment generation, additional income to farmers, and multi-fold health benefits. Rajasthan has become the first state to implement a national policy on biofuels. We have started achieving success in incorporating biofuels in the transport sector. In August 2018, India has joined the elite group of countries (others being the US, Canada, and Australia) that operate biofuel-powered flights. The Biofuel used to fly the aircraft of Spice Jet from Dehradun to Delhi was developed by the Indian Institute of Petroleum, Dehradun using Jatropha plant seeds. The aviation sector is one of the largest emitters of Green House Gas worldwide (at 2% of the total human-induced GHG emissions). So, the sector's transition to sustainable and renewable fuels is crucial to meet international climate targets as

said in the Paris Agreement. The aim to use bio-jet fuel is to make air travel more economical and give relief to air flight carriers from rising fossil fuel prices. Biofuels can also address the issue of burning crop residues in India. NITI AAYOG in 2018 released a report named, **"ACTION PLAN FOR BIOMASS MANAGEMENT".** Mr. A.K. Mehta, Convenor, Special Task Force on Biomass Management mentioned in his report for utilization of crop residue in producing bio-ethanol, biochar, briquettes, pellets, etc. The reports also evaluate the cost-effectiveness of each solution proposed.

Globally, biofuels have caught attention in the last decade and it is imperative to keep up with the pace of developments in the field of biofuels. Biofuels in India are of strategic importance as the augers well with the ongoing initiatives of the Government such as Make in India, Swachh Bharat Abhiyan, Skill Development and offers great opportunity to integrate with the ambitious targets of doubling of Farmers Income, Import Reduction, Employment Generation, Waste to Wealth Creation. Biofuel can thus be a good alternative fuel and prove to be sustainable and it demands more research in its development as an energy-efficient fuel on a commercial scale. Biofuels & renewable sources of energy are the future of the energy sector and they need proper research to make them more sustainable, cheaper & widely available without hampering nature anyway. The government should must setup a wide research facility in various parts of the country & Universities and should provide various kinds of subsidies to promote these kinds of fuels & other means of renewable sources of energies. Private entities can also contribute to this field which can also make a profit-making business model for them. However, we are looking for the future towards electric mobility. Albeit, it is a very viable option but we should refrain from putting all eggs in one basket. Side by side we should develop biofuels so that we can use them in various sectors for development. The future seems to be truly promising as India takes on the reigns of her growth in her hands and our youths and scientists are the driving forces behind her success.

कोयला आधारित ऊर्जा का भविष्य

आनंद कुमार यादव
बी.ए. (प्रोग्राम)

कोयला सबसे महत्वपूर्ण पारंपरिक ऊर्जा संसाधनों में से एक है। विश्व में ऊर्जा की मांग का अधिकांश भाग कोयले के द्वारा ही पूरा किया जाता है। साथ ही यह देश की अर्थव्यवस्था में बहुत बड़ी भूमिका निभाता है। कोयला मुख्यतः वनस्पतियों का कार्बनीकृत अवशेष होता है। वैज्ञानिक रूप से समझे तो यह सामान्यतः हाइड्रोकार्बन से निर्मित एक ठोस संस्तरित शैल होता है जो ज्वलनशील जैव पदार्थों से मिलकर बना होता है। भूगर्भ में कोयला बनने में लाखों-करोड़ों वर्ष का समय लग जाता है। करोड़ों वर्षों पूर्व प्राकृतिक आपदाओं के कारण पृथ्वी पर उपस्थित जैविक घटक भूमि के नीचे दब गए। भूगर्भ में उच्च ताप व पर्याप्त दवाब की उपस्थिति में जीव शेष लाखों-करोड़ों वर्षों के पश्चात जीवाश्म ईंधन के कोयले के रूप में धीरे-धीरे विकास होता है।

विश्व में कुछ देशों के पास ही कोयला प्रचुर मात्रा में भूमि के अंदर उपलब्ध है। इस सूची में चीन, भारत, अमेरिका, ऑस्ट्रेलिया, रूस, दक्षिण अफ्रीका, जर्मनी आदि जैसे विकसित व विकासशील देश शामिल है। विश्व में सबसे अधिक कोयला भंडार की उपलब्धता वाले देशों में भारत का स्थान 5वां है।

कोयला को 'उद्योगों की जननी' की संज्ञा दी जाती है। 1760 के दशक में औद्योगिक क्रांति का उद्गम ब्रिटेन में हुआ। फिर यहाँ से इसका विस्तार विश्व के अन्य कोनों तक हुआ। इस क्रांति में कोयले का उपयोग ज्यादा होने के कारण इसकी मांग विश्व भर में बढ़ गई। ब्रिटेन में इन्हीं मांगो को पूरा करने के लिए भारत में कोयला खनन की शुरुआत 1774 में जॉन सुमनेर व एस.जी हीटली द्वारा पश्चिम बंगाल के रानीगंज कोलफील्ड से की थी। इस तरह भारत में कोयले खनन का इतिहास 246 वर्ष पुराना है।

देश की स्वतंत्रता के पश्चात पहली पंचवर्षीय योजना के तहत कोयला उत्पादन को 33 मिलियन टन प्रतिवर्ष तक बढ़ाया गया और इस दौरान कोयला उद्योग के क्रमिक और वैज्ञानिक विकास से कोयला उत्पादन को कुशलता पूर्वक बढ़ाने की आवश्यकता महसूस हुई।

वर्ष 1956 में राष्ट्रीय कोयला विकास निगम की स्थापना के साथ सरकार ने देश के कोयला खनन क्षेत्र के विकास पर विशेष ध्यान देना प्रारंभ किया। देश की बढ़ती जनसंख्या के साथ ही ऊर्जा आवश्यकताओं में भी बढ़ोतरी दिखी। लेकिन निजी कंपनियों के मालिकों के द्वारा कोयला खनन क्षेत्र में पर्याप्त पूंजी निवेश की कमी, खनन के अवैज्ञानिक तरीकों को अपनाने और श्रमिकों के हितों को ध्यान में रखते हुए सरकार द्वारा निजी कोयला खदानों के राष्ट्रीकरण का निर्णय सरकार द्वारा लिया गया।

स्रोत : www.pmfias.com

इसके तहत वर्ष 1971-72 और 1973 में 'कोककर कोयला खान (आपात प्रावधान) अधिनियम, 1971' 'कोककर कोयला खान (राष्ट्रीयकरण) अधिनियम, 1972' और 'कोयला खान (राष्ट्रीयकरण) अधिनियम, 1973' के माध्यम से देश की सभी कोयला खदानों का राष्ट्रीयकरण किया गया। वर्तमान में महारत्न कंपनी कोल इंडिया की कुल 8 सहायक कंपनियां है। जिनमें से ईस्टर्न कोलफील्ड लिमिटेड (ई.सी.एल), सेंट्रल कोलफील्ड लिमिटेड (सी.सी.एल), वेस्टर्न कोलफील्ड लिमिटेड (डब्लू .सी.एल) प्रमुख सहायक कंपनियां है। कोल इंडिया की सहायक कंपनियों द्वारा निम्नलिखित चार तरह के कोयलों का खनन किया जाता है।

- **पीट कोयला** : कोयले के विकास क्रम की प्रथम अवस्था है, लकड़ी से मिलता जुलता, कम गुणवत्ता वाला, इसमें कार्बन का अंश 40% से कम होता है। इसे जलाने पर अधिक राख व धुआं निकलता है।
- **लिग्नाइट कोयला :** निम्न गुणवत्ता वाला, भूरे रंग के होने के कारण इसे भूरा कोयला भी कहते है।इसमें कार्बन का अंश 40-55% तक होता है। इसका उपयोग विद्युत ऊर्जा उत्पन्न करने के लिए किया जाता है। राजस्थान, लखीमपुर (असम) और तमिलनाडु में इसके भंडार हैं।
- **बिटुमिनस कोयला :** यह मध्यम श्रेणी का कोयला है। इसमे कार्बन की मात्रा 55-80% होती है। भारत में पाए जाने वाले कोयले का 80% भाग यही है। इस कोयले का

इस्तेमाल अधिकतर घरेलू कार्यों में होता है। इस प्रकार के कोयले का उपयोग भाप तथा विद्युत संचालित ऊर्जा के इंजनों में होता है।

इस कोयले से कोक का निर्माण भी किया जाता है। इस तरह के कोयले के भंडार झारखंड, पश्चिम बंगाल, ओडिशा, छत्तीसगढ़ और मध्य प्रदेश में हैं।

- **ऐथ्रेसाइट कोयला:** यह सर्वोत्तम श्रेणी का कोयला होता है। इसमें कार्बन की मात्रा 80-90% तक होती है।इसे जलाने पर नीली लौ निकलती है और इस तरह का कोयला जम्मू-कश्मीर में बहुत कम मात्रा में पाया जाता है।

स्रोत: www.financialexpress.com

विश्व के कुल 10% कोयला भंडार होने के बावजूद हम प्रचुर मात्रा में कोयले का आयात करते है। गत वर्ष ही हमने 235 लाख टन कोयला हमें आयात कराना पड़ा था। जिसमें से 135 लाख टन कोयला हम अपने खदानों में से खनन करके इसकी आपूर्ति कर सकते थे। कोयले की उत्पादकता को तेज करने के लिए भारत सरकार ने व्यावसायिक खनन की नीतियों पर बल दिया है। जिससे की हम आत्मनिर्भर भारत के सपने की ओर भी तेजी से अग्रसर हो सके।

भारत में कोयला सबसे महत्वपूर्ण और प्रचुर मात्रा में उपलब्ध होने वाला जीवाश्म ईंधन है। भारत में अभी 1,80,000 मेगावाट से अधिक बिजली का उत्पादन होता है। इसमें 60% से भी ज्यादा कोयले से हम बिजली का निर्माण करते है। हमारी ऊर्जा की जरूरतें कोयले पर बहुत अधिक निर्भर हैं।

कोयला ऊर्जा के लाभ :

- अन्य ऊर्जा स्रोतों की तुलना में कोयले की स्थिर कीमत के कारण कोयला एक सस्ता ऊर्जा संसाधन है।
- कोयले का भंडार अधिक मात्रा में प्रकृति में उपलब्ध है।
- कोयले की खनन की प्रकिया सरल है।
- कोयला खनन प्रक्रिया से आर्थिक विकास को गति मिलती है |
- कोयला खनन से देश के बुनियादी ढांचागत व्यवस्था सुदृढ़ होती है |
- कोयला खनन से बड़े पैमाने पर रोजगार का सृजन होता है |

कोयला ऊर्जा से हानि :

- कोयला प्रकृति में प्रचुर मात्रा में पाए जाते हैं, परंतु जिस खतरनाक दर से इनका उपभोग किया जा रहा है उससे यह स्पष्ट है कि एक दिन वे अवश्य ही खत्म हो जाएंगे।
- कोयला खनन से आस-पास के नागरिकों को अपना निवास स्थान बदलना पड़ता हैं।
- कोयला दहन से ग्रीनहाउस गैसों जैसे- मीथेन और कार्बन डाइऑक्साइड आदि का उत्सर्जन होता है, जो ओज़ोन परत को नुकसान पहुँचाने में सक्षम हैं।
- कोयले के अत्यधिक उपयोग से प्रदूषण का स्तर बढ़ जाता है। साथ ही ये ग्लोबल वार्मिंग में काफी ज़्यादा योगदान देते हैं।
- कोयले के निष्कर्षण ने कुछ क्षेत्रों में पर्यावरण संतुलन को खतरे में डाल दिया है।
- इसके अलावा कोयला खनन के दौरान खदान में श्रमिकों का जीवन का खतरे में रहता है।

वैसे तो कोयल बहुत अच्छा संसाधन है, लेकिन पिछले 300 वर्षों में जिस तरीके से पर्यावरण ह्रास हुआ है और कोयला एक गैर नवीकरण संसाधन होने से कोयले का नवीकरण बहुत तेजी से नहीं हो सकता है। साथ ही भारत में विगत एक दशक के दौरान बढ़ती जनसंख्या, आधुनिक सेवाओं तक पहुँच, विद्युतीकरण की दर तेज होने से ऊर्जा की मांग तेजी से बढ़ी है। अभी भी परंपरागत ऊर्जा संसाधन भारत के ऊर्जा क्षेत्र की रीढ़ की हड्डी बनी हुई है। लेकिन आगे आने वाले वर्षों में हमें उसपर से निर्भरता कम करनी है। इसके लिए हमें **नवीकरणीय ऊर्जा संसाधनों (जैसे सौर ऊर्जा, जलविद्युत ऊर्जा, जियोथर्मल ऊर्जा, जैविक ऊर्जा आदि)** की ओर तेजी से अपने दैन्य जीवन में उपयोग करना होगा। जिसका परिणाम हमें आगे चलकर पर्यावरण व मनुष्य के स्वस्थ स्वास्थ्य के रूप में दिखेगा।

