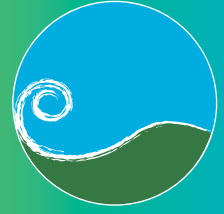


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Sanraksha

Quarterly Newsletter



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Sustainable Energy Authority

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Energy Storage

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4 Energy independence is essential
for the country!



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being built
around the world



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Editorial

Energy storage will pave the way for the nation's energy security

Every country has sufficient renewable energy resources to meet its total energy requirements. Furthermore, the technology needed to harness this renewable energy into usable power is currently well-developed. However, to utilize this energy when needed, it must be stored. The existing technology is still insufficient to store the vast amount of renewable energy scattered across the globe.

Because of this, various countries around the world are engaged in research on energy storage through different technological avenues. Accordingly, various types of batteries are currently being produced, while different countries are also experimenting with alternative energy storage methods.

In line with this, countries are turning to gravity batteries, storing water in elevated reservoirs to generate hydropower when required. In our country, attention has been focused on constructing such a hydroelectric power plant in the Kegalle area, while China is currently building the world's largest gravity battery unit.

Our country generates over 2,000 Megawatts of electricity during the day using solar power. Steps are currently being taken to use batteries to store this power. Consequently, within the next few months, 16 solar power plants equipped with 40 to 50 Megawatt battery storage systems will be installed across various regions of the island.

Through this, the solar power generated during the daytime can be released during the peak demand period at night, saving our country a substantial amount of foreign exchange spent on fossil fuels.

A background image showing several green wind turbines in a field. In the foreground, there are large, grey, rectangular battery storage units. Each unit has a blue battery icon and the word 'ENERGY' on it. The sky is blue with some light clouds.

ENERGY STORAGE

Today, people around the world face a multitude of crises regarding energy. On one hand, the risk of daily rising energy prices is clearly visible. On the other hand, issues related to energy distribution arise due to factors such as wars, sanctions, and regional geopolitical bans. Apart from these, threats like the lack of foreign exchange required to purchase energy and the depletion of certain energy sources, as well as environmental issues stemming from generating energy by burning certain sources, are also evident. Therefore, it goes without saying that every person living in this world suffers from the energy crisis. Nevertheless, humans cannot live even for a single moment without using energy.

To avoid these crisis situations surrounding energy, scientists are searching for solutions from various angles. Consequently, it is no secret that research regarding energy is taking place continuously. Among such research, studies related to energy storage hold a special place today. Energy storage is defined as the process of storing energy generated at a given time for later use, aiming to reduce the imbalance between energy demand and energy production.

Energy storage takes place in several ways. The use of rechargeable batteries is a common form of

energy storage we frequently observe. Chemical energy that can be converted into electricity is found inside a battery. The mobile phone in your hand contains such a battery. Apart from that, lead-acid batteries, nickel-cadmium batteries, lithium-ion batteries, lithium-ion polymer batteries, and aluminum-sulfur batteries are also examples of rechargeable batteries.

Dams built for hydroelectricity generation are also important in storing energy. Storing gravitational potential energy within a reservoir takes place through them. You might be surprised to hear that fossil fuels we use, such as coal and petrol, also store energy. Fossil fuels are formed through a long process involving dead organisms (plants and animals) buried underground. It must not be forgotten that organisms, having stored ancient energy obtained from sunlight, convert into fossil fuels underground over time after their death.

It should be specially mentioned that there are a considerable number of methods used for storing energy. Those methods can be categorized under mechanical, electrical, electromagnetic, biological, electrochemical, thermal, and chemical branches.

► **Prabashini Iddamalgoda**



ENERGY INDEPENDENCE IS ESSENTIAL FOR THE COUNTRY!

Prof. T. M. Wijendra J. Bandara,
Chairman of Sri Lanka Sustainable
Energy Authority

Several important decisions are currently being made to solve the issues that have arisen in our country's energy sector. Among them, the most prominent step being taken is bringing down and installing battery systems capable of storing energy. How are such battery systems utilized to solve the problems in our country's energy sector? What other steps should be taken to solve Sri Lanka's energy crisis? These are addressed in an interview given to 'Sanraksha' magazine by the Chairman of the Sustainable Energy Authority, Prof. T. M. Wijendra J. Bandara.

He further states that it is highly important for Sri Lanka to achieve energy independence at the earliest.

Q: Doesn't Sri Lanka still place greater reliance on fossil fuels for energy generation?

A: Yes, such a situation currently exists in Sri Lanka. Not only Sri Lanka, but we can also consider the global situation here. Even today, around 85% of global energy usage is generated using sources like fossil fuels and nuclear power. Only about 15% of energy is generated from other energy sources.

Q: Will Sri Lanka be able to continue meeting its energy needs by relying solely on fossil fuels?

A: That is a very important question. Fossil fuels are an energy source that exhausts over time. It takes a very long time for fossil fuels to form. It is said that it takes at least around three hundred million years for crude oil to form. For coal to form, it takes a period close to one million years. This shows how slowly fossil fuels develop. Relative to that, the amount of fossil fuels being burned today is extremely large. When limited fossil fuel resources are consumed rapidly in this manner, there arises a risk of very swift depletion. Therefore, the source known as fossil fuels can no longer be considered a reliable source of energy. If crude oil runs out, a situation will arise where we cannot carry out our daily activities. Relying solely on fossil fuels to meet energy needs creates a problematic situation. Attempting to use only fossil fuels for energy generation will force Sri Lanka to face a crisis situation as well.

