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Renewable Energy (Solar, Wind, Geothermal, Tidal, Hydroelectric) : A Necessity for Bright Future

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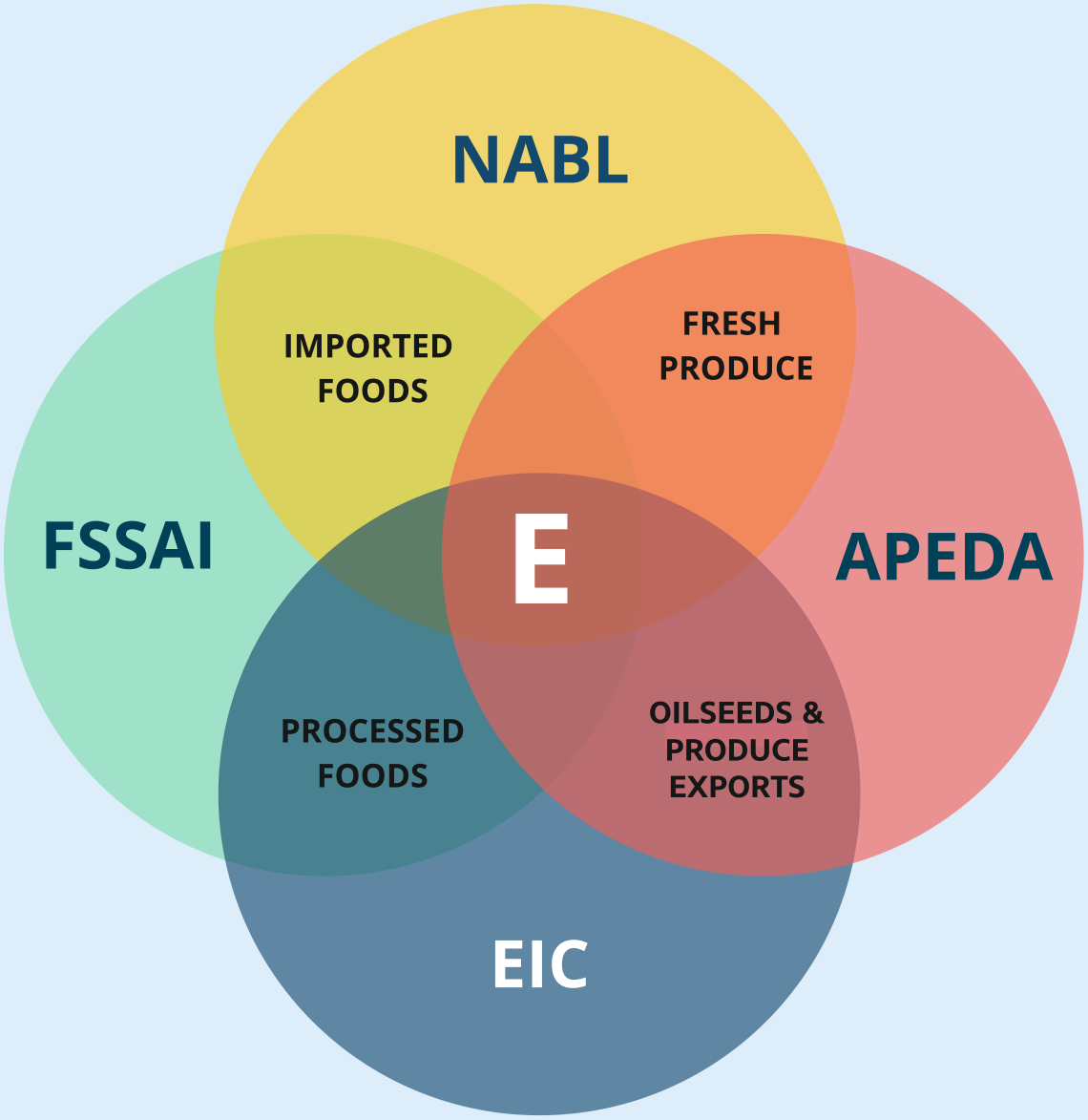

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PURNABRAHMA

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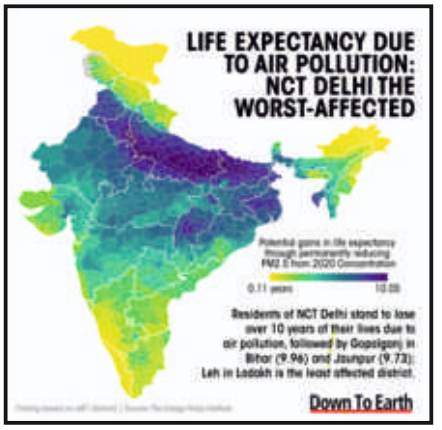

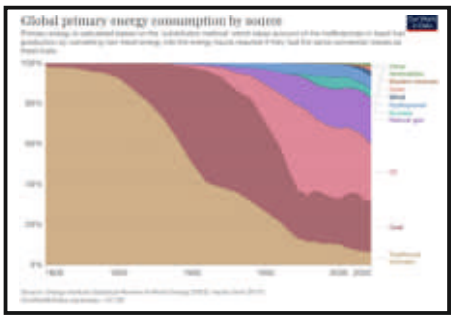

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CASMB ACTIVITIES

CASMB stall at Fi India 2023: 18.08.2023

Some glimpses from FundQuest: Pitching Opportunity for Startups at Fi India 19.08.2023

"Fueling Food Entrepreneurship Success : Insights from CASMB's Empowering Startup School Conference 2023

CASMB was Chosen to Represent India in the Indo-Taiwanese SME Forum and it served as a remarkable platform where the vibrant cultures and dynamic business landscapes of India and Taiwan converge.

Mr. Nilesh Lele and Dr. Umesh Kamble welcomed AFST(I) President and Director IITR, Lucknow Dr. N. Bhaskar at the CASMB stall.

CASMB stall at Annapoorna 2023: 08.09.2023

Introducing Project RRR- Retirees Renewal Resource: 18 Sept 2023 Retired but not tired! CASMB is thrilled to announce the launch of Project RRR (Retirees Renewal Resource).

Former Hon. Minister for Industries Shri. Subhash Desai sir visited CASMB stall at Anufood 2023 exhibition

CASMB MEMBER'S ACHIVEMENT

Mr. Swapnil Mule- Renaissance Superfoods was awarded prize at Starttup Festival pitching contest at Bangalore (10 Aug 2023)

Ms. Kanika Nandurikar won Startup of the Year Award at Fi India 2023 (18 Aug 2023)

Dr. Prakash Kondekar received Visionary Educational Award in Bangalore: 25 Aug 2023

Dr.Prabodh Halde received PHD by hands of Shri Nitin Gadkari Sir - University topper as per research guidelines

Mrs.Trupti Bhatt took workshop on "Kitchen Gardening" at Maniben Nanavati Women's College, Mumbai (02 Sept 2023)

Bhagyashree Mhatre received Start up Woman Entrepreneurs Award by Swift n Lift Media pvt ltd.in Pune (04 Sept 2023)

Dr. Pratima Shastri gave presentation on, "Therapeutic Applications for Traditional Indigenous Foods" in a National symposium organised by . BMN College of Home Science, Mumbai.,in collaboration with Avinashlingam university Coimbatore (06 Sept 2023)

CHAIRMAN'S MESSAGE

Dr. Prabodh Halde

Chairman
Chamber for Advancement of Small and Medium Businesses, CASMB

I am to address you through the pages of this edition of ***Purnabramha,*** which focuses on the theme of renewable energy. In today's world, where sustainability and environmental responsibility are at the forefront of our global agenda, renewable energy stands as a beacon of progress.

Renewable energy, derived from sources like sunlight, wind, water, and geothermal heat, offers us a path toward a cleaner and more sustainable future. Over the past decade, we have witnessed significant growth in renewable energy adoption worldwide, with its share in global electricity supply rising from 20% to 28% from 2011 to 2021. This positive shift is not only evident in the numbers but is also a testament to our collective commitment to reducing our reliance on fossil fuels, which have contributed significantly to global greenhouse gas emissions.

As responsible stewards of our planet, it is our duty to ensure that future generations inherit a world where clean and reliable energy sources power their aspirations. I am heartened to report that India is making impressive strides in this direction. Our Union Power and New & Renewable Energy Minister, Hon.R K Singh, has set an ambitious target of achieving 500 GW of renewable energy capacity before the 2030 deadline, a goal that we are determined to reach.

The National Electricity Plan, devised by the Ministry of Power, has outlined a comprehensive strategy to provide efficient and affordable electricity access to all our citizens. India's significant role in global carbon emissions underscores the urgency of our transition to cleaner energy sources. With nearly three-quarters of our energy demand currently met by coal and oil, the need to explore alternative avenues for electricity generation has never been more pressing.

The transition to renewable energy is not just a choice; it is a necessity. It is our path to sustainable growth, a safeguard against catastrophic climate change, and an opportunity to create jobs and livelihoods for our people. Renewable energy technologies have matured to a point where they can substantially fulfil our electricity demands while reducing harmful emissions. Solar, wind, biomass, waste, and hydropower energies are all part of this transformative journey.

However, this journey is not solely the responsibility of the government or industry; it is a collective effort that demands active participation from every citizen. We must embrace energy conservation and renewable energy practices in our daily lives. It is our moral duty to instil awareness about these critical issues in our educational institutions, ensuring that our youth understand the importance of preserving our natural resources.

Lastly, I wish to emphasize that there is no alternative to renewable energy if we aspire to save our nature and our planet. Let us unite in our pursuit of sustainable growth, and let renewable energy not remain a mere concept on paper but a guiding principle in spirit. Together, we can safeguard our precious natural resources and ensure a cleaner, brighter future for generations to come.

Thank you for your continued support and commitment to a sustainable world.

Sincerely,

Regards

Dr. Prabodh Halde

Chairman
Chamber for Advancement of Small and Medium Businesses (CASMB)

CHAMBER FOR ADVANCEMENT
OF SMALL & MEDIUM BUSINESSES

Nilesh Lele

President,
Chamber for Advancement of Small and Medium Businesses (CASMB)

Harnessing the Power of Renewables: A Message from the President's Desk!

Dear Esteemed Readers,

I hope this message finds you in good health and high spirits. As the President of the Chamber for the Advancement of Small and Medium Business, I am delighted to extend my warmest greetings to each one of you.

In our pursuit of sustainable and responsible business practices, this edition of our magazine focuses on a topic of paramount importance - "Renewable Energy." We believe that embracing clean and green energy sources is not only an ethical imperative but also a strategic move towards a brighter and more sustainable future for businesses worldwide.

Within the realm of renewable energy, we delve into the transformative potential of solar, wind, and biofuels, including ethanol and biodiesel. These sources not only offer eco-friendly alternatives but also present a myriad of opportunities for small and medium enterprises to contribute actively to the global shift towards cleaner energy.

I am particularly thrilled to draw your attention to the groundbreaking initiative announced by our Honorable Prime Minister during the G20 finale — the Biofuel Alliance. This alliance stands as a testament to our nation's commitment to fostering collaboration and innovation in the realm of biofuels. As we explore the possibilities and potential of this alliance, we anticipate a future where sustainable biofuels play a pivotal role in powering our economies.

We, at the Chamber for the Advancement of Small and Medium Business, believe that by championing sustainable practices, we pave the way for a resilient and prosperous business landscape. I encourage each of you to explore the possibilities within the renewable energy sector and consider how your enterprises can actively contribute to a greener, more sustainable tomorrow.

Thank you for your continued support and dedication to responsible business practices. Together, let us embrace the power of renewables and build a future that is not only economically robust but environmentally conscious.

Best Regards,

Mr. Nilesh Lele
President,
Chamber for the Advancement of Small and Medium Business (CASMB)

PURNABRAHMA

Dr. Rahuul Marwah

MD Ayurveda, DYA, CCKS
Chief Editor,
Purnabrahma

Renewable energy stands as the beacon of hope in our quest to combat climate change, drawing from boundless sources that offer a pathway to curbing global warming. With each passing day, it assumes a more substantial role in our energy consumption, becoming a linchpin in the fight against climate change.

The potential of renewable energy to cut carbon emissions is nothing short of remarkable. A transition to renewable energy, coupled with enhanced energy efficiency and electrification, could potentially slash carbon emissions by an astounding 90%. To put it into perspective, every 1% increase in renewable energy adoption translates to a reduction of 0.736% in CO2 emissions, while a 1% rise in non-renewable energy usage results in a 0.614% increase in carbon emissions.

Yet, despite the abundance of renewable energy sources at our disposal, we find ourselves facing formidable challenges, primarily rooted in cost and infrastructure. Establishing renewable energy generation infrastructure is a costly endeavor, compounded by the complexities of energy storage. Further, the extensive land requirements and geographic constraints limit the full realization of renewable energy's potential. It Is now imperative that we shift our focus towards developing innovative technologies and methods that make more efficient use of land, circumvent geographical limitations, and enable long-term energy storage to meet future demands. In doing so, we need to move beyond the realm of mere renewal and embrace sustainability.

