WHITE PAPER

RENEWABLE ENERGY BANK

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CHAPTER 1: CURRENT STATE OF ENERGY IN THE WORLD

1. Overview of Global energy.

Energy is at the heart of development. Energy makes possible the investments, innovations, and new industries that are the engines of jobs, inclusive growth, and shared prosperity for entire economies. Yet nearly 733 million people still live without electricity worldwide. At the current rate of progress, 670 million people will remain without electricity by 2030—ten million more than projected last year. About 2.6 billion people cook or heat their homes with polluting fuels that harm their health and the environment.

The first half of 2022 has witnessed one of the largest shocks to global energy markets that the world has seen in decades. The COVID-19 pandemic and the war in Ukraine have sent energy prices soaring, exacerbating energy shortages and energy security concerns, and further slowing progress toward universal access to affordable, reliable, sustainable, and modern energy by 2030– Sustainable Development Goal (SDG) 7.

Prices for spot purchases of natural gas have reached levels never seen before, regularly over the equivalent of USD 250 for a barrel of oil. Coal prices have also hit records levels, while oil rose well above USD 100 per barrel before falling back. High gas and coal prices account for 90% of the upward pressure on electricity costs around the world.

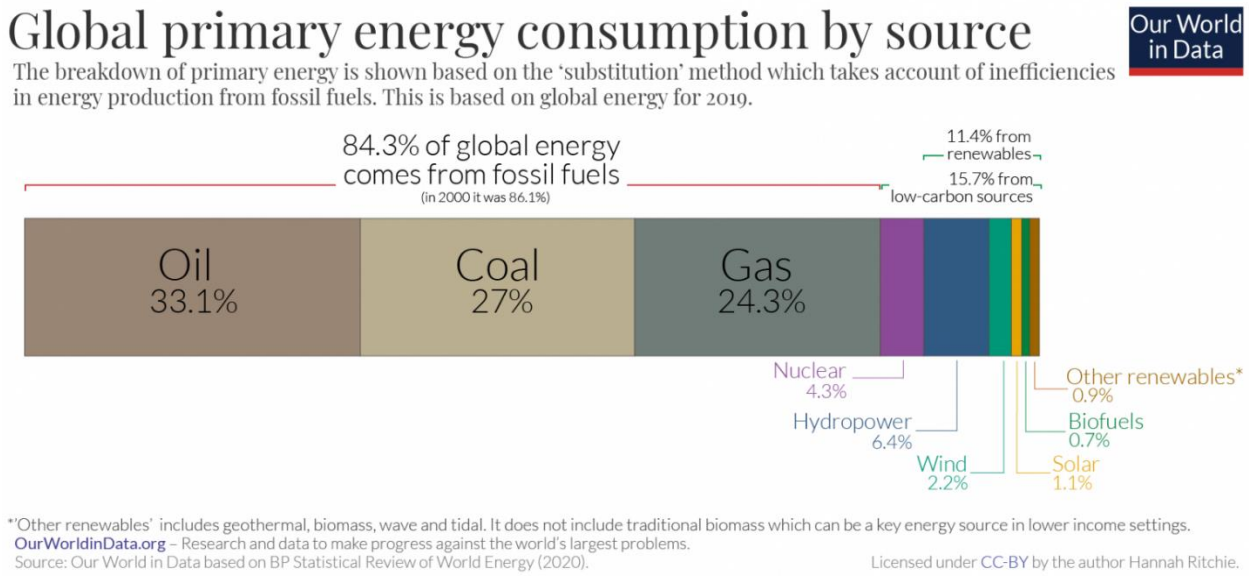
The crisis has stoked inflationary pressures and created a looming risk of recession, as well as a huge USD 2 trillion windfall for fossil fuel producers above their 2021 net income.

Higher energy prices are also increasing food insecurity in many developing economies, with the heaviest burden falling on poorer households where a larger share of income is spent on energy and food. Some 75 million people who recently gained access to electricity are likely to lose the ability to pay for it, meaning that for the first time since we started tracking it, the total number of people worldwide without electricity access has started to rise. And almost 100 million people may be pushed back into reliance on firewood for cooking instead of cleaner, healthier solutions.

Since three-quarters of global greenhouse gases come from energy – the burning of coal, oil and gas – we need to rapidly transition away from them to low-carbon sources.

Whilst we continue to add more renewables, the majority of the world's energy still comes from fossil fuels. In 2019, 84% of it.

This is shown in the chart which gives a breakdown of the global energy mix by source. Low-carbon energy accounted for only 16% – around 11% from renewables and just over 4% from nuclear energy.



Whilst we often focus on the share of energy that comes from fossil fuels versus low-carbon energy, it's really the absolute consumption of fossil fuels that determines real progress.

CO2 is produced when we burn fossil fuels, therefore the key marker of progress is whether we're burning more or less of them than the previous year.