पवन ऊर्जा

आदित्यानंद
बी.ए. हिन्दी (प्रतिष्ठा)

पवन ऊर्जा, अक्षय उर्जा के उन स्त्रोतों में से एक है जिसका प्रयोग बहुलता से किया जा सकता है और यह कभी खत्म भी नहीं होगी । पवन ऊर्जा का प्रयोग मानव पुरातन काल से ही करते आया है, समुद्री नौका परिवहन के लिए तथा पत्थर की चक्कियों को चलाने के लिए पवन ऊर्जा का उपयोग बहुत पहले से हो रहा है। अक्षय पवन ऊर्जा दुनिया भर में व्यापक रूप से उपलब्ध है। पवन ऊर्जा उत्पादन ग्रीनहाउस गैस उत्सर्जन का कारण भी नहीं बनता है। यह अन्य प्रदूषकों जैसे सल्फर और नाइट्रोजन के ऑक्साइड का उत्सर्जन नहीं करता है और न ही पानी की खपत करता है । वायु के वेग से प्राप्त बल को पवनशक्ति कहा जाता है तथा इस शक्ति का प्रयोग यांत्रिक शक्ति के रूप में किया जाता है|

पवन ऊर्जा का वैश्विक इतिहास

ऐसा माना जाता है कि पहली पवन चक्की का निर्माण प्रो. जेम्स ब्लिथ (James Blyth) द्वारा 1887 में स्कॉटलैंड में किया गया था | इसके पश्चात अमेरिका में ब्रुश (Brush) द्वारा इसका अनुसरण किया गया | पवन ऊर्जा का प्रयोग सबसे पहले घरों और व्यवसायों की बिजली बनाने के लिए किया गया था लेकिन जिस प्रकार की पवन चक्कियों से हम परिचित हैं उनका प्रथम प्रयोग द्वितीय विश्व युद्ध के दौरान सन् 1941 में वर्मोंट, अमेरिका में किया गया था |

पवन ऊर्जा मुख्यतः दो प्रकार की होती है

तटीय पवन ऊर्जा - तटीय पवन ऊर्जा से आशय उस पवन ऊर्जा से है जिसका संग्रहण प्रायः उन पवन चक्कियों द्वारा किया जाता है जिनकी स्थापना समुद्र के तटवर्ती इलाकों में की जाती है |

अपतटीय पवन ऊर्जा - अपतटीय पवन ऊर्जा प्रायः उन पवन चक्कियों से प्राप्त की जाती है, जिसकी स्थापना तटों पर नहीं की जाती है अथवा तटों से दूर की जाती है |

अपतटीय पवन ऊर्जा का वैश्विक परिदृश्य

अगर वैश्विक स्तर पर देखा जाए तो आज से लगभग दो दशक पूर्व 1991 में **डेनमार्क** में पहली अपतटीय पवन टरबाइन का प्रयोग किया गया था जिसे 2017 में विघटित कर दिया गया|

वर्तमान में इसकी कुल स्थापना 17 भिन्न-भिन्न देशों में लगभग 28.308 गीगावॉट है जिनमें से महत्वपूर्ण देश यू.के, जर्मनी, चीन, डेनमार्क, नीदरलैंड, बेल्जियम, स्वीडन आदि है|

भारत में पवन ऊर्जा का विकास

भारत में पवन ऊर्जा विकास कार्यक्रम की शुरुआत छठी पंचवर्षीय योजना के अंत [1983-84] में की गई| पवन ऊर्जा के उत्पादन के लिए योग्य स्थलों का चुनाव करने के लिए भारत सरकार द्वारा 1985 में **राष्ट्रीय पवन संसाधन मूल्यांकन कार्यक्रम** शुरू किया गया|

गैर पारंपरिक ऊर्जा स्त्रोत मंत्रालय (वर्तमान में "नव एवं नवीकरणीय ऊर्जा मंत्रालय") ने राष्ट्रीय पवन संसाधन मूल्यांकन कार्यक्रम के अंतर्गत पवन निगरानी स्टेशनों के माध्यम से देश में पवन बाहुल्य क्षेत्रों की खोज करना शुरू किया| फील्ड रिसर्च यूनिट बैंगलोर ,भारतीय उष्णदेशीय मौसम विज्ञान संस्थान, पुणे को राष्ट्रीय एयरोस्पेस प्रयोगशाला, बंगलोर की सहायता से यह कार्य करने के लिए चुना गया| फील्ड रिसर्च यूनिट -भारतीय उष्णदेशीय मौसम विज्ञान संस्थान, बैंगलोर ने विभिन्न राज्यों और केंद्रशासित प्रदेशों के 448 स्टेशनों से पवन डेटा ऐकत्र किया था |

चेन्नई में राष्ट्रीय पवन ऊर्जा संस्थान की स्थापना के पश्चात राष्ट्रीय पवन संसाधन मूल्यांकन कार्यक्रम को राष्ट्रीय पवन ऊर्जा संस्थान में स्थानांतरित कर दिया गया तथा फील्ड रिसर्च यूनिट -भारतीय उष्णदेशीय मौसम विज्ञान संस्थान की गतिविधियों को समाप्त कर दिया गया|

भारत में पवन ऊर्जा की उत्पादन क्षमता विगत वर्षों में काफी बढ़ी है, सितंबर 2020 तक कुल स्थापित पवन ऊर्जा क्षमता 38.124 GW थी | यह दुनिया की चौथी सबसे बड़ी स्थापित पवन ऊर्जा क्षमता है| तमिलनाडु, गुजरात, महाराष्ट्र, कर्नाटक, राजस्थान, आंध्र प्रदेश, मध्य प्रदेश आदि भारत के स्थापित पवन ऊर्जा क्षमता के मामले में अग्रणी राज्य है |

भारत में अपतटीय पवन ऊर्जा की संभावनाएं

अमूल्य प्राकृतिक संपदा रखने के साथ-साथ सीमा निर्धारण में भी प्रकृति का आशीर्वाद भारत को प्राप्त है| तीन तरफ से जल से घिरी लगभग 7600 कि.मी. की भारतीय तटीय सीमा अपतटीय पवन ऊर्जा के दोहन की संभावनाओं के लिए बेहद सकारात्मक है|

सेटेलाइट द्वारा उपलब्ध डेटा व अन्य माध्यमों से प्राप्त किए गए डेटा के अनुसार **गुजरात और तमिलनाडु** में 8 ऐसे अपतटीय क्षेत्र चिन्हित किए गए हैं जहां से अपतटीय पवन ऊर्जा का दोहन किया जा सकता है| राष्ट्रीय पवन ऊर्जा संस्थान द्वारा किए गए प्रारम्भिक आकलन से

पता चला है कि गुजरात के तट पर लगभग 36 गीगावॉट की अपतटीय पवन ऊर्जा क्षमता मौजूद है और लगभग 35 गीगावॉट की अपतटीय पवन ऊर्जा क्षमता तमिलनाडु तट पर मौजूद है|

पवन चक्कियाँ

हवा द्वारा ऊर्जा प्राप्त करने के लिए पवन चक्कियां लगाई जाती है जो विद्युत उत्पन्न करती है। 21 वीं सदी के आरंभ से ऊर्जा सुरक्षा, ग्लोबल वार्मिंग और जीवाश्म ईंधन की कमी पर बढ़ती चिंताओं ने अक्षय ऊर्जा के सभी उपलब्ध स्वरूपों में रुचि का विस्तार किया । इसी कारणवश पवन ऊर्जा पर भी लोगों का ध्यान केंद्रित हुआ | वर्तमान समय में दुनिया भर में कई हजार पवन चक्कियाँ काम कर रही है।

साभार - **https://www.suzlon.com/images/gallery/windfarm/windfarms4.jpg**

समुद्रतटों पर पवन चक्कियों को लगाना अपेक्षाकृत सुलभ और लाभकारी होता है क्योंकि वहाँ हवा का बहाव बहुत तेज होता है और रिक्त पड़ी भूमि का अभाव भी नहीं होता है |पवन चक्कियों के लिए उपयुक्त भूमि रखने के कारण **नीदरलैंड** को **"पवन चक्कियों की भूमि वाला देश"** भी कहते है। वायु के वेग में बहुत परिवर्तन होता रहता है, अत: कभी तो वायु की गति अत्यंत मंद होती है और कभी वायु के वेग में तीव्रता आ जाती है । इसलिए पवन चक्कियों को बनाते समय इस बात का पूरा ध्यान रखा जाता है कि उसे किस क्षेत्र में लगाना है |अगर उस पवन चक्की को कम वायुवेग वाले क्षेत्र मे लगाया जा रहा है तो उसे इस प्रकार से बनाते है कि वो धीमी हवा चलने पर भी ठीक ढंग से कार्य करें और अगर उस पवन चक्की को ऐसे स्थान पर लगा रहे है जहां वायु वेग बहुत ज्यादा रहता है, तो उसे इस प्रकार से बनाते है कि वह वायु का ज्यादा से ज्यादा वेग सहने में सक्षम हो।

पवन ऊर्जा के दोष- वायु की गति सभी ऋतुओं में तथा सभी समय में एक सी नहीं रहती है इसलिए इसके प्रयोग पर न तो निर्भर रहा जा सकता है और न ही इसका अधिक प्रचार हो सकता है। उपर्युक्त कठिनाईयों के होते हुए भी अनेक देशों में पवनशक्ति के व्यावसायिक विकास पर बहुत ध्यान दिया गया है | पवन ऊर्जा के प्रयोग से कोई विशिष्ट प्रकार की हानि नहीं हैं कभी कभी इसके उत्सर्जन वाले स्थान के आस पास संचार माध्यमों में रुकावट आ जाती है तथा कई बार ऐसा भी देखने को मिला है कि इसके आस पास उड़ते हुए पक्षी इससे टकरा जाते है ।

भावी विकास का आधार - पवन ऊर्जा - पवन ऊर्जा भविष्य में आने वाली विद्युत समस्याओं से सामना करने का बेहतर विकल्प है क्योंकि जिस प्रकार से औद्योगीकरण हो रहा है यह कहना गलत नहीं होगा कि भविष्य में मानव को वृहद विद्युत समस्याओ का सामना करना पड़ेगा| यह बात भी उचित ही है कि ज्यादातर कार्यों में प्रत्यक्ष अथवा परोक्ष रूप से विद्युत का प्रयोग किया जाता है आने वाले समय में ग्लोबल वार्मिंग अर्थात वैश्विक तापमान वृद्धि भी बड़ी समस्या बन कर उभरने वाली है और जीवाश्म ईंधन को खत्म होने से बचाना है जिसके लिए अक्षय ऊर्जा का प्रयोग करना पड़ेगा और पवन ऊर्जा इसका एक बेहतर विकल्प है|

वर्तमान में भारत एक विकासशील देश है और विकसित देश बनने की राह पर अग्रसर है, जिसके लिए बड़े पैमाने पर विद्युत खपत होगी तथा भविष्य की जरूरतों को ध्यान में रखते हुए निर्वहनीय विकास का सहारा लेना पड़ेगा और अक्षय ऊर्जा स्त्रोत होने के कारण निर्वहनीय विकास में भी पवन ऊर्जा अपना विशेष प्रभाव दिखा सकती है |

NUCLEAR ENERGY- CLEAN AND CONTROVERSIAL SOURCE OF ENERGY

Siddharth Dubey
B.A. Sanskrit (Hons.)

When humans came into existence, their only need was food water, and shelter after the ages and different civilizations passed another need came into notice as a comfort need and for an easy lifestyle i.e., electricity. Humans founded many sources like coal, oil, natural gas fossil fuels as a traditional source to generate electricity but with the time being, we discovered the most powerful source of energy with endless potential that is NUCLEAR ENERGY. In Indian scriptures, ***Rishi Kanad*** is considered to be the inventor of nuclear science.

HISTORY

There are many names behind the research and development of nuclear energy, some of them are given below: -

Enrico Fermi: Fermi was an Italian scientist who discovered nuclear fission in 1934 in an experiment conducted by him with his team of scientists. The results surprised even Fermi himself. When he bombarded uranium with neutrons, he did not get the elements he expected. The elements were much lighter than uranium. In 1938, Fermi was awarded the **Nobel Prize in Physics** "for his demonstrations of the existence of new radioactive elements produced by neutron irradiation, and for his related discovery of nuclear reactions brought about by slow neutrons."