Sustainable energy is the crux of our future, for it should meet our present needs without imperiling the ability of future generations to meet their own. Sustainability hinges on the efficient acquisition and equitable distribution of energy resources. It's important to note that not all renewable energy sources are inherently sustainable; a case in point is biomass, which, while technically renewable, does not meet the sustainability criterion.

The transition from fossil fuels to renewable energy is an inexorable shift. We are approaching the golden convergence of renewable and sustainable energy sources, where we can strike a harmonious balance between the two. As we march forward, we hope that our readers, along with their acquaintances, will pioneer innovations and technologies that can bring pride to our nation, "BHARAT," on the global stage.

Regards,

Dr. Rahuul Marwah
MD Ayurveda, DYA, CCKS
Chief Editor, Purnabrahma

PURNABRAHMA

Dr. Ritika Joshi

Sub-Editor
Purnabrahma

The need of the hour stresses on immediate action to alleviate green-house emissions so as to reach net zero emissions by 2050. Thus, humanity is disposed at a conjuncture in choosing the way we will power our future.

In our country, the primary objective for deploying renewable energy is to advance economic development, improve energy security, improve access to energy, and mitigate climate change. Strong government support and the increasingly opportune economic situation have pushed India to be one of the top leaders in the world's most attractive renewable energy markets. The government has designed policies, programs, and a liberal environment to attract foreign investments to ramp up the country in the renewable energy market at a rapid rate. It is anticipated that the renewable energy sector can create a large number of domestic jobs over the following years.

Under these premises, through the current issue of Purnabrahma, we urge the food industries to take up encouraging efforts in making transition towards the deployment of renewable energy sources, such as solar, wind, hydro, and biomass for food production, and contribute their bit towards building a sustainable ecosystem.

The benefits of using renewable energy sources for food production are numerous. Firstly, greenhouse gas emissions can be curbed to a large extent leading to a subsequent reduction in global warming.Secondly, renewable energy sources can help the food industries in saving money as they are cheap, reliable and resilient and do not depend on finite and volatile resources that can run out or fluctuate in price.Thirdly, renewable energy sources can help improve product quality and safety as they can provide more consistent and controlled conditions for food processing, storage, and distribution, ensuring that the products meet the highest quality and safety standards. Fourthly, renewable energy sources can help the industry enhance their reputation and competitiveness in the market as the consumers are becoming more aware and concerned about the environmental and social impacts of their food choices, and they are looking for products that are sustainable, ethical, and healthy. Lastly, renewable energy sources can help in creating new opportunities and innovations for the industries because they can open up new markets and niches for the products, especially in rural and remote areas where access to electricity and water is limited or unreliable.

Depending on what electricity infrastructure we build now, we possibly can retard still more decades of planet-warming emissions, or we could lay a solid foundation for a clean energy future and ward off the climate emergency's worst effects.

Thank you.

Dr. Ritika Joshi
Sub-Editor
Purnabrahma

ADVISOR'S NOTE...

Dr. Prakash Kondekar

Fellow of the Royal Society of Health (London); Member, Vienna Energy Forum, Austria

The main intention of reducing non-renewable energy consumption and increasing the share of renewable energy is to reduce carbon footprints. Developing and adopting affordable, sustainable energy is the first target. Our country's oil and gas companies can empower their engineers with simulation-driven design methods to reduce emissions, improve performance, and stay ahead of the competition. One more important a spec there is digitalization for decarbonization. It is a time, now for energy businesses to transition towards a more sustainable future powered by technology and climate change goals.

As compared to India, the global renewables industry is growing fast, with huge potential for those who aim high.

Decarbonization, digitization, cost pressures, and geopolitical uncertainty are just some of the forces transforming the resources industry. Mining and metal, oil & gas, and power utilities companies face a common challenge: how to marry short-term commercial pressures with the need to reshape their future businesses.

So as to become successful, companies need to transform into the businesses they want to be come rather than stick to their old methods.

India aims to reach net zero emissions by 2070 and to meet fifty percent of its electricity requirements from renewable energy sources by 2030 is a highly significant moment for theglobal fight against climate change. India is pioneering a new model of economic development that could avoid the carbon-intensive approaches that many countries have seen in the past & provide a blueprint for other developing economies.

The scale of transformation in India is stunning. Its economic growth has been among the highest in the world over the past twenty years, lifting millions of people out of poverty. Every year, India adds a city the size of London to its urban population, involving the vast construction of new buildings, factories, and transportation networks. Coal and oil have so far served as bed rock of India's industrial growth and modernization.

India stands 4th globally in renewable energy installed capacity (including Large Hydro), 4th in wind power capacity & 4th in solar power capacity (as per REN21 Renewables 2022 Global Status Report). The country has set an enhanced target at the COP26 of 500 GW of non-fossil fuel-based energy by 2030. As oftoday, India is the world's third largest producer of renewable energy, with 40% of its installed electricity capacity coming from non-fossil fuel sources. As a developing nation at the time of independence, India relied heavily oncoal to meet its energy demands. Indian people have access to modern energy services. This includes adding new electricity connections for 50 million citizens each year over the past decade.

The rapid growth in fossil energy consumption has also meant India's annual CO2 emissions have risen to become the third highest in the world. However, India's CO2 emissions per person put it near the bottom of the world's emitters, and they are lower still if one considers historical emissions per person. The same is true of energy consumption: the average household in India consumes a tenth as much electricity as the average household in the USA.

Our Hon.Prime Minister Narendra Modi has announced more ambitious targets for 2030,

including installing 500 giga watts of renewable energy capacity, reducing the emissions intensity of its economy by 45%, and reducing a billion tons of CO2.

Our targets are huge but the good news is that the clean energy transition in India is already well underway. It has overachieved its commitment made at COP 21- Paris Summit by already meeting 40% of its power capacity from non-fossil fuels- almost nine years ahead of its commitment and the share of solar and wind in India's energy mix has grown phenomenally.Owing to technological developments, steady policy support and a vibrant private sector, solar power plants are cheaper to build than coal ones. Renewable electricity is growing at a faster rate in India than any other major economy, with new capacity additions on track to double by 2026. The country is also one of the world's largest producers of modern bioenergy and has bigambitions to scale up its use across the economy. The International Energy Agency(IEA),expects India to overtake Canada and China in the next few years to become the third-largest ethanol market worldwide after the United States and Brazil.

Our country boasts one of the largest manufacturing ecosystems for wind energy and is experiencing rapid growth in solar capacity, propelling **India to be the global leader in renewable energy.**

Let us witness the change not as an observer but by supporting the Government of India in which ever possible way.

Jay Bharat.

******

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Global Scenario of Renewable Energy

Dr. Prakash Kondekar

Fellow of Royal Society of Health(London)
Member, Vienna Energy Forum, Austria

Renewable energy is the energy derived from natural sources that are replenished at a higher rate than they are consumed. Sunlight and wind, for example, are such sources that are constantly being replenished. Renewable energy sources are plentiful and all around us.

Fossil fuels - coal, oil and gas - on the other hand, are non-renewable resources that take hundreds of millions of years to form. Fossil fuels, when burned to produce energy cause harmful greenhouse gas emissions, such as carbon dioxide.Generating renewable energy creates far lower emissions than the emissions from burning fossil fuels. Transitioning from fossil fuels, which currently account for the lion's share of emissions, to renewable energy is key to addressing the climate crisis.Renewables are now cheaper in most countries and generate three times more jobs than fossil fuels.

SOLAR ENERGY

Solar energy is the most abundant of all energy resources and can even be harnessed in cloudy weather. The rate at which solar energy is intercepted by the Earth is about 10,000 times greater than the rate at which humankind consumes energy. Solar technologies can deliver heat, cooling, natural lighting, electricity and fuels for a host of applications. Solar technologies convert sunlight into electrical energy either through photovoltaic panels or through mirrors that concentrate solar radiation. Although not all countries are equally endowed with solar energy, a significant contribution to the energy mix from direct solar energy is possible for every country.

The cost of manufacturing solar panels has plummeted dramatically in the last decade, making them not only affordable but often the cheapest form of electricity. Solar panels have a lifespan of roughly 30 years and come in a variety of shades depending upon the type of material used in manufacturing.

WIND ENERGY

Wind energy harnesses the kinetic energy of moving air by using large wind turbines located on land (onshore) or in sea- or freshwater (offshore). Wind energy has been used for millennia but onshore and offshore wind energy technologies have evolved over the last few years to maximize the electricity produced - with taller turbines and larger rotor diameters. Though average wind speeds vary considerably by location, the world's technical potential for wind energy exceeds global electricity production and ample potential exists in most regions of the world to enable significant wind energy deployment. Many parts of the world have strong wind speeds but the best locations for generating wind power are sometimes remote ones. Offshore wind power offers tremendous potential.

GEOTHERMAL ENERGY

Geothermal energy utilizes the accessible thermal energy from the Earth's interior. Heat is extracted from geothermal reservoirs using wells or other means.

Reservoirs that are naturally sufficiently hot and permeable are called hydrothermal reservoirs whereas reservoirs that are sufficiently hot but that are improved with hydraulic stimulation are called enhanced geothermal systems. Once at the surface, fluids of various temperatures can be used to generate electricity. The technology for electricity generation from hydrothermal reservoirs is mature and reliable and has been operating for more than 100 years.

HYDROPOWER

Hydropower harnesses the energy of water moving from higher to lower elevations. It can be generated from reservoirs and rivers. Reservoir hydropower plants rely on stored water in a reservoir while run-of-river hydropower plants harness energy from the available flow of the river. Hydropower reservoirs often have multiple uses - providing drinking water, water for irrigation, flood and drought control, navigation services, as well as energy supply. Hydropower currently is the largest source of renewable energy in the electricity sector. It relies on generally stable rainfall patterns and can be negatively impacted by climate-induced droughts or changes to ecosystems which impact rainfall patterns.

The infrastructure needed to create hydropower can also impact on ecosystems in adverse ways. For this reason, many consider small-scale hydro a more enviornmentally-friendly option and especially suitable for communities in remote locations.

OCEAN ENERGY-Ocean energy derives from technologies that use the kinetic and thermal energy of seawater - waves or currents for instance to produce electricity or heat.

Ocean energy systems are still at an early stage of development, with a number of prototype wave and tidal current devices being explored. The theoretical potential for ocean energy easily exceeds present human energy requirements.

BIOENERGY

Bioenergy is produced from a variety of organic materials, called biomass, such as wood, charcoal, dung and other manures for heat and power production and agricultural crops for liquid biofuels. Most biomass is used in rural areas for cooking, lighting and space heating, generally by poorer populations in developing countries. Modern biomass systems include dedicated crops or trees, residues from agriculture and forestry and various organic waste streams.

Energy created by burning biomass creates greenhouse gas emissions but at lower levels than burning fossil fuels like coal, oil or gas. However, bioenergy should only be used in limited applications, given potential negative environmental impacts related to large-scale increase in forest and bioenergy plantations and resulting deforestation and land-use change.

Energy is at the heart of the climate challenge – and key to the solution.

A large chunk of the greenhouse gases that blanket the Earth and trap the sun's heat are generated through energy production, by burning fossil fuels to generate electricity and heat. Fossil fuels, such as coal, oil and gas, are by far the largest contributor to global climate change, accounting for over 75% of global greenhouse gas emissions and nearly 90% of all carbon dioxide emissions. **The science is clear: to avoid the worst impacts of climate change, emissions need to be reduced by almost half by 2030 and reach net-zero by 2050.** To achieve this, we need to end our reliance on fossil fuels and invest in alternative sources of energy that are clear.

Why invest in renewable energy

Our world is addicted to fossil fuels. From the lighting in our homes to the fuel in our cars, the energy we use in our daily lives is primarily powered by fossil fuels — the main driver of climate change. The burning of fossil fuels releases large amounts of carbon dioxide, a greenhouse gas, into the air. In turn, greenhouse gasses blanket the Earth and trap the sun's heat, warming the planet with far-reaching consequences for people and planet.

“Racing has always been about innovation, trying to push the boundaries and trying to find ways to do things at the cutting edge; at the highest performance level – but doing it in a sustainable way. And sustainability is so at the forefront of everything we're doing right now in the world that we want to be the best at it, we want to be the innovators." - Josef New garden, Driver, Team Penske.

Waste Makes Haste – Renewable Racing Fuels-USA Shell's motorsports relationships act as an innovation platform to develop new product technologies with the goal of bringing our insights from track to road. Our technical partnership and development of renewable race fuel for the NTT INDYCAR Series proved to be a winning formula, with speeds averaging 232.184 mph – the fastest average speed in Indy 500 history, shattering last year's 231.023 mph.

A significant innovation as part of the larger decarbonization journey

The renewable race fuel is a biofuel created from 2nd generation ethanol sourced from Raízen, one of the largest sugarcane ethanol producers in the world, and a Brazilian Joint-Venture created in 2011 by Shell and Cosan. The fuel provides a 60% race-fuel greenhouse gas emissions reduction compared to fossil-based gasoline.