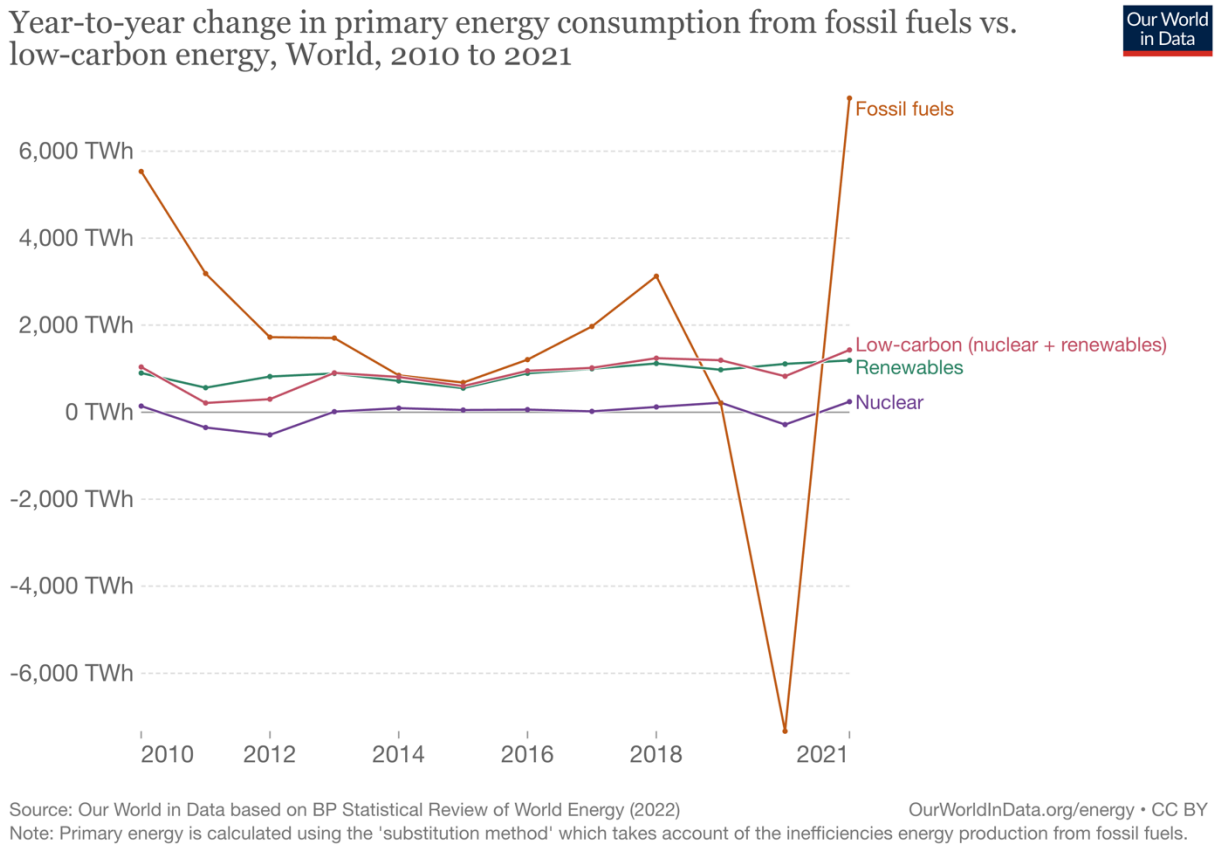
Unfortunately, we continue to burn more fossil fuels each year. This is shown in the chart which measures the change in primary energy consumption by source each year. A positive figure means we consumed more energy from that source than the previous year; a negative number means consumption declined.

