

THE AWARE CONSUMER

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DEMYSTIFYING



Renewable Energy

FOR CONSUMERS

OUT OF THE BOX
Green Hydrogen –
Fuel of the Future!

RESEARCH FEATURE
Powering A Clean Energy
Revolution

INTERVIEW

VIBHUTI GARG
Energy Economist, Lead India at
Institute for Energy Economics
and Financial Analysis (IEEFA)



PLUS

ROUND UP • MY MARKET • THE PRESCRIPTION



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VIEWPOINT



MESSAGE FROM PUBLISHER & EDITOR



Batting for Renewable Energy for Consumers

THE WORLD AS we know it today is almost completely reliant on fossil fuels for generating energy to meet its power, heating/cooling, transport and other needs. We are well aware that the burning of these fossil fuels - like coal, oil and natural gas - releases greenhouse gases into the atmosphere and is considered the primary perpetrator of pollution, climate change and global warming. Not to mention that the finite fossil fuel reserves themselves are running out fast, putting a question on the energy security of the world!

In contrast, energy can also be derived from renewable sources – like the sun and wind – that are not only plentiful but also infinite in nature. Moreover, this sustainable energy is clean and does not vitiate the environment. In fact, we are left with no choice but to shift to renewable energy to address the climate crisis impounding our planet. And studies are supporting the fact that transitioning to renewable energy across sectors is becoming economically viable given the advancements in technology and fall in costs.

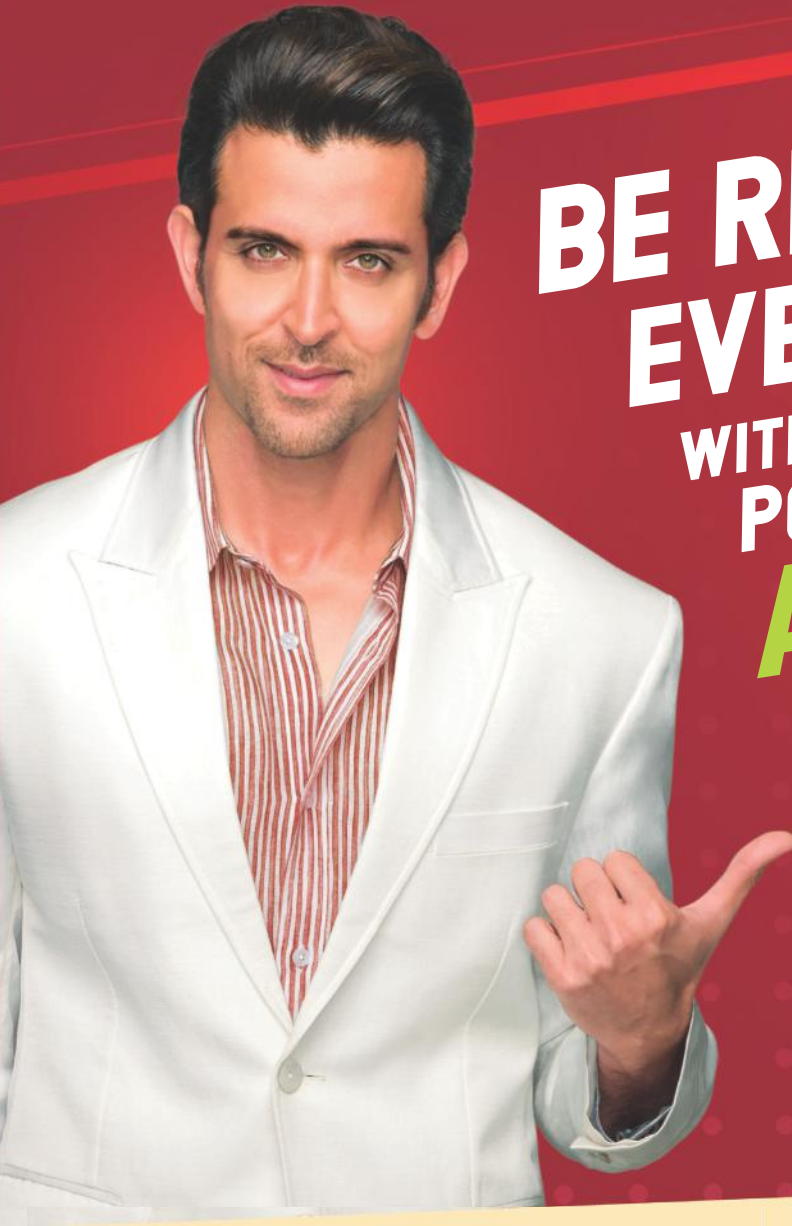
Aren't you feeling the pinch of rising petrol, diesel and electricity prices? Don't you want to switch from the inefficient and harmful ways of powering your home, office and vehicles to more green options?

Lack of awareness and information is to blame here. People do not know the myriad benefits of say, installing solar panels in their homes. And those who happen to be cognizant of the merits in store just don't know how to go about the same. There is a clear need for supportive government policies, regulations and actions to promote both the harnessing and use of renewable energy.

This issue of The Aware Consumer magazine is our attempt to influence the attitudes and practices of consumers on the kind of energy they use and how.

I close with the momentous words of the United Nations Secretary-General, António Guterres, "It's time to stop burning our planet, and start investing in the abundant renewable energy all around us!"

Prof. Bejon Kumar Misra
Publisher & Editor
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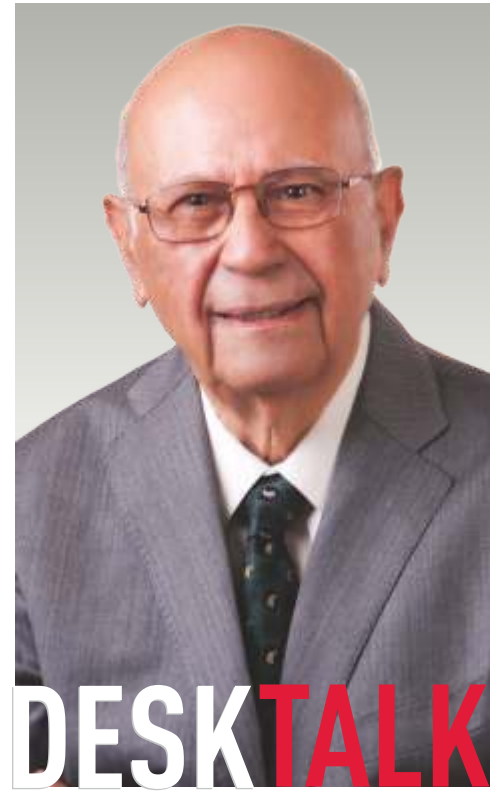
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PRAFULL D. SHETH

Editorial Board Member

DRIVING THE TRANSITION TO A SUSTAINABLE WORLD



THE WORLD IS heating up! A climate crisis is engulfing the Earth! And energy is the crux of the problem! The good news is that energy itself is the key to the solution as well!

The global population is growing and so is the demand for energy. Worries about protecting the planet are also exacerbating by the day. World leaders are increasingly looking to reduce the distressing reliance on traditional fossil fuels and making themselves energy secure in the process. The 2015 Paris Agreement on climate change (at COP-21) marks a major breakthrough with scores of countries pledging to develop or improve renewable energy policies.

India also avowed to ensuring that 40% of its energy will be from renewable sources by 2030. At this point, we were dependent on fossil fuels for most of our energy. The good news is that we seem to be on track to achieving most of our commitments.

More recently, at the COP-26 Summit last year, our Prime Minister promised to cut emissions to net zero by 2070. But will we actually

be able to achieve this dream of carbon neutrality given that we are the fourth biggest emitter of carbon dioxide in the world?

We have set some aggressive targets and it's time to hit the ground running on the implementation frontier as well. The future of green energy deployment looks bright with the Russia-Ukraine war driving up the prices of imported coal and gas on the one hand and falling prices of renewable energy on the other. What we need to focus on now is innovation and expansion, both in terms of affordability and accessibility of renewable energy.

Another point of contention is that most of the efforts and technologies related to green energy are restricted to power generation and provide only electricity. There is a pressing need to diversify into other energy segments.

COP-27 is round the corner and we will be called on to show the legislation, policies and programs for putting the agreements into practice throughout all jurisdictions and sectors! ▶





15

RESEARCH FEATURE

POWERING A CLEAN ENERGY REVOLUTION



Energy is fundamental to all human activities – it is the lynchpin of every opportunity and also every challenge that the world faces today! However, what we need is sustainable energy to transform the economy and the planet!



26

HORIZON

AN ENERGY REVOLUTION IS ON THE CARDS



Energy has been synonymous with coal and oil for decades. However, the world is on a mission to explore new technologies that are clean and sustainable.



33

INTERVIEW



VIBHUTI GARG

Energy Economist, Lead India at Institute for Energy Economics and Financial Analysis (IEEFA)

40

MY MARKET

MAKING THE SWITCH TO CLEAN ENERGY THE SOLAR WAY



Electricity generated from coal plants is becoming costly day by day. Not to mention the level of pollution and environmental effects of the same.



43

IN FOCUS

SHIFTING TO ELECTRIC MOBILITY WILL DECARBONISE TRANSPORT



47

OUT OF THE BOX

GREEN HYDROGEN – FUEL OF THE FUTURE!



We cannot compel the sun to shine all the time or summon winds whenever we want.

VIMAL MAHENDRU

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC) AMBASSADOR

The almost 200 countries invited to next year's COP 27 talks in Egypt are expected to submit updated plans for cutting greenhouse gas emissions by 2030. I am optimistic that global leaders will step up their ambitions.



ROUNDUP

The 100 megawatt (MW) project



India's Largest Floating Solar Power Project Now Fully Operational In Telangana

DATA BRIEFING

The country's solar installed capacity was **56.951 GW** as of 1 June 2022. The Indian Government had an initial target of 20 GW capacity for 2022, which was achieved four years ahead of schedule.

INDIA'S LARGEST FLOATING solar power plant in a single location is now fully operational at Ramagundam in Telangana. The 100 megawatt (MW) project – set up by the state-run energy conglomerate, National Thermal Power Corporation (NTPC) in the reservoir of its thermal power plant through Bharat Heavy Electricals (BHEL) - formally went on stream after the last 20 MW capacity part was ready for commercial operation on 1st July this year.

According to the Ministry of New and Renewable Energy, the project is divided into 40 blocks, each having 2.5 MW. Each block consists of one floating platform and an array of 11,200 solar modules. Made up of 4.48 lakh photovoltaic (PV) panels floating over 500 acres, the total project costed Rs. 423 crore. This is expected to reduce coal consumption by 1,65,000 tonnes while avoiding carbon dioxide emissions of 2,10,000 tonnes per year.

With this, the total commercial operation of floating solar capacity in the southern region has now gone up to 217 MW!

According to a 2020 study by think tank 'The Energy and Resources Institute' (TERI), reservoirs cover 18,000 square kilometres in India and can generate 280 GW through floating solar panels. As South India has a large number of major reservoirs, NTPC Southern Region plans to focus on floating solar plants. It had earlier announced the commercial operation of a 92 MW floating solar plant at Kayamkulam in Kerala and a 25 MW floating solar plant at Simhadri in Andhra Pradesh.

Floating solar plants deploy PV panels on the surface of water bodies. They have emerged as a viable alternative to land-based solar arrays as they save valuable land resources. A ground-based 1 MW solar plant requires five acres of land and acquiring this land is becoming increasingly difficult.

Moreover, as the water exerts a cooling effect, the performance of solar panels improves by 5% to 10%. The other benefits include reduced water evaporation, reduced grid interconnection costs, low algal blooming and improved water quality. Equipped with advanced technology as well as environment friendly features, the NTPC plant is expected to conserve water by avoiding approximately 32.5 lakh cubic meters of water evaporation per year.

Floating solar units also prove to be cost-effective when compared to ground-mounted ones. According to NTPC officials, setting up floating solar units on water bodies and huge reservoirs is helping them cut down on the costs.

NTPC has set a target of producing 60 GW (gigawatts) capacity through renewable energy sources, constituting nearly 45% of its overall power generation capacity, by 2032.

Meanwhile, Karnataka Gas Power Corporation Limited has invited bids to set up Bengaluru's first (and Karnataka's second) floating solar park in Yelahanka with a capacity of generating 1.15MW of power on a daily basis. ▶

Green Open Access Rules – Good Renewable



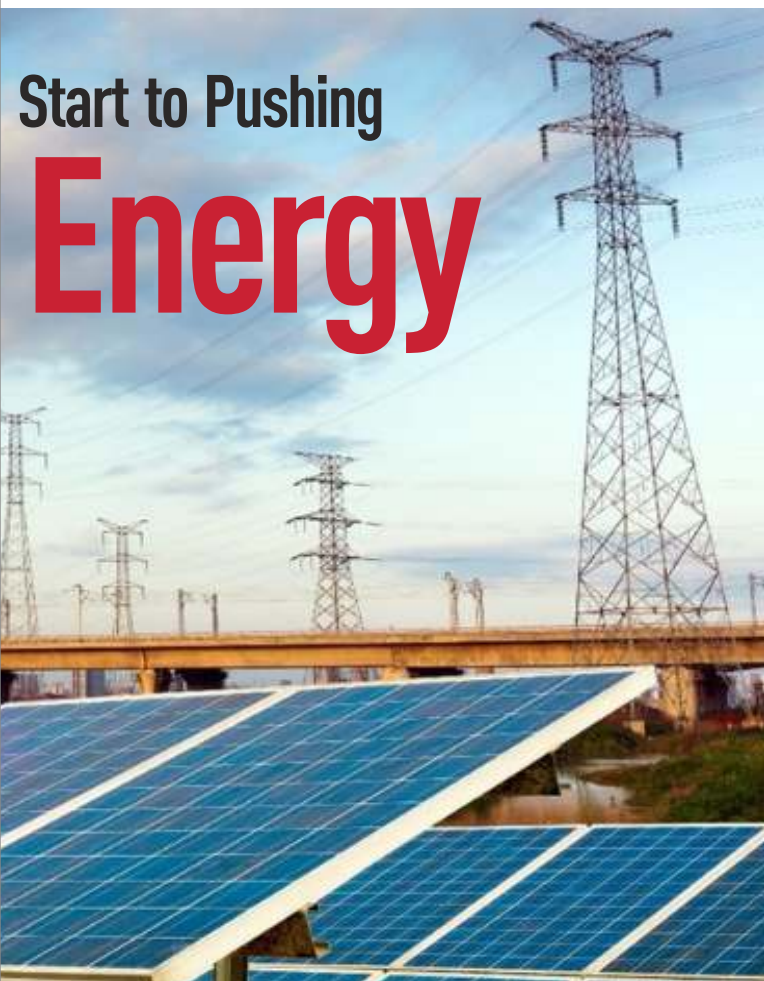
THE MINISTRY OF Power notified the Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2021 on 6th June, 2022 to further accelerate the ambitious renewable energy programmes, with the end goal of ensuring access to affordable, reliable, sustainable and green energy for all.

Informally dubbed as Green Open Access Rules, they are designed to promote renewable energy through green energy open access for the generation, purchase and consumption of green energy. This includes energy from waste-to-energy plants.

The rules enable a simplified procedure for the open access (OA) to green power in the form of faster approval of green OA, uniform banking, voluntary purchase of renewable energy power by commercial and industrial consumers, applicability of OA charges, etc.

The definition of green energy has been made wide and inclusive with, "...the electrical energy from renewable sources of energy including hydro and storage (if the storage uses renewable energy) or any other technology as may be notified by the Government of India from time to time and shall also include any mechanism that utilises green energy to replace fossil fuels including production of green hydrogen or green ammonia...".

This is indeed a watershed moment in India's journey towards a clean energy future. The rules will speed up



Start to Pushing Energy

the mission of achieving half the installed power capacity through non-fossil fuels by 2030.

What is Open Access?

India's power sector has always been closely regulated by the government. Consumers have no choice but to purchase electricity from the state-owned electricity distribution companies (also known as DISCOMs).

DISCOMs have monopoly over electricity distribution and retail – they source power from various sources (generators or open market) and supply it at regulated tariffs to the consumers.

However, the Electricity Act, 2003 brought in drastic changes in the way electricity is generated, transmitted and distributed in the country. Consumers with a load requirement above 1 MW got the freedom to procure power from a supplier of their choice. This can be either a third party (by signing bilateral agreements for power purchase) or setting up their own (captive/group captive) power plant. The electricity can be sourced from within the state or outside.

The state/central transmission and distribution network can be used to supply this power, subject to appropriate charges. The arrangement can be short-term (up to a month), medium-term (three months to three years) or long-term (12 to 25 years).

The Act also mandated DISCOMs and other large

consumers to procure a specified share of electricity from renewable energy sources (Renewable Purchase Obligations). Therefore, open access is used by consumers to lower their electricity bills, increase reliability or meet their RPO obligations.

What Do The New Rules Say?

The Green Open Access Rules 2021 will reduce the limit of open access transaction from 1 MW to 100 kW for green energy. This will enable even small consumers to purchase renewable power through open access. Captive consumers can take power with no minimum limitation. Therefore, they are now free to demand green power from their DISCOMs. But this will be subject to a commitment of a minimum period of a year.

The rules seek to streamline the overall approval process of the open access applications, including timely approval. The concerned nodal agency will be required to approve the application within 15 days, failing which it will be deemed to have been approved, subject to fulfilment of technical requirements. This will be through a national portal. To persuade consumers to use renewable energy, open access to non-fossil fuel sources shall be given priority over open access to fossil fuels.

On the price front, the tariff for green energy shall be determined separately by the appropriate commission, which shall comprise of the average pooled power purchase cost of the renewable energy, cross-subsidy charges, if any, and service charges covering the prudent cost of the distribution licensee for providing the green energy to the consumers.

The rules will bring in the much-needed certainty and stability in open access charges, which includes transmission charges, wheeling charges, cross-subsidy surcharge and standby charges. Capping the increase in cross-subsidy surcharge and removal of additional surcharge not only incentivises the consumers to go green but also addresses the issues that have hindered the adoption of open access in the country. Moreover, cross subsidy surcharge and additional surcharge shall not be applicable if the open access consumer gets power produced from waste-to-energy plant or utilises the green energy for production of green hydrogen/ammonia.

Consumers will get green certificates if they consume green power!

The rules further allow green energy consumers to bank their surplus green energy with the DISCOMs at least every month (bringing it down from 12 months). The permitted quantum of banked energy will be at least 30% of the total monthly electricity consumption, on payment of charges to be fixed by the appropriate commission.

Therefore, small-scale industries, commercial consumers and large households can easily transition to green energy. In the words of Power and New & Renewable Energy Minister, R.K. Singh, "Every consumer becomes stakeholder to contribute in achieving India's commitment of 500 GW of non-fossil fuel by 2030!"

The power is now literally in the consumers' hands – they have to walk the talk and translate their 'green intent into action! ▶



Amendment to Energy Conservation Act On The Cards



Raj Kumar Singh
Power and Renewable Energy Minister

“India will ban firms to export carbon credits until the nation meets its climate goals! These credits will have to be generated by domestic companies, bought by domestic companies.”

THE CENTRE HAD planned to table the Energy Conservation (Amendment) Bill 2022 in the monsoon session of Parliament in a bid to enable India to reach its climate targets under the Paris Climate Agreement before its 2030 commitment.

The Bill proposes to amend the Electricity Conservation Act 2001 (last amended in 2010) to introduce changes that will increase the country's demand for renewable energy, thereby reducing the nation's carbon emissions. This will not only enable a much-needed positive change to the environment but will also provide a regulatory framework for carbon trading in India which in turn will further encourage the consumption of renewables.

The Ministry of Power had proposed the following amendments to the Act on 30th October, 2021 with a primary objective of reducing fossil fuel-derived power consumption:

- Defining the minimum share of renewable energy to be consumed by industrial units or any establishment. This consumption may be done directly from a renewable energy source or indirectly via the power grid.
- Incentivising efforts to use clean energy by issuing carbon saving certificates.

- Strengthening institutions set up originally under the Act, such as the Bureau of Energy Efficiency.
- Facilitating the promotion of green hydrogen as an alternative to the fossil fuels used by industries.
- Considering additional incentives like carbon credits for the use of clean energy to lure the private sector to climate action.
- Including larger residential buildings under energy conservation standards to promote sustainable habitats. Currently, only large industries and their buildings come under the ambit of the Act.

The proposed regulation on the minimum consumption of energy will directly contribute to reducing the fossil fuel-based energy consumption

and carbon emissions into the atmosphere. The additional incentive of carbon credits against deployment of clean technologies will result in the proliferation of the carbon credit industry with more players, leading to increased climate actions. The aim is to develop India's carbon market and boost the adoption of clean technology. It will also prepare Indian companies for the looming carbon taxes in export markets.

The Government of India had enacted the original Energy Conservation Act in 2001 with an aim to redeem the country's potential for energy saving and conservation. It provides the legal framework, institutional arrangement and regulatory mechanism (at both the Central and State level) for the efficient use of energy and its conservation. Under the Act, the Bureau of Energy Efficiency (BEE) was established in March 2002 for the implementation of policies and programmes with the primary objective of reducing the energy intensity in the Indian economy through energy conservation activities.

The amendments are geared towards transforming India from an energy importer into a net exporter of energy in the future by using the clean energy potential. This will also empower us to strive towards the net-zero commitment of 2070 in a timely manner. ■

Tata Power's Massive Green Energy Push

TATA POWER HAS always bet big on renewable energy. This just got even bigger with the announcement of a massive investment of Rs. 750 billion towards renewable energy (in the next five years) at its latest annual general meeting.

Chairman N Chandrasekaran said, "Tata Power added 707 MW of renewable capacity in 2021-22. This has increased our clean and green portfolio to 34 per cent of total capacity and the company aims to raise this to 60 per cent in the next five years." The company had 9.7 GW of fossil fuel generation capacity and 2.7 GW of renewables at the end of 2021.