Ernest Rutherford: British physicist Ernest Rutherford is called the ***Father of Nuclear Science*** because of his contribution to the theory of atomic structure. He was responsible for a series of discoveries in the field of radioactivity and nuclear science. He discovered alpha and beta rays, the laws of radioactive decay, and identified alpha particles as helium nuclei. Experiments done in Rutherford's laboratory showed that when alpha particles are fired into gas atoms, a few are violently deflected, which implies a dense, positively charged central region containing most of the atomic mass.

Niels Bohr: Niels Henrick David Bohr was a Danish Physicist who received **Nobel Prize in Physics** for making contributions towards understanding atomic structure and quantum physics in 1922. Bohr developed the Bohr model of the atom, in which he proposed that energy levels of electrons are discrete and that the electrons revolve in stable orbits around the atomic nucleus but can jump from one energy level (or orbit) to another.

Nuclear energy originates from the splitting of uranium atoms – a process called fission. This generates heat to produce steam, which is used by a turbine generator to generate electricity. Because nuclear power plants do not burn fuel, they do not produce greenhouse gas emissions.

Series of events leading to the discovery of the first Nuclear Reactor:

In 1934, physicist Enrico Fermi conducted experiments in Rome that showed neutrons could split many kinds of atoms.

In the fall of 1938, German scientists Otto Hahn and Fritz Strassman fired neutrons from a source containing the elements radium and beryllium into uranium (atomic number 92). They were surprised to find lighter elements, such as barium (atomic number 56), in the leftover materials.

They contacted Lisa Meitner before publicizing their discovery. Meitner used Einstein's theory to show the lost mass changed to energy. This proved fission occurred and confirmed Einstein's work.

In 1941, Fermi and his associate, Leo Szilard, suggested a possible design for a uranium chain reactor. Their model consisted of uranium placed in a stack of graphite to make a cube-like frame of fissionable material.

Fermi and his group had successfully transformed scientific theory into technological reality in December 1942, by constructing the world's first nuclear reactor which came to be known as Chicago Pile-1. It contained control rods made of cadmium which is a metallic element that absorbs neutrons. When the rods were in the pile, there were fewer neutrons to fission uranium atoms. This slowed the chain reaction. When the rods were pulled out, more neutrons were available to split atoms.

An Atomic Energy Commission (AEC) was established by congress in 1946 which authorized the construction of Experimental Breeder Reactor I at a site in Idaho. A major goal of nuclear

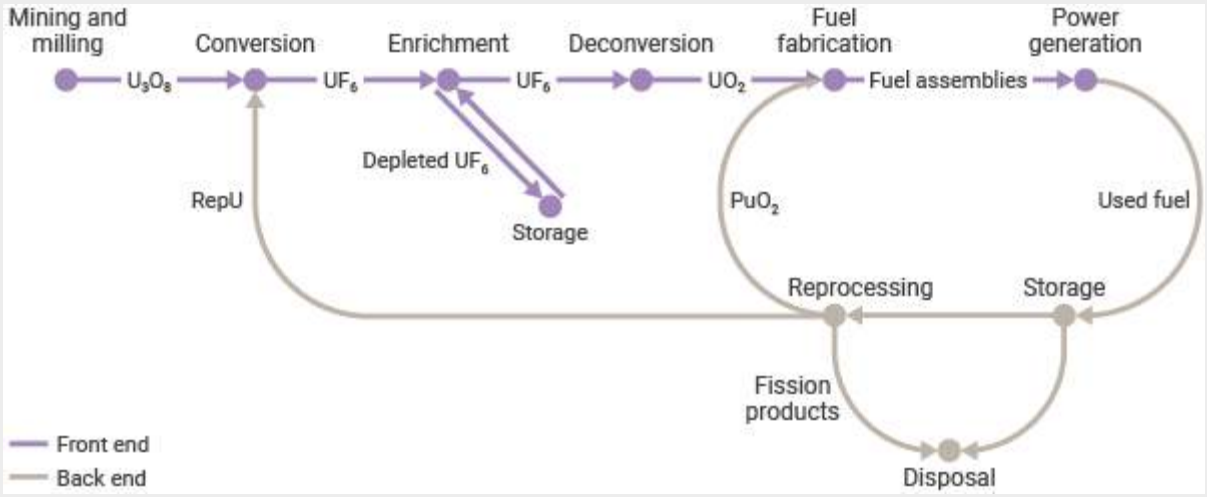
research in the mid-1950s was to show that nuclear energy could produce electricity for commercial use. This led to the generation of the first electricity from nuclear energy on December 20, 1951. The nuclear power industry in the U.S. grew rapidly in the 1960s. Utility companies saw this new form of electricity production as economical, environmentally clean, and safe.

DEVELOPMENT OF NUCLEAR POWER IN INDIA

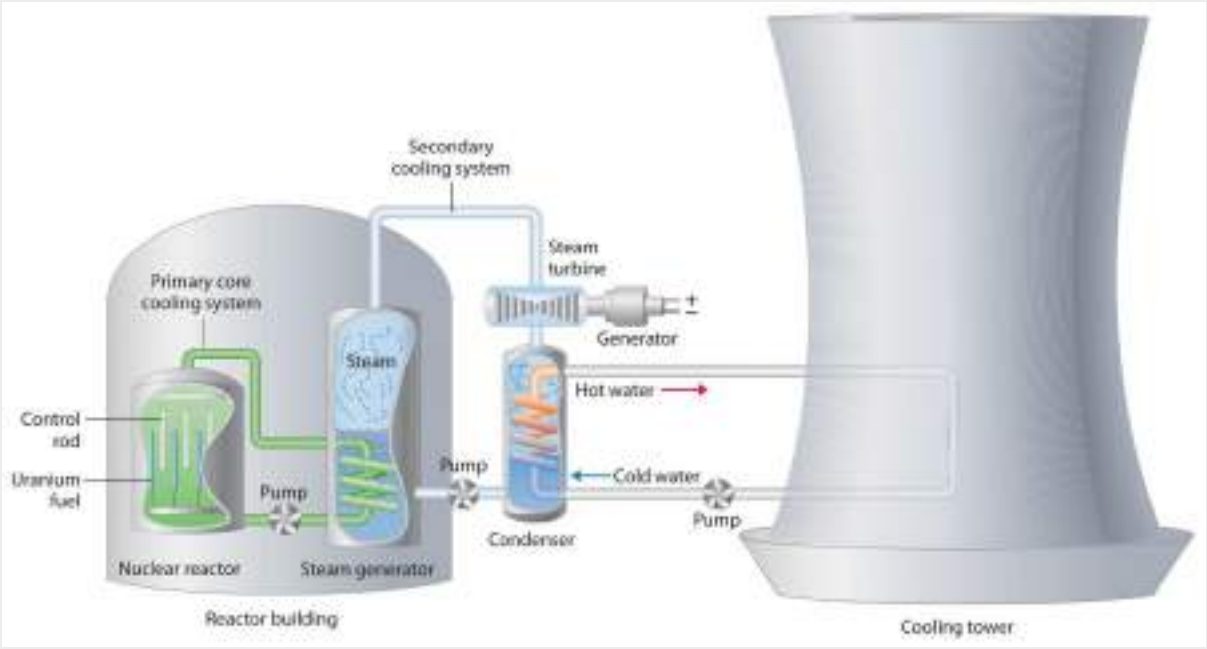
Whenever we talk about nuclear power in India the first name that comes into our mind is **Dr. Homi J. Bhabha** who is the father of the Indian nuclear program. Dr. Bhabha was a nuclear physicist who made important contributions to quantum theory and cosmic radiation. In 1948, Nehru led the appointment of Bhabha as the director of the nuclear programme of India. He became the first chairperson of India's Atomic Energy Commission in 1948. He formulated a strategy of focussing on extracting power from the country's vast thorium reserves rather than its meagre uranium reserves. The first two stages of the programme involved the natural uranium-fuelled heavy water reactors and plutonium-fuelled fast breeder reactors to generate sufficient fissile material from India's limited uranium resources. In the third stage, the thorium reserves can be fully utilized in thermal breeder reactors. In November 1954, Bhabha presented the three-stage plan for national development, at the conference on "Development of Atomic Energy for Peaceful Purposes" and later he became the founding director of the Atomic energy establishment, Trombay (AEET) which was later renamed as Bhabha Atomic Research Centre (BARC) after the sad demise of Dr. Bhabha in an accident. It was under his direction that the scientists of India made their way into making an atomic bomb and the first atomic reactor was operated in 1956.

STRUCTURE AND WORKING OF NUCLEAR POWER PLANT

In nuclear power plants, neutrons collide with uranium atoms, splitting them. This splits releases neutrons from the uranium that in turn collide with other atoms, causing a chain reaction. This chain reaction is controlled with "control rods" that absorb neutrons. In the core of nuclear reactors, the fission of uranium atoms releases energy that heats water to about 520 degrees Fahrenheit. This hot water is then used to spin turbines that are connected to generators, producing electricity and this electricity is transferred to the households.



Nuclear Fuel: From Mine to Reactor (Source: https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/nuclear-fuel-cycle-overview.aspx)



Nuclear Reactor (Source: https://chem.libretexts.org/Courses/Furman_University/CHM101%3A_Chemistry_and_Global_Awareness_(Gordon)/07%3A_Nuclear_Energy/7.04%3A_Generating_Electricity_by_Using_Fission)

NUCLEAR POWER PLANTS IN INDIA

Name	Model	Reactor Type	Reference Unit Power (MWe)	Grid Connection
Kaiga 1	Horizontal Pressure Tube type	PHWR	202	2000-10
Kaiga 2	Horizontal Pressure Tube type	PHWR	202	1999-12
Kaiga 3	Horizontal Pressure Tube type	PHWR	202	2007-04
Kaiga 4	Horizontal Pressure Tube type	PHWR	202	2011-01
Kakrapar 1	Horizontal Pressure Tube type	PHWR	202	1992-11
Kakrapar 2	Horizontal Pressure Tube type	PHWR	202	1995-03

Kudankulam 1	VVER V-412	PWR	932	2013-10
Kudankulam 2	VVER V-412	PWR	932	2016-08
Madras 1	Horizontal Pressure Tube type	PHWR	205	1983-07
Madras 2	Horizontal Pressure Tube type	PHWR	205	1985-09
Narora 1	Horizontal Pressure Tube type	PHWR	202	1989-07
Narora 2	Horizontal Pressure Tube type	PHWR	202	1992-01
Rajasthan 1	Horizontal Pressure Tube type	PHWR	90	1972-11
Rajasthan 2	Horizontal Pressure Tube type	PHWR	187	1980-11
Rajasthan 3	Horizontal Pressure Tube type	PHWR	202	2000-03
Rajasthan 4	Horizontal Pressure Tube type	PHWR	202	2000-11
Rajasthan 5	Horizontal Pressure Tube type	PHWR	202	2009-12
Rajasthan 6	Horizontal Pressure Tube type	PHWR	202	2010-03
Tarapur 1	BWR-1 (Mark 2)	BWR	150	1969-04
Tarapur 2	BWR-1 (Mark 2)	BWR	150	1969-05
Tarapur 3	Horizontal Pressure Tube Type	PHWR	490	2006-06
Tarapur 4	Horizontal Pressure Tube Type	PHWR	490	2005-06
Reactors under construction in India				
Reactor Name	**Model**	**Reactor Type**	**Gross Capacity**	**Construction Start**
Kakrapar 3	PHWR-700	PHWR	700	2010-11-22
Kakrapar 4	PHWR-700	PHWR	700	2010-11-22
Kudankulam 3	VVER V-491	PWR	1000	2017-06-29
Kudankulam 4	VVER V-491	PWR	1000	2017-10-23
PFBR	Prototype	FBR	500	2004-10-23
Rajasthan 7	Horizontal Pressure Tube type	PHWR	700	2011-07-18
Rajasthan 8	Horizontal Pressure Tube type	PHWR	700	2011-09-30

(Source: https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx)

***BWR- Boiling Water Reactor; PWR- Pressurized Water Reactor; PHWR- Pressurized Heavy Water Reactor**

Figure: Nuclear Power Plants in India (Source: https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx)

TARAPUR ATOMIC POWER STATION

India's first atomic power project began on May 8, 1964, after a contract was signed between the governments of India and the United States. It is located near Boiser in the Thane district of Maharashtra and is very well known as the Tarapur Atomic Power Station (TAPS). Construction began in October 1964, after boiling water reactors (BWRs) were supplied by US company general electric, and both the Units-1 and Units-2 BWRs commenced commercial operation on 28 October 1969. Since then, it has produced 193 billion units of electricity as of September 2019 with these units accounting for more than 98 billion units.