Powering Progress sets out our strategy to support a more equitable energy transformation that balances secure, affordable and cleaner energy for today and the future. It is designed to create value for our shareholders, customers and wider society, underpinned by our core values and focus on safety. Powering Progress has four main goals:

- Generating shareholder value
- Achieving net-zero emissions
- Protecting Nature
- Powering lives

Shell is providing the energy people need today to power their lives, while taking action to address the urgent challenge of climate change. They are working with their customers and across sectors to accelerate progress to net zero. This means reducing their own emissions and helping their customers reduce the emissions that come from the use of their products.

We're proud to work with the Club on delivering decarbonization solutions, just as we offer 100% renewable electricity plans to homeowners in Houston and across Texas. I'm excited for our teams to continue to build on the positive legacy of the Club in Houston through the wide range of initiatives both at the stadium and in the broader community.

Glenn Wright, Senior Vice President, Shell Energy

The facts on climate and energy-Climate change is a hot topic – with myths and falsehoods circulating widely. Here are some essential facts . Share them, use them and talk about them to help counter mis- and disinformation and build support for urgent action.

FACT: Climate change is happening

Climate change is already affecting every region on Earth. Changes in rainfall patterns, rising sea levels, melting glaciers, a warming ocean, and more frequent and intense extreme weather events are just some of the changes already impacting millions of people.

Climate change can affect our health, ability to grow food, housing, safety and work. Some of us are more vulnerable to climate impacts, such as people living in small island developing countries. Threats like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate. In the future, the number people displaced by climate change is expected to rise.The changes in the climate are widespread, rapid and intensifying, and some of the changes, such as sea level rise or melting ice sheets, are irreversible over hundreds to thousands of years.

FACT: Climate change is caused by human activity

Natural changes in the sun's activity or large volcanic eruptions have caused ancient shifts in the Earth's temperatures and weather patterns, but over the last 200 years, these natural causes have not significantly affected global temperatures. Today, it's human activities that are causing climate change, primarily due to the burning of fossil fuels like coal, oil, and gas.

Burning fossil fuels creates a blanket of pollution trapping the sun's heat on Earth and raising global temperatures. (Global warming then leads to other changes like droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, intense storms and declining biodiversity).

The more of this pollution, such as carbon dioxide (Co_2), accumulates in the atmosphere, the more of the sun's heat gets trapped, the warmer it gets on Earth. There is a strong relationship between cumulative CO_2 emissions and the increase in global surface temperature.

The amount of CO_2 in the atmosphere has been increasing at an unprecedented rate since the Industrial Revolution, when manual labor began to be replaced by machinery fueled by coal, oil and gas. Today, the concentration of CO_2 in the atmosphere is about 50% higher than in 1750, far exceeding the natural changes over at least the past 800,000 years.

FACT: Scientists agree that humans are responsible for climate change

Multiple independent studies over the past 19 years have found that between 90 and 100% of scientists agree that humans are responsible for climate change, with most of the studies finding a 97% consensus.

A 2021 study found a greater than 99% consensus on human-induced climate change in the peer-reviewed scientific literature (reviewed by export in the same field prior to publication) - a level of certainty similar to that of the theory of evolution.

The Synthesis Report by the Inter governmental Panel on Climate Change (IPCC), released in March 2023, categorically confirmed that human activity is the overwhelming cause of climate change. The IPCC's comprehensive assessments are written by hundreds of leading scientists from around the globe, with contributions from thousands of experts, and endorsed by the governments of every country in the world.

FACT: Every fraction of a degree of warming matters

With every increment of global warming, extreme heat and rainfall events become more frequent and more intense.

Greenhouse gases, such as carbon dioxide, from human activities are responsible for approximately 1.1°C of warming since 1850-1900. This has already caused significant changes in the climate, including

more extreme weather events, which have caused widespread harm to people and nature.

If global warming exceeds 1.5°C above pre-industrial levels, there will be more heat waves, longer warm seasons and shorter cold seasons. At 2°C of global warming, extreme heat would more often cross critical tolerance thresholds with devastating impacts on agriculture and human health. Increasing changes to wetness and dryness, to winds, snow and ice, coastal areas and oceans, will affect different regions in different ways.

FACT: The climate is changing faster than humans, plants and animals can adapt

If global temperatures keep rising, adapting to climate change will become increasingly difficult, especially for poorer countries. A small island, for example, may become uninhabitable due to sea level rise and lack of sufficient freshwater. In that case, inhabitants may have no other option than to abandon their homes.

Adaptation alone cannot keep up with the impacts of climate change. Adaptation is crucial for saving lives and livelihoods, but humans' ability to adapt to climate change is not limitless.

Rising sea levels that submerge coastal communities and extreme heatwaves intolerable to the human body are examples of 'hard' limits to our ability to adapt. (UNFCCC)

With increasing global warming, losses and damages will increase and more human and natural systems will reach the limits of their ability to adapt. Many species and ecosystems are already near or beyond their adaptation limits. (IPCC)

FACT: Climate change is a major threat to people's health

The impacts of climate change are harming human health – through air pollution, disease, extreme weather events, forced displacement, food insecurity and pressures on mental health – and will only get worse with every fraction of a degree of warming. (WHO)

The main cause of climate change – the burning of coal, oil and gas – also causes air pollution which in turn can lead to respiratory diseases, strokes, and heart attacks. More than 8.7 million people currently die every year due to outdoor air pollution. (REN21)

Replacing fossil fuel-based power plants with renewable energy, such as wind or solar farms, will greatly benefit human health. Wind turbines and solar panels do not release emissions that pollute the air or cause global warming. (REN21)

FACT: Natural gas is a fossil fuel, not a clean source of energy

Natural gas is a fossil fuel like oil and coal – formed from the remains of plants, animals, and microorganisms that lived millions of years ago. When burned, it releases carbon pollution into the atmosphere.

Burning natural gas was responsible for 22% of global carbon emissions from fuel combustion in 2020 (not far behind oil, 32%, and coal, 45%). (IEA)

In addition, the extraction and transport of natural gas often releases methane – a powerful greenhouse gas – into the atmosphere. Natural gas production was responsible for 40 million tons of methane emissions in 2021 – about the same amount of methane emissions as from the oil industry. (IEA) (Methane is about 84 times more potent than CO_2, measured over a 20-year period). (UNEP)

FACT: Clean energy technologies produce far less carbon pollution than fossil fuels

Clean energy technologies – from wind turbines and solar panels to electric vehicles and battery storage – do require a wide range of minerals and metals(IEA) and produce thus some emissions but still far less than fossil fuels. (IEA)

Solar panels produced today only need to operate for 4-8 months to make up for their manufacturing emissions (and the average solar panel has a lifetime of around 25-30 years). (IEA). Wind turbines, similarly, take only about 7 months to produce enough clean electricity to make up for the carbon pollution generated during manufacture (and they have a typical lifespan of 20-25 years). (Science Direct)

Most of the carbon pollution generated during a wind turbine's life occurs during manufacturing. Once it's up and spinning, the turbine generates close to zero pollution. A coal or natural gas plant, in contrast, burns fuel — and releases carbon dioxide — every moment that it runs. (Yale)

Even the most carbon-intensive wind turbine is responsible for far less carbon emissions per kilowatt-hour of electricity produced than any coal or natural gas-fired power plant. (Coal-fired power plants produce 675 to 1.689 g of CO_2 per kilowatt-hour while natural gas power plants produce 437 to 758 g — far more than on- and offshore wind which produce, on average, 15 and

12 g (UNECE), or even the most carbon-intensive wind turbine at 25.5 g). (Yale)

Electric vehicles, over their lifecycle, from manufacturing to disposal, produce about half the carbon emissions of the average internal combustion engine car, with the potential for a further 25% reduction with low-carbon electricity.(IEA)

FACT: Entire countries already rely 100 per cent on renewable electricity

Costa Rica, Denmark, Norway, Iceland, Paraguay and Uruguay power their grids with hydro, geothermal, wind and solar energy. (REN21)

Some provinces and sub-national states also use 100 per cent renewables-based electricity: South Australia, Hawaii (U.S.), Quebec (Canada) and Qinghai (China), as well as the islands of Ta'u (American Samoa), Eigg (Scotland), El Hierro (Spain), Graciosa (Portugal) and King Island (Australia).(REN21)

Denmark, Scotland, South Australia and Hawaii have met more than 100% of their total electricity demand with wind and solar, with some exporting their surplus. (REN21)

Other regions have generated surplus electricity with hydropower: Paraguay and Quebec both export their surplus hydropower. (REN21)

NOTE: No examples exist of fully renewable-based energy systems that span the electricity, heating, cooling, and transport sectors (the above examples cover only electricity). The foundations of such systems are now being laid, including the technologies, infrastructure and markets. (REN21)

FACT: Renewable energy will soon deliver most of the world's electricity

Renewable energy sources – such as water, geothermal, wind and solar – are available in every country, and their potential is yet to be fully harnessed.

Almost 30% of global electricity comes from renewables today. (IEA)

By 2050, 90% of the world's electricity can and should come from renewable energy. (IRENA)

The world is set to add as much renewable power in the next 5 years as it did in the past 20. (IEA)

Renewables are projected to become the largest source of global electricity generation by early 2025, surpassing coal. (IEA)

In many regions, renewables are the fastest-growing energy source. (IEA)

FACT: Renewable energy is cheaper than fossil fuels

In most parts of the world, electricity from new renewable-energy plants, such as wind or solar, is now cheaper than power from new fossil fuel plants. (IRENA)

New onshore wind and solar projects cost roughly 40% less than coal or gas plants built from scratch—and the gap is widening. (BloombergNEF)

The world has witnessed a seismic shift in the competitiveness of renewable power options since 2010: Solar has experienced the most rapid cost reductions, with costs of newly commissioned utility-scale projects falling 88 per cent globally between 2010 and 2021 - mostly thanks to continuing technology improvements, greater economies of scale and reduced financing costs for wind and solar power plants. The cost of onshore wind fell by 68%, and offshore wind by 60% since 2010. (IRENA)

FACT: Solar panels and wind turbines make good use of land

All energy sources require land: from the plot used for mining coal, to the land taken up by a power plant.Wind farms require a lot of land, but while a coal mine is used just once, a wind farm continues to produce energy, year after year. Over time, an acre of wind or solar can generate more electricity than an acre of coal or uranium mines.

Land used for solar and wind farms can be “dual-use” – used for energy production and agriculture at the same time. Once built, a solar or wind farm has so little impact on its land that it is increasingly common to allow grazing and farming on the same acres at the same time.

Solar panels do not need to be installed directly on the ground, they can be put on existing structures like rooftops, roads or parking lot canopies, over canals and on agricultural land, and even floated on lakes and ponds.

In South-East Asia and Africa, where solar projects tend to compete with agricultural land, “agrivoltaics” and “floatovoltaics” allow agricultural land and water to be “dual-used” for solar panels without compromising water and food resources. (REN21)

Solar farms can also be installed on land that is not suitable for other uses – deserts, landfills, old coal mines or contaminated territory (Chernobyl now hosts a solar plant).

Solar panels can be put anywhere on Earth because the sun shines everywhere. No other type of electricity generation can match this flexibility.

FACT: Renewable energy is better at withstanding extreme weather events

Weather affects all energy sources. (IEA)

Gas-fired power plants could not keep up with electricity demand during the exceptionally cold weather in Texas, in the United States, in February 2021, leaving up to 5 million customers without power over a period of four days – primarily due to frozen gas wells and power outages in gas generators. Coal and nuclear plants also experienced outages. (IEA)

Increasing the share of wind and solar in the energy mix improves electricity security: a well-diversified energy mix can reduce the risks that come from disruptions in the supply of fossil fuels. Small-scale generators, such as distributed wind and solar panels, can also speed the recovery of communities from disasters or large-scale blackouts, while large thermal power plants take longer to resume normal operations since they need a large part of the system to be restored. (IEA)

Systems with distributed resources can be more resilient than centralized systems. Renewable energy technologies reduce vulnerability to climate risks by diversifying the sources of power and using battery storage and smart information technology.

Solar energy can also provide energy for emergency communication and natural disaster response in remote areas.