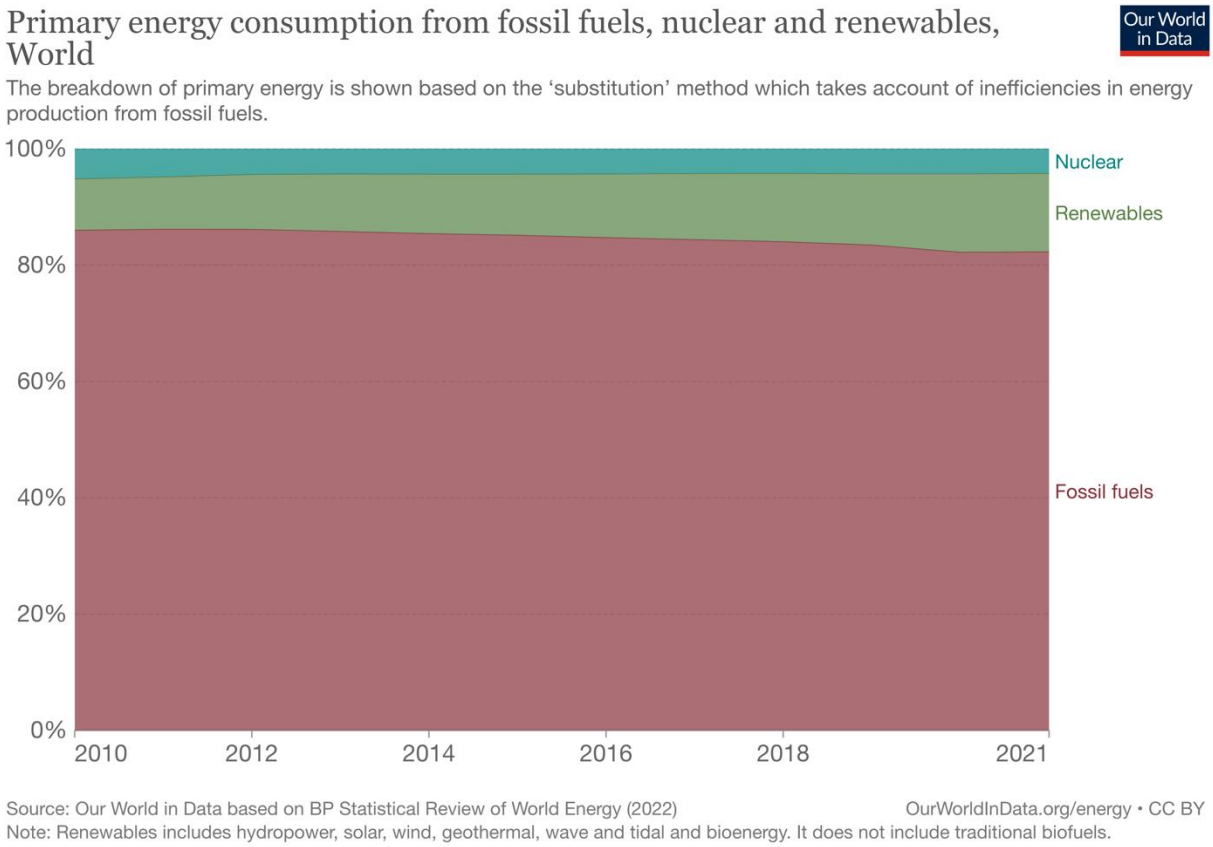
Collectively, our consumption of fossil fuels is still growing. This means CO2 emissions from energy are also still rising.

The global energy supply is still dominated by fossil fuels. But if this was shifting quickly, we might have case for optimism.

The share of energy we get from low-carbon sources is increasing. But unfortunately this is progress is slow.

In the interactive chart we see the breakdown of the global energy mix between fossil fuels and low-carbon energy (which is the sum of nuclear and renewables). From 1970 to 2000, the low-carbon share more than doubled from 6% to 13%. But since the millennium, progress has been slower: in two decades it has increased by only 3 percentage points.





Renewable energy is the world's necessary trend

Renewable energy is being considered as an inevitable solution and trend of the current energy industry in the world. When fossil fuel sources such as open oil coal become more and more depleted, causing serious environmental pollution, forcing countries around the world to accelerate the restructuring of the energy industry towards clean and sustainable. . The development of renewable energy sources is gradually taking an important position in the sustainable economic development of countries, due to the great benefits in making the most of inexhaustible natural resources (such as wind, sun, etc.) , as well as contribute to reducing the impact of the greenhouse effect and climate change.

According to research by the International Energy Agency (IEA), by 2025, renewable energy will become the main source of electricity generation, providing a third of the world's electricity, it is estimated, wind power capacity and Photovoltaic will exceed the capacity of gas by 2023 and coal by 2024.

2. Renewable Energy

What is Renewable Energy?

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

Since the Industrial Revolution, the energy mix of most countries across the world has become dominated by fossil fuels. This has major implications for the global climate, as well as for human health. Three-quarters of global greenhouse gas emissions result from the burning of fossil fuels for energy. And fossil fuels are responsible for large amounts of local air pollution – a health problem that leads to at least 5 million premature deaths each year.

To reduce CO2 emissions and local air pollution, the world needs to rapidly shift towards low-carbon sources of energy – nuclear and renewable technologies.

Renewable energy will play a key role in the decarbonization of our energy systems in the coming decades.

Renewables Benefit the Economy

Renewable energy provides reliable power supplies and fuel diversification, which enhance energy security, lower risk of fuel spills, and reduce the need for imported fuels. Renewable energy also helps conserve the nation's natural resources.

Energy Security

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Economic Development

The renewable energy industry is more labor intensive than its fossil fuel counterpart, meaning on average greater job creation. The industry also creates positive ripple effects down to the renewable energy supply chain and unrelated businesses due to increased household incomes.

Environmental Justice

Communities located near fossil fuel generators are affected disproportionally by local increases in pollution, including particulate matter and toxic gasses. There is

also often increased pollution from diesel traffic located close to adjoining residential areas servicing these facilities. Clean energy facilities do not increase local pollution or the need for diesel traffic in marginalized communities.

Price Stability

Renewable energy sources such as wind, solar, hydro and geothermal do not entail fuel costs or require transportation, and therefore offer greater price stability. In fact, some electric utilities factor this into their retail electricity prices, exempting customers that buy renewables from certain fuel-related charges.