RAJASTHAN ATOMIC POWER STATION

The Rajasthan Atomic Power Project (RAPP), located in Rawatbhata in the north Indian state of Rajasthan, currently has six pressurized heavy water reactor (PHWR) units, operating with a total installed capacity of 1,180MW. It has 7 reactors working and unit 8 will be installed by December 2021 which will increase the capacity of RAPP by 1400MW.

KUDANKULAM NUCLEAR POWER PLANT: - The Kudankulam Nuclear Power Plant (KNPP) is located 650km south of Chennai, in the Tirunelveli district of Tamil Nadu, India. It is being developed by the Nuclear Power Corporation of India (NPCIL). Kudankulam, or Koodankulam, is India's first nuclear plant to use imported PWR technology. Two 1,000 megawatt (MW) pressurized water reactor (PWR) units based on Russian technology were constructed in phase one of the project in 2001. Excavation works for the construction of units three and four started in 2016 to make them operational by 2023. The home state Tamil Nadu is allocated 50% (925MW) of the power generated while the neighbouring states share 35% of the residual power, including 442MW for Karnataka, 266MW for Kerala, and 67MW for Puducherry.

KAIGA ATOMIC POWER STATION: A 220 Megawatt (Mw) Kaiga Atomic Power Station (KAPS) in Karnataka has created a world record for continuous operation of 941 days, surpassing the earlier world record of 940 days held by Heysham-Unit 2 of the United Kingdom. The total installed capacity of the four units is 880MWe.

KAKRAPAR ATOMIC POWER STATION: The Kakrapar Atomic Power Station (KAPS) is located near Surat in the state of Gujarat. KAPS currently operates two PHWRs. As of 28 February 2003, KARP's cumulative energy generation since its commercial start date was 24,892 million units (MUs). This included 12,926 MUs for the Unit-1 PHWR and 11,966 MUs for Unit-2.

The Madras Atomic Power Station (MAPS): located within 30 kilometres of Chennai City and was the first indigenously built nuclear power station in India. The two Pressurized Heavy Water Reactors (PHWR) installed there, are capable of generating 170MWe each. MAPS is also home to a pilot plant for the removal of tritium from heavy water that is used as a moderator in the reactors.

Narora Atomic Power Station: located in Uttar Pradesh consists of two PHWRs. On 31 May 1993, a major fire occurred when the two steam turbine blades servicing Unit-1 malfunctioned and in September 1999, an air-locking inner door malfunctioned. The plant was immediately shut down and Unit-2 remained off duty for approximately one month. Due to various malfunctions, the facility had been inspected by the Bureau of Indian Standards by December 1999 and its environmental management system had been certified. Therefore, NAPS became the first ISO-14001 certified atomic power station in Asia and also received the Golden Peacock Award from the World Environment Foundation for its efforts in environmental preservation.

India only has small uranium reserves and as a result, electricity generation from nuclear power declined by 12.83% during 2006-2008. With the commencement of international nuclear trade, the country has however signed bilateral deals on civilian nuclear technology cooperation with countries like Russia, France, the US, UK, and Canada which have adequate uranium reserves.

With a strong focus on nuclear power, India envisages more than double the nuclear power contribution to overall electricity generation from the current 4.2% to 9% in the next 25 years. As the power from a 1 KG of uranium 235 is equivalent to 42 Gallons of oil, 1 ton of coal, or 17000 Cubic feet of Natural gas. Like with a 1kg bag of Uranium we can save a tremendous amount of Fossil Fuels which could be useful for future

NUCLEAR REACTOR ACCIDENTS

There are large variations in peoples' understanding of the issues surrounding nuclear power, including the technology itself, its deployment, climate change, and energy security. Three major incidents in nuclear history

Three-mile island (1979): In 1979 Cooling system malfunctioned at the Three Mile Island, USA caused a part of the Core to meltdown in reactor number 2 and the three-mile island's second reactor was destroyed. Some days after the incident happened some radioactive gases were released from the Site but no casualties occurred during the incident

Chernobyl Disaster (1986): This incident was turned into a disaster in April 1986 at Chernobyl, Ukraine due to a flawed reactor design that was operated by inadequately trained professionals resulting in an explosion, fires released at least 5 percent of the radioactive material present in the core into the environment. The accident Destroyed the fourth reactor, killing 30 operators and firemen within 3 months and several further deaths later.

Fukushima Daichi: An earthquake of magnitude 9 hit Great East Japan on 11 March 2011, eleven reactors at four nuclear power plants in the region were operating at the time and all shut down automatically. The main problem initially cantered on Fukushima Daiichi units 1-3. Unit 4 became a problem on day five. After two weeks, the three reactors (units 1-3) were stable with water addition and by July they were being cooled with recycled water from the new treatment plant. Official 'cold shutdown condition' was announced in mid-December. The accident was rated 7 on the INES scale and official figures show that there have been 2259 disaster-related deaths.

There had been many anti-nuclear movements throughout the world including India, there have been mass protests against the Jaitapur Nuclear Power Project in Maharashtra and the Kudankulam Nuclear Power Plant in Tamil Nadu, and a proposed large nuclear power plant near Haripur was refused permission by the Government of West Bengal. So, the question arises here that is nuclear energy safe for the extraction of power? Nuclear energy might not be the safest Source for Extracting power for consumption but if precautions and care measures are taken, it can prove to be the highest and the cleanest potential source for electricity production. This can save a tremendous amount of fossil fuels.

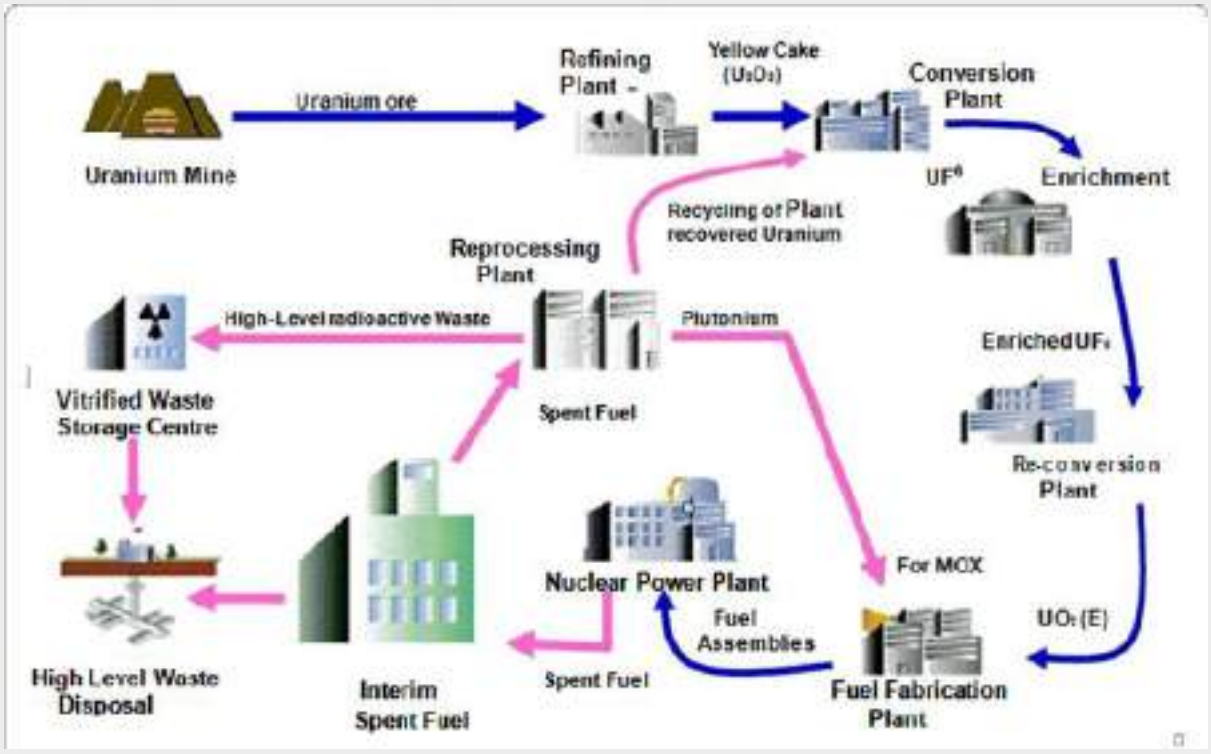
NUCLEAR WASTE MANAGEMENT

Whenever energy is generated from any of the non-renewable sources of energy, the waste is generated if it is treatable then it is treated, and if it isn't then it is released in the ecosystem i.e., in the water, air, and soil. But nuclear waste is radioactive, it can't be released directly into the environment So, India has adopted a closed fuel cycle option, which involves reprocessing and recycling of the spent fuel. During reprocessing, only about two to three percent of the spent fuel becomes waste and the rest is recycled. In the end, the high-level waste will be emplaced in geological disposal facilities. The processing technologies adopted for the management of nuclear waste are:

- Solid waste: Solid waste generated from nuclear power plants after suitable conditioning are disposed of in Near Surface Disposal Facilities (NSDF), designed and

constructed to contain the radionuclides within the disposal system, located within the exclusion zone boundary of nuclear power plants.

- Liquid waste: Low-level liquid waste generated from nuclear power plants is discharged to the environment with regulatory limit after suitable treatment which comprises chemical treatment, evaporation, ion exchange, filtration, etc.
- Gaseous waste: Gaseous waste is treated at the source of generation, then is discharged to the environment through a 100 m high stack after filtration and dilution with continuous monitoring of radionuclides and compliance with the regulatory limits.



GREEN ENERGY AND EMPLOYMENT OPPORTUNITIES

Parijat
B. Com. (Hons.)

Introduction

The scope of green energy and its resources are very wide. If we refer to employability rates under it, as per the 2019 U.S. Energy Employment Report (USEER), 611,000 people worked in zero-emission technology industries, including renewables and nuclear domains in the United States. The International Renewable Energy Agency (IRENA) recorded even higher renewable energy employment in the United States at 855,000 direct and indirect jobs in 2018. Jobs in energy efficiency experienced significant growth as the sector now employs more than 3 million people in the United States. Apart from this, IRENA reported that the renewable energy sector employed 11 million people in 2018, 700,000 more than in 2017 on a global level.

Climate adaptation and resilience stand out as rapidly emerging areas of employment as a result of climate change impacts. These sectors will be critical to track in tandem with jobs in renewable energy and energy efficiency in the coming years. However, the Standard Occupation Classification (SOC) system managed by the Bureau of Labour Statistics does not currently include codes to allow for the comprehensive analysis of employment in these fields. To address the lack of country-wide data, the American Society of Adaptation Professionals (ASAP) has initiated efforts to define and quantify the adaptation and resilience workforce.

Defining Clean Energy Jobs

The U.S. Bureau of Labour Statistics (BLS) defines green jobs as either "jobs in businesses that produce goods and provide services that benefit the environment or conserve natural resources" or as "jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources." These definitions include employment in 1) renewable energy; 2) energy efficiency; 3) pollution reduction and removal, greenhouse gas reduction, and recycling and reuse; 4) natural resources conservation; and 5) environmental compliance, education and training, and public awareness.

Energy Efficiency Jobs in India: India's energy sector is expected to generate hundreds of thousands of jobs over the coming years as the country is trying to reduce its dependence on fossil fuels. Also, this can surely help India's rural sector, but also it poses major challenges including the given skills gap existing now.

DEFINING EMPLOYMENT EFFECTS

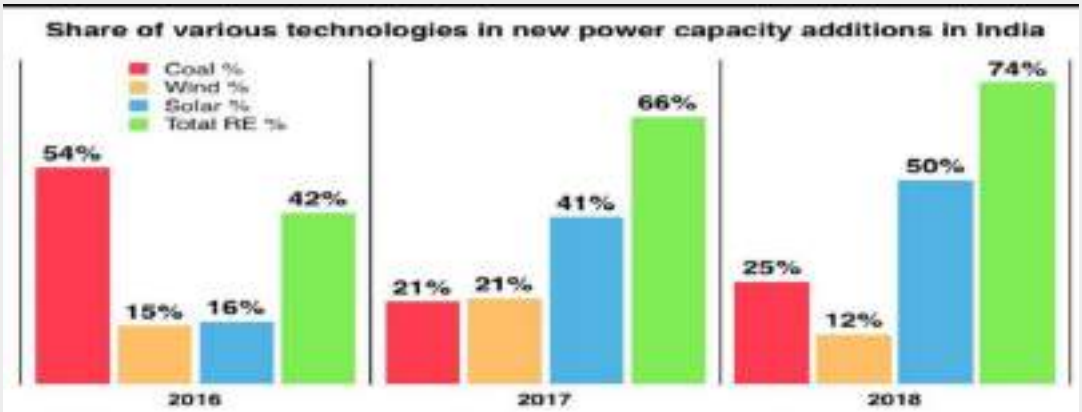
Employment through the sector could be broadly classified into three categories: Direct, Indirect and Induced jobs (CEEW-NRDC, 2017; Cartelle Barros, 2017)

- **Direct jobs:** This includes employment in the project deployment phase. Various associated activities include plant design, site development, financial closure, project management, fuel supply, construction/installation and the operation and maintenance of power plants.
- **Indirect jobs:** This includes jobs in the secondary industries that supply equipment to the primary industries. This relates to the manufacturing of equipment and materials used for the direct functioning of a power plant, which includes manufacturing of turbines, generators, boilers, solar PV panels and wind systems for power plants. It also includes jobs created at facilities that fabricate structural hardware, foundations and electrical components for power plants.
- **Induced jobs:** Induced jobs are created when the salaries earned in the primary and secondary industries are spent. For instance, earnings spent by the power plant's workers on purchasing food at grocery stores and restaurants, house rents, etc., induce additional employment in these respective industries.