With operations ranging from generation to transmission and retailing of power, Tata Power aims to double its total capacity to over 30 GW by 2027. It also aspires to become an ESG (Environmental, Social and Governance) benchmark in the power sector. The company has outlined three key goals - carbon net-zero by 2045, 100% water neutral by 2030 and zero waste to the landfill before 2030. The carbon net zero goal has been advanced by 5 years from the earlier deadline of 2050.

Apart from this, the company is equally focused on growing its consumer-centric and new-age energy solutions business segment. This includes solar rooftops, electric vehicle chargers, solar pumps, smart metering and energy management solutions. It is leading the electric vehicle charging station pack with over 1,300 charging stations under its umbrella. Aiming to create a large dedicated electric vehicle battery charging infrastructure, the company plans to become the leader with over 1 lakh chargers installed by 2026.

Meanwhile, other private players are also ramping up their renewable capacity. Adani Green Energy is developing a renewable portfolio of 25 GW by 2025. It plans to invest \$20 billion over 10 years in the renewable energy supply chain, including power generation, manufacturing, transmission and distribution. Last year, Reliance committed Rs 75,000 crore for renewable energy (over three years) and aims to set up 100 GW renewable energy capacity by 2030. ▶



Tata Power is the first company in the sector to declare a net carbon zero target

'Ujjwal Bharat Ujjwal Bhavishya - Power @2047' was organised from 25th to 30th July this year as part of the ongoing 'Azadi Ka Amrit Mahotsav'. As part of the celebrations, Prime Minister Modi launched the revamped distribution sector scheme of the power sector along with the national solar rooftop portal. He also laid the foundation stone of various green energy projects of National Thermal Power Corporation Limited worth over Rs 5,200 crore.

INDIA TO SOON HAVE AN E-HIGHWAY, NITIN GADKARI ANNOUNCED

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Consumers, Beware

Sceptical About Shifting to Renewable Energy?

We are going gaga over the multiple benefits of using renewable energy. But, despite the keen awareness, people are still wary of making the switch to greener sources. We attempt to resolve the looming apprehensions like cost and logistical barriers to improve the perspective of renewable energy!



Debunking the myths surrounding renewable energy

INFLATION AND COST of living is at its peak now. What can be a better initiative to reduce your carbon footprint and be kind to the planet when it can cut your electricity and fuel bills too!

Public perception of climate change has heightened and is driving discussions on energy saving and renewable sources like never before. But, while consumers are demanding that energy be sustainable, alas, the actual move towards renewable energy on a personal front remains sluggish by a long shot.

It is not as if we are not aware that renewable energy will not only protect the environment, but will be better for our health and our pockets too. Yet, the landscape of adoption is clouded by an overload of disbeliefs and confusion. With solar panels being the most common and easy way of switching to renewable energy, let us examine some of the perceived challenges:

- **High cost stakes** – It is commonly believed that solar power works out to be very expensive. People argue that it is not feasible for stand-alone homes and middle class households. While this was true earlier, technological advancements coupled with rising demand have literally brought down both the price of solar panels and installation costs to a fraction. Add the available financing options, government subsidies and other incentives, and the solar power will start paying for itself within just a few years. In many places across the world, solar and wind energy is already proving to be cheaper than fossil fuels!

A typical 3 BHK house will need around 12 solar panels to support the daily energy needs.

- **Not reliable all the time** – Naysayers contend that the panels will not produce energy on cold and cloudy days. Fact of the matter is that you don't have to live in a perennially clear and sunny environment for solar power to prove worthwhile. Here it is about harnessing the sun's light and not

the heat! Moreover, now there are both storage and grid connectivity options for the surplus renewable energy produced which makes it possible to use the energy in the dead of the night as well. 100% uptime is a reality now! And those who quibble over the cost of batteries may not be aware that these prices are tumbling just like those of solar panels!

- **High maintenance** – What about the costs of cleaning and upkeep, not to mention damage from rain, wind, birds and so on? Well, solar panels are much sturdier now and can withstand the elements. They are easy to maintain too. Dust, debris and other damage will merely impair their efficiency; they can be cleaned easily to maintain perfect working condition.



India has set a target of having 175 GW of renewable energy capacity, including 100 GW of solar and 60 GW of wind energy, by 2022.

- **Grid instability** – Whoever said that existing electricity grids cannot cope with the high renewable energy sources needs to get their facts right! Quality panels that are properly installed and connected actually take the pressure off the grid as they produce energy right where it is being consumed.
- **Cannot cope with the demand** – People do not hesitate to say that renewable energy is not available in sufficient quantity to cater to the entire population. Meanwhile, experts affirm that renewable energy can meet 100% of our needs. With the growing demand on the one hand and rising investments in the arena on the other, efficient and creative ways of producing and storing renewable

energy are being developed by the day.

- **Dangerous** – It is unbelievable where the theory of toxic materials in the solar panels has sprung from! Exposure to solar panels holds no risks for human health. The contentions of waste management and pollution can also be countered by opting for recyclable options.

In a similar vein, solar panels will not damage the roof. They can power geysers and air conditioners too. And rest assured, all solar panels are not made in China!

Why are we waiting for renewable energy to be handed to us on a platter?

Therefore, switching to green energy is neither a luxury nor a cumbersome task any more. To be honest, it is more about an inherent lethargy where we are comfortable with the old and ingrained ways of living. Can we resist this minor change in our lifestyle when it has the potential to preserve the environment for our future generations? It may disrupt things for a while, but the payoffs will be huge – both on a personal and global scale!

Consumers in certain parts of the world are exploring installing geothermal heat pumps to heat/cool their homes. Some are even experimenting with small wind systems in their backyards to reduce their reliance on the electrical grid.


Conclusion

The fact remains that fossilfuel-derived energy has been around for much longer and is perceived to be cheaper and more reliable, even though it is not environment-friendly. Reality alludes the consumers – are you aware that renewables are on the rise across the world and with your support, they can overtake fossil fuel-derived energy very soon?

Stop propagating baseless myths! Make energy-smart decisions for the future! ▶

RESEARCH **FEATURE**

Powering A Clean Energy Revolution

A large, realistic-looking globe of the Earth is the central focus, showing the continents of North and South America in vibrant green and yellow. The globe is positioned on a dark, reflective surface that mirrors its image. The background is a clear, light blue sky above a flat, sandy or desert-like ground.

Energy is fundamental to all human activities – it is the lynchpin of every opportunity and also every challenge that the world faces today! However, what we need is sustainable energy to transform the economy and the planet!

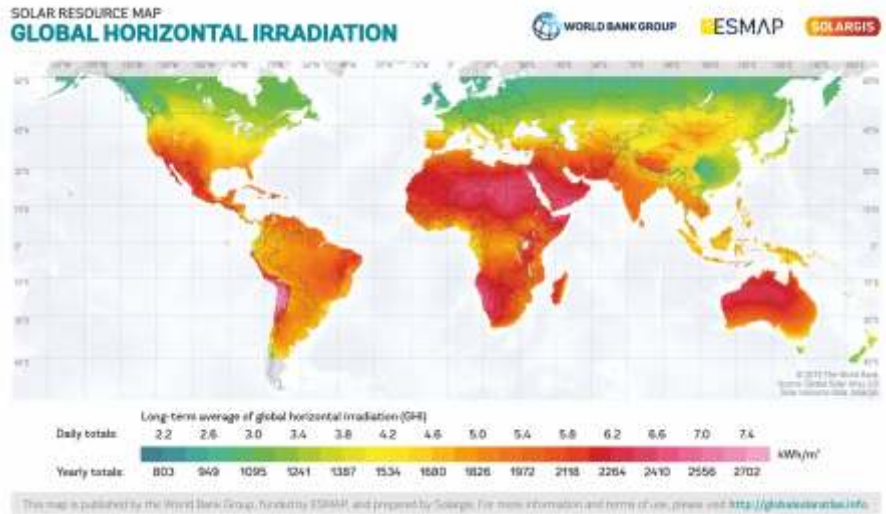
WHEN MANKIND FIRST started using energy, the sources were renewable! In other words, the energy was derived from natural sources that constantly get replenished at a higher rate than they are consumed. As wood and other biomass was primarily used for cooking, lighting and heating, there was no fear that the source would run out in the future.

It was in the late 1800s that the world started shifting to fossil fuels to generate energy. Since then, coal, oil and natural gas have become the major energy sources across the globe. The problem here is that these resources may be natural but are considered non-renewable on a human timescale as they take millions of years to form. Not only are these resources finite, but given the rate at which we are depleting them, it is very likely that they will get exhausted very soon. In fact, experts forecast that we only have about 50 to 150 years of fossil fuels left to use.

Since the past couple of decades, there is an intensified focus on finding alternatives to power our daily lives before we face shortages and emergencies. An unprecedented energy crisis is already gripping the world which has only got exacerbated by the Russia-Ukraine war. Energy security concerns are rising across the globe.

To add to this, the burning of fossil fuels to generate energy emits harmful greenhouse gases (like carbon dioxide) that blanket the Earth and trap the sun's heat. In fact, fossil fuels account for over 75% of global greenhouse gas emissions and nearly 90% of the carbon dioxide emissions.

Global solar electricity power generation capacity	849 GW (2021)
Global solar electricity power generation capacity annual growth rate	26% (2012-2021)
Share of global solar electricity generation	2% (2018)



Therefore, they are the largest contributor to climate change, which is progressing exponentially.

Alas, the world has reached a tipping point in more ways than one.

But the good news is that the world is investing in diverse sources of renewable energy that are clean, sustainable and reliable. Let us take a look at the primary alternatives in use today:

Solar Energy

Sunlight is the most abundant and freely available resource in nature. The rate at which the Earth intercepts solar energy is about 10,000 times greater than the rate at which we consume energy. In fact, we receive

more solar energy in an hour than the energy consumed by all human activities in a year! Given the limitless supply of sunlight, it alone has the capacity to render all fossil fuels obsolete.

The radiant light from the sun can be harnessed anywhere that receives sunlight by using photovoltaic panels or mirrors that concentrate solar radiation and convert it into heat, electricity or hot water. Yet, all parts of the globe are not equally endowed with sunlight. The amount of solar energy generated also varies depending on the weather conditions and time of day.

Wind Energy

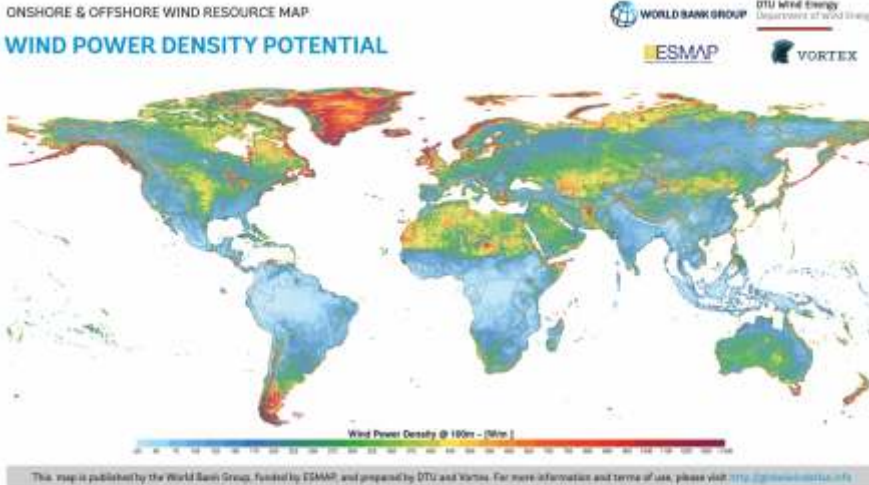
Wind is another plentiful source of clean energy. Although the kinetic energy of moving air is being harnessed since hundreds of years, now we are using advanced technology like large wind turbines - both on land (onshore) and in water (offshore) - to maximise the energy produced. These wind farms are usually in remote locations.

Again while wind speeds vary by location, the world's technical potential

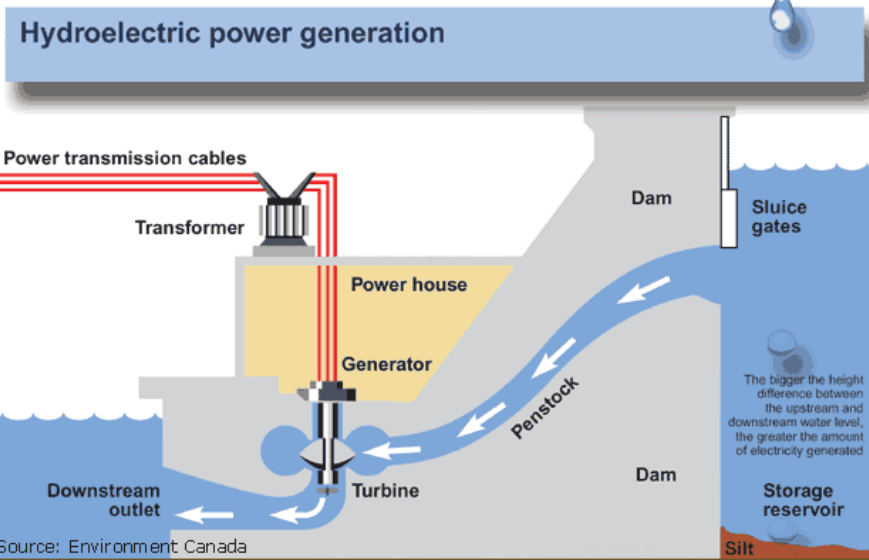


UN Secretary-General António Guterres recently delivered a sharply worded address where he demanded that people stop 'treating nature like a toilet' and criticised the continued use of fossil fuels as 'we are digging our own graves'.

Global wind electricity power generation capacity	825 GW (2021)
Global wind electricity power generation capacity annual growth rate	13% (2012-2021)
Share of global wind electricity generation	5% (2018)



Global hydro electricity power generation capacity	1,230 GW (2021)
Global hydro electricity power generation capacity annual growth rate	2.5% (2012-2021)
Share of global hydro electricity generation	16% (2018)



time. However, the dam can disrupt the waterways and the associated ecosystem in an adverse manner.

Geothermal Energy

The natural heat that was generated and stored below the Earth's surface from its formation billions of years ago is being harnessed in the form of geothermal energy. This heat is extracted by drilling wells in search of high temperatures and pumping water down the suitable ones. The resultant steam drives turbines to generate electricity or is even used directly for heating and cooking. This is not utilised commonly as of now; building the requisite infrastructure is also a costly proposition.

Biomass Energy

Traditional organic materials like wood, charcoal and manure were used as a source of energy for domestic cooking and heating. Modern biomass systems use dedicated trees, crops and grasses, agriculture and forestry residues and even industrial and domestic waste to generate energy. The natural decomposition of organic materials releases methane gas – also known as landfill gas – which is converted into various types of biofuel in solid, liquid and gas form to power vehicles, factories and even power plants.

Global biomass electricity power generation capacity	143 GW (2021) ^[87]
Global biomass electricity power generation capacity annual growth rate	7.1% (2012-2021) ^[88]
Share of global biomass electricity generation	2% (2018) ^[55]

The above sources are plentiful and all around us. They are also endless – the sun will shine, wind will blow, rivers will flow and plants will grow day after day! Moreover, the energy generated from these renewable sources is clean – either zero emissions (wind, sun and water), neutral (biomass) and low (geothermal).

Burning of biomass emits greenhouse gases but at much lower

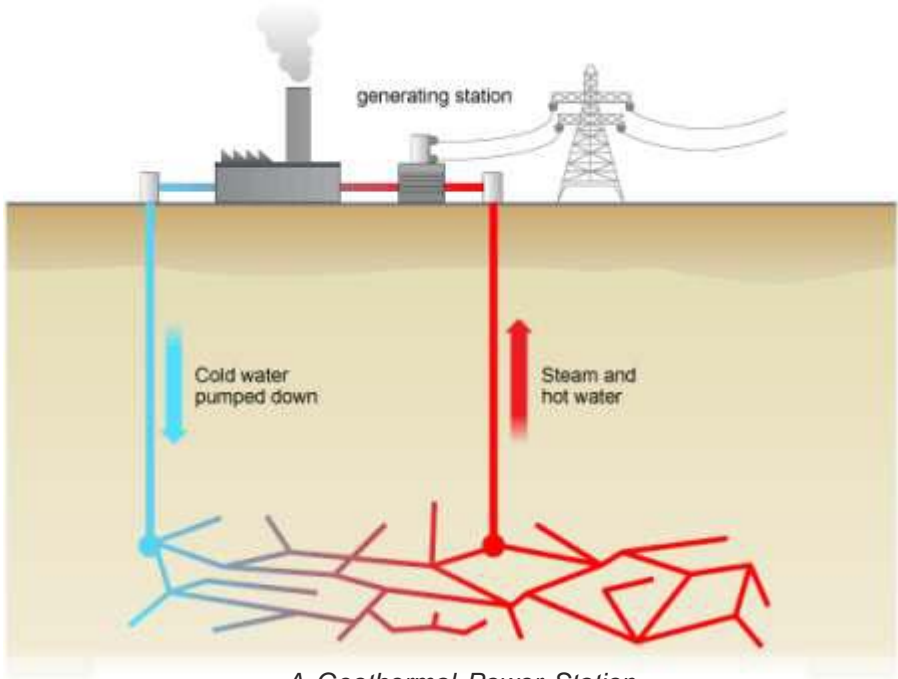
for wind energy exceeds global electricity production. But, as the wind does not blow all the time, the energy produced remains variable.

Water Energy

The energy of water is harnessed from reservoirs or even the run of

river to drive turbines which generate electricity in the form of hydropower. This is the largest source of commercially-developed renewable energy today with hydropower projects built on dams in various parts of every country. This electricity can also be stored for use at a later

Global geothermal electricity power generation capacity	16 GW (2020)
Global geothermal electricity power generation capacity annual growth rate	4.5% (2012-2021)
Share of global geothermal electricity generation	<1% (2018)



A Geothermal Power Station

levels than fossil fuels. Moreover, the emissions from the former are balanced by the amount of carbon dioxide absorbed during the growing process. Sourcing them is easy and there will always be more of it.

However, the overall environmental impact of a renewable resource also has to take the manufacturing and installation of the equipment along with the land use into account. To add to this, wind and solar power is naturally intermittent in nature.



Fatih Birol
Executive Director,
International Energy
Agency (IEA)

“Countries should invest more in renewables to ease the pressure on consumers from high fossil fuel prices, make our energy systems more secure, and get the world on track to reach our climate goals.”

Pushing the Envelope

Of the 17 Sustainable Development Goals (SDGs) established by the United Nations General Assembly in 2015, SDG 7 focuses on Affordable and Clean Energy. The primary goals include:

- Ensure universal access to affordable, reliable, sustainable and

modern energy services by 2030

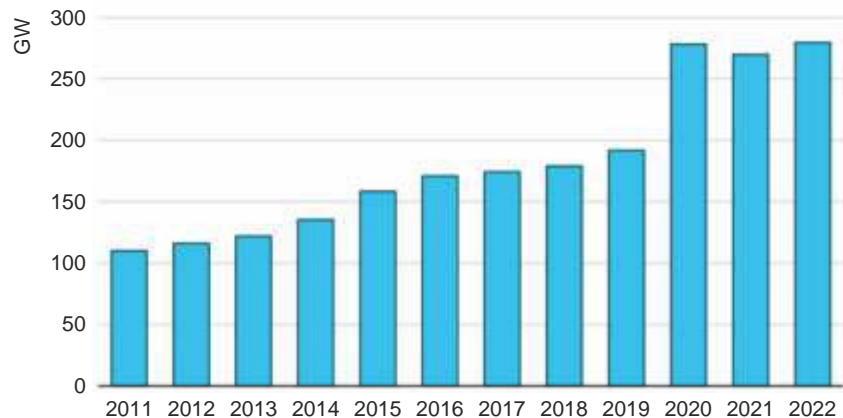
- Substantially increase the share of renewable energy in the global energy mix by 2030
- Double the global rate of improvement in energy efficiency by 2030

This is slowly shaping into a reality as a major portion of the newly installed electricity capacity across the world is renewable. To top this, renewable energy generation is not only becoming more efficient but cheaper too.

According to the IEA's Renewable Energy Market Update 2021 report, the world now has 295GW of green generating capacity. Additionally,

- In 2020, annual renewable capacity additions increased 45% to almost 280 GW – the highest year-on-year increase since 1999. (see Figure 1)
- Exceptionally high capacity additions became the 'new normal' in 2021 and 2022, with renewables accounting for 90% of new power capacity expansion globally.
- There was a record-breaking increase of 6% in 2021. It is expected to further increase by 8% to scale 320GW in 2022 led by a surge in solar power. (see Figure 2)
- Solar energy is expected to account for 60% of the increase in global renewable capacity this year. (see Figure 3)
- In India itself, the rate of growth in renewable energy doubled in 2021.

Figure 1: Net renewable capacity additions, 2011-2022



Alas, while renewable energy is witnessing unprecedented growth, its share in total energy consumption continues to remain mostly the same - at about 17% (2021 Tracking SGD7 Report). This is because the global energy demand and consumption are

also increasing at a similar rate. (see Figure 4)

However, there is hope in the future for renewables to increase their share, at least in the electricity sector. The IEO2021 (International Energy Outlook) projections for

renewable energy's share of total world energy consumption, liquid fuels production, and electricity generation are as follows:

	2020	2030	2040	2050
Energy consumption	15%	19%	23%	27%
Liquid fuels production	3%	3%	3%	3%
Electricity generation	28%	42%	50%	56%

The U.S. Energy Information Administration (EIA) publishes modelled projections and analysis for world consumption and production of renewable energy (and other types of fuel/energy sources) in the IEO.

How Do We Get There?

The United Nations Environment Programme (UNEP) estimated that to meet the Paris Agreement commitments of limiting temperature rise to 1.5°C and in pursuit of climate stability, the world has to cut 30 gigatonnes (Gt) greenhouse gas emissions annually by 2030.