FACT: The transition to clean energy will create millions of jobs

The transition to net-zero emissions (away from fossil fuels and towards clean sources of energy) is projected to lead to an overall increase in jobs in the energy sector: about 5 million jobs in fossil fuel production could be lost by 2030, but an estimated 14 million new jobs would be created in clean energy, resulting in a net gain of 9 million jobs globally. (IEA)

The number continued to grow worldwide over the past decade, with most jobs in the solar photovoltaic, bioenergy, hydropower and wind power industries. (IRENA). The renewable energy sector employed 12.7 million people, directly and indirectly, in 2022, up from about 7.3 million in 2012. (IRENA)

Tens of millions of additional jobs will likely be created in the coming decades as investments grow and installed capacities expand. By 2050, the renewable energy sector is expected to employ at least 42 million people. Energy efficiency measures would create 21 million additional jobs and system flexibility 15 million additional jobs. (IRENA)

Every dollar of investment in renewables creates three times more jobs than in the fossil fuel industry. (SG)

FACT: Alternatives to petroleum-based products already exist

Many everyday products are still produced using oil or other fossil fuels. The process of extracting and transporting those fuels, then manufacturing the products creates lots of carbon emissions. Most plastics, clothing, tires, digital devices, fertilizer, laundry detergents and countless other everyday items are made from petrochemicals. (IEA)

The production of plastic is one of the most energy-intensive manufacturing processes in the world. The material is made from fossil fuels such as crude oil, which are transformed via heat and other additives into a polymer. In 2019, plastics generated 1.8 billion metric tonnes of carbon emissions – 3.4 per cent of the global total. (UNEP)

But there are alternatives. Plastic can be made fully or partially from plant materials, such as cellulose, potato or corn starch, sugar cane, maize and soy, instead of petroleum or natural gas. Bio-based plastic can be designed to be structurally identical to petroleum-based plastics. (UNEP)

A variety of carbon- and hydrogen-containing materials can replace oil, natural gas and coal as chemical feedstocks. Key among these are bioenergy products, which are a source of both carbon and hydrogen. Alternatively, each element can be obtained separately from gases produced by the iron and steel industry or from CO_2 and water. (IEA)

Replacing the fossils fuels used to manufacture plastics or fertilizer is possible with biomass (organic material from plants and animals). The hydrocarbons in coal, oil and gas themselves originally came from biomass millions of years ago.

There is an enormous opportunity to produce these

materials without fossil fuels. For example, bioplastics make up only about 1% of the plastic produced worldwide today. (IEA) However, using plant-based materials must be thoughtfully designed to take into account environmental, social, and economic factors across ecosystems and communities.

FACT: We can still limit climate change, if we act now!

The choices we make today will determine the changes in the climate we will experience in the future. (IPCC)

Large and sustained reductions in emissions of carbon dioxide and of other greenhouse gas emissions would limit climate change. (IPCC)

If we act now, we can limit climate change and preserve a livable planet.

We have the knowledge, tools and resources to secure a livable, sustainable future for all.

Act for Our Common Future

Embrace the possible. That's the call of the 17 Sustainable Development Goals, a blueprint for a better world. We don't have to wait for the future we want—we can create it right now. Everyone can join the global movement for change.

Act Now is the United Nations campaign to inspire people to act for the Sustainable Development Goals. The Goals can improve life for all of us. Cleaner air. Safer cities. Equality. Better jobs. These issues matter to everyone. But progress is too slow. We have to act, urgently, to accelerate changes that add up to better lives on a healthier planet.

What happens when millions of people act together for our common future? A lot. Join the campaign to learn more— and do more.

Reference: " Climate Ambition Summit "

20 September 2023, United Nations Headquarters, New York

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Renewable Energy: A Perspective for a Brighter Future

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A true gentleman or lady leaves a place cleaner than they found it. Let us stop and ponder: how did we inherit the earth prior to the industrial revolution and in what shape have we brought it?

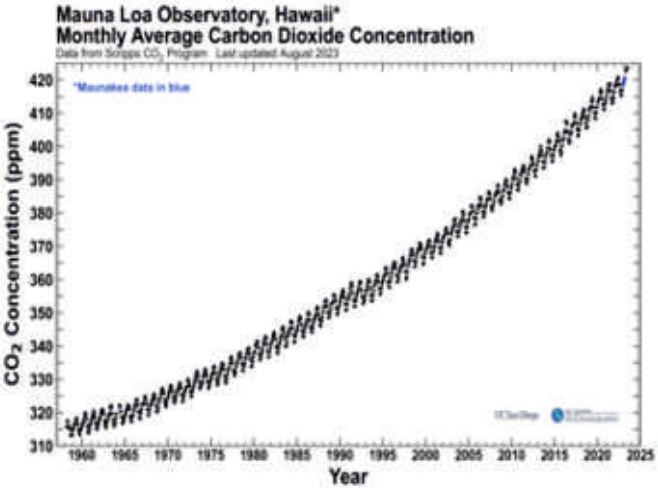

FIG 1. Increasing CO_2 concentration in the earth's atmosphere with every passing year. *Ref. C. D. Keeling, S. C. Piper, R. B. Bacastow, M. Wahlen, T. P. Whorf, M. Heimann, and H. A. Meijer, Exchanges of atmospheric CO_2 and $^{13}CO_2$ with the terrestrial biosphere and oceans from 1978 to 2000. I. Global aspects, SIO Reference Series, No. 01-06, Scripps Institution of Oceanography, San Diego, 88 pages, 2001.*

So, one way of solving our energy-related problems would be to return to a pre-Industrial Revolution lifestyle. But we want to have our cake and eat it too! The labor intensity would be much higher, for one. And, advances have become so deeply entrenched in our societies that it would be most difficult to abandon these.

With the Industrial revolution, began our love affair with fossil fuels. However, since the mid 1900s, we have received a reality check about their usage:

- Greenhouse gas emissions (Fig. 1) are leading to global warming, climate change, melting of glaciers and ice caps
- SOx, NOx, VOCs, particulate matter leading to air pollution.
- Water pollution from oil spills, extraction, processing
- Land degradation/ Soil Erosion due to drilling and extraction activities
- Ecosystem disruption.

Ok, that sounds bad but how does that impact me or my loved ones?

Think about this.

Fig. 2. Irreversible damage in lungs due to Air Pollution. Ref. Lung Care Foundation, New Delhi

Living in Delhi and inhaling SOx, NOx, VOCs, and tiny particulate matter is akin to smoking 25 cigarettes a day, even when one is not a "passive smoker", let alone "active smoking". This applies to everybody; unfortunately, even babies. Lungs in non-smokers are

ideally a healthy pink; only smokers used to have black deposits on their lungs. Now, even teenagers have these dark deposits indicating irreversible, incurable lung damage (Fig.2). And the threat of asthma and lung cancer.

(Ref: www.hindustantimes.com/delhi-news/breathing-delhi-s-polluted-air-akin-to-death-sentence-say-doctors/story-okJ0SxUpFO1p2uvbHQVjAO_amp.html)

And, of course, this is not exclusive to Delhi. The *Business Insider* reported last year that 70% of kids in Bengaluru have lung disorders. Steroid treatments to ease the lung ailments expose these kids to an elevated risk of diabetes.

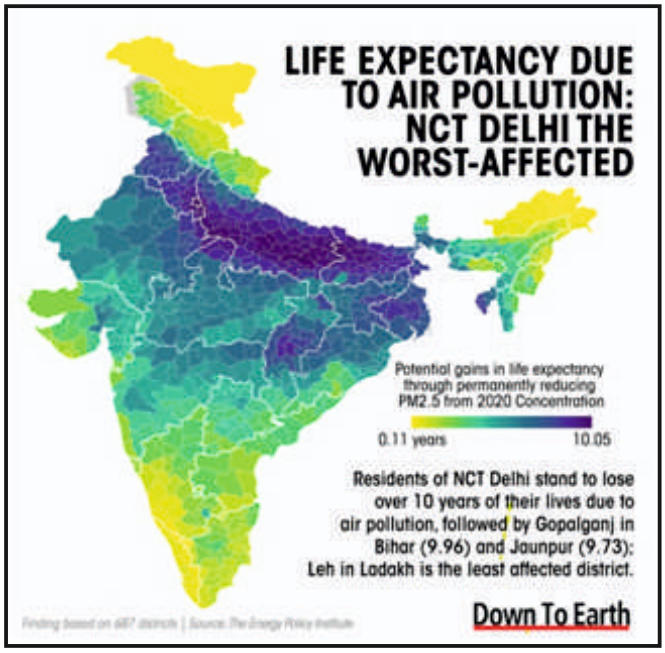

Fig.3. Air Pollution reduces average life expectancy. The darkest blue indicates worst air pollution with an accompanying 10 years loss in lifespan; the yellow regions are the least impacted with almost no impact on lifespan. Ref. CSE Down to Earth, June 2022

Fig. 3 shows that most parts of India are badly affected by air pollution. The World Health Organization's upper limit for a healthy human habitat for PM2.5, inhalable particulate matter is less than 2.5 microns in size that enters our lungs and bloodstream, is 5 micrograms per cubic meter. In Delhi, the PM2.5 is **17 times** this WHO safe limit; in Ahmedabad, about 10 times; in Kolkata, about 9 times; in Mumbai, about 8 times, in Hyderabad, 7 times and in Chennai, 5 times the permissible level.

How many days can one survive without food? Upto 3 weeks.

How many days can one survive without water? Upto 3 days.

How many days can one survive without air? Upto 3 minutes.

In spite of being the most critical resources essential for human life, air, water, soil, food are indiscriminately abused and contaminated in our quest for progress. Additionally, fossil fuels have, post-Industrial revolution, been at the heart of all efforts towards progress. That is slowly changing, as it should be. Yet in India, about 80% of electricity is generated in thermal power plants, which is predominantly coal-fired.

As per the law of thermodynamics, the maximum theoretical efficiency of a thermal power plant is about 60%. It is shocking to know that in our country, the actual efficiency of thermal power plants is as low as 10-15%.As per Dr. Himanshu Paliwal's calculations performed as a part of his lectures on Thermodynamics in the Department of Chemical Engineering at the Indian Institute of Technology Ropar, this means that thermal power plants in India are wasting 5000 TWh energy annually. Bumping up their operation efficiency by just 5% means that less coal needs to be burned to produce an equivalent amount of energy; this corresponds to a reduction of CO_2 emissions by **550 mega tonnes** annually. Think of the difference to the air quality!! And additionally, this should help save Rs. 18 lakh crores annually!!

Furthermore, coal continues to fuel the iron & steel industry, non-ferrous industry, chemical industries. Improving operation efficiency in these sectors as well will definitely enhance not only our profitability, but our air quality as well. The use of non-renewable energy will continue to damage our invaluable life-sustaining resources and environment, often irreversibly.

Moreover, non-renewable resources are limited in quantity. Oil and gas are projected to last another 50 years, whereas coal should last another 100 years. Reserves are concentrated in areas making pricing and availability of these fossil fuels sensitive to geopolitical pressures. Nuclear power produces no greenhouse emissions but does produce radioactive waste.

Renewable sources of energy, such as solar energy, wind energy, etc., are sustainable alternatives to meet our energy needs and do not diminish in quantity. It is of great significance that renewable sources of energy do not produce greenhouse emissions during operation, nor do they pollute the environment - air/water/soil

during operation. Yes, in terms of manufacturing solar panels, wind turbines, etc. for harnessing energy, and batteries for energy storage, there is an environmental cost in terms of emissions, but that is quite small compared to the environmental cost of using fossil fuels.

To reap the maximum benefits from renewable energy sources, our efforts must be focused on:

- Addressing variability in supply from non-renewable sources; for e.g., the amount of sunshine and wind vary with the time of the day/year and location.
- Better energy storage solutions - electricity generated from the sun and the wind is intermittent and must be stored for use when the sun is not shining or the wind is not blowing. Battery storage, hydro storage, thermal storage are some means of doing this.
- A larger area is required to produce a given electrical output using a renewable source compared to fossil fuels, i.e., renewables have lower energy density compared to fossil fuels.

E.g.1. To power a lightbulb, one would need a credit card sized piece of land if the power is generated from fossil fuel; land the size of the palms if the power is generated using nuclear energy; twice the size of a cafeteria tray in case of solar energy; half of a parking lot in case of wind energy.

E.g.2. ATF has an energy density of 45 MJ/kg while lithium ion batteries can store 0.5 MJ/kg. So, an airplane would need to carry a battery 90X the weight of ATF to power the same flight!!

How can this energy density be improved? That's a problem worth investigating.

- Solar farms, hydro-energy plants, wind farms, etc. are usually located in relatively remote regions, quite far away from centers of high human density. To transport electricity from distributed generation sources and variable power sources will require expensive upgrades to the grid. And superconductors will help eliminate transmission losses! But we need these superconductors to work at room temperature, and not their current low temperatures of operation - we cannot spend so much additional energy to cool the transmission lines!
- Recycling/ proper management of non-functioning solar panels, wind turbines, batteries, etc. Improper disposal can otherwise become a major problem, just like the island of plastic in the Pacific Ocean or the graveyard of tyres in Kuwait.