India's expansion of wind and solar power over the next 5 years would generate around 3.3 lakhs of jobs in areas like manufacturing, project design, construction, business development, and so on, according to World Resources Institute. The Government of India has set itself an ambitious target to generate 40% of its energy through renewable resources by 2030 to meet the country's growing demands. For instance, New Delhi is striving 175 GW from renewable energy sources by 2022, with solar power accounting for the majority basis, with a target of 100 GW, followed by the wind power source.

An expanding economy of scale, urbanization and focus on the growth of manufacturing or production activities are contributing factors to India's growing energy needs. We also know that India, today has become the third-largest carbon emitter after the United States and China. Official figures say that one million Indians enter the workforce every month in the country because of the young demographics of the population and for their income.

According to USEER, energy efficiency employment is defined as “employment [that] covers both the production and installation of energy-saving products and the provision of services that reduce end-use energy consumption.”

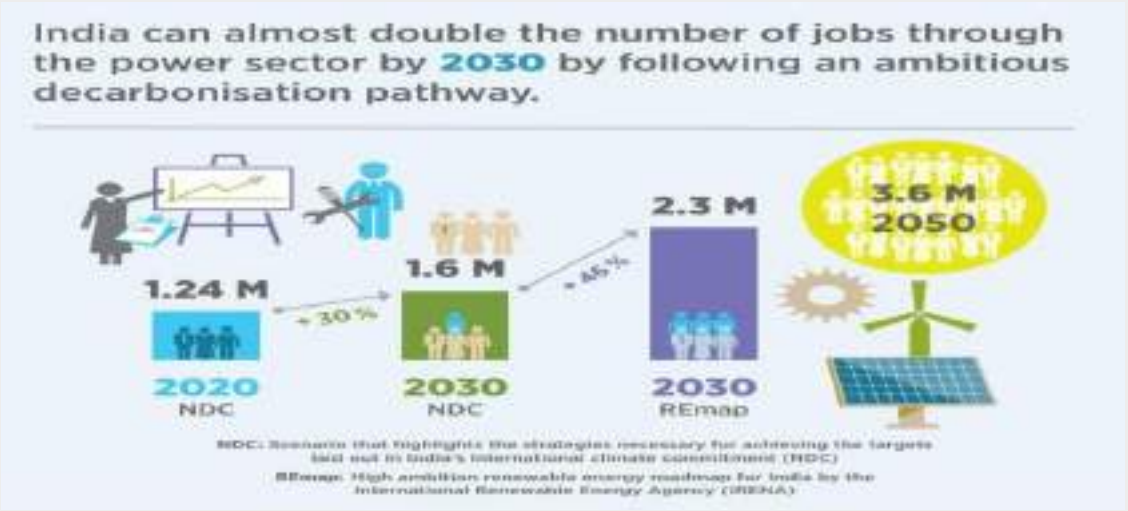


Workers migrate because in search of work to feed up their lives and their family lives. However, it is observed especially during this lockdown time amidst coronavirus disease in India, inter-migration has been at a large level. People had no food, no money and so, they went on to heading towards their home or the place where they can get some amount of work either in the green energy sector or in factories.

If there are certain facilities been provided for the workers in green energy in advance along with better facilities, this can surely stop the migration of workers keeping in mind the current condition as well as in future time too. The government needs to look into harnessing the opportunities for renewable energy resources like the building of dams, providing infrastructure for solar panels and windmills, etc.

THE WAY FORWARD

"GO GREEN, LEAD GREEN" should now become the motto for the government to work towards a common goal of ensuring opportunities for employment of the people of the country at a wide scale. It can be further re-stated that in India, the central, as well as state governments, are giving their best by launching various schemes, initiatives, etc. to help the people come out from the bounded trap of unemployment and poverty.



The government is taking various steps to incentivize the renewable energy sector and is encouraging private sector developers to implement advanced technologies in renewable energy projects to tap maximum energy.

The Minister of State (IC), New & Renewable Energy, Power and Skill Development and Entrepreneurship, R.K. Singh has stated that private sector developers selected through transparent bidding process were undertaking most of the renewable energy projects in the country. "Government has issued standard bidding guidelines to enable the distribution licensees to procure power at competitive rates in a cost-effective manner," Singh said.

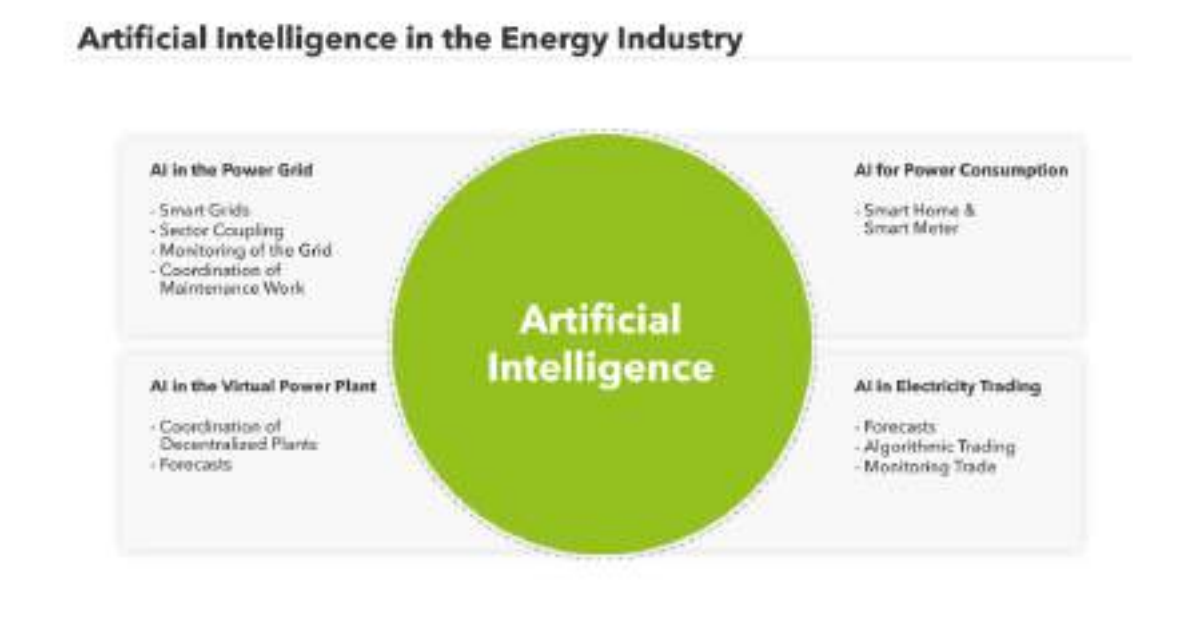
Discussing the initiatives taken by the ministry to aid the growth of renewable energy, Mr. Singh said that the government is facilitating developers by allowing Foreign Direct Investment (FDI) of up to 100% through the automatic route. Moreover, Inter-State Transmission System (ISTS) charges and losses for inter-state sale of solar and wind power shall also be waived for renewable projects commissioned by December 2022.

Besides, the norms for Renewable Purchase Obligation (RPO) until 2022 has been prescribed. Grid integration of large-scale renewable energy capacity addition shall be aided by the development of Green Energy Corridors.

Role of Artificial Intelligence in the Energy Sector

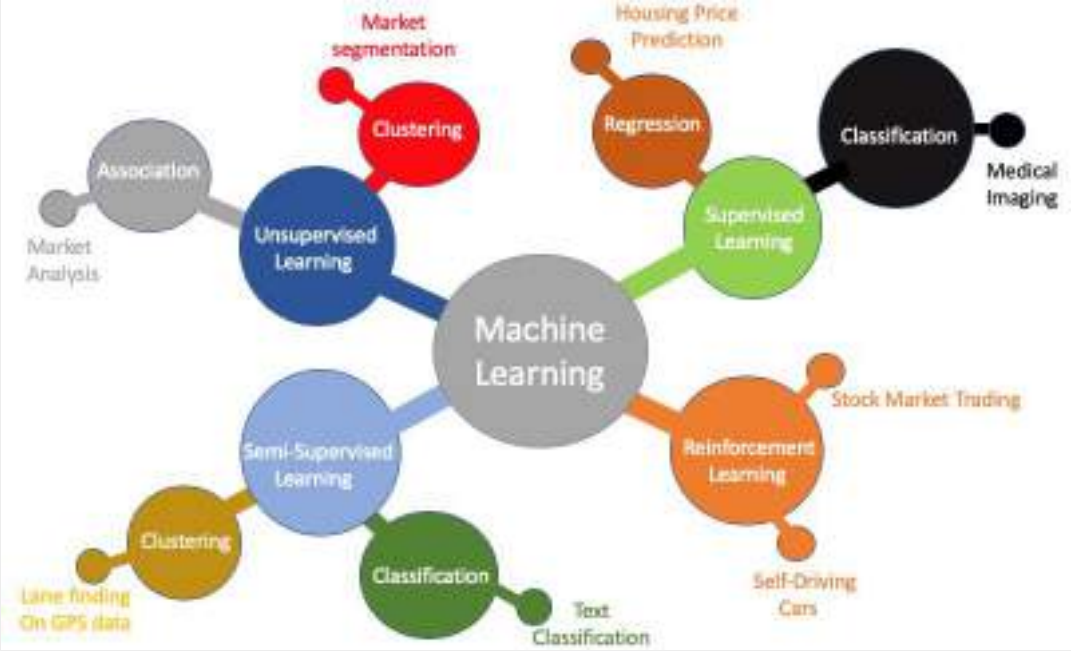
Chitranjan Thakur
B.Sc. Mathematics (Hons.)

Through this article, I want to draw the attention of all readers regarding the role of artificial intelligence in the energy sector. First and foremost, what is Artificial Intelligence (AI) in the energy sector? As in recent years, artificial intelligence has gained relevance in a wide variety of sectors. However, defining the term poses some difficulties. The essence of artificial intelligence is that it makes and implements decisions based on data independently concerning defined goals. The term artificial intelligence distinguishes it from the "natural intelligence" attitude as compared to humans and animals. Narrower definition sees AI as a branch of computer science that deals with machine learning and the automation of intelligent behavior. Still, the definition of religion remains vague and excludes other areas of research such as robotics or linguistics.



Albert Einstein said about artificial intelligence that "the measure of intelligence is the ability to change. "Now coming with the reference that artificial intelligence: the attempt at differentiating. Artificial intelligence is on everyone's lips right now. It is the fastest-growing branch of the high-tech industry. The German government sees AI as a key strategy for mastering some of the greatest challenges of our time such as climate change and pollution. It is difficult to establish a clear definition of artificial intelligence or even a precise definition.

AI is often used in connection or sometimes even synonyms with the term machine learning, big data, or deep learning. These inaccuracies are not due to the least concept of intelligence which includes a clear and unambiguous definition. Artificial intelligence is clearly distinguished from "Natural Intelligence" which is attributed to humans and animals. A central aspect of Intelligence in AI is that it makes decisions based on the information and reacting flexibly to change and the environment to carry out actions about its goal.



However, while coming across with artificial intelligence we often use a common term i.e., machine learning. Machine learning is often used in a connection with AI and is of great importance in the energy industries. However, machine learning and AI are not the same, since machine learning includes only a part of AI. Machine learning means that machines can learn independently to draw the conclusion for the future from their experience and solve the problem that has not been there before.

Upcoming with artificial intelligence in the energy sector. Artificial intelligence has become more and more important in the energy sector about industries and is having great potential for the future design of the energy system. Typical areas of applications are electricity trading, smart grids, or the sector coupling of electricity, heat, and transport, etc. Pre-requisite for increased use of AI in the energy systems are the digitalization of the energy sector and a corresponding larger set of data. AI may help to make the energy sectors more efficient and secure by analysing and evaluating the data volumes.