To do this, UNEP has developed a roadmap called the Six-Sector Solution that can reduce 29-32 Gt across sectors. The six sectors

Figure 2: Net renewable capacity additions by technology, 2017-2023

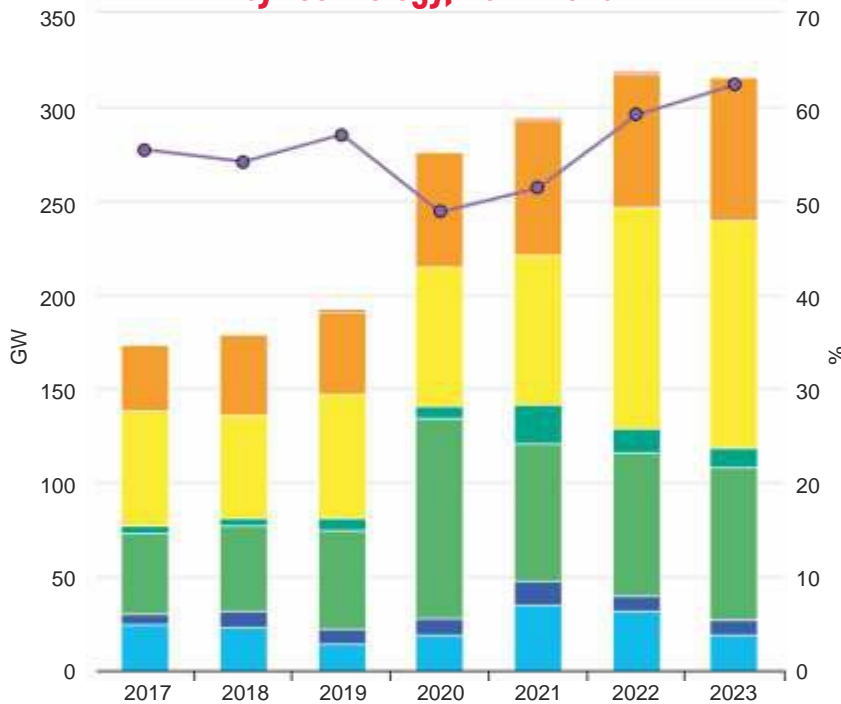
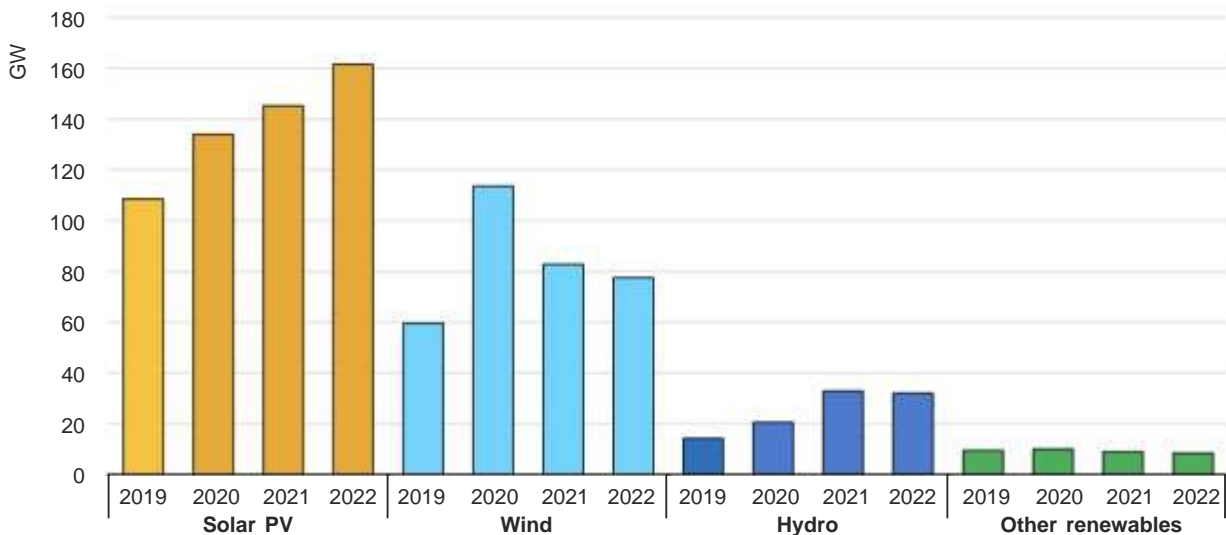
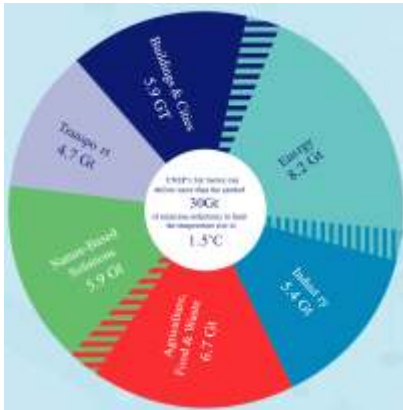


Figure 3: Net renewable capacity additions by technology, 2020-2022



identified are: Energy, Industry, Agriculture & Food, Forests & Land Use, Transport, and Buildings & Cities.

UNEP's Six-Sector Solution



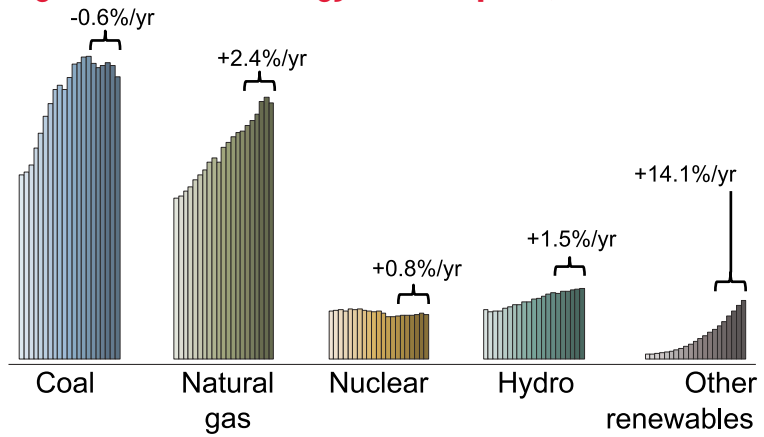
The primary actions include:

- In the energy sector, we can cut 12.5 Gt greenhouse gas emissions annually by shifting to renewable energy and using less energy.
- The industry can reduce its emissions by 7.3 Gt yearly by embracing passive or renewable energy-based heating and cooling systems, improving energy efficiency and addressing other pressing issues, like methane leaks.
- Transport is responsible for about one-quarter of all greenhouse gas emissions, which is set to double by 2050. We can reduce that number by up to 4.7 Gt by using electric vehicles in private and public transport as well as encouraging people to walk, cycle and use other forms of non-motorised transport by creating safe spaces.

Conclusion

The erstwhile UN Secretary-General, Ban Ki-Moon had said, “Energy is the golden thread that connects economic growth, social equity and environmental sustainability. With access to energy, people can study, go to university, get a job, start a business – and reach their full potential.” The onus is on us to keep this energy clean and sustainable! ▶

Figure 4: Global energy consumption, 2000 to 2020



SDG GOAL 7: AFFORDABLE AND CLEAN ENERGY



BY: MARGREET DE HEER

WE MUST MAKE SURE EVERYONE HAS ACCESS TO CLEAN, RELIABLE ENERGY!

ESPECIALLY FROM RENEWABLE SOURCES!

WE MUST WORK TOGETHER TO DEVELOP ALTERNATIVE ENERGY TECHNOLOGIES, PROMOTE ENERGY EFFICIENCY AND HELP COUNTRIES EXPAND THEIR ENERGY SYSTEMS IN A SUSTAINABLE WAY!

MISSING THE GREEN ENERGY BUS POST THE PANDEMIC

RENEWABLES 2022
GLOBAL STATUS REPORT



A historic chance was within reach, but we missed it by a whisker! While the Renewables 2022 Global Status Report paints a pretty picture of the record growth in both investment and installation of renewable energy, it is clear that the much-anticipated (and needed) global shift of the energy system to renewables is just not happening!

2021 was supposed to be different – a new, greener beginning!

THE COVID-19 PANDEMIC presented a golden opportunity for the world for a green recovery. We were hoping to transition to renewable energy and it could have happened to, but unfortunately, the world seems to have missed the chance!

According to the latest 'Renewables 2022 Global Status Report' published by REN21 in June this year, the world recorded a record growth in renewable energy deployment in 2021. But it goes on to prove that the overall share of renewables in the world's final energy consumption has stagnated!

The report stresses that the continued reliance on fossil fuel energy is leading to the threat of energy poverty for billions of people. It calls for bold actions to phase out fossil fuels and accelerate the deployment of energy efficiency and renewables.

REN21 (Renewable Energy Policy Network for the 21st Century) is a global collective of renewable energy actors, including scientists, governments, non-governmental organisations and members of the industry. They take stock of renewable energy deployment worldwide by collating data on renewable energy installations, markets, investments and policies in countries across the world on an annual basis. The 2022 report is the 17th consecutive edition - more than 650 experts have contributed data and information for the report.

Global Overview

Renewables experienced yet another year of record growth in power capacity, despite aftershocks from the pandemic and a rise in global commodity prices that upset renewable energy supply chains and delayed projects.

- Globally, renewable power capacity additions grew 17% in 2021, amounting to more than 314 GW of added capacity. Overall, the total installed renewable power capacity globally grew 11% to reach around 3,146 GW.
- Investment in renewable power and fuels rose for the fourth consecutive year, reaching USD 366 billion.
- A record increase in global electricity generation led to solar and wind power providing more than 10% of the world's electricity for the first time ever.
- Strong market rebounds for solar thermal and biofuels, following declines in 2020, improved the outlook for renewables in heating and transport.
- Strengthened political commitments and rapid growth in sales of heat pumps and electric vehicles also led to increased renewable electricity use in these sectors.

India also progressed in terms of capacity addition and investment in renewables. We installed 15.4 GW of renewable energy projects in 2021 while the total new investment in renewables increased by 70% to \$11.3 billion.

In May, the International Energy Agency (IEA) published its 'Net Zero by 2050' scenario, which supports growing momentum for energy efficiency and accelerated uptake of renewables and underscores the urgency of ending fossil fuel use.

We Are Progressing, But Unevenly

As of 2020, modern renewable energy accounted for an estimated 12.6% of total final energy consumption (TFEC), nearly one percentage point higher than in 2019. Looking sector-wise:

- The highest share of renewable energy use was in the electricity sector (28%) similar to past years. However, electrical end-use accounts for only 17% of TFEC.
- The transport sector had the lowest share of renewables (3.7%) even though it accounts for an estimated 32% of TFEC.
- The remaining thermal energy use (including space and water heating, space cooling and industrial process heat) was powered to the extent of 11.2% by renewable sources. It represents more than half (51%) of TFEC.
- Therefore, the share of renewables in total final energy demand remained low in the buildings, industry and agriculture and transport sectors. (see Figure 1)



135 countries
have some form of net
zero target, covering
88% of global
emissions

It is clear that despite the record increase in renewable energy capacity, it is nowhere close to the targets that need to be met to fulfil the global climate goals in this decade. (see Figure 2). Energy scientists upheld that India, too, will have to do much more to reach its renewable energy target.

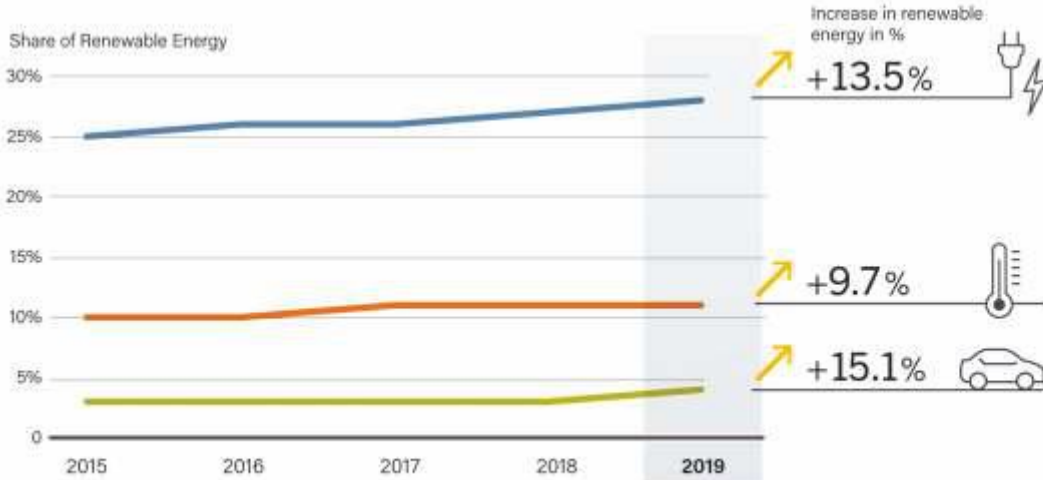
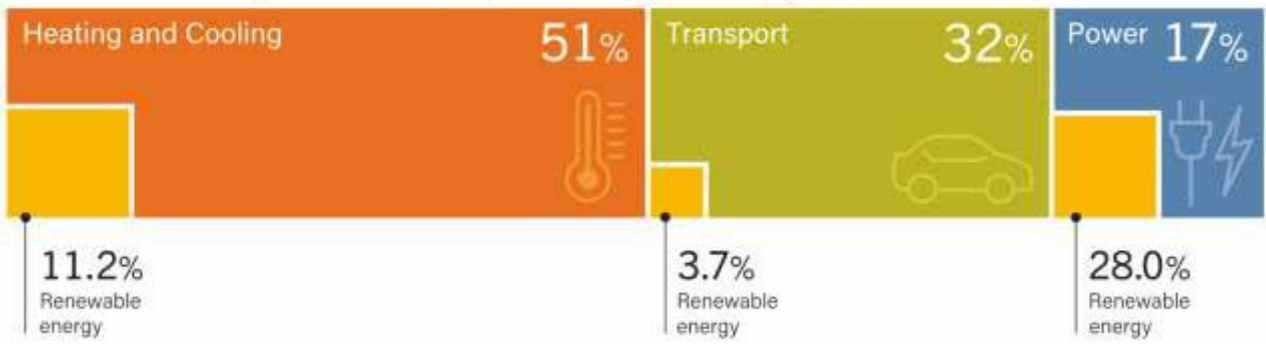
For the first time, the report provides a world map of renewable energy shares by country and highlights progress in some of the leading countries (see Figure 3).

Ambition Is Increasing But Energy Transition Is At A Standstill

The overall share of renewables in the world's final energy consumption has stagnated – rising only minimally from 10.6% in 2009 to 11.7% in 2019. Diverse factors slowed down the global shift to renewable-based energy systems:



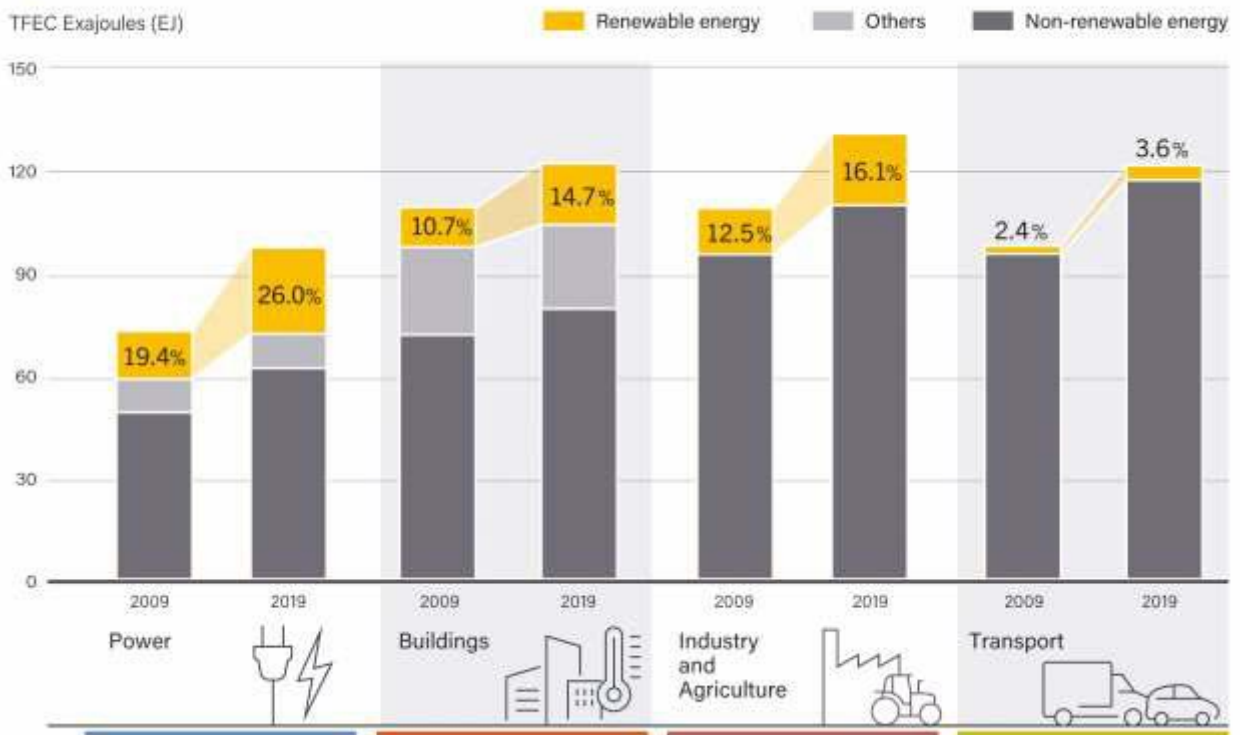
FIGURE 1.
Renewable Energy in Total Final Energy Consumption, by Final Energy Use, 2019



Source: Based on IEA data. See endnote 56 for this chapter.



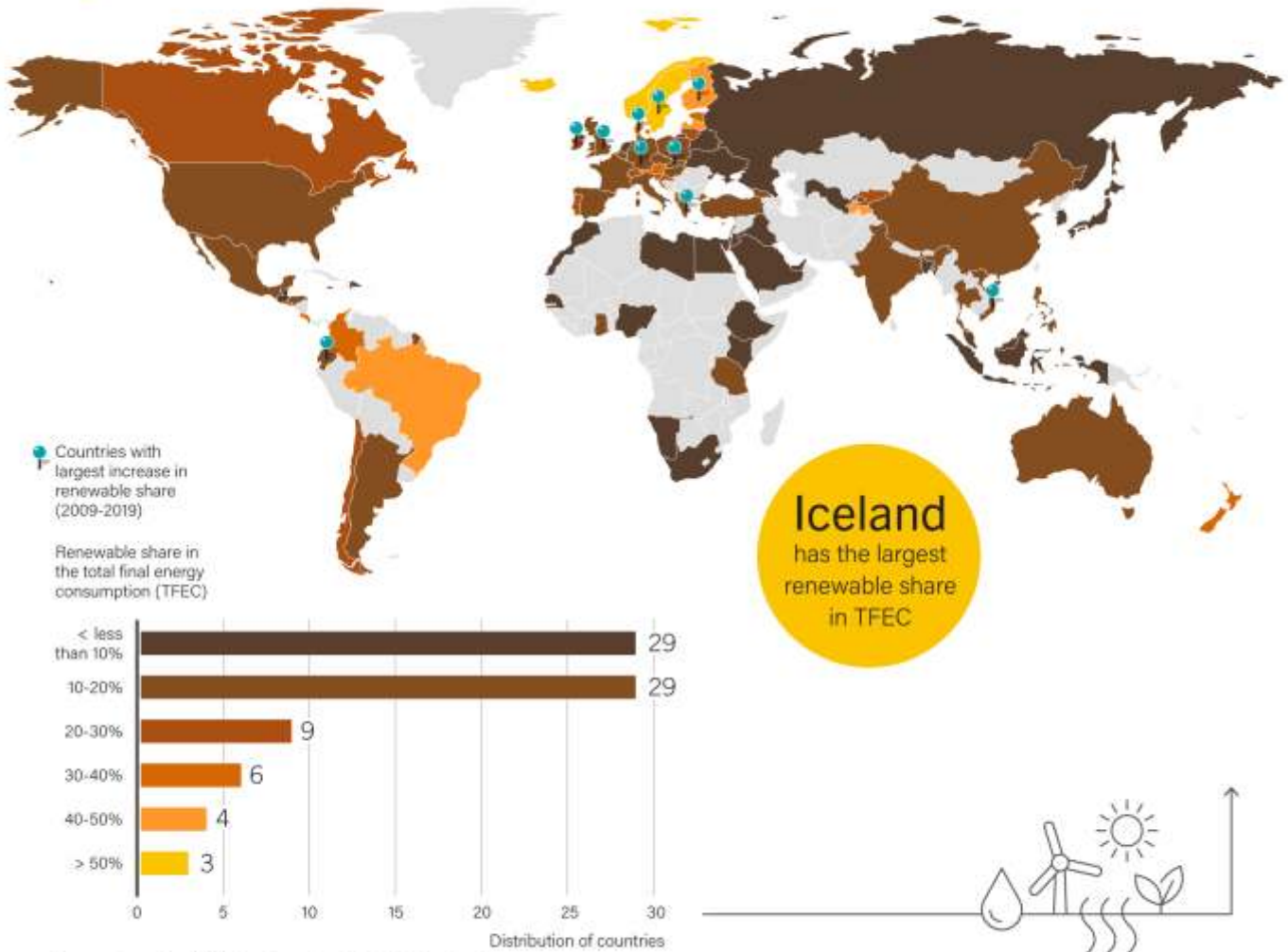
FIGURE 2.
Evolution of Renewable Energy Share in Total Final Energy Consumption, by Sector, 2009 and 2019



Source: Based on IEA data. See endnote 57 for this chapter.



FIGURE 3.
Renewable Energy Share in Total Final Energy Consumption for Selected Countries, 2019



Source: Based on IEA data. See endnote 35 for this chapter.

Note: This figure includes a selection of 80 nations among the largest energy-consuming countries in the world.

- A rebound in worldwide energy demand (increased by about 4% in 2021) was met largely with coal and natural gas and led to record carbon dioxide emissions (up 6%, adding more than 2 billion tonnes).
- 2021 marked the end of the era of cheap fossil fuels with the largest spike in energy prices. The Russian invasion of Ukraine added to the energy crisis but governments responded by increasing fossil fuel production and subsidies.
- Large sums continue to be invested to subsidise fossil fuels. 2020 witnessed \$5.9 trillion in subsidies, equivalent to roughly 7% of global gross domestic product.
- Political momentum has not translated into action.