Energy - we need it for development but, ironically, minimizing its usage is the only way to save the planet! And we need to do whatever it takes to minimize human-induced damage to our planet. Some suggestions for doing this are given below:

- Currently, renewable energy accounts for 13% world's energy usage. We can increase that proportion. Solar, wind, hydro, geothermal, biomass - whichever has more potential in a given geography - can be developed there. E.g., Venezuela with its huge Guri dam, and Norway with its long coastline and fast flowing water, depend heavily on hydro energy.
- Innovative ways like green architecture to reduce the energy consumption in our increasingly urban landscapes.
- CO_2 capture machines are a fascinating way to remove CO_2 from the atmosphere but they would be more efficient if they did this at the source, i.e., at the location of emission, where the CO_2 concentration is quite high, rather than from the atmosphere, where the CO_2 concentration is comparatively lower.
- Planting more trees is an effective way to capture and store CO_2 from the atmosphere – by way of photosynthesis; this CO_2 would otherwise intensify the greenhouse effect. The carbon so absorbed is stored in the tree's trunks, branches, leaves, and roots. Each mature tree can capture and store 20-40 kg of Co2!! ■

Solar Energy: A Boon For Illuminating A Bright And Renewable Future-Review Of Literature

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The global world stands at a pivotal moment in its history, where the choices we make today will shape the future of our planet. One of the most promising and sustainable solutions to combat climate change and ensure a brighter, more renewable future is the widespread adoption of solar energy applications. Solar energy, derived from the sun's inexhaustible power source, has the potential to revolutionize the way we generate electricity, heat our homes, and power our industries. Solar energy is an environmentally friendly technology, an excellent source of energy and one of the most important sources of green and renewable energy. It plays a key role in achieving energy solutions for sustainable development. Therefore, the huge amount of solar energy accessible on a daily basis makes it a very attractive resource for electricity production. Both technologies, concentrated solar power applications or photovoltaic solar power, are constantly evolving to meet our energy needs. Large installed capacity of solar energy applications in the world, in the same context, will support the energy industry and adequately meet the growing needs of the job market. In this article, we will explore the myriad applications of solar energy and why they are essential for a sustainable and prosperous future. Additionally, it highlights the role of solar energy applications in promoting sustainable development by meeting energy requirements, creating employment opportunities, and improving environmental sustainability. Finally, the promise of solar technology is demonstrated in its application to the energy sector and a vision of the future development of this sector is given.

Review of Literature-

1. Maka, A. O. M., & Alabid, J. M. (2022). Solar energy technology and its roles in sustainable development. *Clean Energy*, *6*(3), 476–483.

   According to the research studies, investing in solar energy can achieve environmental protection goals by reducing carbon emissions not affecting the country's development adversely. In countries located in the “sun belt”, there is huge potential for solar energy, where the overall horizontal solar radiation is abundant all year round and have great potential for solar technology. The distribution of solar radiation and its intensity are two important factors that influence the efficiency of solar photovoltaic technology, and these two parameters vary by country. Therefore, it is essential to realize that a portion of solar energy is wasted due to the lack of its use. On the other hand, solar radiation is abundant in some countries, especially in developing countries, making it invaluable.

2. SITNFlash. (2019, March 21). The Future of Solar is Bright. *Science in the News*.

   Research study reveals to outperform current solar cells. The new design should be able to capture more light, convert light energy into electricity more efficiently, and be cheaper to build than current designs. Energy producers and consumers are more likely to adopt solar electricity if the energy they produce is as expensive as or cheaper than other often non-renewable forms of electricity. So

improvements to the current design of solar cells can lower the overall cost. Adding hardware that allows solar cells to capture more light does not require us to alter our current solar cell design. Solar cells can be equipped with electronics that allow the cell to track the sun as it moves across the daytime sky. If a solar cell always points to the sun, it will receive many more photons than if it only points to the sun around noon. Currently, designing electronics that can accurately and consistently track the sun's position over several decades at a reasonable cost is an ongoing challenge, but innovation in the field continues. An alternative to starting the solar cell itself is to use mirrors to direct the light to a smaller and thus cheaper solar cell.

3 *Benefits of Solar Lighting System | Solar Lighting Advantages*. (n.d.). Retrieved September 15, 2023, Research reveals solar lighting is called a modern lighting system that is mainly driven by renewable energy, sunlight. It has been recognized as one of the most effective solutions to help people and administrations curb the growing environmental problems and energy crisis, especially in the urban areas. According to leading commercial lighting manufacturers, solar lighting solutions can increase safety and meet room lighting needs efficiently and sustainably. It is a green alternative to all lighting solutions that rely on heat production. As a result, it has been recognized as a leading renewable energy technology worldwide. Solar lighting systems consist of photovoltaic or solar cells, which are primarily responsible for converting sunlight into electrical energy. This energy is then stored in batteries and finally used in the LED array at night.

4. *Scope Of Solar Energy Business In India | Things To Know*. (2022, November 25). Republic Of Solar. India's geographic location allows for a low-cost platform that supports the solar industry. The energy produced by solar projects helps meet the needs of the country and generate additional energy to support the world. The location of the country is one of the main reasons why the country falls under the category of tropical region. The quality of a tropical region is that it receives a huge amount of solar radiation throughout the year, i.e. about 3000 long hours of sunshine. Some Indian states have great renewable energy potential during cloudy days too.

5. *Current Status | Ministry of New and Renewable Energy, Government of India*. (n.d.). Retrieved September 16, 2023, In the Indian energy scenario, solar energy has had a visible impact in recent years. Decentralized and decentralized applications based on solar energy have benefited millions of people in Indian villages by meeting their cooking, lighting and other energy needs in an environmentally friendly manner. Social and economic benefits include reducing the working career of rural women and girls collecting firewood from afar and cooking in smoke ovens, minimizing the risk of lung and eye diseases, creating jobs at the village level, and ultimately improving living standards and creating opportunities.

   Additionally, India's solar sector has become a major player in grid-connected power generation capacity over the years. It will support the government's sustainable growth plan, while becoming an integral part of the solution to meet the country's energy needs and a major player in terms of energy security.

6. Pandey, A., Pandey, P., & Tumuluru, J. S. (2022). Solar Energy Production in India and Commonly Used Technologies—An Overview. *Energies*, *15*(2), Article 2.

   Research reveals enough sunlight to meet global energy needs. The earth's surface receives enough sunlight in an hour and a half to cover the entire energy consumption of the world.

   Current solar technologies convert sunlight into electricity by using solar cells or concentrators to convert solar radiation into heat energy. These solar technologies are classified into two main types: (1) concentrated solar system and (2) solar cells. Sunlight, or solar radiation, is radiant energy (electromagnetic) coming from the sun, which produces light and heat. The amount of solar radiation in a given location depends on many factors such as geographic location, terrain, and weather. Solar energy technologies can capture solar radiation and convert it into useful forms of energy such as heat/heat using a concentrator and electricity using solar panels or solar cells. In India, several technologies have been used in recent decades to convert sunlight into energy that can be used for various purposes.

7. *The Future of Solar Energy | MIT Energy Initiative*. (n.d.). Retrieved September 16, 2023, from The future of solar energy examines only two widely accepted classes of technologies for converting solar energy into electricity—photovoltaic (PV) and concentrated solar power (CSP, sometimes called solar thermal)—in their current and plausible future forms. Because electrical distribution facilities typically last several decades, these classes of technologies will dominate solar generation from 2050 onward. Unlike some previous studies, we do not make predictions for two reasons. First, the dramatic expansion of the solar industry from its relatively small current scale could bring about changes that we cannot foresee today. Second, we recognize that the future adoption of solar energy is highly dependent on future uncertain market conditions and public policies, including, but not limited to, policies designed to mitigate global climate change.

8. Ganesh N. Prabhu(2017), Some of the immediate actions to enable growth are efficient implementation of renewable energy certificates, usage of carbon trading as a source of revenue, immediate implementation of grid-powered energy in regions of Rajasthan and Gujarat development of off-grid usage in various applications such as cellular towers and encouraging localized mini-grids in areas that lack connectivity today. If these initiative work as planned, it is only a matter before India becomes one of the world leaders in solar energy.

9. Patrick R. Brown a, Francis M. O'Sullivan (2019) The increasing urgency of climate change mitigation [1] necessitates rapid deployment of zero-emissions electricity generation resources [2]. Most zero-emissions technologies—including hydroelectric generation, nuclear power, and variable renewable energy (VRE) sources such as solar photovoltaics (PV), concentrated solar power (CSP), and wind—are characterized by high upfront costs and near-zero marginal operating costs. Utilization of zero-emissions generation thus tends to depress wholesale electricity prices as higher-marginal-cost generators in the dispatch order are displaced.

Conclusion:

Solar energy applications are more than just a technological innovation; they represent a pathway to a brighter, more sustainable future. With the global community's commitment to combat climate change and reduce greenhouse gas emissions, the adoption of solar energy has become not just a choice but a necessity. By harnessing the power of the sun for electricity generation, heating and cooling, desalination, transportation, and even agriculture, we can reduce our reliance on fossil fuels and transition towards a clean, renewable energy future. Governments, industries, and individuals must continue to invest in and support solar energy applications to secure a brighter and more sustainable tomorrow for generations to come.

References:

1. Maka, A. O. M., & Alabid, J. M. (2022). Solar energy technology and its roles in sustainable development. *Clean Energy*, *6*(3), 476–483. https://doi.org/10.1093/ce/zkac023
2. SITNFlash. (2019, March 21). The Future of Solar is Bright. *Science in the News*
3 *Benefits of Solar Lighting System | Solar Lighting Advantages*. (n.d.). Retrieved September 15, 2023, from https://www.wiprolighting.com/blog/benefits-associated-with-solar-lighting
4. *Scope Of Solar Energy Business In India | Things To Know*. (2022, November 25). Republic Of Solar. https://thesolarlabs.com/ros/scope-of-solar-energy-business-india/ Research
5. *Current Status | Ministry of New and Renewable Energy, Government of India*. (n.d.). Retrieved September 16, 2023, from https://mnre.gov.in/solar/current-status/
6. Pandey, A., Pandey, P., & Tumuluru, J. S. (2022). Solar Energy Production in India and Commonly Used Technologies—An Overview. *Energies*, *15*(2), Article 2. https://doi.org/10.3390/en15020500
7. *The Future of Solar Energy | MIT Energy Initiative*. (n.d.). Retrieved September 16, 2023, from https://energy.mit.edu/research/future-solar-energy/
8. Ganesh N. Prabhu(2017), https://tejas.iimb.ac.in/articles/75.php
9. Brown, P. R., & O'Sullivan, F. M. (2019). Shaping photovoltaic array output to align with changing wholesale electricity price profiles. *Applied Energy*, *256*, 113734. ■

Solar Energy...Need of the hour

Sahadev S. Shivalkar

Director
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Engr Sahadev with Dr. Kondekar, in ICT Matunga in one program.

In today's cut throat competition one may find it difficult to reduce the cost of energy production to match with the market price. Here pricing is not subject to the laws of demand and supply in fact cost of production does matter. It will be much more difficult if one thinks only about raw material cost or labor cost. One must think about generation cost.

What does generation cost mean? Well once raw material is purchased, one is required to process it to produce the final product. This requires lot of energy. And here most of the factories depend on fossil fuel power supply. Looking at the current scenario, the cost of power is increasing tremendously day by day. One must have also come across an article in TOI in the month of March 2023 about higher-priced electricity.

Renewable energy is the best suitable, economical, low cost option to bring down the production cost.

Renewable energy, often referred to as clean energy, comes from natural sources or processes that are constantly replenished. For example, sun keeps shining and wind keeps blowing, even if their availability depends on time and weather.

The most popular renewable energy sources are:

1) Solar energy
2) Wind energy
3) Hydro energy
4) Tidal energy
5) Geothermal energy
6) Biomass energy

The following is the installed capacity for renewable energy in India:

1) Wind power: 44.09 GW
2) Solar Power: 71.60 GW
3) Biomass/Co-generation: 11.1 GW
4) Small Hydro Power: 4.94 GW
5) Waste To Energy: 0.32 GW
6) Large Hydro: 46.85 GW

Source: Ministry of New and Renewable Energy (Ministry of the Government of India)

An energy specialist has concluded that out of many resources, the most feasible economical source at consumer level is biomass, wind & solar energy. These resources are the fastest-growing, the cheapest and do much less damage to nature and wildlife surrounding their sites as opposed to fossil fuels.

So what does it mean, consumers like small factories, resorts, hotels can use these resources to fulfill their own energy requirement at the most economical rate.

Well, let's find out more about this!

Biomass

Biomass is a renewable energy resource that is derived from the waste of various human and natural activities. Bioenergy encompasses biomass power, gasses co-generation, waste to energy, bio-ethanol, bio- diesel etc. Solid bioenergy products are likely to be the most effective substitute for coal mostly used in blast furnaces in cement kilns.

Waste in any form, is bad for business. Quite simply; reducing waste, reduces cost which improves a business's bottom line.

Trashes generated from factories as well as waste material like wood, municipal solid waste, agricultural waste, food waste, lawn clippings, etc., are not easily thrown out of the factory. This is a completely paid job where the concerned staff has to take care of its proper disposal. One sensible way is to generate energy from these waste materials.

[Materials that are made out of glass, plastic, and metals are not biomass because they are made out of non- renewable materials.]

One may say that this generates pollution. But, still it does not produce pollutants like sulfur that causes acid rain. So it is safer than fossil fuel or nuclear power.

Many manufacturing companies in the wood and paper product industry use wood waste to generate their own steam and electricity. This is highly economic as they don't have to dispose their waste products and there isn't any need to buy electricity. But one may lose carbon credits in such bio energy options.

Biodegradable waste such as lawn clippings, leaves, rotten food, etc. should be deposited in landfills, where they get decomposed aerobically and anaerobically into manure. During this process methane gas is released which can be utilized as a fuel for the canteen's kitchen. One may not fulfill the total monthly consumption but a lot of expenditure can be curtailed. Manure in large quantities can be sold or if not you can use it in your plant for trees.