Now artificial intelligence in the power grid- smart grid and sector coupling. In particular, AI is present in the field of intelligent networking of electricity consumers and generators across sectors boundaries. With the increasing decentralization and digitalization of the power grid participants, man is a large number of grid and keep the grid in a balance. This requires evaluating and analysing a flood of data. Artificial intelligence helps process this data quickly and efficiently.

Smart grids are another area of application. These networks transport not only electricity but also data especially with an increasing number of volatile power generation. It is becoming more and more important for power generation to react intelligently to consumption. AI can help evaluate, analyse, and control the data of the various participants connected via the grid.

A particular focus of AI in the energy industries is the integration of electron mobility. An increase in e-cars offers opportunities and challenges. The charging of electric cars must be coordinated but at the same time, they offer the possibility of storing electricity and stabilizing the grid for example by adjusting the charging demand to price signals and availability. AI can help with all this by monitoring and coordinating. Besides, the AI can stabilize the power grid for example detecting anomalies in generation consumption or transmission in near real-time and then develop suitable solutions. Initial research projects in this field such as at the Fraunhofer institute, are already underway.

Another reference would be artificial intelligence in the virtual power plant. Numerous data that are processed are made in the virtual power plants. The AI algorithms help generate increasingly accurate forecasts as well as co-ordinate various participants in the virtual power plant. This happens for example when it necessary to co-ordinate which plant generates or consumes how much electricity and when. The basis of the analysis is, among other data, live feed in data, historical data, data from trading centers, and weather forecasts. Some Al algorithms are already sufficiently intelligent that they can trade on their own. This is what they call algorithmic trading, algo -trading, or automated trading. AI can also help to automatically monitor and analyse trading on the electricity market. This makes it possible to detect and prevent deviations from the norm, such as abuse of market power, more quickly and specifically.

AI for power consumption. Consumers, intelligently connected in the electricity system, can contribute to a stable and green electricity grid. Smart Home solutions and smart meters already exist but they are not yet widely used. In a smart network home, the network devices react to

prices on the electricity market and adapt to household usage patterns to save electricity at a reduced cost. One example is a smart network air conditioning system. They react to a price on the electricity Market by boosting their output when it is abundant and cheap. By analysing user data, they can also include information about the user's preference and time windows in their calculations.

At last, talking about artificial intelligence in the energy industries whether it's an obstacle or criticism. Any artificial intelligence is only as smart as it is data. This is one of the biggest sticking points the topic of data protection and data securities are some of the greatest pickup points in the use of artificial intelligence. Those who are connected digitally and intelligently reveal a lot about themselves and the system becomes vulnerable to a cyber-attack. In 2018 the German federal office for security observed that the number of cyber-attacks on critical infrastructure triple in comparison to the previous years. So, it is quoted by Eliezer Vudkowsky "By far, the greatest danger of artificial intelligence is that people concluded to earlier that they understand it". Energy supply and the entire system are a part of critical infrastructure. This is why cybersecurity is becoming more and more important today and, in the future, to protect the high network Power grid from attacks and data theft from the outside. There is already a strict security requirement for the participant in the security market in the area of data protection and data security though. Contrary to the widespread opinion that AI can make the power grid less secure, AI can make an important contribution to the fight against cyber-attacks. It can quickly check large amounts of data and thus detects deviations. AI can also conclude the past several cyber-attacks. Machine learning has already achieved great success in the areas, for example in the detection of defence of Trojans. Many end users are critical of artificial intelligence, especially concerning smartphone technology. This is understandable because the data of the most favoured private space reveals a lot about the user. Studies have shown that the biggest obstacle to the acceptance of smart meters is the fear of revealing private information without knowing exactly how it is used. These fears are justified, as there are still no regulations on how to handle this sensitive data, which is important for the electricity system of the future. To give the energy industry and in particular and consumers more confidence in the AI, it must be communicated how the data is used and by whom, and data security must be guaranteed. Another criticism of AI is the power consumption of artificial intelligence itself. The processing of a large amount of data consumes a lot of electricity. When using AI for energy system transformation, it is crucial to analyse as well as how to design data centers themselves to be energy -efficient and as climate-neutral as possible. Possible solutions to this

dilemma include the physical proximity of data centers and renewable energy generation plants, the postponement of power-intensive computing operations to times when a lot of power is available, more energy-efficient, IT hardware, or programming that requires as little computing power as possible which seems to be transparent and comprehensible.

At last, I came to put my conclusion that whether AI is an obstacle or criticism. It's up to you all readers. I think my words of approval and disapproval regarding the role of AI in Energy security would put you to think over it.

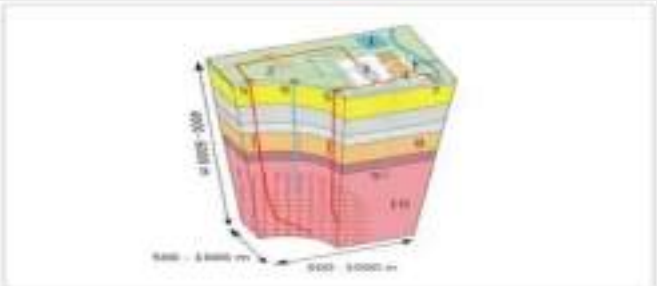
GEOTHERMAL ENERGY

Priyanshu Bhardwaj
B.A. (Prog.)

Nature is known for its giving tendency as everything we wish is fulfilled by Nature, whether it is energy, shelter, food, gum, etc. So, every time nature acts as a god to fulfil our demand. Today we are focusing on one of the major assets of nature that is recently growing and will soon touch the peak, yes, I am here talking about energy, particularly geothermal energy.

Geothermal energy is the heat energy that comes from the subsurface of the earth. Its major sources are rocks, fluids beneath the earth's crust and can be found as far down to the earth's hot molten rock, magma.

India has planned to satiate the country's growing energy demand by the year 2040. For sustainable growth, the country must optimize the use of available energy sources (conventional and renewable) in an environment-friendly manner. Since India is the third-largest country in the world emitting greenhouse gases, it is very important to increase the share of renewable and green energy sources like geothermal energy, solar power, wind energy, etc. in our energy portfolio. While there has been a significant increase in solar and wind energy production, geothermal energy is yet to be harnessed. India has got great potential in geothermal fields predominantly controlled by the high heat-producing granites which are located in different parts of the country. The planned production of electricity from these fields is 850 GWh/year by the year 2020. A wet geothermal system, as well as an enhanced geothermal system, can be utilized to generate electricity at a low production cost. Moreover, some of these fields are also rich in helium content which can be extracted to be utilized for domestic purposes.



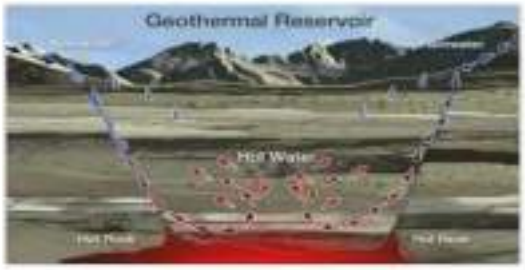
Enhanced geothermal system. 1:Reservoir 2:Pump house 3:Heat exchanger 4:Turbine hall 5:Production well 6:Injection well 7:Hot water to district heating 8:Porous sediments 9:Observation well 10:Crystalline bedrock. (Source: https://en.wikipedia.org/wiki/Geothermal_energy)

Geothermal Reservoirs

Several factors need to work together to make an area feasible for harnessing geothermal energy. There needs to be a geological heat source relatively close to the surface or at an approachable depth. There are two basic types of geothermal

heat resources that can be harnessed. The first type is a Hydrothermal heat source, in this scenario, the heat is transferred by water to the surface, water is recharged into the ground by rain or surface bodies (like river, lakes, or glaciers) and is then heated by an underlying hot rock which is hot due to seismic or volcanic activity. The presence of hot springs in Iceland, The Himalayas, and The Alps are wonderful examples. The lithology of the area needs to permeable so that it can allow water to flow freely, it is necessary to recharge the system and also for the hot water to come up. The potential of a geothermal reservoir can be calculated by testing the temperature and flow rates. This is the more traditional source of geothermal energy as it is easy to locate and exploit.

The second type of resource extraction can be done by Deep/Enhanced Geothermal systems in which a deep borehole is dug to reach the hot basalt rock and then water is pumped into the holes to obtain steam, which is aimed to run a turbine. Accessing the deep basal rock bed is an expensive process and hence this method isn't as popular.



Formation of a Geothermal Reservoir. (Source: http://www1.eere.energy.gov/geothermal/pdfs/40665.pdf)

Indian Geothermal Provinces Nearly 400 thermal springs have been reported from India to date. Early investigations of the thermal springs in Maharashtra, Madhya Pradesh, Uttar Pradesh, and Bihar with the general description, chemical characteristics of the springs from various records. Investigators constructed a general geothermal picture of the terrestrial heat flow from widely distributed locations in India. After the 1970s energy crisis, the Geological Survey of India (GSI) conducted reconnaissance surveys on the viable geothermal sites. The studies were funded under the United Nations Development Programme (UNDP), and the results were published in several of the GSI records and special publications. Subsequently, under joint collaborative research between India and CNR-Italy (Consiglio Nazionale Delle Ricerche), fluids from many of the thermal springs were analyzed between 1996 and 2000, and the results were published in several international journals. Detailed geological and geophysical studies of several geothermal provinces, as well as geochemical characteristics of the thermal fluids and estimation of reservoir temperature, have been carried out by several workers. The need for an in-depth exploration program on the thermal springs has also been emphasized during several national and international conferences.

Geothermal provinces of India (modified after Chandrasekharam, Chandrasekhar [51])

How it is produced?

To produce power from geothermal energy, wells are dug a mile deep into underground reservoirs to access the steam and hot water there, which can then be used to drive turbines connected to electricity generators.

Geothermal energy is used in over 20 countries. The United States is the largest producer of geothermal energy in the world and hosts the largest geothermal field. Known as "The Geysers" in California, the field is spread over 117 square kilometres and formed of 22 power plants, with an installed capacity of over 1.5GW. The energy source is also prevalent in Iceland, where it has been used since 1907. Describing itself as a 'pioneer' of geothermal power, the country produces 25% of its energy from five geothermal power plants. This is due to the 600 hot springs and 200 volcanoes in the country.

Geothermal Energy in India

In India, exploration and study of geothermal fields started in 1970. The GSI (Geological Survey of India) has identified 350 geothermal energy locations in the country. The most

promising of these is in the Puga valley of Ladakh. The estimated potential for geothermal energy in India is about 10000 MW.

The major sites for geothermal energy are:

- Himalayas: J&K, HP, and Sikkim; PUGA hot spring in J&K and Manikaran in HP Sohana: Haryana, Rajasthan.
- Son-Narmada-Tapi (SONATA): MP, Chhattisgarh, and Jharkhand; Tattapani spring in Chhattisgarh.
- Cambay: Mainly Gujarat and some parts of Rajasthan
- Godavari: AP
- Mahanadi: Orissa, Taptapani Spring in Orissa.

As described above, India has two types of geothermal fields, the wet geothermal system, and enhanced geothermal system, which can be used for power generation to meet the electricity demand. Currently, in India, there is no power generation from the geothermal energy source. However, the planned construction of a 35 MWe geothermal power plant is going on. The projected use of geothermal energy by 2020 is 850 GWh/year with an installed capacity of 100 MWe. Most of the geothermal systems in India are in the low-enthalpy geothermal system category. Therefore, it is suggested that these areas can be effectively used for power generation using a binary cycle technique known as Organic Rankine Cycle (ORC). Essentially, in this technique, heat is extracted from the geothermal fluid through a heat exchanger and is transferred to a low boiling point (BP) organic liquid which in turn evaporates and develops sufficient pressure to drive the turbine. The selection of working fluid is the most important part of ORC. The working fluid should have a low BP and it should evaporate at atmospheric pressure. It should be non-corrosive, non-flammable, and non-reactive at the working temperature and pressure. However, in practice, all the requirements may not be met as many organic fluids are inflammable and not environmentally friendly. The main advantage of an organic working fluid is that the turbine chamber need not be under the vacuum condition.

Himalayan Geothermal Belt:

The HGB is a large geothermally active area that stretches across the entire Himalayan orogeny spanning half a dozen countries. This region currently produces a negligible amount of electricity compared to its actual potential. Over 150 sites across India, China (Tibet), Nepal, Myanmar, and Thailand have been identified to be hot enough to produce electricity. The geothermal activity is the result of the collision which happened between India and Asia around

40 million years ago. The collision causes the Indian Plate to subduct under Asia, this caused the heating of large granitic batholiths under the Himalayas which heat the subsurface water. The water is recharged by large glaciers, creating an ideal environment for geothermal energy exploitation. Since the countries around the region have ignored geothermal energy for such a long time and have only shown interest in the resource, the region has the potential to develop as a geothermal energy hotspot.