How much of our primary energy comes from renewables?

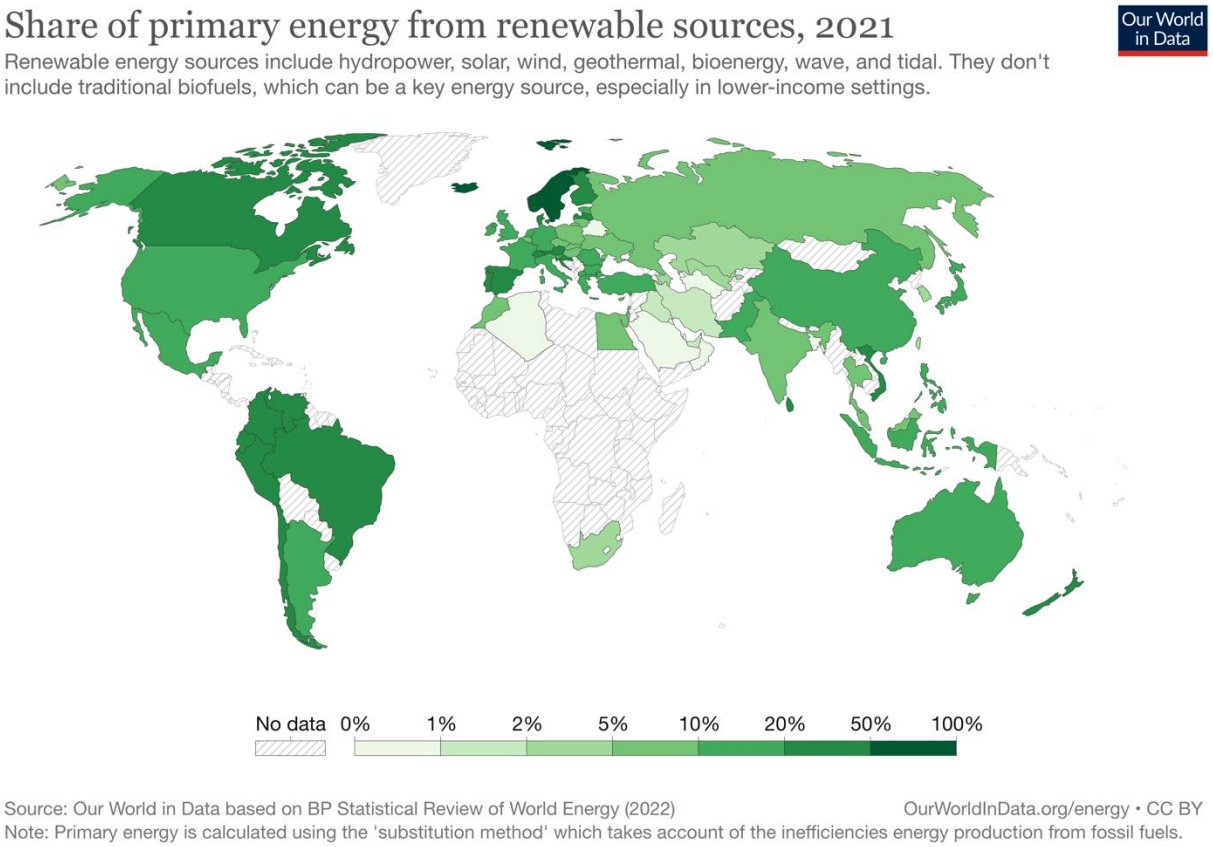
We often hear about the rapid growth of renewable technologies in media reports. But just how much of an impact has this growth had on our energy systems?

In this interactive chart we see the share of primary energy consumption that came from renewable technologies – the combination of hydropower, solar, wind, geothermal, wave, tidal and modern biofuels.

This data is based on primary energy calculated by the 'substitution method' which attempts to correct for the inefficiencies in fossil fuel production. It does this by converting non-fossil fuel sources to their 'input equivalents': the amount of primary energy that would be required to produce the same amount of energy if it came from fossil fuels.

In 2019, around 11% of global primary energy came from renewable technologies.

Note that this is based on renewable energy's share in the *energy* mix. Energy consumption represents the sum of electricity, transport and heating.



Types of Renewable Energy Sources

Solar Energy

Humans have been harnessing solar energy for thousands of years—to grow crops, stay warm, and dry foods. According to the National Renewable Energy Laboratory, “more energy from the sun falls on the earth in one hour than is used by everyone in the world in one year.” Today, we use the sun’s rays in many ways—to heat homes and businesses, to warm water, and to power devices.

Solar panels on the rooftops of East Austin, Texas

Roschetzky/iStock

Solar, or photovoltaic (PV), cells are made from silicon or other materials that transform sunlight directly into electricity. Distributed solar systems generate electricity locally for homes and businesses, either through rooftop panels or community projects that power entire neighborhoods. Solar farms can generate enough power for thousands of homes, using mirrors to concentrate sunlight across acres of solar cells. Floating solar farms—or "floatovoltaics"—can be an effective use of wastewater facilities and bodies of water that aren't ecologically sensitive.