Use of bio-diesel for pump, generator or vehicle, is much less polluting than petroleum diesel. Though efficiency levels differ but it is more economic & does not cause pollution.

Wind and solar is the safest energy resource as it doesn't produce any pollutant. This can be installed at any plant, factory, and resort.

The use of wind power, for example by driving air compressors enables the storage of energy in the form of compressed air.

Solar Power

An industrial plant has a rooftop. Either one can keep it open or it can be covered with Asbestos for shading.

This rooftop can be utilized for the generation of electricity using wind or solar energy. For installation, it is a one-time investment accompanied with fast returns. Besides, there is less maintenance cost & non-recurring cost as no fuels are used.

Solar Thermal Power

There is one plant in U.P., where the client produces steam for their boilers. So we had suggested them to use solar water heater. We installed a solar water heater system to boil water from 30 °C to 60 °C. So now the client is able to produce the steam from water which is already heated up to 50 °C to 60 °C which saves almost 40 % electricity cost. Don't you think this is a huge saving?

HEAT PUMPS FOR PROCESS HEAT

Heat pumps can take heat from the environment or from waste heat streams and supply it to industrial applications without the need to burn any fuel. In applications where the pumping energy input is in the form of electricity produced from renewable energy sources, heat pumps are a fully renewable energy technology.

Solar Dryers

In food industries many plants are using electric dryers to remove moisture or water content in the food. Solar dryer is the best option as there is no recurring cost once installed.

Carbon Credit

If your business is looking to reduce its carbon footprint and adopt more sustainable practices, one option to consider is the use of carbon credits. You can earn cash with carbon credits.

One carbon credit has a monetary value of $40 to $80, on average per metric ton. However, this can be expected to fluctuate greatly with supply and demand. One credit permits the emission of one ton of carbon dioxide or the equivalent in other greenhouse gases. Carbon credit in India is traded on NCDEX only as a future contract.

Tax Benefit

Another advantage of using renewable energy resources is Tax benefit.

If your plant has waste management system and rain water harvesting, then while using any one renewable resources for power generation, one gets property tax benefits from the Municipal Corporation.

So what are you thinking about?

I had attended many solar trainings, one of which was in Israel, before starting my solar carrier. Despite having a world class technology, the Israelis always appreciated India because of its greater opportunity for harnessing solar radiation considering its geographical location, solar feasible infrastructure, and land availability and so on.

Renewable energy is economic, environment friendly with tax benefits with added advantages of high rate of return on investment.

Of course, making fully renewable energy will take efforts and investment but if slowly started towards diverting to renewable energy will provide greater long term security. The decreasing costs of renewable paired with rapid technological improvements have helped make manufacturers more competitive.

Many companies like Godrej, Wartsilla, Sanofi are putting efforts to make necessary changes for diverse energy portfolio. These are initiatives where companies are both cleaning up the environment and using the materials they've collected to replace unsustainable raw materials.

So don't just wait grab the awesome opportunity given by nature. ■

Harnessing the Future: The Innovative Potential of Floating Solar Farms

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Introduction

As the global demand for clean and sustainable energy continues to rise, innovative solutions are imperative to meet this challenge. One such solution that has gained significant attention is the concept of floating solar farms. Unlike traditional land-based solar installations, floating solar farms leverage water surfaces, presenting a unique approach that combines energy generation with water conservation and land optimization.

Advantages of Floating Solar Farms

- **Land Conservation:** The scarcity of available land for solar installations is a growing concern. Floating solar farms can be installed on reservoirs, lakes, and even offshore waters, effectively utilizing space that would otherwise remain unused. This approach mitigates the land-use conflicts associated with large-scale solar projects.
- **Enhanced Efficiency:** Water bodies provide natural cooling effects that improve the efficiency of solar panels. The cooling effect of the water prevents the panels from overheating, thus enhancing their overall performance and longevity. Studies have shown that floating solar panels can yield up to 10% more electricity compared to land-based installations due to this cooling effect.
- **Water Preservation:** Floating solar farms reduce water evaporation rates by limiting direct exposure to sunlight. This conservation benefit is particularly relevant in arid regions where water resources are scarce. The shade cast by the panels reduces water loss, thereby contributing to local water security.
- **Reduced Algae Growth:** The shade created by floating solar panels helps control the growth of algae on water surfaces. Algae blooms can have detrimental effects on aquatic ecosystems, and by limiting their growth, floating solar farms can contribute to maintaining healthier water bodies.
- **Energy Yield Stability:** Many land-based solar installations experience energy production fluctuations due to temperature variations and uneven sunlight exposure across the day. Floating solar farms, benefiting from the consistent reflections off water surfaces, can generate relatively stable energy yields.
- **Synergy with Hydropower Infrastructure:** Floating solar farms can be integrated with existing hydropower infrastructure. Reservoirs of hydropower dams provide suitable sites for these installations. The synergy between hydropower and floating solar power can offer more consistent energy generation by compensating for fluctuations in each technology's output.

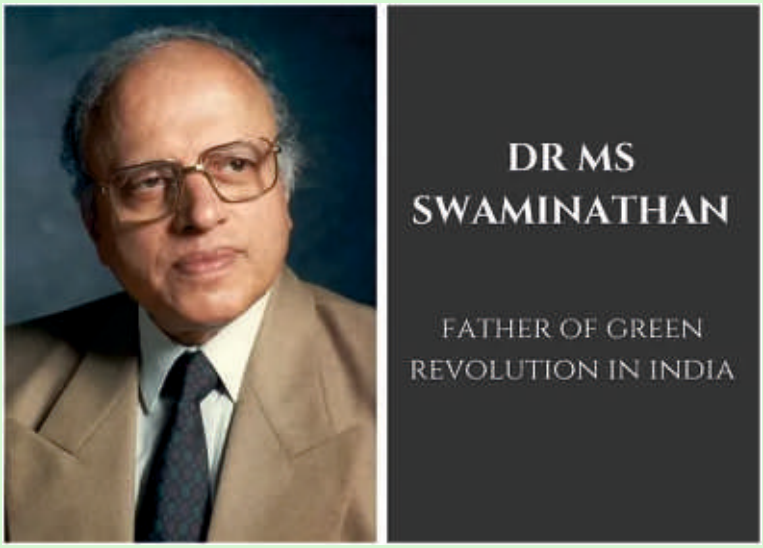
Challenges and Mitigations

- **Environmental Impact:** Critics argue that floating solar farms might disrupt aquatic ecosystems and negatively impact local biodiversity. However, proper site selection, environmental impact assessments, and the use of eco-friendly materials can mitigate these concerns. Collaborative efforts between energy companies, researchers, and environmental agencies are crucial in ensuring responsible deployment.
- **Maintenance Logistics:** Floating solar panels require maintenance, which can be challenging due to their location on water bodies. Implementing remote monitoring systems, automated cleaning mechanisms, and efficient maintenance protocols can address this challenge effectively.
- **Weather Vulnerability:** Floating solar farms are exposed to weather elements such as storms, strong winds, and waves. Engineering solutions like robust anchoring systems and flexible panel arrangements can help these installations withstand adverse weather conditions.

Conclusion

Floating solar farms represent an innovative and promising avenue for sustainable energy generation. Their ability to optimize land usage, conserve water, and enhance energy production efficiency underscores their potential to address multiple environmental challenges simultaneously. While challenges exist, technology advancements and collaborative approaches can pave the way for responsible and impactful implementation. As we navigate the transition to a clean energy future, floating solar farms stand out as a beacon of innovation, harmonizing our energy needs with environmental stewardship. ■

A Tribute to the Visionary Agricultural Scientist Who Transformed Farming



It is with heavy hearts that we bid farewell to a true luminary in the field of agriculture, Dr. M.S. Swaminathan. The eminent agricultural scientist, often hailed as the "Father of the Green Revolution in India," passed away on 28th September 2023, leaving behind a legacy that has forever transformed the agricultural landscape not only in India but across the globe.

Dr. Swaminathan was born on August 7, 1925, in Kumbakonam, Tamil Nadu, India. His journey in the world of agriculture began with a fervent belief in the power of science to uplift the lives of farmers and eradicate hunger. Over the course of his illustrious career, he lived up to this belief, becoming a beacon of hope for millions.

The cornerstone of Dr. Swaminathan's contributions lies in the Green Revolution, a period of agricultural transformation characterized by the adoption of high-yielding varieties of crops, improved irrigation, and advanced agronomic practices. His vision and leadership played a pivotal role in making India self-sufficient in food production during the 1960s and 1970s, preventing the spectre of famine that loomed large over the nation.

Beyond India, Dr. Swaminathan's influence extended globally. His expertise was sought after by international organizations, and he served in various capacities, including as Director-General of the International Rice Research Institute (IRRI). His commitment to alleviating world hunger and promoting sustainable agriculture earned him numerous accolades, including the World Food Prize in 1987.

Dr. Swaminathan was not only a scientist but also a compassionate advocate for farmers' rights. He ardently believed in empowering farmers through scientific knowledge, technology transfer, and social justice. His efforts to bridge the gap between scientific innovation and the agricultural community have left an indelible mark.

In addition to his ground breaking work in the field, Dr. Swaminathan was an eloquent spokesperson for environmental sustainability. He emphasized the importance of maintaining a delicate balance between agricultural productivity and ecological health, highlighting the need for eco-friendly farming practices.

As we mourn the loss of this visionary scientist, it is essential to reflect on his teachings and continue the work he started. Dr. Swaminathan's legacy challenges us to address the pressing issues facing agriculture today, from climate change to food security, with the same dedication and passion that he exhibited throughout his life.

The passing of Dr. M.S. Swaminathan is not just a loss for the scientific community but for humanity as a whole. His pioneering spirit, innovative thinking, and unwavering commitment to the welfare of farmers will forever serve as an inspiration. Let us honour his memory by continuing to strive for a world where no one goes to bed hungry, and where agriculture is a sustainable force for good.

Harnessing the Breeze: A Sustainable Windmill Model for Combatting Climate Change

Saloni Atul Chinchmalatpure

San Jose State University
Sunday, 1st October, 2023

Wind power has come to be seen as a ray of light in a world that is struggling with an urgent requirement for sustainable energy sources to slow down climate change. Anin-depth analysis of an innovative windmill model created for the generation of renewable energy is provided in this article, along with an examination of how such initiatives might aid in the fight against global warming. This cutting-edge concept, which uses the strength of the wind to generate clean energy while simultaneously playing a critical part in lowering greenhouse gas emissions, offers a potential route to achieving a greener and more sustainable future.

Introduction

The climate tragedy is no longer merely a theoretical idea; it is an urgent reality requiring to be addressed right away. The switch to renewable energy sources is one of the best methods to prevent climate change. Given its inherent sustainability as well as negligible environmental impact, wind energy in particular has become more popular. In this essay, a windmill model that serves as a concrete illustration of the ways that renewable energy might be used for tackling climate catastrophe is technically analyzed.

Technical Aspects and Contribution to Renewable Energy of the Windmill Model.

The Windmill model is constructed with a focus on efficiency and durability. The main components of the model include Rotor Blades, a Generator, a Tower, and a Base. The Rotor Blades are carefully designed to capture the maximum amount of wind energy. Their shape and angle are optimized to ensure the most efficient conversion of kinetic energy into mechanical energy. Whereas, the generator transforms the mechanical power via the rotation of the blades into electrical energy, which is the system's central component. For more efficiency, a magnetized generator is used. The tower is designed to elevate the rotor blades to a height where they can capture stronger and more consistent winds. The base provides stability and support to the entire structure.

To optimize energy production, the windmill model incorporates a wind monitoring system that continually measures wind speed and direction. This data is used to adjust the orientation of the rotor blades for optimal performance. This adaptability ensures that the windmill operates at maximum efficiency regardless of varying wind conditions. To store extra energy produced during times of strong winds, the windmill model is fitted with a battery system. In order to provide a steady supply of renewable energy, this stored energy can beutilized during times of low wind. Wind energy is completely pure and has no direct green house gas emissions. We can dramatically lower carbon dioxide emissions, which is contributing significantly to climate change, by switching to wind energy for the generation of electricity.

Achieving the carbon reduction goals established by global climate agreements depends critically on this transformation. By reducing our reliance on limited fossil fuel supplies, wind energy improves energy security. This lack of reliance on fossil fuels lessens the risk of changes in energy prices while also easing geopolitical conflicts that are frequently linked to the mining and transportation of fossil fuels. Wind energy projects create job opportunities in manufacturing, installation, maintenance, and research and development. This fosters economic growth while simultaneously addressing environmental concerns, contributing to a sustainable future.

The windmill model, when scaled up to industrial levels, has the potential to replace coal and natural gas power plants. This transition would significantly reduce

the carbon footprint of electricity generation, a critical step in mitigating climate change. There are no pollutants in the atmosphere or harmful emissions from wind energy production. The discharge of dangerous pollutants including nitrogen oxides, sulfuric acid, and particulate matter by fossil fuel-based power plants, which contribute to the deterioration of air quality and a variety of health problems, stands in stark contrast. Extreme weather events aren't something that wind energy is particularly vulnerable to because of its inherent resilience. Windmills are a reliable source of electricity in a more erratic climate because they are less susceptible to harm from hurricanes or floods than traditional power infrastructure.