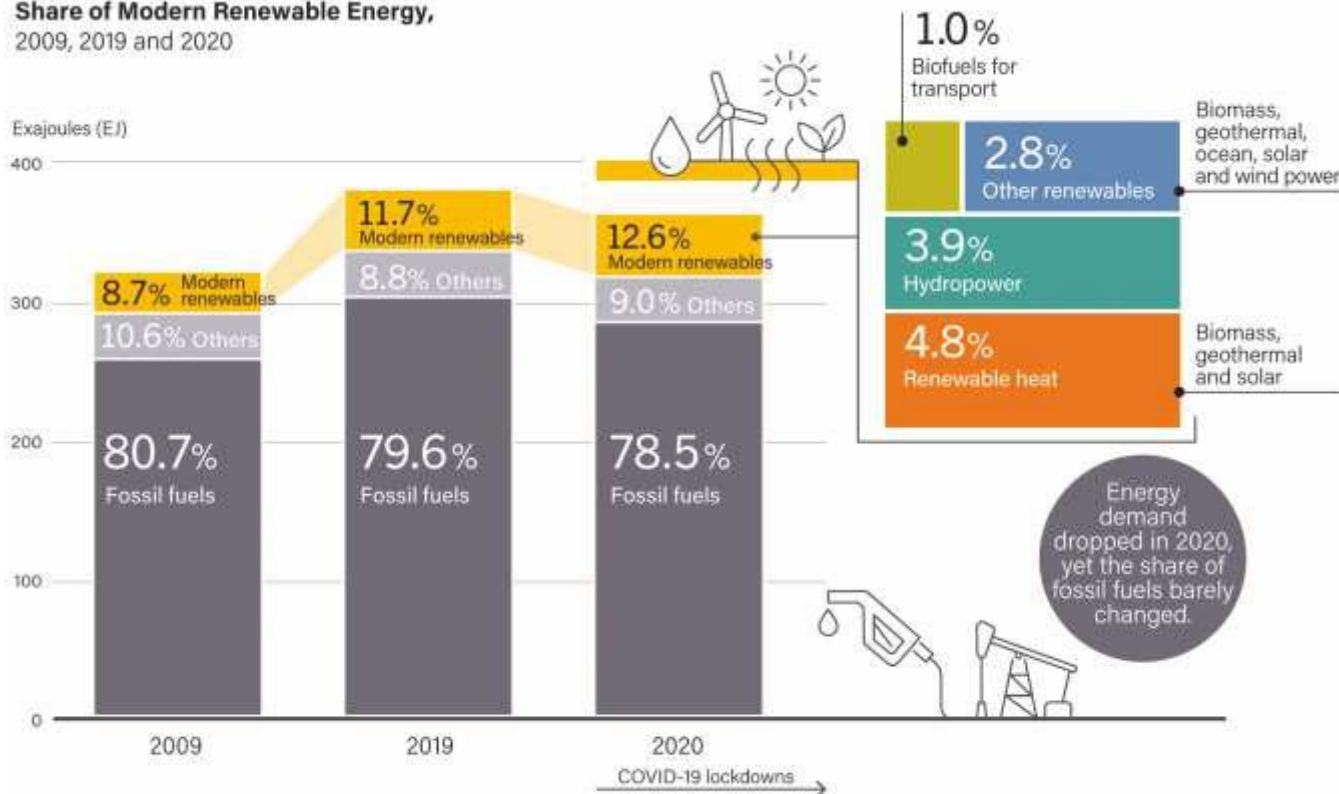
Alas, rising energy consumption and a hike in fossil fuel use outpaced the record growth in renewables.

Moreover, the slow progress in energy conservation, energy efficiency and renewables prevents the transition away from fossil fuels that is necessary to meet global energy demand and reduce greenhouse gas emissions. (see Figure 4) The report concludes that it is unlikely that the world will be able to meet the critical climate goals this decade.

Towards A New Energy Order

It cannot be denied that a structural shift in the energy system is increasingly urgent. The crisis facing our current fossil fuel-based energy system is alarming, and we urgently need to transition to renewables in all economic and societal activities. Only an energy-efficient and renewable-based economy can be a game changer for a more secure, resilient, low-cost and sustainable energy system.

FIGURE 4.
Share of Modern Renewable Energy,
2009, 2019 and 2020



Source: Based on IEA data.

The report highlights that this year must serve as a turning point for the energy transition. Renewables need to be at the heart of the political response to the energy crisis. We need to strengthen the role of renewables in improving energy security and sovereignty by replacing fossil fuels.

“This progress is insufficient and has not matched the growth in overall global energy demand. To get back on track, we need to increase the energy transition pace three-fold. A key reason why the transition is not occurring as needed is the ongoing subsidising of fossil fuels. Between 2018 and 2020, governments spent US\$18 trillion – 7 per cent of global GDP in 2020 – on fossil fuel subsidies, in some cases while reducing support for renewables. We don’t need to remove these subsidies from the energy sector but we do need to move towards renewable energy and support the transition.” - Niklas Hagelberg, Coordinator on Climate Change at the United Nations Environment Programme (UNEP) commented on the latest REN21 report.

Conclusion

How do we work towards a more sustainable, secure and just energy system? The report showcases the existing challenges but also highlights the opportunities. The



current energy crisis must be a wake-up call to replace fossil fuels with renewables. We must seize this historic moment to usher in a systemic transformation of the global economy and society as we know it. In doing so, we can address the climate challenge while building a resilient and secure renewable-based energy system for reliable and affordable energy! ▶

An Energy Revolution Is On The Cards

Energy has been synonymous with coal and oil for decades. However, the world is on a mission to explore new technologies that are clean and sustainable. Apart from the popular renewable sources, there are emerging alternative sources of energy that are priming to literally take the world by storm.



We cannot predict the future, but it looks like the energy sector will definitely look very different by 2050!

WARNINGS FROM SCIENTISTS are echoing around the globe – we have to achieve carbon neutrality by the middle of this century to avert the most dangerous levels of global warming. Last year, the International Energy Agency outlined that to reach net zero carbon emissions much more efforts are needed to build-up generation of renewable energy so that it can increase by about 12% a year to 2030.

“This is a time of unprecedented uncertainty for the energy sector. Energy demand will continue to increase. The pressure and challenge to develop and transform the energy system is immense” – World Energy Council in its report on 'Composing Energy Futures To 2050'

Looking Forward

The sun and wind are the primary sources of renewable energy as of now. Solar and wind power sectors are booming with new innovations that drive up efficiency while levelling the costs. Concentrating Solar Power (CSP) technology is re-emerging backed by improved thermal energy storage solutions. Efforts are not limited just to efficient battery storage to compensate for energy imbalance, smart grids are being developed to make renewable energy smooth for the consumers.

Printable organic solar cell technology will take regular photovoltaic solar power generation to the next level. These can be printed directly onto flexible stretchable thin plastic or steel before being laminated onto external surfaces like building walls or even directly built into the construction materials, thus transforming both the affordability and efficiency factors.

Floating wind turbines – akin to the floating oil and gas offshore platforms that are merely anchored to the seabed with cables and do not require erecting a concrete base – are unlocking the offshore wind power potential of deeper waters where winds are often stronger and steadier.

Hydro energy, geothermal energy and biomass energy are also being harnessed and put to different uses. Recent research is focusing on converting biomass into combustible

gas and using it for power generation. Tidal energy is still being explored wherein the kinetic and thermal energy of ocean currents and waves can be used to drive turbine generators. Prototype devices are at a nascent stage but can emerge as a viable commercial scale green power technology in the long term. Indeed, ocean energy is an untapped source that itself has the potential to exceed our total energy requirements.

Tech cannot be left behind either. The World Economic Forum predicts that artificial intelligence will play an essential role in the world's transition to clean energy by way of more accurate forecasting of supply and demand. The Internet of Energy will power energy decentralization where energy is used as close as possible to the time and place where it is created.



What's in Store?

A report from global financial institution ING perceives that come 2040, while companies will still produce fossil fuels, renewables could account for almost 70% of the world's energy mix with nearly 80% less carbon being emitted into the air.

However, getting there will be far from easy! Decarbonising energy production is the most pressing challenge today and this calls for introducing more renewables into the global energy mix. The world is exploring many new alternative sources of energy.....

Touted as the 'new oil', green hydrogen can be the gamechanger in the future of energy. This is the most abundant material in the universe and can easily be transported by pipelines. As a clean energy carrier, it can be used to generate electricity, cook food, heat spaces and also run vehicles. Supply logistics and production

upscaling are the primary challenges that need to be worked on. Better ways to store hydrogen for vehicles also need to be developed.

Research is underway for developing a new power source called **neutrinovoltaic energy** by using a tiny subatomic particle called neutrino that is emitted along with an electron during the decay process. This technology opens the doors to a solution that 'never stops working'!

Fascinating ways of generating energy from ocean thermal energy and nuclear fusion are being worked on. There is an ambitious project to harness the power of solar winds and transfer the billions of gigawatts of energy to the earth. Scientists are even attempting to produce liquid fuels from varieties of algae as it will have a minimal impact on land and water resources.

In addition to this, it is difficult to even wrap our heads around development of energy from 'resources' like protein cells of certain jellyfish, kinetic energy of the dance floor, combining alcohol with animal remains or human waste and even channelling body heat!

London's West End has a 107 square foot pavement that produces energy from the footsteps of people walking across it to power nearby street lamps and Bluetooth transmitters.

These may sound fanciful for now, but who are we to argue if they have the potential to generate power at relatively low costs with minimal impact on the environment!

Point to ponder – the world was sceptical about solar energy till as recently as a few decades ago. Could we ever have fathomed that this technology will be on the path to vanquishing the reign of fossil fuels in the future?

Conclusion

Efforts are ongoing in various arenas – all we need is some major technical breakthroughs for either developing new renewable energy sources or overcoming the limitations of the existing ones. Coupled with proper support and incentives, we will have the potential to produce much more power than the planet can consume! ▶



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- Tourism
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- Public Sector Insurance Companies
- National Saving Scheme of Ministry of Finance
- Employees' Provident Fund Organization
- Regional Passport Authorities
- Central Government Health Scheme
- Central Board of Secondary Education
- Kendriya Vidyalaya Sangathan
- National Institute of Open Schooling
- Navodaya Vidyalaya Samiti
- Central Universities
- ESI Hospitals and Dispensaries directly controlled by ESI Corporation under Ministry of Labour. ▶



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India is persevering to reduce its carbon footprint and mainstreaming sustainability in energy!

India Moves Towards a Cleaner and Greener Future!

A rapid transition to clean energy is underway in India as we lead the global fight against climate change. We have managed to attain stellar heights in renewable energy with phenomenal achievements to our credit.

INDIA IS A large developing economy with huge energy demands. Coal and oil have been the bedrock of our industrial growth and modernisation. These fossil fuels have given Indian consumers access to modern energy services. In fact, we are the world's third largest consumer of electricity today. The fossil energy consumption is such that our annual greenhouse gas emissions have risen to become the fourth highest in the world (after China, USA and the European Union).

The good news is that our country has massive potential for renewable energy across sources that are yet to be fully exploited. We need to make a seismic shift from fossil fuels to renewable energy on the one hand while working on enhancing our renewable energy capacity on the other.

The government also stands committed to increasing the use of clean energy sources. We hold the proud distinction of being the first country in the world to set up a separate ministry for non-conventional energy resources – the Ministry of New and Renewable Energy (MNRE) was set up in the early 1980s itself.

Paris Agreement

It was at the COP-21 (Conference of Parties) in Paris in 2015 that 196 countries entered into a legally binding international treaty on climate change for a sustainable low carbon future. It features the parties that signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1994. The overarching goal of the landmark Paris Agreement is to limit global warming to well below 2°C, and aiming for 1.5°C, compared to pre-industrial levels. To achieve this long-term temperature goal, the countries vowed to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by the middle of the century.

Accordingly, the parties were required to submit their plans for climate action - known as Nationally Determined Contributions (NDCs) - by 2020 along with long-term low greenhouse gas emission development strategies (LT-LEDS). They also have to report regularly on both their emissions and implementation efforts. It even provided a framework for financial, technical and capacity building support to those countries who need it.

India's NDC comprised of eight goals of which three had quantitative targets with a ten-year time frame (to 2030):

- Increase the share of non-fossil fuel sources to 40% of the power generation capacity
- Reduce the emissions intensity of the economy by 33% to 35% compared to 2005 levels
- Create additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent

The establishment of these carbon neutrality targets has sparked low carbon solutions that are becoming competitive across sectors, industries and companies. The government is also undertaking various large-scale sustainable power projects and promoting green energy heavily.

COP-26

India actually managed to achieve its 2030 target of 40% of energy from renewable sources nine years ahead of schedule. Our installed renewable energy capacity has scaled 162 GW, which is 41% of the 402 GW of electricity installed!

Prime Minister Narendra Modi announced this formidable achievement at the COP-26 in Glasgow in November 2021. He followed this by updating our 2030 climate targets under the Paris Agreement to 500 GW of renewable energy which will then be 50% of the installed capacity. India's new intensified climate action commitment now comprises of the following five nectar elements (Panchamrit):

- Reach 500 GW non-fossil energy capacity by 2030
- 50% of energy requirements from renewable energy by 2030
- Reduction of total projected carbon emissions by one billion tonnes from now to 2030
- Reduction of the carbon intensity of the economy by 45% by 2030, over 2005 levels
- Achieving the target of net zero emissions by 2070 across all greenhouse gases

"A coalition of 14 global think tanks has rated that India is the only G20 that has 1.5 degrees Celsius compliant policies" - **Amitabh Kant, former CEO, NITI Aayog** said while emphasising that India is the only G20 nation well on track to achieve the NDCs under the Paris Agreement.



The PM jointly launched the Green Grids Initiative – One Sun One World One Grid (GGI-OSOWOG) with the UK Prime Minister, Boris Johnson, with the aim to connect energy grids across borders to facilitate a faster transition to the use of renewable energy.

The Roadmap Driving Our Renewable Energy Growth

The government has rolled out several policies and reforms to facilitate the growth of the renewable energy sector. It is facilitating investments in clean technologies like green hydrogen, electric transport and energy storage. Transmission charges for renewable energy have also been waived off.

Other initiatives like Production Linked Incentives (PLI), Green Open Access Rules, Green Term Ahead and Day-Ahead Market are further accelerating deployment of renewable energy. For instance, the Green Open Access Rules facilitate the generation, purchase and consumption of green energy by enabling open access to consumers big and small. PLI schemes are used to attract investments and boost manufacturers' competitiveness.

The Union Budget 2022-23 seeks to reduce India's carbon footprint with initiatives like:

- Allocation of Rs 19,500 crores to facilitate domestic solar manufacturing
- Use of 5% to 7% biomass pellets for co-firing in thermal power plants
- Additional differential excise duty of Rs 2 per litre to be levied on unblended fuel to promote blending of fuel
- New battery swapping policy to be formulated for electric vehicles to achieve clean transport
- Allocation of Rs. 1,000 crores for the Solar Energy Corporation of India (SECI), which is currently responsible for the development of the solar energy industry.

It has actually become cheaper to build solar power plants than coal ones! Also, solar power costs just Re. 1.99 per unit today as opposed to Rs. 8 to 9 in 2015.

With a focus on harnessing offshore wind power, the Ministry of New and Renewable Energy has unveiled a roadmap for installing 30GW by 2030. Reverse bidding auctions are leading to better price discovery. The ministry has also set a target of 5 million tonnes a year of green hydrogen capacity by 2030. We are rapidly moving towards electric mobility in the transport sector. Subsidies for electric vehicles are in place since a couple of years.

Realising that energy storage systems play a critical role in achieving the renewables targets, the government has instituted various initiatives and policy support for the sector. Inter-state transmission system charges have been waived off for energy storage projects commissioned before June 2025. It is also working on a National Energy Storage Policy to address major impediments facing the industry.

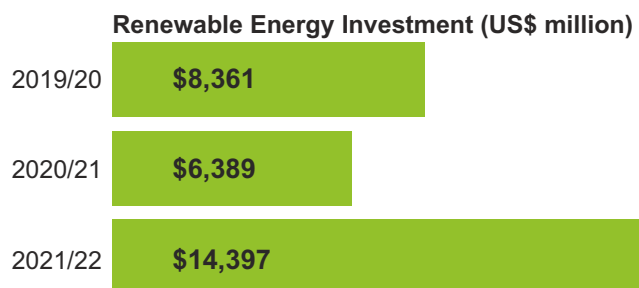
According to a report by Institute for Energy Economics and Financial Analysis, India reported record levels of investment in renewable energy - at \$14.5 billion – in 2021-22. This was up by 125% from 2020-21 and 72% higher than the pre-pandemic period of 2019-20 (see Figure 1).

There are plans to develop a 'green city' in every state of the country, powered by renewable energy. The 'green city' will mainstream environment-friendly power through solar rooftop systems on all its houses, solar parks on the city's outskirts, waste to energy plants and electric mobility-enabled public transport systems.

The government is also initiating mandatory Environmental, Social and Governance (ESG) reporting, proposing green taxonomy and working on regulating ESG ratings and data products.

On the global front, India initiated the International Solar Alliance (ISA) where 121 countries are working together to scale up solar energy, reduce the cost of solar power generation through aggregation of demand for solar finance, technologies, innovation, research and development, and capacity building.

FIGURE 1:
Renewable Energy Investment Since FY2019/20



Source: JMK Research.

Efforts Bear Fruits

In 2019, India for the first time managed to break into the ranks of the top 10 countries in the Climate Change Performance Index (CCPI) that was presented at COP-25. CCPI measures the emissions, renewable energy share and climate policies of 57 countries and the European Union. It has continued this winning streak for three years in a row and continues to rank 10th in the CCPI 2022 (see Figure 2).

The Indian renewable energy sector is considered the fourth most attractive renewable energy market in the world. India also retained its third rank on the Ernst & Young's Renewable Energy Country Attractiveness Index (RECAI) in 2021 with a score of 66.2 (behind just USA and China). The technology-specific RECAI scores (and rank) in 2021 are as follows:

Technology	India	USA	China
Solar PV	62.7 (1)	57.6	60.3
Solar CSP power plants	09.2 (4)	46.2	54.3
Hydroelectricity	46.4 (3)	57.6	60.3
Biofuels	47.4 (10)	45.3	52.8
Onshore wind power	54.2 (6)	58.1	55.7
Offshore wind power	28.6 (29)	55.6	60.6
Geothermal power	23.2 (16)	46.0	31.7

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.

“Despite having among the lowest per capita emissions in the world, we have invested in this energy transition because our traditions teach us to respect and care for our environment. We are not doing this for economic reasons” - **Power, New & Renewable Energy Minister R.K. Singh** at the Sydney Energy Forum in July 2022.



2022

OVERALL RESULTS

FIGURE 2

Rank	Rank change	Country	2021 Rank	2021 Rank change	2021 Country	2021 Score	2021 Rank change	2021 Country
1	-	-	21	1 ▲	Egypt	43	new	Viet Nam
2	-	-	22	-6 ▼	European Union (27)	44	0 -	Bulgaria
3	-	-	23	new	Philippines	45	0 -	Japan
4	-2 ▲	Denmark	24	10 ▲	Greece	46	-7 ▼	Ireland
5	-1 ▼	Sweden	25	new	Colombia	47	-1 ▼	Argentina
6	-2 ▲	Norway	26	-13 ▼	Latvia	48	-12 ▼	Belarus
7	-2 ▼	United Kingdom	27	-3 ▼	Indonesia	49	-9 ▼	Belgium
8	-1 ▼	Morocco	28	-10 ▼	Croatia	50	-1 ▲	Slovenia
9	0 -	Chile	29	3 ▲	Mexico	51	+4 ▼	Czech Republic
10	0 -	India	30	-3 ▼	Italy	52	-4 ▼	Poland
11	4 ▲	Lithuania	31	-5 ▼	Thailand	53	-3 ▼	Hungary
12	0 -	Malta	32	6 ▲	Estonia	54	-11 ▼	Algeria
13	-8 ▲	Germany	33	-8 ▼	Brazil	55	6 ▲	United States
14	-3 ▼	Finland	34	7 ▲	Spain	56	-4 ▼	Russian Federation
15	-1 ▼	Switzerland	35	-7 ▼	New Zealand	57	-1 ▼	Malaysia
16	1 ▲	Portugal	36	-1 ▼	Austria	58	-4 ▼	Australia
17	6 ▲	France	37	-4 ▼	China	59	-6 ▼	Korea
18	3 ▲	Luxembourg	38	-8 ▼	Romania	60	-3 ▼	Chinese Taipei
19	10 ▲	Netherlands	39	-2 ▼	South Africa	61	-3 ▼	Canada
20	0 -	Ukraine	40	-9 ▼	Slovak Republic	62	-3 ▼	Islamic Republic of Iran
			41	8 ▲	Cyprus	63	-3 ▼	Saudi Arabia
			42	0 -	Turkey	64	-9 ▼	Kazakhstan

*None of the countries achieved positions one to three. No country is doing enough to prevent dangerous climate change.

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Still A Long Way to Go

India also set a target of 175GW of renewable energy capacity by 2022, comprising of 100GW of solar, 60GW of wind, 10GW of biomass power and 5GW of small hydropower. But it is projected that we will miss the solar and wind capacity targets. Experts further feel that we are lagging in rooftop solar installations and will not be able to achieve the target of 500GW of non-fossil fuel energy by the end of the decade.



According to the 'Financing India's 2030 Renewables Ambition' report published by BloombergNEF in association with the Power Foundation of India, India will need US \$223 billion of investment to meet its goal of wind and solar capacity installations by 2030.

We still happen to hold the ignominious position of being the world's third largest energy importer. Our energy security risks remain high. Work is needed on renewable energy storage and supportive policies for green hydrogen along with intensified efforts to phase out the subsidies on fossil fuel so as to reduce the overdependence on coal.