Q: Scientists have pointed out that harmful gases and particulate matter are released into the atmosphere from burning fossil fuels. Considering that as well, doesn't the use of fossil fuels create a harmful situation for both humans and the environment?

A: Yes, the use of fossil fuels is extremely harmful to the environment. It has been confirmed that even

the process of mining fossil fuels is harmful to the environment. Scientists point out that digging the earth to obtain fossil fuels, as well as volatile substances released into the environment during these mining operations, are not safe. Environment pollution occurs even during the transportation and refining processes of crude oil. It is no secret that a massive amount of carbon dioxide is released into the atmosphere during this. Nano-particles of unburnt volatile organic compounds are released into the atmosphere, and these are carcinogenic. Likewise, it is clear that lead is also added to the atmosphere. It has been confirmed that such chemicals harm human lungs and the respiratory system. Not only that, but the combustion of fossil fuels also causes gases like nitrogen oxide and sulfur oxide, which create acid rain, to be added to the atmosphere. Global warming must also be mentioned; carbon dioxide emissions are the primary cause for it, which is another severe problem. Looking at it accordingly, it can be said that the entire process, from fossil fuel production to combustion is harmful to both the environment and humans.

Q: You categorized the damage caused to humans and the environment by the use of fossil fuels under two main points. Can you further elaborate?

A: Yes, I highlighted two risk conditions that arise due to the use of fossil fuels. The first is the risk of limited fossil fuel resources being depleted very rapidly. The second is the damage caused to the environment due to fossil fuel usage. When considering these two risk factors, what can be said is that fossil fuels are not a suitable energy source to be used in the future.

Q: Aside from this, it appears that Sri Lanka faces another severe issue by continuing to rely on fossil fuels?

A: Clearly. When talking about Sri Lanka, in addition to the first two points mentioned, we must pay attention to another important factor. By continuing

to rely on fossil fuels, we can clearly see a threat being posed to the country's energy security. Due to the war situation that existed between the United States and Iran, we faced such a situation recently. The closure of the Strait of Hormuz obstructed maritime navigation. We had to bear those obstacles as well as the hardships caused by the fluctuation of fuel prices.

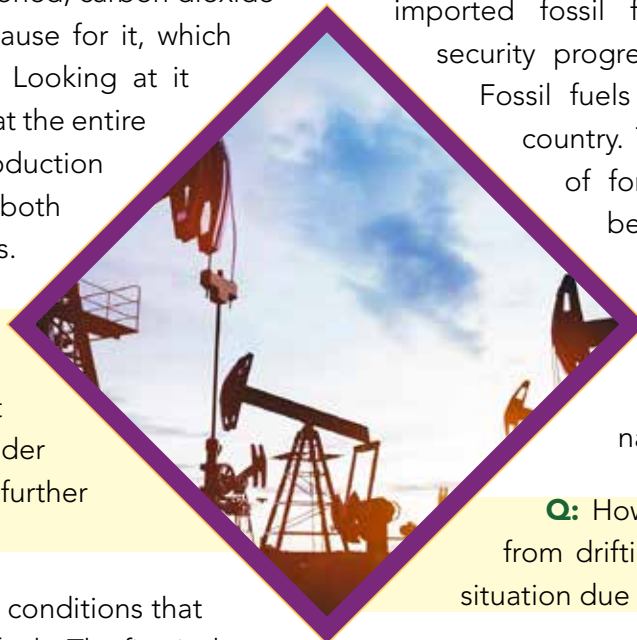
Q: Are you also saying that relying solely on fossil fuels leads the country into an unstable situation?

A: All industries in the country depend on energy. We must realize that a huge cost has to be incurred for energy. Every citizen in the country uses energy. If fuel prices are subject to sudden fluctuations, the country's industries experience a certain degree of instability as a result. Likewise, the public in the country becomes agitated as well. By relying on imported fossil fuels, the country's energy security progresses toward a critical level.

Fossil fuels are not located within our country. Therefore, a massive amount of foreign exchange also has to be spent to import fossil fuels. It must not be forgotten that in certain instances, we even have to submit to the influence of other nations.

Q: How do we prevent the country from drifting towards such an unstable situation due to issues related to energy?

A: Rescuing our country's energy sector from its reliance on fossil fuels and establishing national energy independence is an imperative step. This is crucial for maintaining a stable economy, ensuring the welfare of the public, and supporting a stable government. Sri Lanka is a nation endowed with abundant renewable energy resources, which we can harness to an optimal degree. Positioned near the equator, our country receives ample sunlight throughout the entire year. Furthermore, the regions around Sri Lanka's Mannar Basin are located along one of the best wind energy corridors in the world. We also have no shortage of water resources. These three sources represent three vital assets for our



nation. Another important point is that whichever renewable source is used to generate electricity, the resulting environmental impact remains minimal. Renewable electricity is eco-friendly. Therefore, we must transition toward generating electricity through renewable energy sources.

Q: Are you emphasizing that renewable energy sources are currently not being utilized to an optimal level in generating the energy required for the country?

A: Actually, yes. As an example, let us consider the wind received by our country. Sri Lanka possesses a very high wind potential. If that potential is utilized to an optimal level, around 24 Gigawatts of electricity can be generated alongside the solar power plants constructed in the country. A study conducted about ten years ago by an institution in the United States demonstrated this fact. To meet the country's peak energy demand, only around three Gigawatts of electricity are required. However, wind energy has not been integrated into our power grid to an optimal level.

Q: Is the situation regarding solar energy similar as well?