Conclusion

We must switch to renewable energy sources immediately in light of the climate catastrophe. Our windmill model proves that harvesting wind power is technically feasible and shows how renewable energy initiatives may be crucial in the fight against climate change. Wind energy is an essential part of the global drive toward a more sustainable, more sustainable future by lowering greenhouse gas emissions, supporting energy independence, and encouraging sustainable growth. We can work toward a world whereby clean, sustainable energy is a norm rather than an exception by investing in technologies that produce renewable energy and continuing to innovate in this area. ■

USA blueberries

Nutrition Facts

What do you get in every boost of blue? Fiber, vitamin C, vitamin K, manganese – all at just 80 calories per cup. Fresh Blueberries are also low in sodium and have virtually no fat. It's a simple, no-stress food you can enjoy any time of day and anywhere.

Energy Balls

Ice-Cream

Patisseries

Cereals

Bakery Products

Blueberry Snack

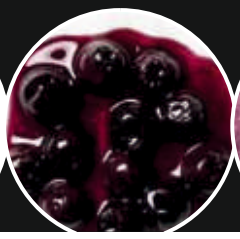
Frozen Blueberries

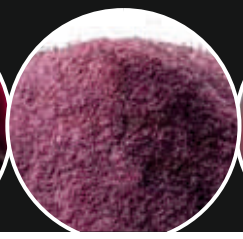
Dried Blueberries

Canned Blueberries

Blueberry Powder

Puree





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समुद्राच्या लाटांपासून वीज निर्मिती

Dilip Tulshiram Patil

Retired, 36 Years Experience From Mahindra and Mahindra Ltd. From Maintenance department.

Specialization In Fluid Engineering like as Pneumatics and Hydraulics, Chronical and Repitative mechanical problems solver.

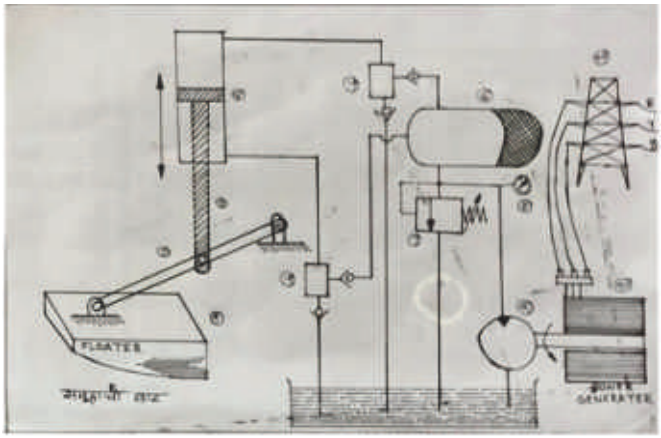
नमस्कार,पूर्णब्रम्ह मासिकासाठी लेख लिहित असतांना मला अतिशय आनंद होत आहे. यात आपण एका वेगळ्या आधुनिक वीज यंत्राची माहिती घेणार आहोत विद्युत यंत्राची माहिती घेता घेता त्या अनुशंघाने संबंधित हायड्रोलिक या विषयाचीही थोडक्यात माहिती जाणून घेणार आहोत.

कुठल्याही क्षेत्राच्या आर्थिक विकासाचा महत्वाचा घटक हा तेथील पायाभूत सुविधाच असतो. याशिवाय सामग्री आणि मनुष्य बळ हा घटकही तितकाच महत्वाचा ठरत असतो. देशातील औद्योगिक विकासाकरता मुलभूत पायाभूत गरज म्हणजे वीज होय. ऊर्जा म्हणजे कोणताही भौतिक बदल घडवण्याची अथवा कायि करण्याची क्षमता होय. उर्जा म्हणजे कायि करण्याची क्षमता. उर्जा निर्मितीसाठी इंधन आवश्यक असते. उर्जाही सदैव स्थिर असते. उर्जा निर्माण वा नष्टही करता येत नाही ती फक्त एका रूपातून दुसऱ्या रुपात बदलवता येते. उर्जेचे दोन प्रकार आहेत. गतिज उर्जा व स्थितिज उर्जा. निळ्या रंगात उर्जा जास्त असते आणि तांबडया रंगात कमी असते. उष्णता, प्रकाश, हवा किंवा वीज हे उर्जेचे प्रकार आहेत. रेणूंची गती वाढली म्हणजे रेणूंमधील गतीज उर्जा वाढते. आणि हो उर्जेलाही वस्तुमान असते.

उर्जेचा अक्षयतेचा नियम असा आहे की उर्जा एका स्वरूपातून दुसऱ्या स्वरुपात रुपांतरीत केली जाऊ शकते, परंतु तयार किंवा नष्ट केली जाऊ शकत नाही. उर्जेचे एस आय एकक ज्यूल आहे, एखादी वस्तू 1 न्यूटनच्या शक्तीच्या विरुद्ध 1 मिटर आंतरावर हलविण्याच्या कार्याद्वारे हस्थांतरित केलेली उर्जा आहे. विद्युत उर्जेचा विचार केल्यास प्रामुख्याने ही उर्जा आपण पुढील स्त्रोतांमधून मिळवत असतो जसे कि सौर, जलविद्युत, पवन, बायोमास, औष्णिक, खनिजतेल, सागरी लाटांची उर्जा, परमाणु उर्जा इतर. समुद्र किनाऱ्यावर रात्रंदिवस लाटा एकापाठोपाठ एक येत असतात. या लाटा म्हणजे वेगाने वाहणारे पाणीच असते. लाटांमध्ये असलेली ही गतीज उर्जा वापरून वीज निर्माण करण्याचे तंत्र शास्त्रज्ञांनी विकसित करण्याचा प्रयत्न केला आहे. ज्या किनाऱ्यावर लाटांची उंची आणि वारंवारता अधिक, तितकी तेथील लाटांपासून मिळू शकणारी ऊर्जाही अधिक असते. अशा जोरदार

लाटांचा शोध घेऊन त्या ठिकाणी विद्युत यंत्रे बसविल्यास किफायतशीर वीज निर्माण होऊ शकते. भारतीय तंत्रज्ञानावर आधारित काही प्रायोगिक यंत्रे केरळ राज्याच्या तिरुअनन्तपुरम जवळ विझीज्जम येथे कार्यान्वित आहेत. विजेची वाढती मागणी लक्षात घेऊन विज निर्मितीचे नवनवे प्रकल्प उभारले जात आहेत, सुदैवाने आपल्याला भरपूर सूर्यप्रकाश व सागरी किनारा लाभलेला आहे, या दोन्ही पासून मोठ्या प्रमाणात विजेची निर्मिती करता येणे शक्य आहे. आपल्या महाराष्ट्रात समुद्राच्या पाण्यात छोटेसे यंत्र टाकून विज निर्मिती करण्याचा यशस्वी प्रयोग रत्नागिरी जिल्यातील व दापोली तालुक्यातील कोलथरे येथे केला जात आहे. वाहत्या वाऱ्याचा समुद्राच्या पाण्यावर दाब पडल्यामुळे समुद्रात लाटा सतत निर्माण होत असतात या समुद्राच्या लाटांमधेही भरपूर शक्ती असते. त्यात गतीज व स्थितीज अशा दोनही प्रकारची उर्जा साठवलेली असते, या दोन्ही प्रकारच्या सांयुक्तरीत्या साधारपणे 5 किलोव्याट इतकी

असते, या लाटांची लांबी व उंचीही तेथील वातावरणावर अवलंबून असते. तरी आज आपण समुद्राच्या लाटांपासून आधुनिक पद्धतीने वीज निर्मिती कशी केली जाते याची योजनाबद्ध रीतीने तांत्रिक माहिती आकृतीच्या सहाय्याने जाणून घेणार आहोत आणि जाणून घेता घेता हायड्रोलिक या विषयाचाही सोबत अभ्यास करणार आहोत.



1) फ्लोटर.
2) लीव्हर.
3) पिस्टन रॉड.
4) सिलिंडर.
5) पंप्स.
6) एक्युम्युलेटर.
7) प्रेशर रिलीफ व्हाल्व.
8) प्रेशर गेज.
9) हायड्रोलिक मोटर.
10) विद्युत यंत्र.
11) पॉवर ग्रीड.

आता आपण योजनाबद्ध आकृतीचा अभ्यास करणार आहोत. म्हणजे थोडक्यात समुद्राच्या लाटांपासून वीज निर्मिती कशी केली जाते या सयंत्राची तंत्रशुद्ध माहिती जाणून घेणार आहोत. ही आकृती म्हणजे एक हायड्रोलिक सनकि टच आहे. हा प्रकल्प घेण्याचा उद्देश म्हणजे आपणास या विषयाचेही थोडे ज्ञान व्हावे असाही आहे.

हे संयंत्र एका समुद्राच्या किनाऱ्यावर ठेवलेले असून प्रथम समुद्राच्या लाटांवर एक पोकळ पाण्यावर तरांगणारा तराफा किंवा फ्लोटर (1) ठेवलेला असून त्याचा लिव्हर (2) एका सिलिंडरच्या (4) पिस्टन रॉडला (3) जोडलेला असतो, पाण्याच्या लाटांमुळे सिलिंडर मधील पिस्टन प्रत्येक लाटेबरोबर वर-खाली होत असतो त्या सिलिंडरच्या दोन छीद्रांना (पोटि) दोन हायप्रेषर हायड्रोलिक पंप्स (5) जोडलेले असतात. सिलिंडर मधील पिस्टनच्या वर-खाली होण्याने ऑईल पंपात सक्शन आणि हाय प्रेशर डिलेव्हरी सतत होऊन दोन्ही पंपांनी खेचलेले दाबयुक्त ऑईल एका ग्यास चाजि एक्युम्युलेटर (6) थोडक्यात दाबयुक्त टाकीत जमा होत असते. या एक्युम्युलेटर मध्ये ऑईलवर असलेला दाब व प्रवेग स्थिर होत असतो. नंतर ते दाबयुक्त ऑईल प्रेशर रेग्युलेटर (7) माफि त आपणास उपयुक्त असलेला ऑईल प्रेशर सेट केला जातो. साधारपणे 25 kg/cm 2 एवढा ऑईलचा प्रेशर सेट केला जातो. त्या दाबयुक्त ऑईल माफित एक हायड्रोलिक मोटर (9) फिरवली जाते व त्या मोटरच्या शाफ्टच्या दुसऱ्या टोकाला विद्युत यंत्र (10) जोडलेला असतो. यंत्रमाफित तयार झालेली वीज पॉवर ग्रीड (11) माफित पॉवर हाउसला पोचवली जाते. व तेथूनच विजेचे वितरण हे घराघरांत केले जाते.

आपले महाराष्ट्र राज्य 17,813 मेगाव्याट वीज निर्मिती करते त्यापैकी 3,551 मेगाव्याट वीज ही जलविद्युत प्रकल्पांतून केली जाते. म्हणजे साधारण 20 टक्के. आणि आपल्या महाराष्ट्रामध्ये एकूण 45 वीज निर्मिती प्रकल्प आहेत.

निसर्गात या संसाधनांचे प्रमाण व्यवहारिक द्रुष्ट्या अमर्याद असून त्यांच्या नुतनकरणास वा परिवर्तनास सापेक्षतः फारच अल्प कालावधी लागतो. बहुतांशी अक्षयक्षम उर्जा साधनांच्या उर्जेचा प्रत्यक्ष–अप्रत्यक्ष मुख्य स्त्रोत सूर्य हाच आहे.

पाण्यामुळे संस्कृती अस्तित्वात येते तशीच पाण्या अभावी ती नष्टही होऊ शकते. ■

Bio Fuels: Source of Energy

Satish Lele

These are renewable products which reduce green house gases from air. The renewable energy that we use today, in India, can be categorized in number of headings which are used by different sections of society. Some of these can be the following:

1. **Cow Dung (Cattle Waste)**: It is used as fuel for thousands of years and satisfies 20 to 25% of the energy needs for the rural India. It is a fuel based on solar energy. The bio mass is used by animals to produce food and fuel for the mankind. Since it can be used as fertilizer, it is also used as Natural Bio-Fertilizer. Another alternative is to separate the energy part as Bio Gas and use balance as fertilizer. This is possible only in India and other developing countries, because cow dung has to be collected manually and then dried using solar energy.

2. **Firewood**: It is also a widely used fuel in rural areas in India, and it also provides 20 to 25% needs of fuel. Since climatic conditions in India are favorable for growing trees, it is used as fuel. To sustain the requirement of fuel wood, more trees are planted and balance is maintained. This can be widely used in India, as large population is available to collect firewood, from wide-spread areas, which is lying on the ground as deadwood. A tree is the cheapest form of solar energy generating plant. Some verities of trees which grow very rapidly and have very low requirement of water, are specially grown for supply of firewood.