While India added record-high capacities of renewable energy in 2021, it will take more for the country to reach its target of 500 GW by 2030. India will have to increase the annual capacity deployments by a factor of three; one of the significant challenges is to integrate such a huge capacity in the grid", said Neeraj Kuldeep, Programme Lead, Council on Energy, Environment and Water (CEEW).

Conclusion

India has set some ambitious targets in its updated NDCs. Yet, questions are being raised on the actual implementation! We need to build an entire ecosystem around renewable energy. The focus should be on energy transition to the consumers with well-designed policies to promote both affordability and sustainability. ▶

“**From solar to hydrogen, Vibhuti Garg explores the future of renewable energy across the country!**”



VIBHUTI GARG

Energy Economist, Lead India at
Institute for Energy Economics and Financial Analysis (IEEFA)

The World Economic Forum spoke with Vibhuti Garg - the author of a new report titled 'Renewable Energy Investment Surges in India' by the think tank, IEEFA - to uncover more about the current state of renewables in India and what's coming next.



Q The report says that India has committed to reaching 175GW of renewable capacity by the end of 2022, and increased its 2030 goal to 450GW. Is the country on track to do this, given the challenges of the COVID-19 pandemic?

In 2016, India set a target of reaching 175GW of renewable energy capacity by 2022, comprising 100GW of solar,

60GW of wind, 10GW of biomass power and 5GW of small hydropower. But with just seven months of 2022 remaining, only around 57% of the 100GW solar target and 67% of the wind target has been met. This means India is projected to miss its 2022 solar and wind capacity targets by about 27% and 18%, respectively.

The shortfall in solar capacity is mainly from rooftop solar. Utility-scale (grid-scale) solar capacity is largely on track. Headwinds ranging from COVID-induced supply chain disruption to deeply rooted policy restrictions are holding back the growth of the rooftop solar market in India.

For wind, reverse bidding auctions led to better price discovery, but also encouraged aggressive bids. Renewable energy developers found it increasingly difficult to deliver at these lower prices. Also, the best sites for wind energy, which are located in coastal areas of Tamil Nadu and Gujarat, have already been exploited. New sites have lower capacity utilisation factors, resulting in higher prices.

India's electricity demand fell during COVID, but it rose sharply as industrial activity picked up, and the recent extreme heat has pushed up demand for cooling. High electricity demand will drive the installation of more renewable energy capacity in the next few months.

Renewable energy prices are falling, and renewables are now a cheaper source of electricity than coal-based power. The Russia-Ukraine war has driven up the prices of imported coal and gas and is adding strain to the dispatchability of high-cost power. Renewable energy combined with energy storage systems such as battery storage and pumped hydro have become a cheaper source of electricity to meet electricity demand round the clock.

Q Which areas are the key drivers of India's renewables growth right now, and do you see this trend shifting at all over the coming decade, towards other technologies?

Rising electricity demand, falling prices for renewable energy, India's push to manufacture solar photovoltaic modules, government support schemes aimed at boosting Indian manufacturers' competitiveness and attracting investment (Production Linked Incentive schemes), and the waiver of transmission charges for renewable energy are the key drivers of India's renewable energy growth right now.

The growth trend will continue, but renewables need support from the government. The issuing of big tenders for

energy storage and supportive policies for green hydrogen will accelerate the roll-out of clean energy technologies to decarbonize not just the electricity sector but also other hard-to-abate sectors like fertilizer production and petroleum refining. Government policy so far has provided a boost from the supply side. The government can further support these positive developments by implementing a green hydrogen consumption obligation mechanism for fertilizer production and petroleum refining, similar to the renewable purchase obligations that require a minimum percentage of electricity to be bought from renewable energy sources. This would provide strong offtake visibility for developers and incentivize investment into production facilities.

Energy storage systems are another growth area. The government has realised that energy storage will be critical to achieving India's renewables targets and has come up with initiatives and policy support for the sector. It has waived inter-state transmission system charges for energy storage projects commissioned before June 2025. In addition to issuing standard bidding guidelines for energy storage systems in March 2022, the government is working on a National Energy Storage Policy to address major impediments facing the industry. Also, a time-based target in the upcoming policy – similar to India's targets for renewable energy – would act as a key driver for growth in energy storage.

The government is now also pushing for offshore wind. The Ministry of New and Renewable Energy has revived its offshore wind power development goals by unveiling a roadmap for installing 30GW by 2030. With offshore project costs falling globally, it's the right time for this move.

Q How much can India do with hydrogen, and how quickly? The government has launched a roadmap with incentives for investors.

India has a target of 5 million tonnes a year of green hydrogen capacity by 2030. While this is ambitious, some major developers have made big financial commitments to green hydrogen in India.

Recent green hydrogen announcements include:

- At the recent World Economic Forum Annual Meeting in Davos, Indian renewable energy developer ACME signed a memorandum of understanding worth \$7 billion with the state government of Karnataka to develop an integrated solar to green hydrogen to green ammonia facility that will produce 1.2 million tonnes a year of green hydrogen by 2027.
- In June, French oil and gas giant TotalEnergies announced another partnership with Adani Group subsidiary Adani New Industries to invest \$50 billion over 10 years to produce green hydrogen.
- In April, Indian renewable energy developer ReNew Power announced a joint venture with state-run Indian Oil Corporation and engineering and construction major Larsen & Toubro for green hydrogen production.

According to IEEFA's 'Renewable Energy Investment Surges in India' report, investment in renewable energy hit record levels in India in the 2021-22 financial year, scaling a total of \$14.5 billion!



- The report says 'Investment in renewables would need to more than double to about \$30 billion-\$40 billion per year for India to reach its target of 450GW by 2030'. What is being done to promote this investment at a time of rising inflation, when budgets are tight across the globe?

The Indian government has rolled out policies and reforms to facilitate the growth of the renewable energy sector and is now facilitating investment in other clean technologies, such as energy storage, green hydrogen, energy efficiency and electric mobility.

A large part of the climate finance needed by India can come from sustainable finance markets, which have grown in leaps and bounds over the last couple of years.

Until now Indian companies have struggled to attract a large part of this capital pool due to shallow and illiquid domestic capital markets (especially for debt) which restrict investment opportunities and increase illiquidity risks, a lack of transparent, consistent and comprehensive environmental social and governance (ESG) disclosures, and concerns about greenwashing.

However, India has been trying to tackle these problems through regulatory reforms such as mandatory ESG reporting. It has also been working towards regulating ESG ratings and data products and has a proposed green taxonomy.



Q How do India's renewable energy prospects and potential compare to those of other countries?

India has massive renewable energy potential that has yet to be fully exploited. It is also a large developing economy with huge energy demand growth. The country not only needs to make a seismic shift from fossil fuels to renewable energy, but also has new incremental demand that needs to be met through additional renewable energy capacity.

So India is facing a bigger challenge than many other countries in that it must set up a huge amount of renewable energy capacity for which it will need cheaper financial resources and greater access to clean energy technologies.

Also, wind and solar energy are intermittent, so India needs to build an entire ecosystem around renewable energy. This involves:

- Investing in flexible generation sources like battery storage and pumped hydro.
- Expansion of transmission and distribution networks.
- Modernization and digitalisation of the grid.
- Domestic manufacturing of inputs like solar modules, solar cells, wafers and electrolyzers.
- Promoting electric vehicles.
- Promoting more decentralised renewable energy like rooftop solar. ▶



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100%

Renewable Energy – Can It Be A Reality?

“We are well aware that transitioning to renewable energy is the only way we can maintain life on Earth. But are we deluding ourselves by talking about 100% renewable energy? Is this ambition really achievable, or will it just remain a fantasy spun by climate activists?”

– says *Pyush Misra*



*Making A World Fully
Powered By Renewable
Energy the New Normal!*

THE WRITING ON the wall is clear – there is no choice but to reduce emissions across sectors and transition towards clean energy if we are to continue to survive. There is also a pressing need to leave at least two-thirds of the carbon reserves in the ground if we are to hand over a liveable planet to the generations to come.

The world does seem to be gung-ho about achieving carbon neutrality by the middle of the century. There is a growing momentum for phasing out fossil fuels and gradually moving towards a world that runs completely on renewable energy. However, the idea that 100% of the energy we use will come from renewable sources still sounds overreaching and may even seem like a pipedream to many!

The Tide is Turning

Unbeknownst to most of us, this kind of an ideal scenario is already shaping into reality in different pockets of the world. In June 2020, the UK hit the stupendous milestone of running purely on renewable energy for two months straight. Even before this, emerging countries like Norway, Iceland and even Costa Rica have started running on electricity generated solely from a fossil-free system. Many other European cities and regions (in Germany, Sweden, Denmark and Spain) have committed to - and some have already achieved - 100% renewable energy-sourced electricity, heating and transport.

29% of the world's electricity is already coming from renewable sources (as of 2021). According to the International Energy Agency (IEA), this share is expected to reach 30% by 2024. The European Union has set a target of renewable energy accounting for 40% of the entire electricity generated by 2030. At least 30 nations around the world already have renewable energy contributing more than 20% of their energy supply. New Zealand has committed to achieving 100% reliance on renewable energy by 2030 itself!

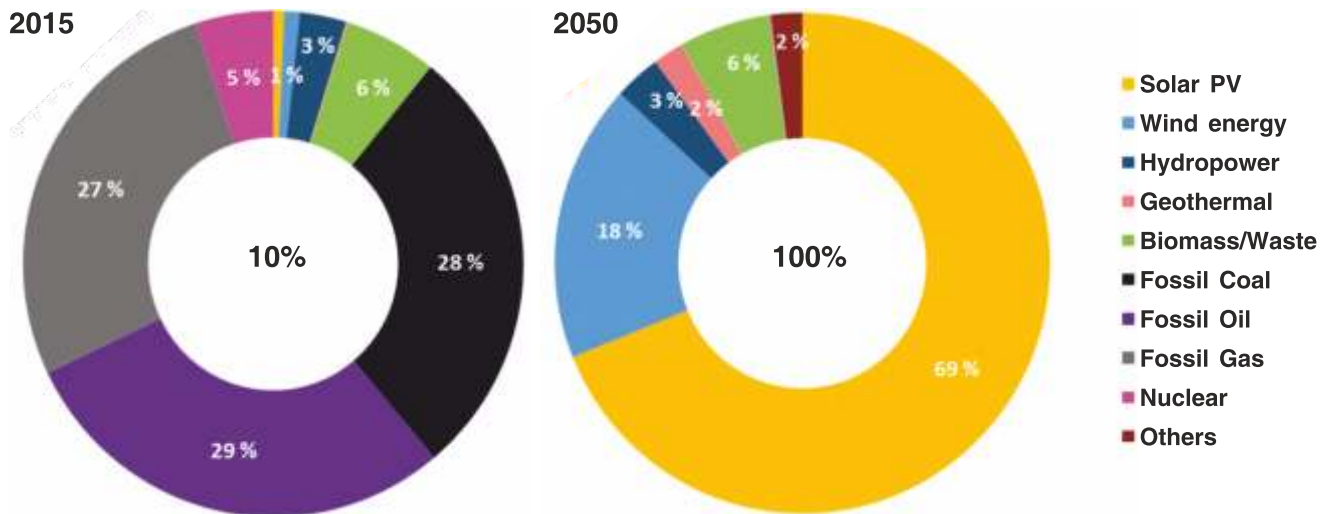
Scores of studies are also showing that a global transition to 100% renewable energy across all sectors – power, heat, transport and desalination – is both technically feasible and economically viable. It is further stated that the shift will stimulate the economy by unlocking millions of new jobs and billions of dollars in avoided climate and health costs.

The LUT University in Finland and Energy Watch Group conducted the first of its kind 'Global Energy System based on 100% Renewable Energy – Power, Heat, Transport and Desalination Sectors' study simulating a global transition to 100% renewable energy on an hourly resolution of 5-year time periods from 2015 until 2050. The nearly five-year-long study demonstrated that the existing renewable energy potential and technologies are capable of generating sufficient and secure power supply worldwide by 2050. Replacing carbon-intensive energy options in the power and heat sectors is possible by 2030, while deeply decarbonising of the transport sector will take place largely between 2030 and 2050. It even proves that such a sustainable energy system will be more efficient and cost-effective than our current energy system which is largely based on fossil fuels and nuclear energy.

The report claims that while energy supply in the fully renewable energy system will be covered by a mix of sources, solar and wind energy will lead the transition by making up 87% of the total energy mix in 2050. It further emphasised that decentralisation of energy production will be vital to increased efficiency. This has to become modular, distributed and resilient.



Shares of primary energy supply in 2015 and 2050



Another study supports that the net efficiency gained by converting from combustion of fossil fuels to renewable electricity for all energy needs will greatly reduce the projected energy demand by as much as 40%.

Current Scenario

Rapid cost reductions and disruptive innovations in the clean energy spectrum are happening even as we speak. Solar and wind power are much cheaper; in some cases, it will be cheaper to transition to these sources as compared to continuing to use the current inefficient fossil fuels.

Renewables are already replacing fossil fuel energy on the electrical grid across the world. The inherent variability in the supply of energy from renewable sources is also being managed in an efficient manner. Battery storage solutions are making it easier to address the erratic nature of our primary renewable sources. Wind and solar projects are being developed rapidly, that too in a cost-efficient manner with low environmental impacts. Private sector investment in green energy is also climbing steadily.

No Silver Bullet

It is clear that getting all our energy from renewable resources is possible, but the path is choked with social and political barriers. According to the 2013 Post Carbon Pathways report which reviewed many international studies, the key roadblocks are climate change denial, the fossil fuels lobby, political inaction, unsustainable energy consumption, outdated energy infrastructure and financial constraints. Indeed, cartelisation in the fossil fuel industry – especially the oil-rich countries - is impeding the transition to renewable energy as they fear losing both the global dominance and economic benefits.

Even the previous report stresses on the need for political will with, “Not only do we need ambitious targets, but also stable, long-term and reliable policy frameworks, adapted to regional conditions and environments”. Regulators and policymakers indeed have to take up the mantle of empowering their countries to leapfrog into a world powered completely by clean energy.

Then again, we can no longer turn our back on the glaring fact that renewable energy is primarily limited to the generation of electricity. However, electricity accounts only for a part of the energy we consume. Can we afford to continue to power transport, heating, cooling, etc. by fossil fuels? They have to be brought under the green energy umbrella by either finding ways to power them with renewable energy or electrifying these sectors as well.

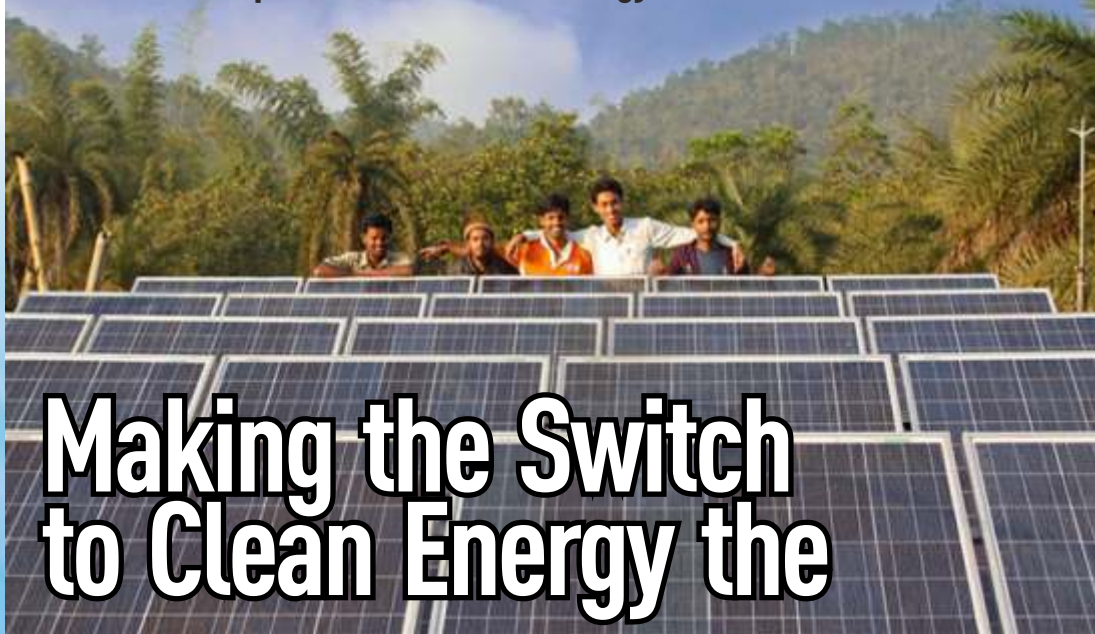
Visualise the growing number of electric vehicles on our roads with green number plates and you will get the picture. Other fuels like green hydrogen can also assist in decarbonising the transport system. It is synergies between the energy system sectors that will enable us to reach a 100% renewable energy mix and make this seemingly overextended ambition a tangible reality!

Conclusion

We are thrusting forward in replacing fossil fuels with solar and wind energy sources, but the true transformation of our energy system is possible only when we overcome the entrenched inertia both at the governmental and consumer level.

Technological changes are taking place, what we need is to shift our behaviour in terms of how and when we use our energy. This calls for a conscious change in our patterns and choices. If only this could also happen at the flick of a switch..... ▶

India has among the best conditions in the world to capture and use solar energy



**Making the Switch
to Clean Energy the**

SOLAR WAY

Electricity generated from coal plants is becoming costly day by day. Not to mention the level of pollution and environmental effects of the same. Solar energy opens the door to cutting down electricity bills to the extent of bringing them to nil even while it reduces your carbon footprint.



WE INDIANS HAVE worshipped the Sun as a giver of life since time immemorial. For centuries, mankind relied on the Sun's heat and light as the solution to varied problems. This is a renewable energy resource and is abundantly available during the day. Now humans have literally started bottling this limitless energy to power our day-to-day life! Indeed, solar power is replacing coal as the source of electricity for running our fans, lights, air conditions, heaters, geysers and other appliances.

The Indian sub-continent happens to be rightly placed that endows it with vast solar energy potential. Scientists have calculated solar energy incidence over India's land area as about 5,000 trillion kilowatt-hours (kWh) per year with most parts receiving 4-7 kWh per sq.m. per day. Based upon the availability of land and solar radiation, the potential of solar power in the country has been assessed to be around 750 GW.

With about 300 clear and sunny days in a year, the solar energy available in a single year exceeds the possible energy output of all of the fossil fuel energy reserves in the country!

Different types of solar technologies have been developed that absorb the Sun's radiation and turn it into energy. The most popular and common one is solar photovoltaics (PV) – all they need is for the sun to shine, and the PV cells in the panels absorb the sunlight, helping in the creation of electric current.

This is used in different forms – from rooftop to ground mounted to floating solar panels. Of these, consumers can easily use a rooftop solar system to harness the sun's energy and convert it into electric power.

Think about it - millions of homes and buildings all over the country receive ample sunlight on their rooftops during the day. This can become a platform for renewable energy by installing solar panels that will capture sunlight to generate DC power. An inverter is used as an interface to convert it into AC power that can power most of the residential and commercial appliances and devices.

India recorded a power supply shortage of 1,201 million units in October 2021 — the highest in 5.5 years due to a crunch in coal stocks available with thermal plants! If this does not underline the urgency of shifting to renewable energy, what else can?

Solar Rooftops: Everything You Need To Know

The following conditions will determine the feasibility of installing rooftop solar panels for generating power:

Area available on the roof: Rooftop solar PV systems can be installed on any type of roof having sufficient load bearing capacity. A 1kW rooftop system generally requires 10 sq. metres (108 sq. ft.) of shadow-free area. It will produce an average of 4 units of electricity per day which translates to 1440 units in a year.

Availability of sunlight: How much sunlight is received throughout the year plays a pivotal role. The daily energy generation will vary depending on the temperature and solar irradiance.

Nature of the roof: A naturally sloping roof that is facing south is considered ideal for solar PVs as it will receive the maximum amount of sunlight. In case of a flat roof, the panels will be placed at an angle facing south. However, installing them in old houses with slate or cedar tiles can prove to be difficult.

Obstructions: The sunlight has to fall directly on the panels for them to be effective. Trees, high-rise buildings and other obstructions should not hinder the exposure to the sun. If even a part of the module is shadowed, it can greatly reduce the power generation, thus wasting installed system capacity.

Depending on the above factors along with the types of appliances and the daily usage patterns, the quantum of electricity to be produced can be calculated before deciding on the number of panels to be installed. Typically, a standard family of four living in a three-bedroom house with a monthly consumption of 200 to 400 units (kWh) can opt for a maximum of 5KW.

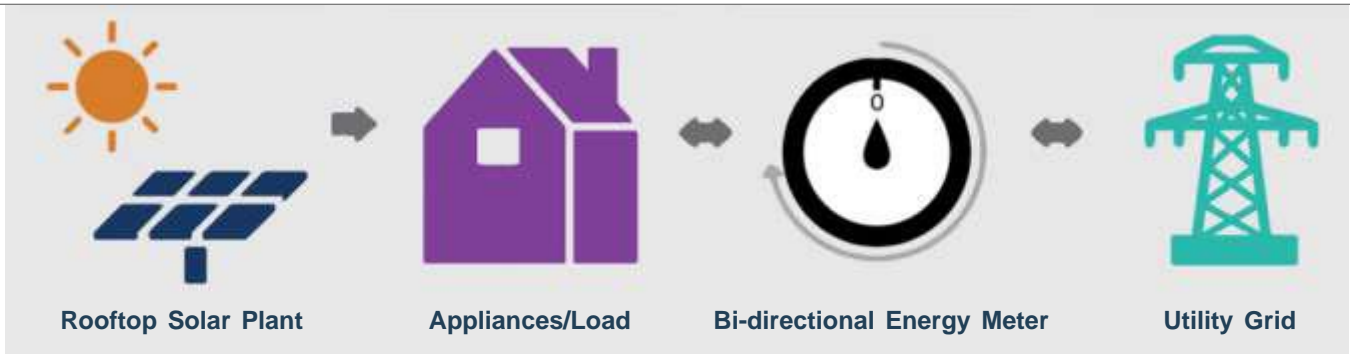
Customisation is also possible. It should be noted that the efficiency depends on choosing quality solar panels and ensuring a proper setup along with regular maintenance and monitoring. Only basic cleaning and repairs will be required.