Solar energy systems don't produce air pollutants or greenhouse gases, and as long as they are responsibly sited, most solar panels have few environmental impacts beyond the manufacturing process.

Wind energy

We've come a long way from old-fashioned windmills. Today, turbines as tall as skyscrapers—with turbines nearly as wide in diameter—stand at attention around the world. Wind energy turns a turbine's blades, which feeds an electric generator and produces electricity.

Other Alternative Energy Sources

Hydroelectric power

Hydropower relies on water—typically fast-moving water in a large river or rapidly descending water from a high point—and converts the force of that water into electricity by spinning a generator's turbine blades.

Nationally and internationally, large hydroelectric plants—or mega-dams—are often considered to be nonrenewable energy. Mega-dams divert and reduce natural flows, restricting access for animal and human populations that rely on those rivers. Small hydroelectric plants (an installed capacity below about 40 megawatts), carefully managed, do not tend to cause as much environmental damage, as they divert only a fraction of the flow.

Biomass energy

Biomass is organic material that comes from plants and animals, and includes crops, waste wood, and trees. When biomass is burned, the chemical energy is released as heat and can generate electricity with a steam turbine.

Biomass is often mistakenly described as a clean, renewable fuel and a greener alternative to coal and other fossil fuels for producing electricity. However, recent science shows that many forms of biomass—especially from forests—produce higher carbon emissions than fossil fuels. There are also negative consequences for biodiversity. Still, some forms of biomass energy could serve as a low-carbon option under the right circumstances. For example, sawdust and chips from sawmills that would otherwise quickly decompose and release carbon can be a low-carbon energy source.

Geothermal energy

The Svartsengi geothermal power plant near Grindavík, Iceland
Daniel Snaer Ragnarsson/iStock

If you've ever relaxed in a hot spring, you've used geothermal energy. The earth's core is about as hot as the sun's surface, due to the slow decay of radioactive particles in rocks at the center of the planet. Drilling deep wells brings very hot underground water to the surface as a hydrothermal resource, which is then pumped through a turbine to create electricity. Geothermal plants typically have low emissions if they pump the steam and water they use back into the reservoir. There are ways to create geothermal plants where there are not underground reservoirs, but there are concerns that they may increase the risk of an earthquake in areas already considered geological hot spots.

Ocean

Tidal and wave energy are still in the developmental phase, but the ocean will always be ruled by the moon's gravity, which makes harnessing its power an attractive option. Some tidal energy approaches may harm wildlife, such as tidal barrages, which work much like dams and are located in an ocean bay or lagoon. Like tidal power, wave power relies on dam-like structures or ocean floor–anchored devices on or just below the water's surface.

3. Store of Renewable Energy

Among the number of renewable sources, solar and wind energy are volatile and unpredictable, classified as Variable Renewable Energy (VRE). Therefore, solar and wind power plants can transform large capacity in a short period of time. Therefore, in order to develop new renewable systems, notably solar and wind power, systems to enhance the operation of power systems and computational storage systems are essential.

According to the researchers, the work of enhancing the performance of the power system can apply synchronously many solutions, such as: applying power generation technologies that can be started, turned off and controlled to fast power output adjustment (eg LNG electrification); automatically adjust the power load through the smart grid; invest in building energy storage systems such as hydroelectricity, batteries, supercapacitors, flywheels (flywheels), air compressors... In the format storage, hydroelectricity uses more than 90% of the total. stored electricity globally. The hydroelectric plant located in Virginia, USA has more than 3 GW of storage and is called "the largest battery in the world".

Let's take a good example from Germany to see why renewable energy storage is important in the development process.

If we look at Germany's installed capacity at present, we see that the percentage of renewable energy (RE) is one of the highest in the world. Adding renewable energy sources including hydroelectricity (excluding stored hydro), biomass, wind, and solar, Germany has 141 GW, while the maximum electricity demand is only 80 GW. So the installed capacity of RE in Germany is 1.76 times higher than the demand, or 76% of the reserve. Fortunately, the peak load in Germany occurs at midday - that is, when solar power is at maximum capacity. Germany's electrical system is very well connected to the whole of Europe. So what else is missing that still needs nuclear power, coal, gas and even oil?

But if we look at the structure of Germany's electricity production in 2021, we see that electricity from renewable energy, including hydropower, only meets 45.7% of electricity demand. The rest is electricity production from fossil fuels (coal, gas, oil), 41.1% and nuclear power, 13.2%.

That is due to the nature of wind and solar power. Let's take a look at a recent week (July 11 to July 18, 2022). In that week, at noon on July 17, solar power generated 40.16 GW, equal to 65% of the installed capacity. But it was only a short time, before and after, even though the German summer had light until 10pm, the solar power capacity also dropped rapidly. On the worst day of the week, July 11, the peak of solar power capacity reached 25.39 GW, equal to 41% of the installed capacity. After 9pm of course the transmit power is 0.