Benefits of Geothermal Energy

- It is a clean fuel as compared to fossil fuel such as oil, gas, or coal. A geothermal field emits only 1/6th CO2 as compared to any clean natural gas-fired power plant. Binary plants are further less polluter among all geothermal power plants.
- Ground Source Heat Pumps can be a good source of saving money for consumers by reducing electricity bill as it includes only the capital cost and maintenance cost is very less.
- The capital cost of the geothermal power plant is very high but the average units produced every year is very high as compared to other renewable energy resources such as solar, hydro, wind, etc.
- Reinjection/Recycle of Ground Water: Salts and dissolved minerals contained in geothermal fluids are usually re-injected with excess water back into the reservoir at a depth well below groundwater aquifers. This system prolongs the life of the reservoir as it recycles the treated wastewater.
- Geothermal Energy (Other than Power) can also be applied in Cold Storage, Tourist Resorts and pools, Melting snow, Poultry & Fish Farming, Mushroom Farming, Horticulture, Greenhouses, Aquaculture, Industrial processes, Space heating, etc.

Indian organizations working on geothermal energy

- Central Electricity Authority
- Geological Survey of India
- Indian Institute of Technology, Mumbai
- Regional Research Laboratory, Jammu
- National Geophysical Research Institute, Hyderabad
- Oil and Natural Gas Corporation, Dehradun

Ongoing Projects in India

- Magneto-telluric investigations in Tattapani geothermal area in Madhya Pradesh
- Magneto-telluric investigations in Puga geothermal area in Ladakh region, Jammu & Kashmir
- Achievements:
- Geothermal Atlas of India, prepared by the Geological Survey of India (GSI) gives information/data for more than 300 geothermal potential sites. This Atlas is being updated by GSI with support from MNES.
- Applications of geothermal energy for small-scale power generation and thermal applications are being explored.
- Potential Applications:
- Power generation
- Cooking
- Space heating
- Use in greenhouse cultivation
- Crop drying

Technology for electricity generation

There are two types of plants:

1. Flash steam plants: When the geothermal energy is available at 150 °C and above temperature, the fluids can be used directly to generate electricity. In some cases, direct steam is available from the geothermal reservoir; otherwise, the steam is separated and turbines are used for power generation.

2. Binary plant: These plants are used when the geothermal temperature is between 100 °C and 150 °C. The fluid is extracted and circulated through a heat exchanger where the heat is transferred to the low boiling point organic liquid. This gets converted into high-pressure vapor, which drives organic fluid turbines (Figure 3b)

Government Initiatives

- First Geothermal power plant to come in Chhattisgarh by the cooperation of NTPC and Chhattisgarh Renewable Energy Development Agency (CREDA). It is Tattapani geothermal field in SONATA geothermal province.

- For Industrial Projects, the government has planned to provide a capital subsidy of up to 30%.
- Ministry of New and Renewable Energy (MNRE) provides large incentives and subsidies for Research, Design, Development, and Demonstration (RDD&D) for harnessing geothermal energy in India.
- Ministry of renewable energy has planned to generate geothermal energy up to 1000 MW by 2022.
- As per the Geological Survey of India (GSI), 10000 MW geothermal potential has been identified in India

VANVASI DIARIES

भारत की वनवासी सम्पदा

वनटंगिया: तराई वनक्षेत्र के जन्मदाता

डा. मयंक पाण्डेय

पुरातन काल से ही भारत-भूमि पर वनों के संवर्धन एवं संरक्षण में वनवासियों एवं ग्रामीणों का अतुलनीय योगदान रहा है | यह कहना अतिशयोक्ति नहीं होगा कि देश के वन-क्षेत्र की वृद्धि करना एवं जैवविविधता को संजोये रखना वनवासियों के अथक प्रयासों के बिना संभव नहीं हो पाता | भारतवर्ष असंख्य वनवासी समुदायों का उद्गम स्थल रहा है तथा उनकी विशिष्ट परम्पराओं और विविधताओं का पोषण करता रहा है | ऐसा ही एक वनवासी समुदाय है **'वनटंगिया'** जिनकी सहायता से अंग्रेजों ने पूर्वी-उत्तर प्रदेश और तराई के इलाकों में सघन वृक्षारोपण करवाया |

वनटंगिया जनजाति (Source: https://www.downtoearth.org.in/news/forests/vantangiyas-forests-builders-but-not-considered-forest-dwellers-64530)

वनटंगिया: एक परिचय

'टंगिया' शब्द का अर्थ है वनों का रोपण करने वाला (Tangiya- 'Tang' means Farming and 'Ya' means Forests) | इसी प्रकार जिन जनजातियों अथवा समूहों के नाम के अंत में 'या' जुड़ा होता है वे भी वनों के रोपण के कार्य से सम्बंधित होते हैं, जैसे भिछिया, धाकिया, ताडिया, चाफरिया, बद्खादिया, कटारिया इत्यादी | वर्ष 1853 में भारत में रेल की शुरुआत के साथ ही तत्कालीन शासन को रेलवे लाइन बिछाने में प्रयोग होने वाले स्लीपर के लिए अत्यधिक लकड़ी की आवश्यकता पड़ी | अवध फारेस्ट रूल, 1861 (Awadh Forest Rule, 1861) पारित करने के बाद तत्कालीन शासन के आदेश पर पूर्वी-उत्तर प्रदेश (गोरखपुर, महाराजगंज, गोंडा, बहराइच,

बलरामपुर, लखीमपुर खीरी) और तराई के क्षेत्रों में बड़े पैमाने पर वनोंमूलन हुआ और शीघ्र ही पूरा क्षेत्र बंजर भूमि में परिवर्तित होने लगा | ऐसे में अंग्रेजों को बर्मा (म्यांमार) में प्रचलित टंगिया प्रथा की याद आई जिसमें वनवासी समूहों की सहायता से वहां पर सघन वृक्षारोपण कार्यक्रम संभव हो सका | ब्रिटिश सरकार ने अपने कुछ अधिकारियों को टंगिया प्रथा सीखने के लिए बर्मा भेजा और लौटकर उन अधिकारियों ने पूर्वी-उत्तर प्रदेश के ग्रामीणों और वनवासियों को टंगिया प्रथा में प्रशिक्षित किया | टंगिया प्रथा का प्रयोग करके पूर्वी-उत्तर प्रदेश एवं तराई क्षेत्र के मूल किसानों, वनवासियों एवं ग्रामीणों की सहायता से व्यावसायिक वृक्षों (मुख्यतः साखो, यूकेलिपटस आदि) का सघन वृक्षारोपण किया गया और कुछ ही वर्षों में पूरा इलाका पुनः वनाच्छादित हो गया | वृक्षारोपण द्वारा बंजर भूमि को वन क्षेत्र में बदलने के कारण वे **वनटंगिया** कहलाये |

धूमिल अतीत

वन बसाने में माहिर इस समूह को अंग्रेजों द्वारा कठिन परिश्रम की पारिश्रमिक के रूप में आर्थिक सहायता के स्थान पर खाली ज़मीन दी जाती थी और खेत से उत्पादित फसल और लकड़ी का आधा हिस्सा ब्रिटिश शासन को चला जाता था | इस कारण वनटंगिया समूह की सामाजिक-आर्थिक स्थिति सदैव दयनीय बनी रही | स्वतंत्रता प्राप्ति के पश्चात भी इनकी स्थिति में कोई विशेष परिवर्तन नहीं आया जिसका अंदाजा इसी बात से लगाया जा सकता है कि 1990 के दशक तक इन्हें मताधिकार भी प्राप्त नहीं था | साथ ही वर्ष 2006 में संसद द्वारा पारित वन अधिकार अधिनियम [Scheduled Tribes And Other Traditional Forest Dwellers (Recognition Of Forest Rights) Act, 2006 or Forest Rights Act, 2006] के अंतर्गत इन्हें वनों से ऐसे प्राकृतिक संपदा चुनने और एकत्र करने का अधिकार भी प्राप्त नहीं है जिनके लिए पेड़ काटने की आवश्यकता नहीं हो (Non-timber Forest Produce), जबकि देश की अन्य जनजातियाँ इस कानून का लाभ उठा रहीं है| कुछ समय पहले तक वनटंगिया समूह सरकारी योजनाओं (सब्सिडी आधारित चिकित्सा, शिक्षा, बिजली तथा पानी, विधवा, वृद्ध एवं दिव्यांग पेंशन, प्रधानमन्त्री आवास योजना. आधार कार्ड आदि) के लाभ से भी वंचित था | जिन क्षेत्रों में इनकी सर्वाधिक घनी आबादी है, उन गाँवों को निकट भूतकाल तक राजस्व गाँवों का दर्जा नहीं मिला था | इस जनसमूह की बड़ी संख्या गोरखपुर (उ.प्र.) के निकट स्थित महबूबनगर में केन्द्रित है और साथ ही अन्य जिलों में भी बसी है | इन्हीं क्षेत्रों से वनटंगिया समूह लगातार शासन व्यवस्था से अपनी स्थिति सुधारने हेतु प्रार्थनारत रहा है |

सरकार द्वारा सराहनीय प्रयास एवं वर्तमान परिस्थिति

हाल ही में वर्तमान उ.प्र. शासन ने वनटंगिया समूह की दशा को सुधारने हेतु सराहनीय कदम उठाते हुए वनटंगिया बहुल गाँवों को राजस्व वन घोषित किया | राजस्व ग्राम घोषित होते ही वनटंगिया समूह उन सभी सरकारी योजनाओं का अधिकारी हो गया जिनसे वे अभी तक वंचित थे | अब प्रदेश में उन्हें उस जमीन पर अपना मालिकाना हक़ मिलेगा जिसपर वे पीढ़ियों से जमीन छिन जाने के डर के साथ रह रहे थे |

हमारी नैतिक जिम्मेदारी है की हम वर्तमान पीढ़ी को ऐसे समूहों के विषय में अवगत कराएं जिनके अथक परिश्रम और लगन से हमारे देश की प्रचुर प्राकृतिक सम्पदा एवं जैवविविधता संरक्षित रह सकी है | साथ ही, हमें ऐसा विश्वास है की शासन व्यवस्था ऐसे समूहों का जीवन स्तर सुधारने में सकारात्मक एवं ठोस कदम उठाएगा |

सन्दर्भ

1. Ghosh R., Vantangiyas: Forests builders but not considered forest dwellers, Down to Earth, https://www.downtoearth.org.in/news/forests/vantangiyas-forests-builders-but-not-considered-forest-dwellers-64530, May 14, 2019, visited on 11.01.2021
2. SabrangIndia, The rich history of Vantangiya's are threatened when villages like Mahbubnagar are not given their rightful status, https://sabrangindia.in/article/rich-history-vantangiyas-are-threatened-when-villages-mahbubnagar-are-not-given-their, March 12, 2019, visited on 11.01.2021

KNOWLEDGE CHECKPOINT

Know Our State/UT- Delhi


Know Your State/ U.T
National Capital Territory
DELHI
Background
On 12th December, 1911, at the historic Delhi Durbar, the George V, the Emperor of the British Empire proclaimed the shifting of the capital of India from Calcutta to Delhi.
Geography
Delhi covers an area of 1484 Sq. Km. out of which 783 Sq. Km. is under the rural and 700 Sq. Km. is under the urban section. The city is bordered on its northern, western, and southern sides by the state of Haryana and to the east by that of Uttar Pradesh (UP).
DELHI CITY
Population
According to the 2011 census, Delhi's population was over 11 million Population of Delhi in 2020 - 1.91 crore (approx).
Male Population 8,987,326
Female Population 7,800,615.
Sex Ratio 868/1000 males
Important Geographical Terrain
River- Yamuna
The Yamuna stretches 22km in Delhi and lies Between Wazirabad and Okhla barrage.
Delhi's 'Ridge' is the tail-end of the ancient Aravalli hills, The Aravallis stretch 800 kilometers from Gujarat through Rajasthan and Haryana, pushing into Delhi from Gurgaon to the south-west.
DELHI CITY
Protected Area
Asola Bhatti Wildlife Sanctuary
Tughlaqabad Biodiversity Park
Neela Hauz Biodiversity Park
Aravalli Biodiversity Park
Kamla Nehru Biodiversity Park
Yamuna Biodiversity Park
Forest
The total forest cover of Delhi is 195.44 sq km, which is 13.18% of the National Capital Territory's area. About 6.72 square kilometre of this is classified as Very Dense Forest 56.42 sq km is moderately dense forest and 132 sq km is 'open forest.