A: Yes, solar energy is the same. A vast amount of sunlight falls upon the ground of this country. It has been confirmed that during daytime, an amount of sunlight capable of generating about one kilowatt of power per square meter falls upon the earth. That means an amount of sunlight capable of producing 1,000 watts falls on a single square meter during the day. The amount of sunlight falling on our country's land has still not been utilized to an optimal level for electricity generation. Looking at the number of solar panels installed on building rooftops in our country confirms this clearly. Although there are around seven million electricity consumers in the country, solar panels have been installed by a number close to only one hundred thousand. This implies that there are a vast number of rooftops where solar panels have not been installed.

Q: How does obtaining energy from renewable sources contribute to the development of the country's transportation sector?

A: Talking about the transportation sector is also very important here. In our country, transportation activities currently depend 100% on fossil fuels. A massive cost has to be borne to import the fossil fuels required for that. This can be minimized if we move toward electric vehicles. However, that can only be done if a sufficient amount of energy from renewable sources is added to the country's grid. Therefore, the foremost task must be adding as much renewable energy as possible to our power grid.

Q: Generating energy from renewable sources seems reliable. At the same time, there also appears to be a delay in our country's shift toward renewable energy generation?

A: We state that something is reliable by saying, 'It is as certain as the sun rising tomorrow.' In reality, we receive sunlight every single day. Likewise, wind has been blowing since time immemorial. Fossil fuels are getting depleted, but sunlight or wind is available to us all the time. The sunlight received today or the wind blowing today cannot be saved for tomorrow. Therefore, these renewable sources must be utilized as much as possible. If we do not do so, we are simply letting those resources go to waste. On the other hand, we have to bear a massive cost to import fuel. We are now forced to turn toward generating energy at an optimal level by using renewable sources. We can achieve this transition only by rapidly arranging the necessary facilities to store the electricity we generate. Truth be told, we are already late in doing so.

Q: In generating energy from renewable sources, don't we have to face challenges?

A: It is not untrue that we have to face challenges when generating energy from renewable energy sources. As an example, let us take sunlight. The amount of sunlight can suddenly drop. That impacts electricity generation. Immediately, that deficit must be compensated for by using another renewable energy source. We must prepare as quickly as possible to successfully face the problems and challenges that arise in this manner when using renewable energy sources. Otherwise, what will happen is that integrating renewable energy into our grid will be

delayed further. We cannot forget that generating energy from renewable energy sources depends on weather and climate. When attempting to generate electricity from hydro, wind, or sunlight, impacts from weather or climate cannot be avoided. However, there are technological solutions to overcome those obstacles.

Q: How do we face such problems and challenges?

A: We need a scientific method of forecasting regarding renewable energy sources. That means knowing how those sources change in a few minutes' time. As an example, when taking rainfall, we need to know accurately what pattern rainfall will take within the next few hours or the next few days, and accordingly, how much water can be stored in the country's reservoirs. If rainfall is low in the coming month, and if the water level in reservoirs drops to a low level, how much coal or diesel should be imported for electricity generation and in what quantities? A mechanism to forecast these factors is needed. A requirement arises for a system capable of short-term and long-term forecasting regarding renewable energy generation.

Q: Could you explain how we can benefit from such a renewable energy forecasting system?

A: According to a renewable energy forecasting system, the Electricity Board can provide the country with an uninterrupted power supply. The electricity used in our country is generated from a mix of energy sources. Hydroelectricity, solar power, wind power,

power generated from coal, and power generated from diesel belong to this mix. Knowing in advance and accurately the amount of electricity generated from each of these renewable energy sources is important in meeting the country's electricity needs.

Q: Isn't it necessary to store the generated electricity?

A: Storing electricity generated by whatever means becomes necessary. Storage facilities are required for that. As an example solar energy, in particular, is generated during daytime. Even though solar energy is generated during the day, it has the potential to fluctuate. Regardless, a battery energy storage system is required to use the excess electricity generated during the day at night. There are a vast number of technologies available today for that purpose.

Q: What are those technologies that can be used in energy storage?

A: At this stage, the world is moving toward battery technology. The reason for this is that within the last five to ten years, battery technology has achieved significant advancement. Especially when looking at lithium-ion batteries, this fact becomes evident. When generation is high, there is the capability to supply electricity to such batteries and store it. Battery systems such as 5 Megawatt-hours are currently in use.

Q: Is Sri Lanka currently planning to acquire such battery technology as well?

A: Yes.

Although solar energy is generated during the day, it is subject to fluctuations. Consequently, an energy storage system is required to utilize the surplus electricity generated during the day for consumption at night. A wide range of technologies is available today for this purpose.



Our energy demand is around three gigawatts. Solar power plants can generate a capacity of around 2.8 gigawatts. A considerable amount of electricity is also generated from solar panels installed on rooftops.



Q: In what manner will battery technology be used in our country?

A: Cabinet approval was received by this government to install battery systems through three methods. Installing sixteen 40 megawatt-hour battery systems in various locations across the island is one of them. These sixteen systems are scheduled to be installed in Kilinochchi, Vavuniya, Polonnaruwa, Valachchenai, Ampara, Vavunathivu, Monaragala, Mahiyanganaya, Chunnakam, Beliatta, Galle, Puttalam, Hambantota, Anuradhapura, Maho, and Norochcholai.

Cabinet approval has also been received to install another 50 megawatt-hour battery system to match the existing solar power plants.

In addition to that, approval has also been received to install a battery system of around 1,000 Megawatt-hours.