Wind has a different erratic pattern, at 7pm on July 14, wind power capacity peaked at 21.40 GW both onshore and offshore - that is, the highest wind time was only 33 % of set capacity. At the quietest time, at 8:00 am on July 12, the wind power capacity was only 1.37 GW, equivalent to 2% of the installed capacity. And yet, during the two days of July 11 and 12, wind power capacity only averaged 4 GW, or 6% of installed capacity.

Another reason why wind power can never be generated at full capacity is that the system needs to maintain 15-20 GW of stable background capacity. The background running part is done by nuclear power, biomass, hydroelectricity (mainly flow type), a part of brown coal and coal thermal power. Only 40-60 GW remains for variable sources, while the total installed capacity of wind and solar is 126 GW, more than double the demand. If at a rare time, wind and solar power can be generated at full capacity, then there is no need to use stored hydroelectricity in moderation.

Together with renewable energy, hydroelectricity and biomass provide much more stable electricity than wind and solar. But their capacity in Germany is too small to compensate for solar power at night. Germany's storage capacity of hydroelectricity is very respectable, but it can only make up for a short time in a day, unable to bear the shortage of wind power for two days.

Because of the volatility of wind and solar, although the installed capacity of these two types is much higher than the demand, Germany still has to maintain electricity sources from fossil fuels. And fossil energy in Germany provides no less electricity than renewable energy. Especially, electrification has a high degree of flexibility, so it must be worth compensating for RE. In 2021, electrification will contribute 10.4% of Germany's electricity production. Germany's coal power also has to make full use of its capacity flexibility to compensate for renewable energy.

From the concrete example of Germany we see more clearly the importance of storage and transmission in the development of renewable energy.

How to store renewable energy

1. BATTERIES

Batteries are probably the most familiar method of storing energy. Humans use batteries in all sorts of electrical devices, from smartphones to cars. The most popular batteries are lithium-ion batteries, which are used in small devices and also make up more than 90% of battery storage on the global electricity grid.

Lithium-ion batteries have some disadvantages. For example, they become less efficient and more likely to fail over time, according to the Clean Energy Institute(opens in new tab) at the University of Washington. They are also expensive to produce on a large scale, and extracting the raw materials needed to make them has a negative environmental impact. Like most other energy-storage methods, batteries don't retain all the energy that is put in them; they have an efficiency of 85% to 95%, according to a 2020 report by the World Energy Council, a network of energy leaders promoting sustainable energy.

2. PUMPED HYDRO ENERGY STORAGE

A pumped hydro energy storage plant in Spain. (Image credit: Burakyalcin/Shutterstock.com)

Pumped hydro energy storage, or pumped storage hydropower, uses two water reservoirs to store electricity. Excess energy is used to pump water from a lower reservoir to a higher reservoir. Then, when the electricity is needed, water in the higher reservoir is released to flow back down to the lower reservoir through turbines that generate electricity, according to a 2021 review of pumped hydro energy storage published in the journal Progress in Energy. Not all of the energy used to pump the water up is regained when it is released; hydro energy storage has an efficiency of about 75% to 85%, according to the 2020 World Energy Council report.

3. PUMPED THERMAL ELECTRICITY STORAGE

A field of solar panels next to a wind turbine at sunset. Such renewable energy sources could be stored using pumped thermal electricity. (Image credit: Peter Cade/Getty Images)

Pumped thermal electricity storage involves using electricity generated from renewable sources to heat gravel or another heat-retaining material inside an insulated tank. This heat can then be used to generate electricity when needed. This technology is still being developed. The first demonstration Pumped thermal electricity storage facility at Newcastle University in England demonstrated an efficiency of 65% in 2019, according to a 2020 study published in the journal Frontiers in Energy Research(opens in new tab)

4. HYDROGEN STORAGE

Hydrogen is used as a form of chemical energy storage. Electricity is converted into hydrogen through a process called electrolysis, which breaks up water into its hydrogen and oxygen elements, according to the U.S. Department of Energy. The hydrogen can then be stored and used as fuel to generate electricity. Hydrogen can also be used to power hydrogen vehicles to reduce greenhouse gas emissions from transport.

Using hydrogen to store energy has an efficiency of 35% to 55%, according to the 2020 World Energy Council report. Hydrogen fuel cells are costly, as they require expensive metals such as platinum. However, they are used to power and backup critical facilities such as telecom relays and credit card processing, according to the Environmental and Energy Study Institute.

4. Carbon neutralization.

Carbon neutrality is a term for energy conservation and emission reduction. Carbon neutrality refers to the total amount of carbon dioxide or greenhouse gas emissions directly or indirectly generated by a country, enterprise, product, activity or individual within a certain period of time. Through afforestation, it can offset its own carbon dioxide or greenhouse gas emissions achieve positive and negative offsets, and achieve relative “zero emissions”.