3. **Biomass Briquettes** or **Pellets**: It is produced from any biomass such as grass, stubs, bagasse, sugar cane tops etc. It basically compresses biomass using heat and pressure to produce a fuel grade material. Biomass briquettes or pallets are, a biofuel substitute to coal and charcoal, in food and bakery industry. Briquettes are mostly used in the developing world, where cooking fuels are not as easily available. Briquettes are produced from any agro waste, bio-mass and bio-waste. It produces smokeless briquettes made from all types of agro waste and biomass waste which currently are not used in conventionally used fuel.

4. **Fuel Ethanol**: In India, the bulk of alcohol is produced from sugar cane molasses. There are about 500 distilleries, scattered all over India. Molasses is a thick viscous by-product of the sugar industry which is acidic in nature, rich in salts, dark brown in color and it also contains sugar which cannot be crystallized. For manufacturing alcohol, molasses is diluted with water into a solution containing 15-16% of sugars. This is then fermented to produce ethanol and carbon dioxide. (Carbon dioxide is collected during fermentation process. It is then purified, liquefied and sold to soft drink industry). Ethanol is separated from spent wash mixture by distillation. The distilled product is called rectified spirit, which contains 95.57% ethanol and 4.5% water. This is then further distilled to produce 99.9% ethanol. This is called as fuel alcohol and it is blended with petrol. The addition of 10% fuel ethanol increases the octane level by 2.5-3 points and adds 3.5% weight oxygen to the base petrol.

5. **Bio Gas**: It is produced from number of raw materials. Industrial biogas is produced from spent wash from alcohol distillery. Spent wash is fermented by acidogenic and methenogenic bacteria to produce biogas. The other source is from press mud of sugar refining. This biogas is then purified by removing sulphur products and compressed to produce BioCNG. Bio gas is also produced from cow dung, but it is used for heating and cooking at home.

6. **Non Edible Oils:** There are a number of non edible oils. The oil extracted from the oil seeds is directly blended with diesel or used for lighting in rural areas. These oils can also be used as raw material for manufacturing soap. Jatropha curcas L or Ratanjyot, is the most widely available oil. Jatropha

plantation produces 650 to 800 liters / hectare per year. Pongamia Pinnata or Karanj, is planted along the roads to reduce soil erosion. Its oil is also used as biofuel. Other non edible oils such as, Mahua, Sal, Kusum etc. are also used as biofuels.

7 **Biodiesel**: It is produced from any vegetable oil. Since edible oils are expensive, non edible fractions of edible oils, such as, used cooking oil, Palm Stearin and Animal tallow is used as raw material. It is produced by trans-esterification of oils using methanol. Methanol is added to oil and glycerine separates as by-product. Production process depends on the temperature of oil, reaction temperature, ratio of alcohol to oil, type and concentration of catalyst, intensity of mixing and purity of reactants.

8 **Drop-in Biofuels**: In this vegetable oils are converted into petrol or diesel by thermal cracking. The main raw material for this is vegetable oil, trapped in spent earth during refining of vegetable oils. It is cracked in furnace at high temperature to produce liquid and gaseous products. Liquids are then separated into different fractions based on their boiling range. These have very low sulphur and oxygen content. ■

Fueling a Greener Future: Harnessing the Power of Pongamia as a Renewable Energy Source

Navjeet Nanda

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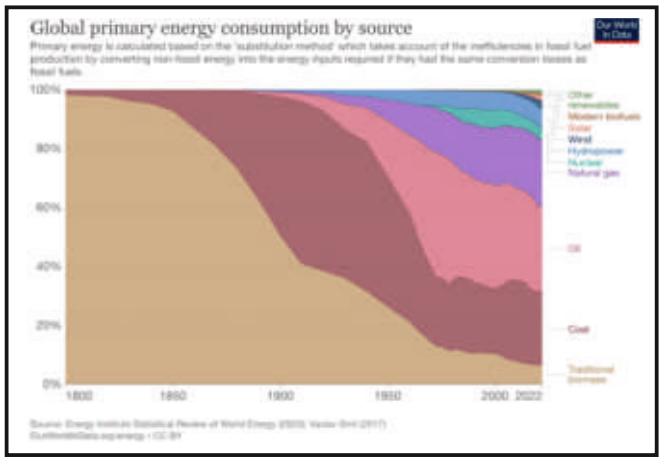
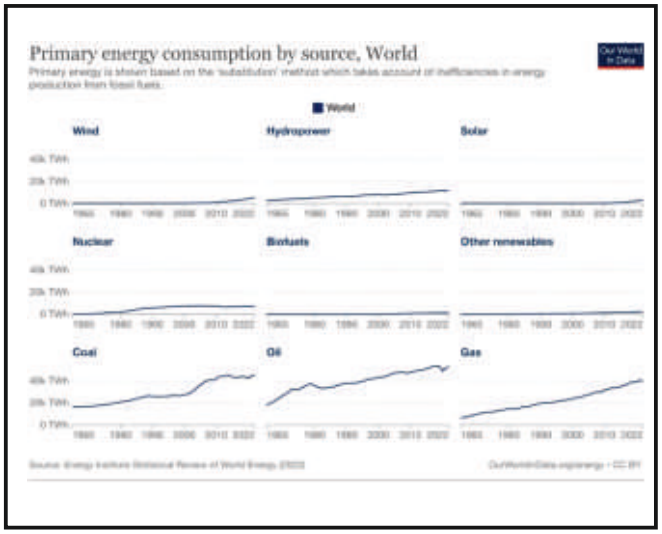
Fossil Fuels: The world we live in

Over the course of the last 200 years, the amount and variety of energy required by the planet has changed drastically. In the 1800s, almost 98% of the planet's energy was “traditional biomass” energy, which, in 2022 is now only 6.21% of global primary consumption. The following graph details how different energy sources have been used globally over the last 200 years in relation to human evolution.



In the last 50 years, coal, oil, and natural gas have dominated the charts as the most utilized source of energy globally. It is only recently that we have understood the harm these fossil fuels have on the environment and have started taking steps to limit and mitigate the damage that the fossil fuels continue to have on our environment (e.g., GHG emissions leading to global warming, air, water and land pollution, extreme weather, sea level rise and much more).

We have heavily relied on fossil fuels as our primary source of energy for the last 50 years. Coal, natural gas, and oil have been the main culprits of our misuse of non-renewable resources, and it has had a significant impact on the environment,economy, and society. The chart below gives a glimpse of the different energy sources used from 1965- 2022.



From the above graph, we can see that up until now, our energy has been produced from coal, oil, and natural gas. Our current reality is not sustainable. It's time to change the ways we produce energy and be mindful of the sources we use.

Exploring Regenerative Energy Sources

The world is currently facing an energy crisis as our dependence on non-renewable sources of energy such as oil, coal, and natural gas continues to grow. These sources of energy are finite and will eventually run out, but more importantly, they have a negative impact on the environment.

It's critical we switch to renewable energy sources such as wind, solar, and hydro power. Not only are these energy sources sustainable and infinite, but they are also much cleaner and healthier for the environment. Renewable energy does not release greenhouse gasses, which helps to reduce the negative impacts of

climate change. It also helps to reduce air and water pollution, which have been linked to various health hazards such as respiratory diseases, cancer, and birth defects.

According to the Global Energy Trends report by McKinsey (2022), renewable energy generation is projected to be 80%-90% of the global energy mix by 2050. While most of the growth in RES is expected to come from solar and onshore wind, due to declining costs, sustainable fuels such as hydro treated vegetable oil (HVO) or bioethanol, and synthetic fuels (synfuels) such as ammonia or methanol will be very important from a short-term strategic point of view.

The costs of sustainable fuels are projected to be more than its alternatives, but their use can achieve comparable Greenhouse Gases (GHG) emission reduction, allowing for faster decarbonization in short-term. Also, investments in sustainable fuels are projected to reach $40 Bn - $50 Bn by 2025. To achieve decarbonization pledges and regulated demand, however, further investments totaling between $1 trillion and $1.4 trillion are required by 2040.

The road transportation industry is expected to experience an increased demand until 2030, which presents a sizable opportunity for sustainable fuel. The market for road transportation may experience a fall after 2035 due to the anticipated rise in the adoption of electric vehicles (EV). However, the rise in anticipated demand for air transportation will balance the reduction in demand from the road transport industry. However, since the availability of waste oil feedstocks is highly constrained, the global supply capacity requires immediate research on new feedstocks for sustainable fuels. Tree Borne Oils (TBOs) such as Pongamia Pinnata present a huge opportunity in this space.

Pongamia Feedstock for Sustainable Fuels

Pongamia Pinnata, a tree native to subtropical regions such as Asia, the Pacific Islands, and Australia has been used for a variety of purposes for centuries. The tree has medicinal properties and an oil content of 20% - 40% (depending on the variety of the plant). This reveals pongamia's immense potential as a sustainable feedstock for fuel and a wide variety of products. Pongamia is a second-generation biofuel made from a regenerative tree crop which thrives on underutilized land and doesn't displace existing food crops which differentiates it from other crop-based feedstocks.

Below are some of the reasons why pongamia is a suitable candidate for feedstock for sustainable fuel:

 # Yield

Pongamia trees can grow under a variety of management conditions ranging from low-input reforestation efforts to high- input orchard plantations. Today, pongamia yields can range between 10 kg – 30 kg per tree depending on the level of caretaking occurring. These yields can potentially double with improved agricultural practices and elite genetics.

 # Resilience to Unfavorable Weather Conditions

Pongamia trees can survive in drylands and the presence of compounds like karanjin and pongamol also make them naturally resistant to pests and insects. Pongamia is a legume and therefore can fix atmospheric Nitrogen (N_2) in the soil, reducing the amount of fertilizer being used and ultimately lowering the carbon intensity score.

 # Carbon Sequestration

Based on internal research, we have estimated that one acre of pongamia can sequester approximately 100t of CO_2 over twenty years. Exact amounts of sequestration will vary depending on agro-ecological conditions such as management practices, soil types, temperature, and precipitation.

About Terviva

Terviva is an ag innovation company partnering with communities and farmers around the world to grow pongamia, a climate-resilient tree which helps to reforest land and revitalize communities.

After more than a decade of innovation, we've created an equitable and transparent supply chain where we grow and harvest pongamia to produce feedstock for biofuel and transform pongamia beans into sustainable food ingredients called Ponova®. ■

"Renewing Hope: The Path to a Greener Future at COP28"

Dr. Rahuul Marwah

MD Ayurveda, DYA, CCKS
Chief Editor,
Purnabrahma

As we delve into the ever-evolving realm of renewable energy, the stage is set for a remarkable development on the policy front. The Conference of the Parties, or COP, an annual gathering convened by the United Nations to address climate change, has been pivotal since 2015 in shaping the implementation of the Paris Agreement. This historic accord lays out three fundamental objectives: to hold the global average temperature increase well below 2°C, striving to limit it to a mere 1.5°C above pre-industrial levels; to fortify our capacity to adapt to climate change and bolster resilience; and to realign financial flows with a trajectory that promotes lower greenhouse emissions and climate-resilient development.

With each passing year, COP takes its stage in a new host country, and in 2023, it will be the United Arab Emirates (UAE) at the helm. The upcoming COP28, slated from November 30th to December 12th in Dubai, is poised to be a crucial rendezvous where global leaders, ministers, and negotiators converge to chart a course forward. The host nation appoints a president to guide the proceedings, bearing the vital responsibility of consulting with governments and various stakeholders, providing leadership and vision, and, ultimately, brokering the agreements that emerge.

The UAE is leading by example, having recently inaugurated its maiden large-scale wind project, boasting a capacity of 104 megawatts. This endeavor harnesses cutting-edge technology to harness low wind speeds, aligning with their commitment to advance renewable energy. Mohammad Abdelqader El-Ramahi, Masadar's Chief Green Hydrogen Officer, emphasized that this project is poised to mitigate approximately 120,000 tons of annual CO2 emissions, marking a significant stride toward sustainability.

Looking ahead to 2023, the global renewable energy landscape is poised for unprecedented growth, with a projected capacity surge surpassing 440 gigawatts. This astonishing 107-gigawatt increase is a historic leap, exceeding the combined installed capacity of Germany and Spain. The driving forces behind this extraordinary growth include expanded policy support, mounting concerns over energy security, and the growing competitiveness of renewables compared to fossil fuel alternatives. Notably, two-thirds of this year's projected global renewable capacity increase is attributed to solar photovoltaic installations, underscoring the ascendancy of solar power in the renewable energy sector.

The momentum In harnessing renewable energy is palpable, with countries and individuals increasingly committed to reducing their reliance on fossil fuels. The call for action is not exclusive to policymakers but extends to every individual. The shift toward renewable energy is imperative, and the time is ripe for collective action.

Furthermore, COP28 is poised to introduce a Global Stock Take (GST) to evaluate our progress and chart a roadmap for accelerating climate action. As we step into this pivotal chapter, the global community has a unique opportunity to reshape our energy landscape, reduce our carbon footprint, and pave the way for a more sustainable future. ■

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