To bring these battery systems into Sri Lanka, the government removed import tariffs entirely (100%). In addition, these battery systems were exempted from the Social Security Contribution Levy (SSCL) as well. Its purpose was not to grant an advantage to investors. If the cost of importing battery systems increases, that cost gets burdened upon the people of the country. Likewise, establishing industries within the country becomes difficult. That is why such a step was taken.

Q: Is a battery system required for us at this stage because our country's solar power generation is currently at a high level?

A: Yes. Our energy demand is around three Gigawatts. Solar power plants can generate a capacity of around 2.8 Gigawatts. A considerable amount of electricity is also generated from solar panels installed on rooftops.

Q: But you mentioned at one point that rooftop solar panel installations can be expanded further. Now you say that a sufficient amount of electricity is generated from already installed solar panels. Can you clarify?

A: Solar panels can be installed further on rooftops. However, the electricity produced in that manner must be stored to be supplied during the night. A storage system is required for that. The battery system brought into the country will use electricity from the national power grid and be charged during daytime. Delivering electricity from that battery system will take place during the night.

Q: Apart from batteries, what other technologies are used for energy storage?

A: Apart from batteries, storage systems like 'supercapacitors' are used in the world. What are known as 'supercapacitors' is a system similar to a battery. Electricity can be stored in it. However, in terms of technology, 'supercapacitors' differ from batteries. They can release a large amount of energy instantaneously and charge rapidly. Nevertheless, they cannot store the amount of energy that can be stored in a battery. Compared to batteries, 'supercapacitors' are safer, less complex, and have a longer lifespan. The issue currently existing regarding

'supercapacitors' is only their lower storage capacity. Numerous research studies on 'supercapacitors' are taking place in the world today. Most of those studies are being conducted to increase the capacity of supercapacitors. There is a high probability that 'supercapacitors' will be used in the near future instead of battery technology for storing energy.

In addition to that, the pumped storage system is used. This method is used in connection with hydroelectric power plants. During the daytime, water is pumped to a higher elevation. That is also similar to a battery. During the night, electricity generation at the hydroelectric power plant takes place by utilizing the water conveyed upwards in that manner. Plans are currently being prepared in our country as well to utilize this method.

Q: Are battery systems the most suitable for energy storage?

A: There are various methods for storing energy. The best method, in my view, which can be installed very quickly, within about three to six months, is Battery Energy Storage Systems (BESS).

Q: You mentioned how our country's power grid must change when generating energy from renewable energy sources and integrating it into our grid. Could you elaborate on that further?

A: Yes, we need to make our power grid more systematic by transforming it into a smart system. By installing smart meters, among other things, renewable electricity generation can be easily

measured quantitatively. We need to set up battery systems and other technological facilities for storage. Renewable energy sources are sometimes located in remote areas. Take wind power as an example. Wind power is generated in regions with the best wind, centered around areas like Mannar. To distribute the energy generated there, developing the transmission line network is necessary. Rectifying such shortcomings after being delayed for so long is itself a major fault. Why there was no such enthusiasm regarding this in the past is also a question. The national treasury pays an immense cost for that mistake. Another factor is that by relying on fossil fuels, whenever a war breaks out anywhere in the world, we are forced to face severe problems. If we truly love our children, we must think about that. Everyone likely remembers the immense problems we faced when payments couldn't be made for two or three fuel ships and their arrival here was delayed. What fate will await our children on a day when fossil fuels become scarce in the world? Therefore, by increasing renewable energy generation alongside the accompanying changes, namely, establishing a smart system, laying transmission lines, setting up a storage system, and establishing a system to forecast renewable energy generation, our country will be able to achieve energy sovereignty.

Q: Today people talk about solar fuels. Is solar fuel merely a theoretical concept rather than a reality?

A: When talking about energy storage methods, people today also discuss 'Solar fuels'. Even when considering fossil fuels, their primary source of energy



is sunlight. During the process of photosynthesis, plants absorb sunlight and synthesize hydrocarbons. Fossil fuels are formed only after those hydrocarbons remain buried underground for a very long time, that is, around 300 million years. If hydrocarbons, diesel, petrol, and similar fuels can be produced by utilizing sunlight directly, that would be extremely significant. Through such methods, by capturing carbon dioxide in the atmosphere, the amount of carbon dioxide in the atmosphere can also be reduced.

Q: Today there is discussion about green hydrogen technology, and research is being conducted regarding it as well. How is that technology important in solving the energy crisis?

A: Yes, hydrogen production has come forward technologically. Green hydrogen is being spoken about frequently now. Electricity can be generated from wind power, and that electricity can be used to subject water molecules to electrolysis. Hydrogen can be produced through that process. Hydrogen is considered the best fuel in the world. The reason for that is because water is produced when hydrogen burns; no carbon dioxide emission occurs there. Research is currently underway regarding the synthesis of hydrocarbons, diesel, and petrol by reacting that hydrogen with carbon dioxide. Research is being conducted to see whether hydrocarbons can be artificially synthesized using sunlight. Such productions are currently taking place at a laboratory level. It will take some more time for that technology to reach a commercial scale. However, hydrogen is currently being used as a fuel. Driving vehicles using hydrogen is taking place even now. Likewise, hydrogen fuel cells have been produced, allowing hydrogen to be stored. By utilizing hydrogen, electricity can be generated

without combustion.

Q: Will Sri Lanka move toward hydrogen technology in the future?

A: Sri Lanka will definitely move toward hydrogen technology. The steps required to bring that technology to this country are currently being implemented. It must be noted that work is underway regarding providing investors with the facilities required to establish hydrogen technology here.