The means to reduce carbon dioxide emissions are: first, carbon sequestration, which mainly absorbs and stores carbon dioxide in the air by natural carbon sinks such as soil forests and oceans. What human can do is afforestation;

The second is carbon offset. By investing in the development of renewable energy and low-carbon clean technologies, the carbon dioxide emissions of one industry can be reduced to offset the emissions of another industry.

The benefits of reaching carbon neutrality

Achieving carbon neutrality is not only the key to avoiding the worst consequences of climate change - it also brings benefits to communities and society as a whole. They include:

• Less environmental pollution and improvements to health.

• A boost to sustainable economic growth and the creation of green jobs.

• Enhanced food security by lessening the impact of climate change.

•A halt to the loss of biodiversity and an improvement in the condition of the oceans.

•Companies, according to the NGO Carbon Trust, can also benefit directly from carbon neutrality:

• It shows the company's commitment to decarbonisation and its desire to compensate for left-over impacts.

• It improves the company's green credentials, differentiating it from the rest as an environmentally responsible brand.

• Implement the economicalization of energy conservation and emission reduction, and find a way out of poverty for millions of people.

• Combined with the current developed Internet technology, through the concept of the metaverse and blockchain technology, it provides practical solutions for global climate problems and environmental protection projects.

• Transform ecological goods and services for growing international markets; and better assess nature conservation.

This very sustainable production method becomes a competitive advantage in these markets, while providing ownership opportunities for local and indigenous communities in the business ecosystem, so they are not just labour or consumers, but drivers of economic change.

CHAPTER 2: BLOCKCHAIN TECHNOLOGY FOR RENEWABLE ENERGY

1. What is Blockchain?

Blockchain (or distributed ledger technology—DLT) is a technology that ensures digital information distribution in a shared database that contains a continuously expanding log of transactions and their chronological order. In other words, it is a ledger that may contain digital transactions, data records, and executables that are shared among blockchain partaking agents. Blockchain technology is distinct from other previously known information systems by its four main features: non-localization (decentralization), safeness,verifiability, and smart execution. It is a highly innovative technology that is the outcome of a decade's efforts from "an elite group of computer scientists, cryptographers, and mathematicians".

The basic procedure within blockchains is structured as follows. Initially, the agent creates a new transaction to be included in the blockchain. This recently created transaction is distributed with the network for authentication and audit. As soon as the transaction is authorized by most of the nodes based on pre-determined and multilaterally established rules, this activity can be transferred to the chain as a new block. A record of that transaction is stored in separate dispersed nodes to ensure the safety of the whole system. In the meantime, the smart contract, as a key component of blockchain, facilitates trustworthy transactions to be performed without third party contribution.

Blockchain technology was first introduced in 2008 as a trading platform supporting the Bitcoin cryptocurrency, but since then, its applications are numerous across different sectors, such as fintech, healthcare, luxury goods, etc. However, it should be noted there are only few examples of blockchain utilization at the advanced stage of development, as many applications are still at their infancy level and most of them are at the testing or pilot phases. Even though it is no longer an unknown technology, its rapidly developing applications are innovative and thus have a disruptive nature due to its transparency, interoperability, and decentralization, which helps markets to provide more secure, resilient, and both cost- and time-efficient solutions.

2. Blockchain technology for Renewable Energy.

Blockchain technology has also gathered considerable attention in the energy market, where blockchain has already contributed to the emerging concept called the Internet of Energy (IoE) which enables transparent, decentralized energy prosumer networks, including energy trading platforms. There have been several successful applications of blockchain in the energy industry, where improvements provided by this technology fostered the energy transition and circular economy initiatives through for example, novel solutions for electric e-mobility, energy democratization, P2P energy trading platforms, demand-response mechanisms, smart metering, smart grid management, automation of green certificates issuance and carbon trading, etc. In substance, blockchain can provide three major benefits for the energy sector, which are:

(1) decentralized energy trading and energy supply.

(2) effective, automated control of energy and storage flows through smart contract . And

(3) secure records of all the business activities in the energy industry.

The list of identified categories of blockchain's key advantages in the renewable energy sector includes:

- Smart metering/billing and security;
- Decentralised energy trading;
- Cryptocurrencies, energy token and investments;
- Green certificates and carbon trading;
- Smart grid management;
- IoT, automation and asset management;
- Electric transportation;
- Circular economy.

Let us see the various factors holding back the mass adoption of renewable energy consumption and how Blockchain implementation becomes a suitable answer:

Microgrids

By creating a peer-to-peer network, Blockchain in the energy sector accommodates the development of microgrids owned by small to medium businesses.

The creation of microgrids truly decentralizes energy production and takes away the dependency on a central authority. If the main grid fails then the microgrids can still accommodate the energy needs in their respective regions. If any microgrid fails, the main grid can provide energy to the region being supported by that microgrid. However, there are several challenges faced in such a setup such as the lack of market visibility, central authority, and political influence.