RUDOLF DIESEL

Diesel Engine

Rudolf Diesel, born on March 18, 1858, in Paris, created the pressure-ignited heat engine known commonly as the diesel engine. After graduating from Munich Polytechnic, he began working as a refrigerator engineer for the Linde Ice Machine Company in Paris, moving to Berlin in 1890 to manage the company's technical office. But his passion for engine design was never far from his mind. Diesel worked on an idea for an efficient thermal engine in his free time, completing a design by 1892 for which he received a patent a year later.

Diesel's design aimed for greater efficiency than was available with existing engines at the time. The diesel engine does not require an externally applied ignition to the mixture of air and fuel inside. Rather, this is accomplished through compressing the air inside the cylinder and heating it so that the fuel, which would be brought into contact with the air just before the end of the compression period, would ignite on its own. As a result, the diesel engine would be smaller and lighter than the traditional engine used in most road vehicles and would not require the use of an additional fuel source for the ignition.

Diesel wanted to see his design become a real, working machine. To accomplish this, he sought assistance from major machine manufacturers. Eventually he was hired to produce a test engine and completed a prototype in 1893. Early tests had dangerous results; Diesel was nearly killed when one of his engines exploded. But this test proved that fuel could be ignited without a spark. He worked diligently to improve his engine model, running his first successful test in 1897.

Just one year later, Diesel became a very rich man. His engine, which ran with a theoretical efficiency of 75 percent compared to a theoretical efficiency of 10 percent for traditional steam engines, was employed immediately to power cars, trucks, and boats. It was also used to power pipelines, electric and water plants, and in mining, factories, and oil fields. Even today's diesel engines are based on the inventor's original concept.

The diesel engine had a major impact during the Industrial Revolution, delivering power more efficiently, thus less expensively, for a variety of industries all over the world. Because its use did not require burning coal, train transport and shipping companies were able to save a great deal of money. This, however, was not a boon to the coal industry, which stood to lose a large portion of its business.

On Sept. 29, 1913, Diesel disappeared from a steamer en route to London. His body was recovered on the shore days later. The circumstances surrounding his death are still a mystery. Some believe he may have committed suicide, while others speculate that he was murdered by coal industrialists

Recent UPSC Questions Based on Environment

Correct Options are marked in **Bold** format

- With reference to solar power production in India, consider the following statements (UPSC 2018):

1. India is the third largest in the world in the manufacture of silicon wafers used in photovoltaic units.

2. The solar power tariffs are determined by the Solar Energy Corporation of India.

Which of the statements given above is/are correct?

a) 1 only b) 2 only c) Both 1 and 2 **d) Neither 1 nor 2**

- The Partnership for Action on Green Economy (PAGE), a UN mechanism to assist countries transition towards greener and more inclusive economies, emerged at (UPSC 2018)

a) The Earth Summit on Sustainable Development 2002, Johannesburg

b) The United Nations Conference on Sustainable Development 2012, Rio de Janeiro

c) The United Nations Framework Convention on Climate Change 2015, Paris

d) The World Sustainable Development Summit 2016, New Delhi

- Momentum for Change: Climate Neutral Now" is an initiative launched by (UPSC 2018)

a) The Intergovernmental Panel on Climate Change b) The UNEP Secretariat

c) **The UNFCCC Secretariat** d) The World Meteorological Organisation

- Consider the following statements (UPSC 2019):

1. Petroleum and Natural Gas Regulatory Board (PNGRB) is the first regulatory body set up by the Government of India.

2. One of the tasks of PNGRB is to ensure competitive markets for gas.

3. Appeals against the decisions of PNGRB go before the Appellate Tribunals for Electricity.

Which of the statements given above are correct?

(a) 1 and 2 only **(b) 2 and 3 only** (c) 1 and 3 only (d) 1, 2 and 3

- In the context of proposals to the use of hydrogen-enriched CNG (H-CNG) as fuel for buses in public transport, consider the following statements (UPSC 2019):

1. The main advantage of the use of H-CNG is the elimination of carbon monoxide emissions.

2. H-CNG as fuel reduces carbon dioxide and hydrocarbon emissions.

3. Hydrogen up to one-fifth by volume can be blended with CNG as fuel for buses.

4. H-CNG makes the fuel less expensive than CNG.

Which of the statements given above is / are correct?

(a) 1 only **(b) 2 and 3 only** (c) 4 only (d) 1, 2, 3 and 4

- Which one of the following statements best describes the term 'Social Cost of Carbon'? (UPSC 2020)

(a) It is a measure, in the monetary value of the long-term damage done by a tonne of CO_2 emissions in a given year

(b) the requirement of fossil fuels for a country to provide goods and services to its citizens, based on the burning of those fuels.

(c) efforts put in by a climate refugee to adapt to live in a new place.

(d) contribution of an individual person to the carbon footprint on the planet Earth.

- According to India's National Policy on Biofuels, which of the following can be used as raw materials for the production of biofuels? (USC 2020)

1. Cassava 2. Damaged wheat grains 3. Groundnut seeds 4. Horse gram
5. Rotten potatoes 6. Sugar beet

Select the correct answer using the code given below:

(a) 1, 2, 5 and 6 only (b) 1, 3, 4 and 6 only (c) 2, 3, 4 and 5 only

(d) 1, 2, 3, 4, 5 and 6

- In India, why are some nuclear reactors kept under "IAEA Safeguards" while others are not? (UPSC 2020)

(a) Some use uranium and others use thorium

(b) Some use imported uranium and others use domestic supplies

(c) Some are operated by foreign enterprises and others are operated by domestic enterprises

(d) Some are State-owned and others are privately-owned

Green Energy & India: Facts and Figure

- Prime Minister Mr. Narendra Modi laid the foundation stone of the **world's largest solar-wind hybrid park (30 GW)**, spread over 72, 600 ha of land in Kutch, Gujarat
- Cochin International Airport- World's first airport fully powered by solar energy
- **India's first Solar DEMU** (Diesel Electrical Multiple Unit) trains have been started between Sarai Rohilla (Delhi) and Fahrukh Nagar (Haryana)
- **Guwahati Railway Station** is the first in North-East which is fully running on solar power
- **Solar Steam Cooking System** has been installed by various pilgrim and religious centers like Akshardham Temple (Delhi), Tirupati Tirumala Temple (Andhra Pradesh), Brahmakumarij (Mount Abu, Rajasthan), and Shirdi Temple (Maharashtra)
- **Canal Top Solar Power Projects have been started in Gujarat**
- **World's largest single rooftop solar plant** is installed at **Beas Dera (Punjab)**
- Ministry of New and Renewable Energy launched a scheme to **solarize the Konark town and Konark sun temple completely**
- India recently virtually organized the 3rd **Global RE-INVEST Renewable Energy Investors Meet & Expo** from 26 – 28 November 2020
- **Gulf of Cambay and Gulf of Kutch** is the potent sites to harvest tidal energy in India
- **National Centre for Clean Coal Research and Development** has been established at IISc Bangalore
- **Bureau of Energy Efficiency** gives a star rating to electrical and electronic appliances in India
- **Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM)** Scheme is meant to provide energy security (solar energy) to farmers

VISIT OUR COLLEGE

Plant from Herbal Garden: Aloe vera

Aloe Vera is a xerophytic cactus-like plant that grows to a height of 12 to 16 inches. It has thick freshly left with sharp points, which are up to 18 inches long and 2 inches wide at the base. Its leaves are even long and triangular in shape. The tissue in the center of the aloe-vera leaf yields the aloe gel. Aloe Vera needs a temperature of above 40 degrees. They should be potted in the spring season and watered carefully until established. It grows in the arid climate. They should be watered regularly in the summers. But overwatering can kill the plant. It also grows in partial shade. It reaches maturity in four years when the leaves are harvested.

***Aloe vera* (घृतकुमारी/घीकवार)**

Medicinal uses: Aloe vera cures skin diseases, facial edema, or swelling and heals the burn marks It can also be used to remove dandruff from the hair. Aloe Vera is taken internally for stomach disorders. Its fluid is beneficial in reducing inflammation and pain. Aloe Vera is used in cosmetics and even in the food industry. Curacao aloe acts as a laxative, which is used against constipation. The fresh juice of its leaf blades can be applied directly to the ulcers, burns, sunburns, and fungal infections. Organic Aloe Vera juice reduces acidity. It prevents fungus, influenza virus, measles, and high fever.

Economic importance: Aloe vera is considered to be one of the most important derivatives of these products in the food, medical, pharmaceutical, cosmetic, nursing, chemical, medical, and other industries. The value of trade in the global Aloe Vera product is estimated at $ 125 million and the value of its finished products is over $ 110 billion.

SRISHTI Quarterly Report

(Anand Kumar Yadav)

It is a pleasure and a privilege to present the Quarterly Report (October - December 2020) of **SRISHTI — The Environment Society of P.G.D.A.V. College (Evening)**. This report gives an insight into the achievements of SRISHTI.

The environment is the center of the vision of this Society – a vision that upholds values of biospheric, altruistic, and hedonic. Respected Principal Sir Dr. R.K. Gupta, Convener Ma'am Ms. Renuka D. Bazaz, and committee members constantly navigate the Society to serve our mother earth in the best possible ways. During this span of 3 months, the Society released its Bilingual e-magazine, organized webinars, and initiated a new project. All the members actively took part in each activity and made it a successful one. A detailed account of each event is given below —

- **Release of Srishti- Bilingual magazine:** October 3, 2020, was a historic day for SRISHTI as on this day the Society released the first edition of SRISHTI Bilingual e-magazine. It will be published online at a quarterly interval. It was released virtually through Google meet. Respected Principal, Sir, esteemed faculty members, and over 60 enthusiastic students witnessed this memorable event. The aim behind publishing an e-magazine is to enrich environment knowledge and spread awareness among the teachers and students. This magazine covers environmental importance, its burning issues, and solution through articles, poems, facts, crossword, Tribal Treasures, etc.
- **Webinar on Vulture Conservation:** On October 11, 2020, the Society organized a webinar on **Vulture Conservation**. **Dr. Vibhu Prakash Mathur, Bombay Natural History Society** was invited as a speaker for this topic. The webinar was attended by committee members and over 50 students of the college. The message which came forward from this webinar was to conserve the scavengers of the ecosystem as these are indispensable for the environment, nature, and society. Therefore, a proper environmental and conservation strategy is required for them to survive.
- **Webinar on Kitchen Waste Management:** Another webinar was organized on November 27, 2020, on Kitchen Waste management. **Dr. Aradhna Sharma and Dr. Sudeep Shukla** were the two eminent speakers who were invited to share their knowledge and experience related to this particular topic. Our Principal Sir, Committee Members, and over 50 students were the participants in this webinar. The core of this

webinar was related to poor management of Kitchen Waste which causes the loss of natural resources, human health issues, pollution, the generation of methane emissions from dumps and landfills, and a missed opportunity to recover valuable energy, organic matter, and nutrients in Kitchen Waste. Therefore, by just managing our kitchen Waste, we can minimize the pressure from the environment and it will be beneficial for ourselves in many ways.

- Society always comes up with new innovative ideas to Save our motherland in all possible ways. **Project *Srijan*** was the latest edition in this tally. Discussion on this project was done in November end and the Society officially released this Project on Social Media accounts on 25th December 2020. The theme of this project was to reuse plastic bottles and make different DIY crafts. More than thirty amazing entries came under this project. During this pandemic, by staying at home was one of the best ways Society could contribute to the environment.

A wonderful performance was shown by the SRISHTI during the above said quarter and hope that together we will reach new heights in the coming days, setting the bar high for Society.

Clickers Zone

P.C .Sourav Kumar

"Animals do Speak, we need to know how to listen"

P.C. BS Aman

"Lifecycle that finishes up with a colourful and attractive butterfly"

P.C. Aryan Tharmatt

"These sheeps are just eating and chilling on this beautiful mountain"

P.C. Prince

"When it comes to beauty, nothing can beat nature's beauty"

P.C. Aryan Tharmatt

"Difficult roads often lead to beautiful Destinations"

P.C. Aryan Tharmatt

Beauty of sunset

P.C. Diksha

Prosopis Cineraria

Srishti E-Magazine

Srishti: Quarterly Published Bilingual E-Magazine of Environment Society (SRISHTI)
P.G.D.A.V. College (Evening), University of Delhi
Ring Road, Nehru Nagar, Delhi - 110065
For Any Query, Mail us at srishtipgdave@gmail.com

http://Fb.me/srishtipgdaveve

http://instagram.com/srishtipgdave