Q: Ultimately, what we require is energy independence. Do you believe that changes must occur in other sectors outside the energy sector as well to establish it?

A: Achieving energy independence for our country is not easy. We have to face various challenges on the path toward it. Even our educational pattern is not an independent one; we have an educational framework inherited from the West. Scholars who go abroad from this country to receive an education return here with a degree of subservience. I state that our education system, which creates a subservience mindset, must also change. The intervention of intellectuals is necessary to produce the energy required for our country right within our borders. We must not forget here that hydroelectric power stations in our country were built due to the struggles waged by independent-minded intellectuals like Wimalasurendra.

**► Interviewed by:
Manjula Wijeyarathne**



ENERGY STORAGE SYSTEMS BEING BUILT AROUND THE WORLD

The use of battery systems for energy storage (Battery Energy Storage Systems - BESS systems) is commonly seen in many countries around the world today. This technology for storing energy will be used even more extensively within the next few years. This article outlines information on several large-scale projects that utilize battery systems for energy storage.

1. Australia – Asia Power Link Project

Under this Australia-based project, the world's largest solar power plant is scheduled to be built. It is stated that the power plant is set to be constructed in the northern region of Australia.



The solar power plant will have a capacity of approximately 20 Gigawatts (GW). The electricity generated will be stored in a battery system. The capacity of this battery system is around 42 Gigawatt-hours (GWh). Once operational, the world's largest battery system will also be located there.

The electricity generated from the proposed solar plant will be utilized for consumption in Australia.

In addition, it is stated that electricity is scheduled to be exported to Singapore. Plans have also been made to export electricity to Indonesia in a later stage. Electricity transmission to these countries will be carried out using subsea cable systems laid in the ocean.

The project is scheduled for completion in 2030, with an estimated cost of approximately 35 billion Australian dollars.

2. Al Azeezah BESS Project

The Al Azeezah BESS project is being implemented centered in the United Arab Emirates (UAE).



The electricity generated from a solar power plant with a capacity of 5.2 Gigawatts (GW) is scheduled to be stored in the battery system of this project. The storage system has a capacity of 19 Gigawatt-hours (GWh). The electricity stored through this will be used to meet the electricity demand of the United Arab Emirates.

It is estimated that the project will cost around 6 billion US dollars. Work on the project is scheduled to begin next year.

The Green Energy Corridor project is being implemented in India. Electricity generated from solar and wind power will be stored in this storage system, which has a capacity of 12 Gigawatt-hours (GWh).

Green Energy Corridor Phase-II,

3. Green Energy Corridor Project

The Green Energy Corridor project is being implemented in India. Electricity generated from solar and wind power will be stored in this storage system, which has a capacity of 12 Gigawatt-hours (GWh).



The Indian Government planned and initiated this project with the aim of increasing the supply of electricity generated from renewable energy sources to the national power grid. It consists of several phases.

In the first phase, infrastructure development has commenced. Accordingly, it is noted that the stringing of transmission lines, construction of substations, and the upgrade of other national grid infrastructure were initiated. During that phase, which began in 2021, Indian authorities managed to complete the construction of new transmission lines spanning over 5,000 kilometers. More than 30 power substations were also installed.

Integrating renewable energy into the national grid is scheduled for the second phase. The second phase is set to be completed in the year 2030.

4. Atacama Oasis Project

It is stated that this storage system, being installed in Chile, a Latin American country, has a capacity of 11 Gigawatt-hours (GWh).



The Atacama Desert region is well known as an area that receives an exceptionally high amount of sunlight. The solar power generated from two solar power plants located there is scheduled to be stored in this system. The project is planned to be completed in seven phases. Reports state that these seven phases will be implemented during the period from 2024 to 2028. The main phase of the Atacama Oasis project was completed last June.

5. Darden Clean Energy

This battery storage system, being established in California, USA, has a capacity of 4.6 Gigawatt-hours (GWh).



The electricity generated by a solar power plant will be stored in this battery storage system. Reports show that the power plant generates enough electricity to power 850,000 homes for four hours. The capacity of the solar power plant is approximately 1.15 Gigawatts (GW).

The power plant has been constructed on an area of approximately 9,500 acres of land that was abandoned after being used for agricultural activities for a period of time.

6. M Terra Solar Project

This battery system, which has a storage capacity of 4.5 Gigawatt-hours (GWh), is being established in the Philippines.



The energy stored here will come from a solar power plant with a capacity of 3.5 Gigawatts (GW).

The project is also considered to be the largest solar project in Asia. It is said that the solar power plant and the battery storage system span over an area of 3,500 hectares. Work on this project commenced in 2024 and is scheduled for completion this year.

7. Khavda BESS Project

This energy storage system, being constructed in the state of Gujarat, India, consists of a capacity of 3.37 Gigawatt-hours (GWh). Electricity generated from solar and wind power plants are stored in this battery storage system.



Adani Green Energy Company is managing the construction of this project. According to reports, this project is capable of supplying electricity to one million homes for an entire day. It is stated that this will fulfill the energy needs of the state of Goa as well as the cities of Indore and Chandigarh in India. Most of the work on this project has been completed by now.

8. Edwards & Sanborn Project

Located in California, United States, the Edwards & Sanborn energy storage system has a capacity of 3.3 Gigawatt-hours (GWh). Electricity generated from a

solar power plant established in the Mojave Desert is stored in this battery system.

The solar power plant spans across 4,600 acres and is reported to feature approximately 2 million solar panels. Through this, electricity can be supplied to more than 971,000 homes. Work on the project commenced in the year 2020.