The Cost Angle

There are many types of rooftop solar systems with different components and the costs also vary accordingly. On an average, installing a 1 kW rooftop solar system will cost between Rs. 45,000 and Rs. 85,000 (batteries cost extra if power is to be stored). Accordingly, a 5 kW system will be around Rs. 2,25,000 to Rs. 3,25,000, but the costs can be easily recovered in 5 to 6 years. And with a life expectancy of up to 25 years, a rooftop solar system can translate into never-ending electric power supply at minimal recurring expenses.

The price outlay can seem prohibitive at first. But, banks do provide loans for solar panels on attractive





terms. Some of the financing schemes can be checked at https://solarrooftop.gov.in/notification/135_notification.pdf.

Moreover, the central government offers financial support in the form of subsidies for residential properties to the tune of 40% for up to 3 kW capacity and 10% for 4-10 kW. Consumers have to pay only the balance amount after deducting the subsidy. No subsidy is available for systems that are off-grid or generate above 10 kW or supply power to commercial/industrial establishments. The expenses incurred can also be calculated as an investment subsidy via tax credits from the total amount of income tax.

Implementation at the local level has been entrusted to the Electricity Distribution Companies (DISCOMs). They have empanelled vendors with fixed rates for setting up a rooftop solar plant which includes 5-year maintenance as well. Additional state subsidies may also be available.

Integration Into Energy System

The rooftop solar panels can be off-grid wherein the system runs on its own and powers various applications in the house. Excess energy produced in the day can be stored in a battery and will be used in the night or whenever power is not being generated.

Alternatively, there is the option of integrating it with the main grid supply. This works on two fronts. One, the household uses its self-generated power but can draw from the grid supply when the panels are unable to supply the required power – think nights, cloudy days or excess usage. This overcomes the intermittent limitation of solar energy and ensures uninterrupted power supply at all times. Secondly, any excess power generated by the system when the sun is shining is fed into the grid. The DISCOM will even compensate the homeowner for this.

The concept of 'net metering' becomes applicable and it can even become an additional revenue for the owners. The monthly electricity bill will be based on the reading provided by the net meter installed at the consumer's premises. It will reflect the net units - total imported units minus exported solar units and can be negative too, thus generating revenue for the surplus power generated.

For instance, if you generate 125 units through solar power in a month and consume 300 units in the same period, you will have to pay only for the net 175 units. But if you happen to use less than the 125 units, you will get a credit for the excess power generated. As per the modified Electricity Rights of Consumers Rules, 2020, net metering

is allowed for loads up to 500 kW beyond which it will shift to gross metering.

With falling prices of solar equipment on the one hand and rising electricity charges on the other, the time is ripe for us to move to solar. As awareness of generating your own solar power rather than purchasing electricity increases, more and more people are installing solar PV systems in their houses and apartments. Rooftop space utilisation is improving with buildings having pre-allocated spaces for panels.

Consumers can apply for a rooftop solar system through the online portal of their respective DISCOM, https://solarrooftop.gov.in/grid_others/discomPortalLink. A toll-free helpline number - 1800-180-3333 – also provides details of installation, subsidies, application, etc.

Government in Action

In 2017, India announced that it will roll out 100 GW of solar power projects by the end of 2022. Of this, 40 GW will be ultra-mega park solar projects, 20 GW utility scale projects and the remaining 40 GW rooftop solar projects.

To meet the target of 40 GW of rooftop solar capacity, the Ministry of New and Renewable Energy (MNRE) is heavily promoting solar rooftop systems among commercial and individual consumers.

The Ministry has launched a dedicated National Portal of Rooftop Solar - <https://solarrooftop.gov.in/>. Then there are government companies like the Solar Energy Corporation of India (SECI) that is completely dedicated to the solar energy sector. The National Institute of Solar Energy (NISE) operates autonomously under the MNRE – it has estimated a potential of 43 GW for grid connected rooftop solar systems in the country.

Despite all these initiatives, India is still failing to fully utilise the potential of rooftop solar technology. We had managed to achieve only 6.7 GW of the 40 GW target by December 2021. Moreover, more than 75% of these rooftop installations are in the commercial and industrial segment. Alas, progress has been extremely slow in the residential sector. Along with awareness and knowledge, there is a need for easy financing, unrestricted net metering and an easy regulatory process to improve the uptake.

Conclusion

Rooftop solar is the way forward for consumers and the government alike. We can and should embark on the green journey of energy-efficient living while hedging energy costs thus increasing savings by way of solar power! ▶

Shifting to Electric Mobility will Decarbonise Transport

There is an urgent need for electrification of road transport. This eco-friendly option is your chance to contribute to a cleaner and greener environment. Let's find out more about the different factors that make it worth becoming a part of the electric vehicle revolution!



Electric vehicles should lead the transition to cleaner fuels in the transport sector

TRANSPORTATION IS THE primary source of pollution in the world, especially air pollution. It accounts for 23% of global greenhouse gas emissions. In India alone, the transport sector emits 142 million tonnes of carbon dioxide annually, with 123 million tonnes being contributed by road transport alone.

The emissions from conventional vehicles that run on diesel, petrol, aviation kerosene or marine gas harm not just our planet, but also our health. The automobile exhaust can cause asthma, bronchitis, cancer and premature death. The grave long-term health impacts are reflected in the growing incidence of asthma attacks, lung damage and heart conditions. According to a Greenpeace report, 12 lakh people die in India every year due to air pollution!

A Harvard University study found “a striking association between long-term exposure to harmful fine particulate matter and COVID-19 mortality! One of the primary causes of fine particulate matter pollution (PM2.5) is combustion from gasoline and diesel car engines.”

Looking at the energy angle, the transport sector accounted for nearly one-third (32%) of global final energy consumption in 2021 (REN21 report). In India, transportation makes up 18% of total energy consumption, translating to an estimated 94 million tonnes of oil equivalent (MTOE) energy. Going by current trends, the country will require around 200 MTOE of energy in 2030 to fuel the transport needs of the consumers. And with our crude oil imports averaging to 80%, we remain highly vulnerable to the volatile fluctuations in international crude oil price. Therefore, relying on conventional energy resources for our transport is just not a sustainable option.

To solve the climate crisis, preserve our health and conserve the natural resources, we have to make the vehicles on our roads as clean as possible. This decarbonising of transport is being driven by biofuels and also hydrogen fuel cells (for heavy transport) to some extent. However, the main push will come from increased use of electric vehicles. Shifting to EVs can save the country up to \$300 billion in oil imports and nearly 1 gigatonne of carbon dioxide emissions by 2030 (Source: FICCI report).

Alas, transport has the lowest share of renewable energy use, with a miniscule 3.7% of global transport energy being derived from renewables. Even worse, renewable electricity in the transport sector barely reached 0.35% in 2019. There are only about 16 million electric vehicles (EVs) on the world's roads, making up around 1% of the global fleet. Indian roads are also dominated by conventional vehicles. As per the Accelerated-Mobility Revolution for India's Transportation (e-amrit) portal, only 7,96,000 EVs were registered till December 2021, of which electric cars make up just a few thousand. In 2021-22, only 1.32% of the total vehicles sold in the country were electric.

The numbers may be dismal right now. But it is heartening to note that concern for the environment –

coupled with worries over the surging price of fuel – is driving an increasing interest in electric mobility. Imagine not being bothered the next time our government hikes petrol and diesel prices, and you will get the picture!

Delving Into the ABCs of Electric Vehicles

An electric vehicle runs on electric motors instead of the internal combustion engine in conventional petrol and diesel vehicles. These motors are powered by electrical energy that is stored in batteries. Road EVs cover a large range from two-wheelers, three-wheelers and cars to buses, trucks, tractors and more.

EVs can be classified into two types:

- **Battery Electric Vehicles (BEVs)** – These are purely electric, with an electric motor that uses electricity stored in batteries. This has to be plugged into a power source and will charge from the electric grid. Additionally, many of the vehicles are designed to generate electricity through regenerative braking.
- **Plug-in Hybrid Electric Vehicles (PHEVs)** – These use batteries to power an electric motor while petrol or diesel powers the internal combustion engine or other propulsion source. Therefore, they are fuelled primarily by liquid fuels and only supplemented with a battery-powered motor for better efficiency. Some PHEVs are designed to use electricity for short distances and once the battery is depleted, they switch to regular fuel. Certain hybrid variants use biofuels or hydrogen fuel cells in place of petrol/diesel/gas for the internal combustion engine.

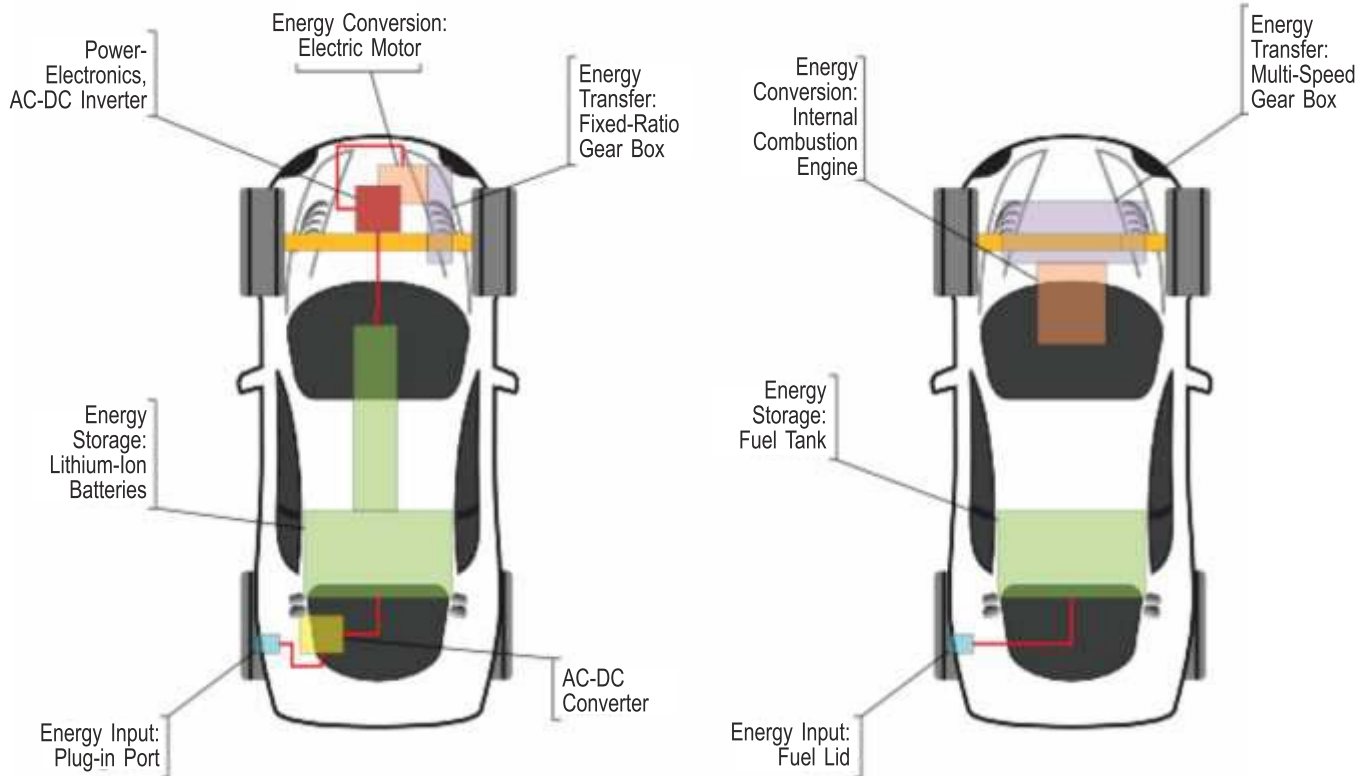
The benefits of EVs are aplenty:

Economical – The price tag of EVs is higher compared to conventional vehicles which can seem prohibitive at first. However, this is more than offset by the significantly lower operational and maintenance costs. The batteries of an EV are charged with electricity which works out much cheaper than petrol and diesel prices. As EVs don't have any moving parts or entail fluid changes, the servicing demands also remain very low. A comparison of Tata Tigor petrol and EV variants reveals that while it costs Rs. 434.75 for the former to run 100 kms, the latter costs just Rs. 96.75! (Prices ex-Delhi) It is further estimated that an EV car owner can save as much as Rs. 20,000 for every 5,000 kms travelled!

Convenient – EVs don't have gears or other complicated controls. All you need to do is accelerate, brake and steer. This makes them easy to drive. There is no need to go to a petrol pump and wait in queues as they can be comfortably charged at home itself.

Eco-Friendly – As EVs run on electricity, no toxic gases or smoke is emitted from the tailpipe; in fact, the vehicle does not even have a tailpipe! Therefore, not only will our dependence on imported crude oil come down, the

Components of Internal Combustion Engine Vehicle and Electric Vehicle



environment and our health will also benefit from the lower greenhouse gas emissions. Even though fossil fuels are used to generate conventional electricity, the carbon footprint of the same is much lower as an EV will account for almost 3 times less carbon dioxide than the average vehicle on the road. In case the household or grid uses clean renewable energy, the environmental impact will be nil.

The Power Of Silence – EVs even negate noise pollution on the roads as they lack the noise-making combustion and mechanical drivetrain engine of conventional vehicles. The electric motor functions so quietly that manufacturers often add false sounds in view of pedestrian safety!

Despite the obvious advantages of e-vehicles, consumers still prefer their petrol/diesel cars and bikes. This is due to lingering doubts fuelled by common myths like:

Elevated Price Factor: We Indians notoriously get stuck on the higher capital cost and refuse to look beyond to the potential savings across the lifetime of the product. 63% of consumers believe that an EV is beyond their budget. However, the cost of EVs is coming down with the development of advanced technology; dedicated research is bound to take it even lower. Batteries make up the costliest component right now, but with falling prices, electric-powered vehicles may very well cost on par with petrol/diesel powered ones in the near future.

Moreover, the government is heavily incentivising electric mobility with direct discounts, subsidies and interest subventions on the loan. This is supplemented by reduced GST of 5% (from 12%) with zero cess, lower registration fees and road tax. Furthermore, EV owners enjoy a discount of 7.5% on the insurance premium! They are even allowed to claim income tax deduction on the loan interest (up to Rs 1,50,000 under Section 80EEB). Scrapping incentives are also provided upon de-registering old petrol and diesel vehicles. While these interventions can vary from state to state, many of them do offer additional incentives for adopting EVs. So, should you still let the price stall your purchase decision?

Long Charging Times: Are you fearful that an EV will take too long to charge? While the precise rate of charging differs from vehicle to vehicle, EVs across vehicle segments can be fully-charged in 4 to 5 hours with slow/moderate chargers. Fast chargers (of 50kW that are available at public stations) can charge a car within an hour itself!

Death of Charging Infrastructure: The best policy is to charge an EV at home or at the workplace. While public charging stations (PCS) are few and far between right now, the government is strongly pushing deployment of EV charging stations with various attractive schemes and incentives. There will definitely be many more PCS - making it convenient to charge EVs on the road - in the future.

Many oil marketing companies are also setting up EV charging stations at their oil retail outlets/fuel pumps. For added convenience, Network Service Providers are developing mobile apps that will provide information about nearest PCS locations, expected waiting time and cost of charging.

Low Drive Range: Do you believe that the battery will run out quickly and require frequent charging? Well, EVs now come with high-density batteries that enhance the storage capacity. The average range of electric 2-wheelers is 84 kms per charge while cars can manage 150-200 kms per charge. Upcoming models boast of even higher battery capacity and range.

Lack of Safety: Questions have been raised on the inherent safety of EVs with risks of fire and explosion in the batteries. However, manufacturers have instituted efficient and intelligent Battery Management Systems (BMS) which perform cooling, heating, insulation and ventilation of batteries, etc. All EV batteries are subject to rigorous testing procedures at National Accreditation Board for Testing and Calibration Laboratories (NABL) certified labs.

The electric-powered vehicles and chargers undergo meticulous safety checks in-house for overcharge, short circuit and vibration which is further reinforced by rigorous testing by certification agencies, Automotive Research Association of India (ARAI) and International Centre for Automotive Technology (ICAT).

Low Speed: Naysayers argue that EVs are low on speed. In reality, while the top speed of EVs varies from model to model (100 to 140 km/hr), they do offer better starting torque and acceleration.

Looking to Buy

Electric-powered cars are being offered by Tata Motors, Mahindra, Hyundai, MG Motors, Kia and Volvo with limited number of model options. The luxury segment is catered to by Audi, Mercedes Benz, BMW, Porsche, Jaguar, Mini Cooper, etc. Many other automobile brands are gearing up to launch their EVs soon. The hybrid segment comprises of Maruti, Toyota, Honda, etc. When it comes to two-wheelers, the options range from Hero, Bajaj, TVS and Ola to Ather, Okinawa, Revolt and more.

When purchasing an EV, consumers are advised to take the driving range and charging time of batteries into consideration. The manufacturer will provide the charging section which has to be installed at the owner's premises.

Government Efforts to Spark EV Adoption

India has committed to the EV30@30 initiative which translates into achieving 30% sales share for EVs by 2030, with a penetration of 30% for private cars, 70% for commercial vehicles, 40% for buses and 80% for two and three-wheelers.

While EVs sales increased by 133% between 2015 and 2020 as compared to conventional vehicles, the real numbers are quite insignificant. However, favourable policies and programmes by the government are accelerating the adoption of EVs across the country. Minister for Road Transport and Highways, Nitin Gadkari mentioned in the Parliament that between 2019-2020 and 2020-2021, the two-wheeler EVs rose by 422%, three-wheelers by 75%, four-wheelers by 230% and electric buses by over 1,200%. Indeed, we are seeing more and more vehicles with the iconic green number plates while electric buses zip by us ever so silently!

The lack of proper support infrastructure is proving to be a major hurdle here. While we have more than 65,000 petrol bunks, there are just about 1,800 public EV charging stations as of last count. Contrast this with international policy that mandates 1 public charger per 10 EVs!

The government has unleashed a slew of initiatives to convert more consumers into EV owners. It is working on building a substantial, affordable and accessible infrastructure coupled with a strong financing ecosystem, policy incentives and technological advancements that will serve all consumer groups. Two phases of FAME (Faster Adoption and Manufacturing of Electric and Hybrid Vehicles) have been implemented with successful results. There is also a plan for setting up 22,000 EV charging

stations by Oil Marketing Companies across the country. In the 2022 budget, a battery swapping policy was announced as an easier way to charge EVs.

Conclusion

We need to get smart with our transport and transition towards e-mobility. Remember the early days of the COVID-19 lockdown when the lack of emissions from fossil fuel-run motors and industries gifted us crystal clear skies and greener landscapes all around. The water in the Ganga was clean once again and we could even spot the Himalayas from hundreds of kilometres away!

Switching to smart transport can make clean and green India a permanent reality in the future! ▶



The EV30@30 campaign redefines the ambition of the CEM's Electric Vehicles Initiative (EVI), setting the objective to reach a 30% sales share for EVs by 2030.



Payal Agarwal
Editorial Consultant

Green Hydrogen – Fuel of the Future!

“We cannot compel the sun to shine all the time or summon winds whenever we want. In contrast, hydrogen is one of the most abundant chemical elements that can be used to derive clean energy! Producing it in a sustainable and environment-friendly manner – read green hydrogen – can help clean up the planet even as it drives the world to net-zero emissions!”

– says Payal Agarwal



Green hydrogen can decarbonise various sectors like industry, mobility and energy storage

HYDROGEN TOO PRODUCES

energy when burnt like other fuels. It is used primarily in the chemicals and refining industries for producing ammonia, oil refining and methanol production. It also finds some usage in the metals, electronics, food and medical industries.

The problem here is that most of this is 'grey' hydrogen which is produced using fossil fuels, thus emitting more of the lethal greenhouse gases into the atmosphere. 'Blue' hydrogen is made using natural gas, but as the carbon dioxide emissions are captured, it is considered cleaner than its grey counterpart.

More than 6 million tonnes of hydrogen is consumed in India every year. Reports by NITI Aayog and The Energy and Resources Institute (TERI) predict a five-fold increase in demand with India's hydrogen usage scaling 28 million tonnes by 2050. The quantum of toxic fallout is simply inconceivable!

Given the huge potential (as well as latent risks) of hydrogen, scientists

have been rethinking the way hydrogen can be produced and used. They started working on using electricity to split water by electrolysis to produce hydrogen and oxygen gases. The by-product when this hydrogen combusts (by combining with oxygen) is not carbon dioxide, but water in the form of vapour which then gets cycled back into the environment! Therefore, it is much cleaner. And when the electricity used for the electrolysis comes from a renewable source (like wind or solar), it becomes completely carbon-free and is considered as 'green' hydrogen.

“Hydrogen is basically a colourless gas; the colours - green, blue, turquoise and grey - indicate how it is produced. Green hydrogen is the only clean type that uses renewable energy.”
 - Ashish Guhan Bhaskar, an energy engineer affiliated with the Council on Energy, Environment and Water (CEEW).

The process goes as such - clean hydrogen is compressed and stored in specific tanks. When required, the gas is channelled into a fuel cell – similar to batteries - where it mixes with oxygen derived from the air to produce nothing but energy and water! To add to this, the efficiency is also much higher than petrol or diesel.

Moreover, hydrogen can not only be used to produce energy, but also to store it. This is emerging as the most viable solution for storing renewable energy for later use.