9. Moss Landing Project

The Moss Landing project in California, United States, is also a prominent project among energy storage systems. The installed storage capacity of its batteries is around 3 Gigawatt-hours (GWh). This battery system receives electricity from a power plant that generates power by burning natural gas.



10. Crimson Energy Storage Project

Located in California, United States, this storage system has a capacity of approximately 1.4 Gigawatt-hours (GWh). Electricity to charge this battery system is supplied by a solar power plant. The solar plant is spread across an area of nearly 2,000 acres. Its power generation is sufficient to supply electricity to more than 87,500 homes.

► **By Prabashani Iddamalgoda**



The solar power plant spans across 4,600 acres and is reported to feature approximately 2 million solar panels. Through this, electricity can be supplied to more than 971,000 homes. Work on the project commenced in the year 2020.



GLOBAL SOLAR POWER GENERATION NEARS 3 TERAWATTS!

According to the organization SolarPower Europe, global solar power generation capacity rose to 2.9 Terawatts (TW) last year. It was also revealed that approximately 664 Gigawatts (GW) of new solar power capacity was added last year. Compared to the year 2024, this represents an increase of 69 GW. Energy experts point out that solar energy generation is growing at twice the speed of wind energy generation. Sunlight falling upon the Earth contributes to fulfilling 9% of the global electricity demand.

Different countries contribute to global energy capacity in varying proportions. SolarPower Europe notes that among the countries adding the highest solar energy capacity per capita are: Australia, the Netherlands, Germany, Estonia, Austria, Spain, Denmark, Greece, Switzerland, and Hungary. Australia produces the world's highest per capita solar energy, amounting quantitatively to around 1.73 Kilowatts (kW). The Netherlands holds the second place in the world for per capita solar generation, producing approximately 1.57 kW per person. A German citizen generates approximately 1.4 kW of solar energy.

In 2025, China produced the highest total amount of solar power. According to reports, the solar power capacity generated in China reached approximately 1,175 Terawatt-hours (TWh). The United States holds the second position among the world's top solar power-producing countries. In that ranking, India claims third place, Japan fourth place, and Germany fifth place.

Meanwhile, 14 European Union member states have increased their solar power capacity by 1 GW each. Apart from them, solar energy production is also rising in Romania, Greece, and Bulgaria.

Energy experts have also turned their attention toward continent-level solar energy production. They state that the African continent can be identified as a region that receives optimal sunlight throughout the entire year. Nevertheless, reports reveal that only a very small fraction of the sunlight received by the continent is converted into solar power. Reasons for this include: a lack of capital required to construct solar power plants, a scarcity of investors, underdeveloped infrastructure for power transmission and extremely high ambient temperatures in areas suitable for solar plant construction (it is noted that solar power plants constructed in regions with such high temperatures fail to achieve maximum operational efficiency)

The situation in the Asian continent is quite different. There, solar power holds third place among the main energy sources. Coal-powered electricity generation still takes the leading position in meeting Asia's electricity requirements, while hydropower holds second place.

► **By Manjula Wijeyarathne**
(Based on SolarPower Europe)



INDIA BEGINS PINK HYDROGEN PRODUCTION

New experiments in the energy sector continue uninterrupted. Such trials are crucial for resolving human energy challenges. A special project of this nature was launched in India. This project is a nuclear-powered hydrogen production initiative based on the copper-chlorine {Cu-Cl} thermo chemical cycle. It is also recognized as the world's first project to produce hydrogen in this specific manner.

The core objective of this project is hydrogen production, utilizing water as the raw material. Water molecules are split into hydrogen and oxygen. The unique feature of this process is using heat derived from a nuclear reactor for the chemical reaction. Reports indicate that while hydrogen is sometimes produced using methane, that traditional method relies on heat generated by burning fossil fuels. Because fossil fuel combustion releases carbon dioxide into the atmosphere, hydrogen produced through that process cannot be considered environmentally friendly.

When producing hydrogen using water, electricity generated from renewable energy sources, such as wind energy or solar power, can be used. Hydrogen produced in that manner is referred to as **Green Hydrogen**, as no carbon emissions are released into the atmosphere during its production.

Indian scientists discovered that a domestic method, specifically the copper-chlorine thermo chemical cycle, could be used for the hydrogen production process. This discovery was made by a team of scientists at the Bhabha Atomic Research Centre (BARC) located in Mumbai, India. Producing hydrogen through this method requires

high temperatures generated by nuclear reactors. Scientists state that these high temperatures, near 500 degrees Celsius, are required for a series of chemical reactions involving copper and chlorine compounds that are continuously recycled within the system. During this process, water molecules are split into hydrogen and oxygen while copper and chlorine are repeatedly reused.

The plant required for this hydrogen production process, the Fast Breeder Test Reactor (FBTR), has been established at the Indira Gandhi Centre for Atomic Research (IGCAR) in Kalpakkam, Tamil Nadu. Indian media reported that hydrogen produced in this manner is referred to as **Pink Hydrogen**.

Because hydrogen produced using renewable energy is called **Green Hydrogen**, and hydrogen produced using natural gas (with carbon capture) is called **Blue Hydrogen**, the hydrogen produced via this new nuclear-thermal process has been designated as **Pink Hydrogen**.

When attempting to produce hydrogen using wind and solar power, weather and climate conditions directly impact those renewable energy sources, leading to fluctuations in power generation. These fluctuations ultimately affect the consistency of hydrogen production. However, under the method used to produce pink hydrogen, such fluctuations do not occur, allowing for a continuous and stable supply.

► **By Prabashini Iddamalgoda**

(Based on a report from *The Times of India*)



CANADA SETS SIGHTS ON "WHITE HYDROGEN"

Researchers state that a natural hydrogen deposit has been located beneath a geological formation in Canada. It has been confirmed that this geological formation dates back billions of years. This information was revealed in a recent research paper published in the *Proceedings of the National Academy of Sciences*. However, specific details, such as the exact location of this hydrogen deposit, how long it has been producing hydrogen, and the exact quantity of hydrogen that can be extracted from it, remain unresolved.

The discovery of the hydrogen deposit was made by a team of geochemists from the University of Ottawa and the University of Toronto in Canada. They stated that they collected data by conducting observations related to the soil in the area where this deposit is located over a period of more than ten years.

Scientists observed that hydrogen is released when conducting drilling tests down to the geological formation. They noticed that, on average, an amount of about 0.008% of hydrogen is released every year. Accordingly, the researchers increased the number of drilling tests. By the time they reached their final conclusions, they had conducted more than 15,000 drilling tests to gather data.

Researchers have confirmed that from one specific area where drilling was conducted, it is possible to obtain more than 140 tonnes of hydrogen annually. It has also been revealed that from the hydrogen released from that location, it is possible to generate 4.7 million kilowatt-hours of electricity per year. According to the scientists' opinion, this could satisfy the annual electricity needs of 400 homes. Researchers say that hydrogen will likely be released from the deposit for at least another ten years. Even so, there is no final conclusion yet on whether the hydrogen extracted from the deposit can be used at a commercial level.

As time passes, scientists have been conducting research to find out how hydrogen is generated from geological formations. Professor Barbara Sherwood Lollar from the University of Toronto, a researcher, states that natural hydrogen is produced as a result of chemical reactions between rocks and the groundwater found within them. The Professor also notes that it is a coincidence that the geological formations and rocks necessary for the creation of natural hydrogen are located in the Canadian soil. Researchers say that Canada could potentially provide hydrogen without emitting carbon. The researchers' hypothesis is that such natural geological structures for hydrogen production may exist in many countries around the world.

In addition to this, it is noted that potential sites with high hydrogen concentrations have been identified in the region. Sites with hydrogen deposits have been identified in areas such as Northern Ontario, Quebec, Saskatchewan, and New Brunswick.

Scientists have named the hydrogen found in this hydrogen deposit "white hydrogen." Today, hydrogen is produced commercially. It is produced by burning petroleum, coal, or natural gas. In every instance where fossil energy sources are used for hydrogen production, carbon dioxide and carbon monoxide are emitted into the environment. It is stated that hydrogen produced by generating electricity using non-renewable energy sources is more expensive. In the near future, the world will need hydrogen in large quantities. Discovering natural hydrogen, or "white hydrogen," in such an environment is a very important milestone.

► **By Manjula Wijayarathna**

(based on *Science Daily*)



BREAKTHROUGH INNOVATIONS IN SOLAR POWER GENERATION

Technology required to carry out solar power generation in novel ways is currently emerging. Here are details regarding a collection of such innovations:

Solar Roof Tiles

The best place to capture sunlight is the roof. That is why solar panels are installed on roofs. However, because solar panels are large and installing them reduces the aesthetic appeal of buildings, some people in European countries began showing a reluctance to install solar panels. With the aim of bypassing these drawbacks, solar roof tiles were manufactured. These tiles are capable of generating electricity from sunlight just like solar panels.

Even so, there are several clear differences between solar panels and solar roof tiles. While solar panels are mounted separately on top of the roof, solar tiles can be laid on the roof in a manner similar to traditional roof tiles. Solar panels cannot be installed on older structures, whereas solar roof tiles can be used to roof even those types of buildings. Roof-integrating solar tiles are a new concept and are not yet very popular. Furthermore, compared to the price of solar panels, solar roof tiles are higher in cost.

Vertical Solar Fences

A vertical solar fence is a structure built by mounting solar panels vertically, used in the manner of a boundary fence. Solar panels are fitted on both sides of the fence, and electricity is generated directly from it. The electricity produced can either be consumed by the building surrounded by the fence or added to the national grid. Such fences are also known as **Renewable Energy Fences**. In situations where installing solar panels on the roof is difficult for any reason, these fences can be used to generate solar power.

These types of fences are also installed around agricultural lands, functioning as **Solar-Powered Electric Fences**. Such structures are useful in protecting crops from animals that cause damage. Solar electric fences built around agricultural land function without drawing electricity from external grid systems. They contain battery systems that can store the electricity generated during daytime hours, allowing the stored electricity to be used at night. Maintaining solar-powered electric fences is easy. Additionally, it is noted that they withstand weather fluctuations. Fences of this nature are also utilized in livestock farms.

Solar-Powered Vehicles

Several solar-powered vehicle models have been manufactured so far. Sunlight is captured through panels attached to the body of the vehicle to generate electricity. The electricity produced in this way is used to drive the vehicle. Since no fossil fuel combustion occurs during the operation of such vehicles, there is no emission of waste gases like carbon dioxide into the environment.

Lightyear and Aptera are two such vehicle models. Lightyear cars are manufactured by an automobile manufacturing company in the Netherlands. The company produces the Lightyear model specifically for consumers who wish to drive a solar-powered car. A handful of consumers in countries like Switzerland, Norway, and the United Kingdom use this car model. Aptera is a two-seater three-wheeled vehicle. It is manufactured by a vehicle manufacturing company located in California, United States. The company is currently conducting various experiments to produce energy-efficient vehicle models.