Putting Green Hydrogen to Use

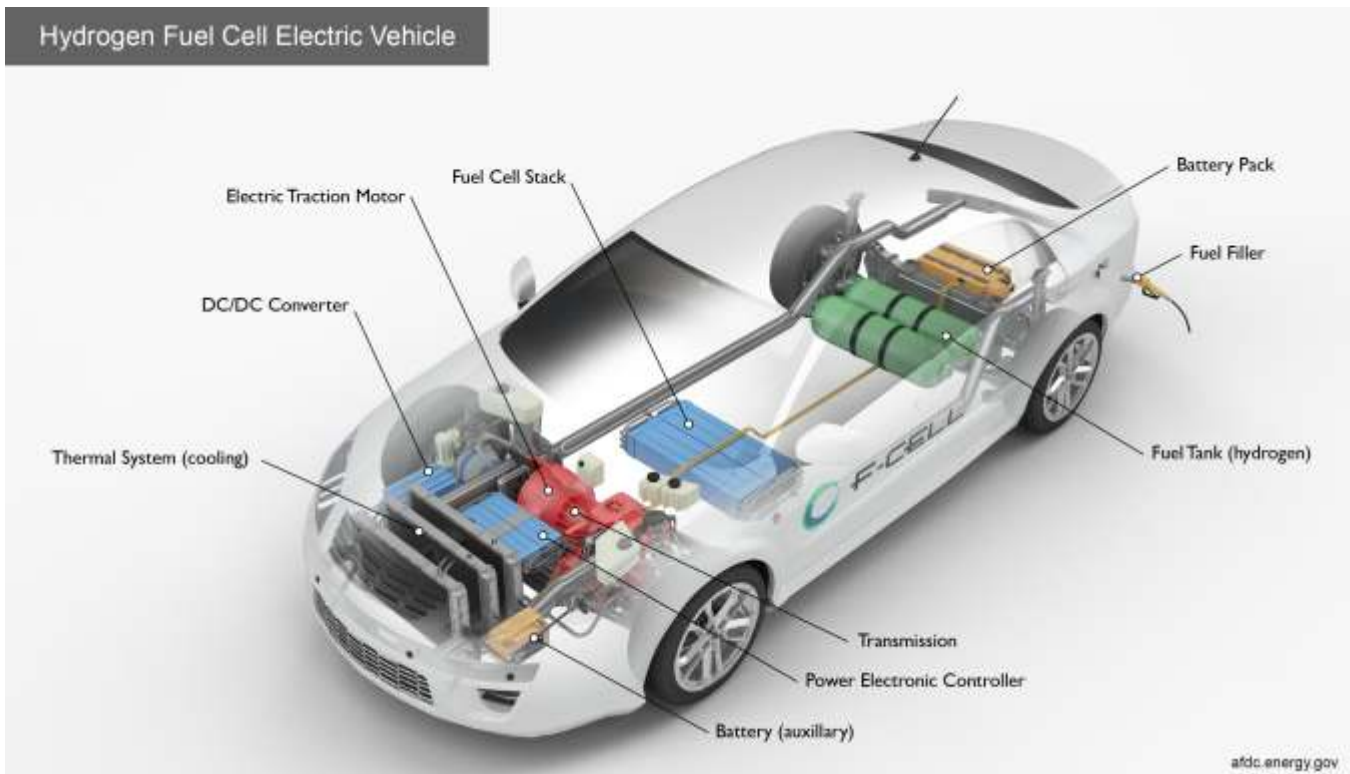
As hydrogen is a key input in fertilisers and refineries, replacing it with green hydrogen can cause a drastic cut in emissions. In fact, green hydrogen is being touted as the key to producing green ammonia! It can also be used in steel manufacturing – both as an energy source in place of coal and as a reducing agent.

DIFFERENT TYPES OF HYDROGEN

	Grey	Blue	Turquoise	Green
Process of Production	Steam Methane Reforming (SMR) or gasification, in which methane reacts with steam at high pressure to produce hydrogen. It also produces carbon monoxide and carbon dioxide	The same SMR or gasification process is used, but the carbon dioxide released is stored in the ground using carbon capture and storage technology	A process called pyrolysis uses steam to break methane down into hydrogen, oxygen and solid carbon. This is done after methane is passed through molten metal which prevents oxygen reacting with carbon to form carbon dioxide	Electrolysis to split water into hydrogen and oxygen
Energy Source	Coal	Coal	Renewable electricity	Renewable electricity
Emissions	Substantial CO2 emissions	Lower GHG emissions than grey hydrogen	Leaves residual carbon in solid form and not CO2	Zero GHG emissions

Source: Council on Energy, Environment and Water

Although hydrogen is massively present in the universe, it does not exist in its natural state. It is produced in different ways as illustrated above.



In addition to this, green hydrogen can help decarbonise the transportation sector right from shipping and aviation to trains, trucks, buses and cars by replacing petrol, diesel and other fuels. It is finding new uses like storing renewable energy, making it amenable for backup power and portable power. Moreover, hydrogen can be used in fuel cells to even generate heat and electricity. This electricity can power everything from electronic devices to electric vehicles. The best part is that the hydrogen fuel cells won't need to be recharged and won't run down either.

"Hydrogen is a good option for things you can't electrify, can't readily place," points out Julio Friedmann, senior research scholar at the Center on Global Energy Policy at Columbia University. Other energy experts suggest that solar and wind energy are not considered amenable for heavy manufacturing and long-distance transport (cargo ships and aircrafts), paving the way for hydrogen to emerge as the best option.

Global hydrogen consumption makes up less than 2% of global energy. But this consumption can reach 25% by 2050 (Hydrogen Council). Hydrogen heating is expected to power most homes in the United Kingdom by 2050.

However, we cannot discount the fact that hydrogen is highly explosive. It has to be carefully stored and transported under pressure to ensure safety on all fronts.

Shot in the Arm for Mobility?

Fuel cell electric vehicles (FCEVs) can revolutionise the transport sector and render it a truly carbon-neutral footprint one. They are considered similar to electric vehicles as they run on an electric motor. However, here a fuel cell battery pack powered by hydrogen produces the electricity to power the motor. Electricity produced by the fuel cell is also stored in an onboard battery which is used when there is more demand for power – like short acceleration events. The only emission from the tailpipe will be water steam!

The hydrogen fuel is stored in a pressurised tank which is designed to be strong enough to withstand impact. Therefore, FCEVs are safe without any chance of hazards even in case of a crash.

The vehicle will deliver excellent performance with full torque available at low speeds. It runs noiselessly, thus making the experience similar to an electric vehicle.

To add to this, the FCEVs can easily run for 500 to 800 kms on a full tank of hydrogen. The pressurised tank can be refuelled just like petrol and diesel in about five minutes itself. It is considered most suitable for long-distance heavy vehicle transport. However, FCEVs are currently very low in number with availability of hydrogen as a fuel being the primary challenge.

Toyota Mirai and Hyundai Nexo are the only two models of hydrogen-fuelled cars publicly available in select parts of the world. Toyota launched a pilot project in March this year to test the Mirai FCEV in India. Hyundai is also likely to introduce its Nexo variant on Indian roads in the near future.

Comparison of Hydrogen and Electric Cars

Parameter	Hydrogen fuel cell cars	Electric cars
Propulsion system	Electric motor	Electric motor
Power source	Fuel cell	External electrical point
Energy storage	Hydrogen fuel tank	Battery pack
Driving range	Higher than electric cars	Lower than electric cars
Availability of refuelling stations	Low, due to lack of hydrogen refuelling stations.	High, due to the easy availability of charging stations across the country.
Price	Expensive	Affordable than fuel cell cars
Emissions	Zero carbon emissions	Zero carbon emissions
Running cost	Higher than electric cars	Low

(Source: Ackodrive)

Union Transport Minister Nitin Gadkari driving into Parliament in the Toyota Mirai!



While the world is buzzing over green hydrogen being the most environment-friendly fuel, the cost factor is putting a spanner in the works. Indeed, the high production costs are severely limiting the use of this type of hydrogen.

Presently, less than 1% of hydrogen produced is green hydrogen. According to the International Renewable Energy Agency (IRENA), hydrogen will make up 12% of the energy mix by 2050.

Going by TERI reports, the current cost of producing green hydrogen is \$5-\$6 per kg, making it simply unfeasible for steel, fertiliser and long-range shipping industries to shift to this fuel. Another report by CEEW in 2021 estimated that steel made using green hydrogen costs 50-127% more than that made using conventional coal.

Green hydrogen prices should come down to at least \$2 per kg to make it practicable. New technologies

Major European companies are working to switch their truck fleets to hydrogen power. Hydrogen-powered ships, aircrafts and even space rockets are already under production.

Power, New and Renewable Energy Minister, R K Singh directed NTPC to start operating hydrogen-powered buses on the Delhi to Jaipur route.

On 15th August, 2021, Prime Minister Narendra Modi reiterated his commitment to 'green hydrogen' by announcing the National Hydrogen Energy Mission. He stated that India will turn out to be the world's biggest green hydrogen hubby exporting this clean fuel!



are being developed with the aim to reduce the cost of producing green hydrogen. Reliance Chairman, Mukesh Ambani has proposed that India should aim to bring down prices to \$1 per kg. The holdup is that only a handful of Indian companies manufacture the electrolyzers that are used to generate green hydrogen. We have to ramp up the production of electrolyzers before we can hope for a reduction in prices.

How Green Hydrogen is Rolling Out in the Indian Arena

Many top Indian companies like Reliance Industries and Indian Oil Corporation have announced plans of

going green and are establishing green hydrogen plants. Other entities like Larsen and Toubro, Solar Energy Corporation of India Limited, Adani Group, ACME and GAIL are also moving towards the green hydrogen sector. The India Hydrogen Alliance – a coalition of Reliance Industries, JSW Steel and experts from think tanks are charting out India's green hydrogen roadmap.

In February 2022, the Ministry of Power notified the country's first Green Hydrogen Policy to regulate and facilitate the transition from fossil fuels to green hydrogen. It lays down a slew of incentives and facilitation measures for stakeholders in the green hydrogen space with a target of 5 million tonnes per annum of

green hydrogen production by 2030.

The primary features of the policy are establishment of manufacturing zones for production with incentives like open access to renewable resources, connectivity to the interstate transmission system and free transmission for 25 years, with few underlined exceptions. There will also be attractive rebates on charges payable by open-access consumers. Further, a single-window portal will be set up for expediting approvals related to manufacturing, transportation, storage and distribution.

This was followed by the recently notified Green Energy Open Access Rules that expand the definition of 'green energy' to include the use of renewable energy used to produce green hydrogen and green ammonia. Work is ongoing for extending the application of the Production Linked Incentive (PLI) scheme to encourage the indigenisation of electrolyzers.

Indeed, green hydrogen is receiving ample incubatory support and is poised to become the fuel of the future!

Conclusion

The time is ripe to tap into the immense potential of green hydrogen for becoming a frontrunner in carving a clean, secure and affordable energy future. It can help India and the world at large in the energy transition to achieve the climate goals! ▶

Current Cost of Green Hydrogen	\$3-10/ kg (₹ 221–737/kg)
Projected Cost of Green Hydrogen in 2030	\$2/kg (₹ 147/kg)
Current Cost of Grey Hydrogen	\$1.76/kg (₹ 129/kg)
Current Cost of Steel Produced Using Fossil Fuels	~\$375-450/Tonne of Crude Steel (₹ 24,126–33,202/TCS)
Current Estimated Cost of Green Steel	\$612-929/tonne of crude steel (₹ 45,154-68,514/TCS)
Estimated Cost of Green Steel in 2040-2050	\$366 (₹ 26,992)/tonne of crude steel

(Source: IndiaSpend)

Mr. Rajesh Maheshwari, Ms. Varsha Misra, Mr. Sreeram Pinnamaraju and Ms. Chinmayi Salooja of NABCB (National Accreditation Board for Certification Bodies) elaborate on how

ACCREDITATION ENRICHES THE QUALITY LANDSCAPE OF RENEWABLE ENERGY

PHYSICS LAW STATES, energy can neither be created nor destroyed, it can only be converted from one form of energy to another. However, the traditional technologies of generating energy largely depend on exhaustible commodities. On the other hand, renewable energy is derived from natural processes such as sunlight, wind, rain, tides, waves, biomass and thermal energy stored in the earth's crust that are replenished constantly, thereby making it virtually inexhaustible.

As we look forward to achieving the Sustainable Development Goals (SDGs), energy sources from renewable energy play a critical role in our survivability. Many nations around the world already have renewable energy contributing to more than 20% of their total energy supply, with some generating over half their electricity from renewables. National renewable energy markets are projected to continue to grow strongly in the 2020s and beyond. Studies have shown that a global transition to 100% renewable energy across all sectors – power, heat, transport and desalination – is feasible and economically viable. Renewable energy resources exist

over wide geographical areas, in contrast to fossil fuels, which are concentrated in a limited number of countries.

Deployment of renewable energy and energy efficiency technologies is resulting in significant energy security, climate change mitigation and economic benefits. However, renewables are being hindered by hundreds of billions of dollars of fossil fuel subsidies. In international public opinion surveys, there is strong support for renewables such as solar power and wind power. But the International Energy Agency said in 2021 that to reach net zero carbon emissions, more effort is needed to increase renewables and called for generation to increase by about 12% a year to 2030.

The Indian renewable energy sector is the fourth most attractive renewable energy market in the world. India was ranked fourth in wind power, fifth in solar power and fourth in renewable power installed capacity, as of 2020. India is working towards achieving 500 GW of installed electricity capacity from non-fossil sources by 2030.

Role of Accreditation

In view of the set target and increased demand, standardising, testing, inspection and certification (which form the conformity assessment activities) become essential for successful growth of renewable energy in the country. Further, in order to ensure the quality of imported equipment, components and subsystems, it is necessary to establish a quality infrastructure. For the global reach of renewable energy-based products and services, adherence to international standards and accreditation is the way forward.

To enable consumers to adjudge the quality of the components imported/exported and services provided, accredited Conformity Assessment Bodies (CABs) provide third party conformity assessment services, thereby benefitting the consumers. Accreditation builds trust in the services of CABs, which provide conformity assessment of products and services based on international and recognised national standards. CABs carry out specific activities and accreditation of CABs to ensure their competence and impartiality.

Accreditation provides market differentiation and objective proof that an organisation complies with best practices. It is the internationally-recognised system that is used to develop and sustain high standards of performance.

Accreditation is granted by independent authoritative bodies to CABs. As a result of accreditation, governments, private sector and consumers can have confidence in the calibration and test results, inspection reports, and certifications provided.

Accrediting the Accreditors

National Accreditation Board for Certification Bodies (NABCB) and National Accreditation Board for Testing and Calibration Laboratories (NABL), Constituent boards of Quality Council of India (QCI) are accreditation bodies in India for certification, inspection, validation and verification, testing and calibration. NABCB and NABL have been instrumental in pushing for improvement in the quality landscape of Renewable Energy in India.

NABCB has been at the forefront for setting up the benchmarks and enhancing quality in various sectors including solar, wind and renewable energy through its various accreditation schemes. NABCB-accredited Certification Bodies and Inspection Bodies help support the renewable energy market to work efficiently by giving high returns and also to reach the products to masses.

ISO 50001 is an energy management system standard that provides organisations with a systematic approach to achieving continual improvement in energy performance. NABCB accredits certification bodies as per ISO/IEC 17021 for ISO 50001 Energy Management system. This ensures that the organisation implementing this standard has reduced energy use, resulting in a reduction in energy costs and also their carbon footprint.

As the renewable energy technologies advance, their continued safety, reliability and performance must be assured. Stakeholders are looking to verify the safety, reliability and performance of renewable technologies, such as wind turbines, solar modules and peripheral equipment, etc.

Inspection Bodies accredited by NABCB provide conformity assessment services to various products critical to the renewable energy sector. NABCB-accredited Inspection Bodies demonstrate that components supplied for renewable energy systems like wind turbines (alternator) or solar (solar cells,



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Rely on National Accreditation for Impartial, Credible Certifications & Inspections

NABCB is a constituent Board of Quality Council of India (QCI), an apex body for quality promotion & accreditation services in India, under the Ministry of Commerce & Industry, Govt. of India. NABCB provides accreditation as per International standards ISO/IEC 17020 for Inspection Bodies, ISO/IEC 17021-1 for Management Systems Certification Bodies, ISO/IEC 17065 for Product Certification Bodies, ISO/IEC 17024 for Personnel Certification Bodies and ISO/IEC 17029 for Validation & Verification Bodies. NABCB has International Recognition and is signatory to the Multilateral Recognition Agreements / Arrangements (MLAs / MRAs) for IAF, ILAC and APAC.

NABCB Accreditation Benefits:

- Government Authorities & Regulators
- Business & Industry-both Manufacturing & Services
- Conformity Assessment Bodies
- Trade – both Domestic & Exports
- Consumers

Accreditation assures technical competence, reliability & integrity of accredited bodies

Accreditation ensures compliance to Standards & Regulations and facilitates trade

For more details on NABCB accreditation, please visit NABCB website

Join us for Monthly Webinar on NABCB Accreditation

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International Accreditation Forum
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www.ilac.org

Inspected or Certified Once, Accepted Everywhere



National Accreditation Board For Certification Bodies
Quality Council of India

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inverters, panels) are as per the applicable technical specifications.

Utilising the services of NABCB-accredited Inspection Bodies means that the bodies carrying out inspections have themselves been assessed against internationally-agreed standards for competence, impartiality and performance capability. NABCB-accredited Inspection Bodies are inspecting items like. PV modules, solar panels, batteries and electric power generation, transmission and distribution system of renewable (solar and wind) plants and transmission line.

To foster the exponential growth of the wind energy sector in the country and to ensure the safety, reliability and performance of these wind turbines and its components, the Ministry of New & Renewable Energy (MNRE), Government of India facilitated in the development of the Indian Wind Turbine Certification Scheme. The scheme aims to certify that the prototypes of wind turbines which are being manufactured in India conform to required technical specifications. This type certification of turbines can be executed only by NABCB-accredited Product Certification Bodies as per ISO/IEC 17065. NABCB has so far accredited one body as per ISO 17065 - i.e. Nation Institute of Wind Energy (NIWE) - for Type Certification of wind turbines and its components.

Testing Laboratories accredited by NABL provide conformity assessment services to various products critical to the renewable energy sector. Test results generated from accredited laboratories ensure that the various products associated with renewable



Studies have shown that a global transition to 100% renewable energy across all sectors – power, heat, transport and desalination – is feasible and economically viable.

energy - such as wind turbine (alternator, pulleys, etc), solar (solar cells, inverters, cables) - meet the defined requirements, thereby ensuring compliance. Compliance to the specified requirements ensure safety, efficiency and durability.

Calibration Laboratories accredited by NABL ensure metrological traceability of the measurement results. Metrological traceability ensures that the results generated by test laboratories are accurate and thereby provides trust in the results.

Ministry of New & Renewable Energy (MNRE), Government of India in their Lab Policy for Testing, Standardisation and Certification for the Renewable Energy Sector has mandated Quality Control Orders

(QCOs) for specific items wherein the testing laboratories which ensure compliance of the QCOs are to ensure their laboratory systems are in line with the requirements of ISO/IEC 17025.

Conclusion

Renewable energy production is a fast moving and innovative industry. By underpinning testing, inspection and certification services, accreditation gives assurance to potential users and increases market, consumer and regulatory confidence in renewable energy schemes, systems and policies. In turn, this will lead to increased adoption of renewable energy products and systems, helping government to reach net zero targets. ▶

Please Note: NABCB & NABL operate in accordance with ISO/IEC 17011 and are full members and signatory to Asia Pacific Accreditation Cooperation (APAC) and International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangements (MRAs), International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA). This ensures acceptance of accredited Conformity Assessment Bodies results in other member economies.



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PRASANNA SINGH

a media professional and Group Editor of Saur Energy International, talks about how India's October 2021 power crisis - when we had barely 3 days of coal supplies left - has blown away many myths!

Saur Energy International is the highest read solar energy magazine in India and enjoys the maximum readership than any other solar or power related media.

6 Myths Blown Away By India's Power Crisis

Myth 1: Renewables Are Too Expensive

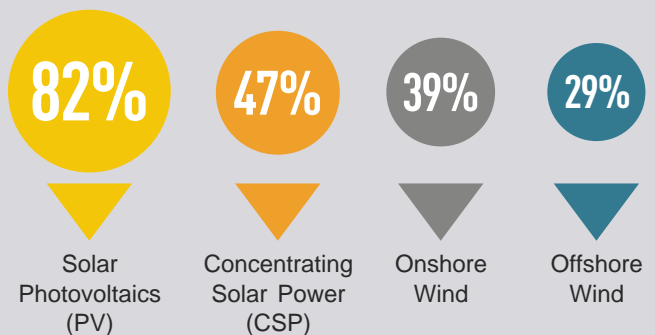
Detractors of the renewable sector, especially solar and wind energy, never tire of pointing to the high cost of renewable energy. When that issue was settled with dropping costs by 2018, they have taken to pointing out the 'subsidies' the sector continues to enjoy by way of access to the transmission network and exemption from other charges.

Well, guess what? Today new renewable energy generation, if charged for those fees and charges, would still be competitive with similarly placed new coal and gas fired stations. Or hydro for that matter. One after another, renewable energy proponents have overcome challenges, be it on cost, on efficiency, on maintenance, or on speed of capacity building.

Today, the need of the hour is actually a more liberal open access system across the country, to enable more industrial consumers to opt for renewable energy, and reduce demand stress on the grid from a consumer market that is consuming more and more power as incomes rise.

While a small part of total renewable energy capacity does throw up rates as high as Rs 8 to Rs 12 per unit, these will only be projects installed before 2016. Projects commissioned since then have moved to a far lower and

Renewable Energy Costs Declined Rapidly Over the Last 10 years (2010-2019); Source: IRENA



competitive pricing structure, be it the outliers at Rs 7-8, or the overwhelming majority below Rs 3.

Considering the fact that over 80% and rising of India's renewable capacity by 2022 would have been capacity established since 2016, it's time to drop the cost argument. Soon, some of the oldest projects will reach the end of their lives, and you can be sure that renewals or repowering (in case of wind), will be at far more lower and competitive rates.

Myth 2: Storage is not an immediate need in India

From starting 2021 with arguments around unfair curtailment of renewable power generation, to a final quarter where people are complaining about how little renewable generators still contribute. How quickly things change! Curtailment, or where state discoms would tell power generators to shut off some generation as they don't need the power, is far from everyone's mind right now. But believe it, the issue will always be around, when the situation improves. And that makes the case for energy storage in India, large energy storage.