Solar Windows

Solar windows look identical to regular windows. However, they are equipped with technology capable of absorbing sunlight to generate electricity. They function similarly to standard solar panels placed on roofs. These windows block strong sunlight from falling into the interior of the building, keeping the inside cool. Solar window technology emerged about ten years ago, but such windows are still not widely popular among the general public.

Solar Paint

Solar paint, or photovoltaic paint, exists in liquid form. Light-absorbing nanoparticles are

embedded within the paint. These absorbed nanoparticles act like liquid solar panels to generate electricity. Scientists have developed several types of solar paint so far. Almost all of these paint models are still at the research stage, so it will take more time before they come into commercial use. However, if an opportunity arises to use such paint, coatings will be produced that can be applied to building walls and roofs, and eventually to vehicles as well.

Solar-Powered Air Conditioners

Several models of solar air conditioners have now been designed. **Hybrid AC/DC Systems** model operates by directly capturing sunlight using solar panels to generate the electricity required for operation. When ample sunlight is available, the AC runs entirely on solar power. When sunlight is unavailable, it automatically switches to draw power from a battery or the national grid. **Off-Grid / 100% Solar DC Systems** model operates entirely on solar power. Electricity is stored in an integrated battery system, allowing the unit to run on stored battery power when there is no sunlight. It never draws power from the national grid under any circumstances. **Add-On Conversion Kits** model works differently. If you own an inverter air conditioner, you can install solar converter devices or solar-ready kits to adapt it to run on solar energy.

Using a solar-powered air conditioner offers significant advantages: it reduces electricity bills and enables people living in areas with frequent power outages to use air conditioning without interruption.

► **By Prabashini Iddamalgoda**

CHINA BUILDS A GIANT BATTERY



Research is currently underway exploring various technological paths for energy storage. Among these, battery-based energy storage technology has advanced significantly. In terms of battery technology, China is a nation that has taken major steps forward. At present, they are constructing a "Gravity Battery" system that allows hydroelectricity to be generated as needed while reusing the same volume of water.

This project has been launched in Daofu County in the Tibetan region. It is planned to pump water from a lower reservoir to a higher reservoir built on a mountain peak using renewable energy during low electricity demand periods. During peak demand periods, the water will be allowed to flow downward to generate hydroelectric power.

Initiated by the Chinese State-owned enterprise **PowerChina**, this project is expected to provide electricity to 2 million homes.



THE WORLD'S LARGEST RENEWABLE ENERGY CITY: INDIA'S KHAVDA PROJECT

energy companies, including Adani Green Energy, NTPC Green Energy, and SECI (Solar Energy Corporation of India), are contributing to its development.

As the global transition to clean, green energy accelerates, the Khavda project stands as a powerful symbol of India's vision for a green energy future.

Sri Lanka's focus on executing such mega-scale renewable energy projects by maximizing solar and wind resources began around **2005**. In **2007**, the Sri Lanka Sustainable Energy Authority (SLSEA) was established, and a solar park was launched in Hambantota. Steps are currently being taken to set up two renewable energy zones in the Puttalam region as well as the Northern and Eastern provinces.

This will serve as a crucial step toward ensuring our country's energy security and accelerating sustainable development.

The **Khavda Renewable Energy Park** project, currently under construction in the Rann of Kutch region of Gujarat State, India, is considered the world's largest renewable energy park. The specialty of this project is the large-scale generation of electricity by integrating solar and wind power.

Its final goal is to establish an installed power generation capacity of **30 Gigawatts (30 GW)**. Once the project is complete, it will supply clean electricity to millions of people while significantly contributing to reducing carbon emissions and reliance on fossil fuels.

Spanning an area of over **500 square kilometers**, thousands of solar panels and wind turbines are being installed for this project. Several leading

► **By Nimalka Samarakoon**

NATIONAL ENERGY EDUCATION MEDIA PROJECT

A two-day workshop was held on June 2 and 3 at the Construction Equipment Training Centre (CETC) in Battaramulla to prepare the evaluation criteria for creations submitted by students for the National Energy Education Media Program, jointly conducted by the Sri Lanka Sustainable Energy Authority (SLSEA) and the Science Education Branch of the Ministry of Education.

This National Energy Education Media Program has been planned to be implemented by the end of this year, allowing participation from school students from Grade 6 and above, with the involvement of both printed and electronic media.

It is planned to execute the program across three stages with first round sponsored via printed media, second broadcast via radio media and the final round telecast via television media.

ENERGY MANAGEMENT TRAINING FOR THE BANKING, FINANCIAL, AND RETAIL SECTORS

A training program on energy conservation and management was conducted by the Sri Lanka Sustainable Energy Authority (SLSEA) on June 02, 2026, at the SLSEA Auditorium for energy managers working in organizations across the banking, financial, and retail commercial sectors.

The objective of this workshop was to enhance the knowledge, skills, and professional capabilities of energy managers, as well as to empower them to effectively implement energy management practices within their institutions.

Accordingly, participating energy managers were educated on energy efficiency and conservation measures. They were guided on areas such as identifying energy-saving opportunities within their respective organizations, improving operational efficiency, minimizing energy costs, contributing toward national energy conservation targets, and understanding the core responsibilities of an energy manager within an institution.



Resource persons for the program were provided by engineers from the Sri Lanka Sustainable Energy Authority, including Director Eng. Sanath Kithsiri, Director Eng. Saman Elvitigala, and other staff engineers.

► **By Kalanika Hewage**

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