The high solar capacity that India is targeting actually means that the country's power sector will have to be much more flexible than it is presently, to absorb the burst of solar power in daylight hours. Or the wind energy in evening hours, when demand peaks. What that means is that as early as 2023, we may have to consider every large solar project with a storage component, to store any excess energy for later in the day.

Myth 3: Coal is on its way out

For too long in India, coal has been equated to Coal India Limited, the public sector monopoly with an unhappy tendency to miss targets and struggle to deliver. Production was 596 million tonnes in 2020-21, as compared to 601 million tonnes in 2019-20. Which itself was a drop from 607 million tonnes in 2018-19. From a target of 1 billion tonnes by 2019-20, CIL, which had deferred the target date to 2023-24, seems unlikely to get to a billion tonnes even then.

But the crisis does show that like another critical source nuclear, simplistic assumptions on coal use in India that follow western media postulates are way off. Coal, as the government has repeatedly stressed, is a critical part of the country's energy mix to 2045 and beyond for now.

It will take a pretty special breakthrough, in energy generation, or even more unlikely, energy efficiency, for coal to be pushed off the table in the next two decades.

Myth 4: Gas Will Play The Role Of A Bridge Fuel

One of the biggest points of contention between international activists, when it comes to Indian strategy to manage the transition from coal to renewable energy has been the use of gas as a bridge fuel. There is no doubt that while less polluting than oil or coal or the other polluting options it replaces, gas offers respite for the country. Despite being well on its way to being 'criminalised' as a fossil fuel on par with coal today, possibly as soon as 2030.

The fact that there is possibly no better alternative available for now, considering the expected rise in demand for energy in India. Faster electrification, of the type being attempted in the US and Europe, where some

areas have even banned new builds from having gas supplies, is simply not possible. India's per capita energy consumption as compared to the rest of the world also supports its views, for now.

But here's the problem. Where the country has 90-95% self-sufficiency in coal supplies, in gas supplies, our dependence on imported gas is going up all the time. Currently at over 45% (with a high share of long term supply contracts), that is one reason the huge spike in global gas prices has been contained for now to just 10-12% increases in domestic markets.

Electrification of the kind being attempted in the US and Europe is simply unviable for the huge demands it will place on the power sector, well before cleaner options start to reach a market share that will stabilise supplies. The 15% target for gas by 2030 thus, looks safe for now, but not for much beyond that time, especially if the proven impact of climate change escalates to a point where the pressure to change is irresistible. What will hasten the shift will be higher gas prices and a more efficient, renewables powered economy. Stable, or lower gas prices will make this one of the most contentious points of argument between the developed and developing countries by 2030.

Myth 5: Ignore Nuclear

One of the most ludicrous sights of the past couple of years has been the one where large economies have claimed a low existing carbon emission level to justify their slower push into renewables. Or worse, lecture poorer countries like India to do more. It is incredible how in the noise around solar, wind and sometimes hydro, the nuclear option is quietly ignored. Supplying over 70% of electricity in France, close to 20% in the US, almost 12% in Germany, and even in China, close to 5%, India can ignore the nuclear option at its own peril.

Keep in mind that in all cases, share of nuclear power in generating capacity is much lower, nuclear simply works at higher efficiency.

Myth 6: Electric Vehicles Will Solve The Pollution Issue

The most obvious of them all. With close to 75% share of power coring from fossil fuels, EV's will have only limited impact unless we take a more determined approach to the challenge they seek to address. A key attraction for India is a cut down on our huge crude oil bill.

For EV's to truly make a mark, there needs to be a concerted effort to fix, not just the charging problem, as the government seems to be doing but to do it using renewable energy as far as possible.

Seen together, these 6 myths actually make a case for a stronger push for renewables!

You can read the full article at:

<https://www.saurenergy.com/solar-energy-news/6-myths-blown-away-by-indias-power-crisis> ▶

Are You On A 'GREEN' Job?

The drive towards renewable energy has a positive fallout of job creation. Indeed, green energy employment opportunities are booming in solar and wind power. There is huge potential in the upcoming geothermal energy, biofuels and other related sectors too. And with the world seeking to transition to a 100% renewable energy system, the scope is simply immense!

A worker installing rooftop solar panels on a building



WHILE MOST OF today's energy is derived from non-renewable fossil fuels, it is evident that mankind cannot rely on this for much longer. Renewable energy is marking its presence in the share of total energy consumption as it is increasingly being adapted for a sustainable future.

The good news is that as renewables increase, their social and economic sides are also coming to the fore. The dynamics of job creation are a healthy benefit of this sustainable scenario. Indeed, even as governments across the world focus on climate resilience, energy independence and economic development, employment generation is on a steady rise across the renewable energy sector.

And with renewables defining the future, the arena will be marked by sustainability in the job prospects too. Truly, there is a lot of scope for both stable and high-wage employment here. From a personal standpoint, imagine being able to contribute to saving the planet and gaining job security in the bargain!

Global Job Scenario

According to IRENA's 'Renewable Energy and Jobs: Annual Review 2021' report, renewable energy employment worldwide reached 12 million in 2020, both directly and indirectly (up from 11.5 million in 2019). It is obvious that, in general, this sector withstood the effects of the COVID-19 pandemic. Solar and wind jobs continued leading global employment growth in the green energy sector, accounting for a total of 4 million and 1.25 million jobs respectively. (see Figure 1)

The majority of the renewable energy jobs are available in China, India, Japan, Brazil, U.S.A. and Germany. In

"The potential for renewable energies to generate decent work is a clear indication that we do not have to choose between environmental sustainability on the one hand, and employment creation on the other. The two can go hand-in-hand." - *Guy Ryder, ILO Director-General*

fact, 62% of all renewable energy jobs are based in Asia with India ranking third in the share of renewable energy jobs worldwide in 2020.

The report was compiled by the International Renewable Energy Agency (IRENA) in collaboration with the International Labour Organization (ILO). IRENA Director-General, Francesco la Camera remarked, "Renewable energy's ability to create jobs and meet climate goals is beyond doubt!"

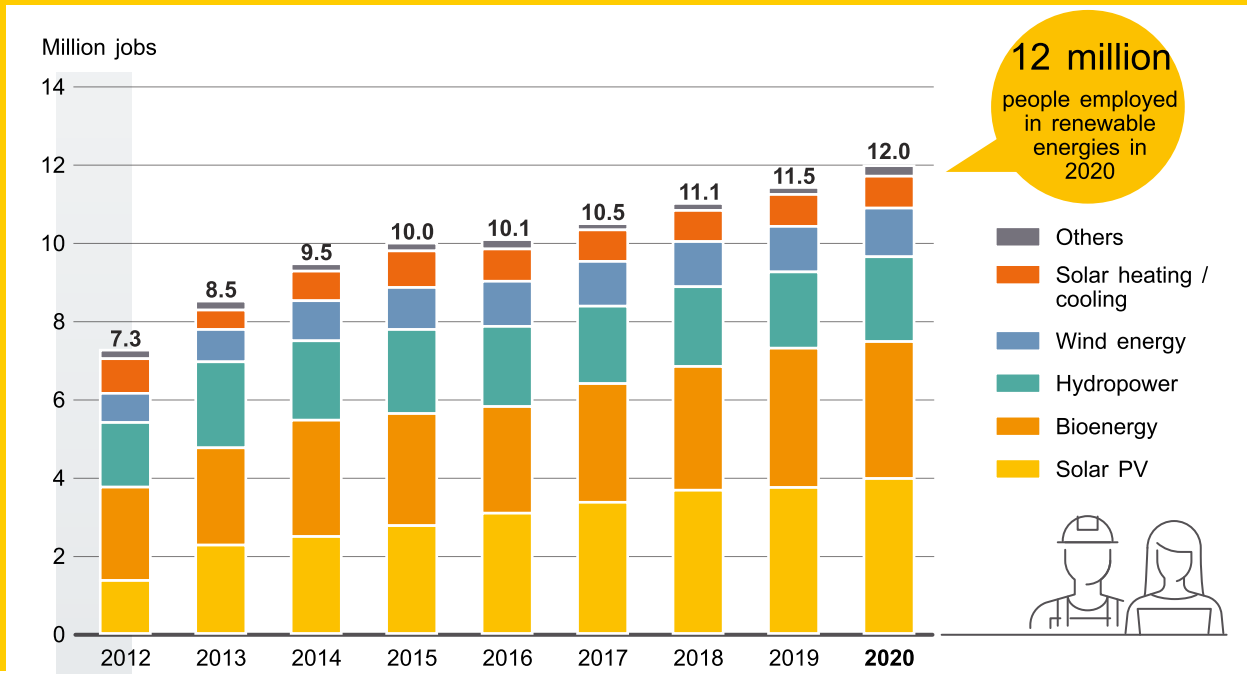
Another ILO Global Sustainability Scenario to 2030 estimates that the number of people employed in the renewable energy sector across the globe could rise to 24 million by 2030 while global investment will reach USD \$1.5 trillion per year. IRENA's World Energy Transition Outlook forecasts that renewables will add about \$20 trillion to the global economy and will employ about 43 million by 2050.

The International Energy Agency (IEA) further predicts that by 2030 more than half of those working in the energy sector will be employed in renewables. Contrast this with the fact that the global power sector employed approximately 20 million people in 2015, of which more than 70% were in the fossil fuel sector. However, jobs in fossil fuel industries (especially coal mining) are dwindling now due to both mechanisation and market forces. Employment in the oil sector has always been unreliable



FIGURE 1.

Global Renewable Energy Employment, by Technology, 2012-2020



and difficult to predict. Other estimates state that renewables are generating three times more jobs than fossil fuels!

India-Centric Outlook

According to a 2022 report on 'India's Expanding Clean Energy Workforce: Opportunities in The Solar and Wind Energy Sectors' conducted by the Council on Energy, Environment and Water (CEEW), Natural Resources Defence Council (NRDC) and the Skills Council for Green Jobs (SCGJ), the wind and solar energy sectors employed a workforce of 1,11,400 as of 2021. With a whopping 77% share (85,900), the solar sector (utility-scale and rooftop solar) continued to employ the majority of this workforce while the wind sector accounted for 23% (25,500). (see Figure 2)

FIGURE 2. Cumulative workforce employed by wind and solar energy sectors as of 2021

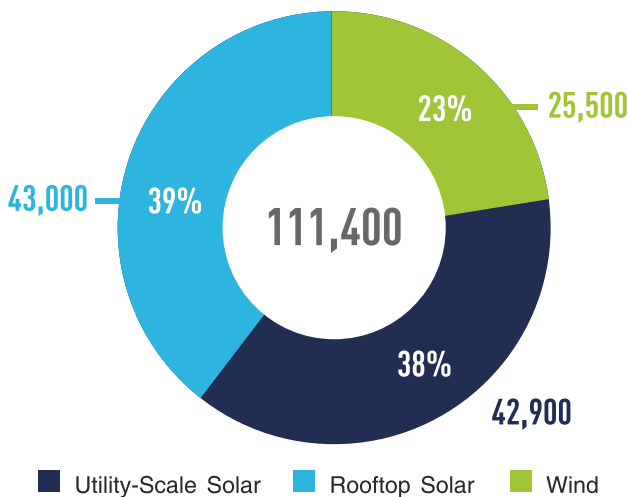
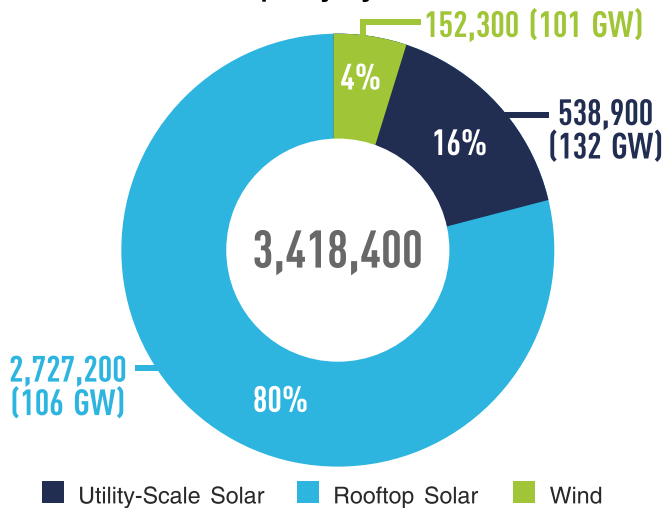


FIGURE 3. Sector-wise jobs creation potential by achieving 101 GW wind and 238 GW solar targets of non-fossil fuel capacity by 2030



The study further predicts that India can potentially create about 3.4 million new clean energy jobs (short and long term) by installing 238 GW solar and 101 GW new wind capacity to achieve the goal of 500 GW non-fossil electricity generation capacity by 2030. (see Figure 3) This will employ 1 million people, a number ten times than the existing workforce! A large chunk of these jobs will likely be generated through distributed renewable energy that creates local employment opportunities and will improve the livelihood of the workers.

Job Opportunities

The future looks bright as expanding clean energy has huge employment and economic potential. This will be further spurred by our clean energy goals. The declining costs work in our favour as they translate into more installations, and thus, more jobs. In contrast, job scope in the global coal industry will reduce to nearly zero by 2050!

Solar-panel installers and wind-turbine technicians are the fastest-growing green energy jobs right now. Renewable energy companies will always need civil engineers, operating engineers, construction managers, structural workers along with other technicians and operators. Other lucrative roles that are expected to be in demand are urban and regional planners, system software developers, financial analysts and more. The role of environmental, atmospheric and space scientists, geoscientists and other specialists remains ubiquitous here.

While some people are already suited for these jobs in the renewable energy sector, others may require reskilling and upskilling to make them employable. The government is focusing on building the necessary workforce for the future with initiatives for both improving educational opportunities for developing clean energy skills and re-skilling existing workers. Various job training and skilling programs have been initiated that trained more than 100,000 people in this segment between 2015 and 2021. 78,000 trainees were certified under the national-level solar energy *Suryamitra* training program.

"To meet the growing demands of India's renewable energy sector, we will now focus on improving technical competency of skill development centers, deepening penetration of training institutes in smaller cities and rural areas, increasing collaborations with industry, constantly upgrading training programs, and creating a larger pool of skilled trainers." - Dr. Praveen Saxena, CEO, Skill Council for Green Jobs, a public-private partnership that has provided trainings, through partners, for around 500,000 persons in areas such as renewables, electric vehicles and carbon sinks.

Conclusion

Renewable energy is the proverbial dark horse when it comes to emerging job potential and a buzzing career in the future. Can we discount the fact that Bill Gates lobbied for the energy sector as one of the top three career choices for making an impactful career? [w](#)

Decoding the Promise of a Clean Energy Future



When India attained independence, we had a measly 1,362 MW of electricity generation capacity. The per capita electricity consumption was merely 16 kWh. Cut to June 2022, now we boast of a total installed power capacity of around 402 GW with a per capita electricity consumption of around 1200 kWh!

However, while we were worried about ramping up the electricity production earlier, now the challenges have a new face of energy security and climate change. Alas, the share of fossil energy in the total electricity mix is a massive 75% (60%). Given how heavily dependent we are on coal for generating power, it is extremely important to take stringent steps to increase both renewable energy production and usage.

We bring a collation of consumer views and experiences with renewable energy:

THE AVAILABILITY OF fossil fuels is limited. Their use is destroying our planet. Global warming can be directly attributed to our unhindered use of 'dirty' energy. A few generations down the line will find it terribly difficult to survive in this world. We have to reduce our dependence on traditional fossil fuels on the one hand and liberate Mother Earth from the claws of carbon emissions on the other. All this and more is possible by moving to renewable energies like wind and solar! The transition will address the climate crisis that has gripped us like never before!

– Sitaram Deshpande, Mathura

A renewable energy source provides energy that is sustainable. However, most of the renewable energy technologies generate only electricity. Innovation and expansion in this arena is crucial for maintaining a viable level of energy! We know that renewable sources are infinite, but are they cost-effective too? How many people will actually shift because of the 'green' factor when they have to pay much more from their pockets?

– Pranay G.J., Mumbai

The Russia-Ukraine war has driven up the prices of imported coal and oil. Consumers are writhing under the impacts of rising energy prices coupled with overall inflation. It cannot be denied that the government is working full throttle to put the renewable energies to work, at both scale and speed. Creative solutions are being developed to overcome the inherent challenges and limitations. However, how many of us are actually aware of the investments,

incentives and other schemes? Shouldn't we as taxpayers keep ourselves abreast of the latest developments and opportunities? Why doesn't the government work on spreading information and awareness on aspects like the benefits and opportunities in the renewable energy sector?

– Saurabh Nathany, Kolkatta

Electric vehicles are the future of mobility! I have purchased not one or two but three electric cars for my textile factory operations. These cars are a joy to drive and I am delighted by the savings of around Rs. 25000 a month just in fuel costs. I have installed the charging system in the factory but am still trying to figure out alternative options of charging the battery. What if I am stranded in traffic and the electric charge runs out? Telangana government is talking about setting up PCS but I am yet to see them in reality!

– Vinay Kumar Agarwal, Kottur

There is a huge momentum for renewable energy across the world riding on the tails of the Paris Agreement. Many countries are levying carbon border taxes in a bid to get manufacturers to reduce their carbon footprint. Many Indian companies are also pledging to consume power that is generated from renewable energy. Tata Motors, Infosys, Mahindra and Mahindra, etc. have even committed to 100% renewable energy consumption. The future looks exciting in this sector and I hope everything pans out as expected.

– Beverly Pereira, Goa

UPDATE ...



Moving a Step Ahead

Update on the July edition on

Insurance Sector in India: How Customer-Friendly Is It?

Vehicle Insurance to Factor in Usage and Behaviour!

INDIAN AUTO INSURANCE policies have always been under fire for their archaic approach. For instance, the premium payable remains standard irrespective of the specific usage of the vehicle. The concept of user behaviour-based pricing was unknown to the consumers.

Therefore, a person who hardly uses his/her vehicle has to pay a premium on par with someone who uses it extremely frequently! The very thought makes it off-putting to the extent that many vehicle owners never opt for Motor Own Damage cover.

In a progressive mode, the Insurance Regulatory and Development Authority of India (IRDAI) is now introducing a utility based 'Pay as you Use' model! In July this year, it allowed general insurance companies to introduce the tech-enabled concepts of Pay As You Drive and Pay How You Drive as add-ons in an 'Own Damage' motor insurance policy. This will be based on the owner's driving behaviour – how and how much they drive the car.

Additionally, they can also offer a Floater Policy for consumers who own more than one vehicle. This is an add-on motor cover on a floater basis that allows vehicle owners to get a single policy for multiple vehicles including two-wheelers.



Pay as You Drive: Consumers can pay the premium based on the quantum of usage with infrequent drivers enjoying a lower premium than the standard plans. The vehicle owner has to declare the approximate planned usage per year which will be tracked with a geo-tagging app. As the premium will be charged in tune with the kilometres done by the car, people who work from home, have company transportation or use public transport will stand to benefit greatly.

Pay How You Drive: With this add-on, the premium will be priced based on driving parameters like speed, safety and efficiency. Driving behaviour will be tracked using live-tracking and those who drive carefully, safely and efficiently will be able to avail lower premiums.

Floater Policy: A single policy for multiple vehicles owned by the consumer opens the door to more affordable premiums. This will also ensure seamless renewal and single window communication with the insurers.

Therefore, consumers can enjoy flexibility and convenience in the choices available by paying premium that takes their driving patterns, usage, mileage and even general upkeep of vehicle into account.

This radical move will go on to make motor insurance more cost-effective even as it increases the penetration in the market. To add to this, it will also encourage people to follow traffic rules, drive properly and take care of their vehicles. What's more, it can even prompt them to use their vehicles less so as to pay less! This will promote savings in terms of fuel consumption and air pollution as well. ▶

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INSURANCE SECTOR IN INDIA

How Customer-Friendly Is It?

RESEARCH FEATURE
The Coming of Age of Insurance in India – Still A Long Way to Go!

OUT OF THE BOX
Digital Transformation of Insurance – A Win-Win for Consumers

INTERVIEW
TAPAN SINGHEL
Managing Director and Chief Executive Officer
Bajaj Allianz General Insurance

PLUS
ROUND UP • MY MARKET • THE PRESCRIPTION

YOUR OPINION MATTERS

We are truly humbled by the praise and acknowledgment that is flowing in from varied sources. Please feel free to send in your comments, views or feedback on The Aware Consumer magazine at bejonmisra@theawareconsumer.in – we will publish your opinions and implement your feedback while ensuring that your voice is heard on the right platforms.

Letters to the



(July issue:
**Insurance Sector in India:
How Customer-Friendly Is It?')**



I read your magazine about Insurance. I applaud the work done by the editorial consultant and Prof. Bejon to communicate information regarding this. I am proud to be the subscriber of such a wonderful institution, which provides us information with new issues and topics. How the magazine is put together is

amazing and I will surely recommend everyone to read it.

– **Pragati Pandey**, Kamala Nehru College,
University of Delhi • pandeypragati151@gmail.com



This edition of The Aware Consumer focuses on how customer friendly the insurance sector in India actually is. It very beautifully points out the importance of insurance as a safety net required for every individual. Starting with the history of traditional insurance to "How it's now Coming of Age" and goes further to stress on the way forward very comprehensively. Very educative articles by industry

stalwarts point out the pros and cons of various insurance policies and the digital transformation of the industry. Kudos to The Aware Consumer... Keep up the good work!

– **Macjoe Rebello**, Goa • macjoe@invertairsystems.com



It is a very good initiative to have a series on insurance, that too from the consumer perspective. It has been enlightening in some aspects and I wish more people use it to gain awareness of why they need insurance. The content is good with varied font sizes and graphics/photos The flow of articles is also good.

The focus seems to be on health and life – here, a background of the changes in the sector will help put more perspective into things. A little about new retail products will also help garner attention – individual, cyber, motor pay as you go, etc. Something about the state of the industry would help, how new age private insurers are gaining edge and so on.

– **Tina Selvaraj**, Hyderabad • tina.prashant@gmail.com

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