If a business can be sure of the constant demand for energy, it will be more interested in developing a renewable energy production house such as windmills, to create constant supply. Being on the Blockchain, the whole lifecycle of the energy produced can be tracked which removes the possibility of central authority dominance.

The most important use of Blockchain in the energy sector here will be to connect the microgrids with the main grids to manage the demand and supply in an unbiased manner.

If one microgrid falls short of energy supply due to high demand, a smart contract can be triggered to provide additional energy to the microgrid from another microgrid that has an extra supply. After such a scenario the same smart contract also provides that supply back at a later point in time when the first microgrid stabilizes.

Therefore, Blockchain-based smart contracts can be used to minimalize human intervention and automatically execute certain conditions.

Smart meters

A smart meter is a device used for monitoring the consumption of energy and deciding the energy rates. In a Blockchain ecosystem, these smart contracts provide data directly to the blockchain ledger and not to any third party. Therefore, the possibility of manipulation of data by a third party becomes obsolete.

Further, these smart meters can be controlled by smart contracts. Smart contracts can be developed to automatically calculate the energy rates and provide transparency in terms of charges. These smart contracts can also regulate the energy consumption of individual households.

Lack of market visibility

The market for renewable energy sources is fragmented. Whether the objective is to connect the producer with the seller or the seller with the consumer,

connecting the two entities is not easy in a fragmented market. Therefore, use of blockchain in the energy sector as a marketplace becomes a global platform where buyers, sellers, transporters, storage providers, and all other entities can interact.

Another perspective in market visibility is the lack of interaction between a skilled professional and businesses.

In most cases, energy producers are unable to meet the best storage facility or the best transport facility. This is due to the absence of a marketplace where all the entities can meet and interact. Traditionally, if a renewable energy producer wants to provide services in a different geographic location, they require a storage facility, transport, and seller in that location. This process is done over the phone or email which makes it lethargic, slow, and inefficient.

The reason why this interaction has not been digitalized properly is that Internet-based communications are not believed to be trustworthy and there is always a possibility of fraud. However, the advent of Blockchain in the energy sector has made this feasible.

Centralization

One of the prominent use cases of Blockchain in energy is decentralization. The current energy segment is governed by central authorities or large corporations. The rates for energy are decided by the authorities and they control the production as well as supply of the energy. This leads to a significant dependence on the seller.

Blockchain in the energy sector allows it to be customer-centric. Every interaction related to energy consumption, payments, charges, and production will be recorded on the immutable ledger of Blockchain. This induces a sense of responsibility among the entities as all of them will be answerable for their actions. Further, the process the be streamlined using smart contracts.

With pre-written code executing pre-defined functionalities and existing in a definite state on Blockchain's ledger, the different processes such as calculation of charges, taxes, and regulating the energy consumption can be done in defined and transparent standards.

Lack of transparency

Many businesses around the world claim that they have leveraged the latest technologies to reach cleaner fossil fuel production and usage. For instance, the burning of coal is believed to be made more cleaner and efficient. Therefore, other businesses or the normal population become reluctant towards the usage of alternative resources such as wind or solar energy due to the misbelief that conventional resources can be used in a sustainable way.

The biggest challenge here is to bring reality into the picture rather than just assumptions. Even if the use of fossil fuels becomes cleaner, it can never be as clean as the current climate conditions require. Even if there is a minimal greenhouse effect of using fossil fuels, the fact is that these fossil fuels are being used at an extremely large scale and the small numbers add up to millions.

Therefore, the need of the hour is a system where we can convince the world about the grave effects of fossil fuel consumption and the value brought by renewable energy sources. Therefore, one of the major barriers in the adoption of renewable energy sources is the lack of transparency as to how much value they carry.

Even if we use an Internet-based platform to track individual usage and show the effects of that usage on the climate, it becomes a non-trustworthy source. Many people think of it as a trick by climate activists.

This is where Blockchain in the energy sector adds value. Building a Blockchain-based marketplace where the consumption and its effects can be monitored in real-time.

The two most prominent benefits from having such a marketplace are Transparency of industry usage and Individual awareness.

Blockchain in the energy sector can be used to track each individual activity and provide real-time authentic data of how these activities are affecting the climate. For instance, if a person can see that his daily car usage is contributing 0.01% to the reduced air quality index in his area, he will be tempted to reduce individual usage.

More importantly, if the carbon footprint of the industries is visible to the masses along with credibility, it will force industries to adopt sustainable energy resources in order to get customer interest.

Tokenization of Carbon Credits

A carbon credit is equivalent to one metric ton of carbon dioxide and represents the allowed greenhouse gases the companies can emit. These are the credits given by governments under cap-and-exchange programs set up to restrict the quantity of carbon dioxide produced by the organizations. In other words, carbon credits are used to define how much harm can a company do to the earth's atmosphere.

Tokenization of Carbon credits on Blockchain helps in the monetization of illiquid credits to motivate people. As industry consumption becomes transparent, the need for additional carbon credits will be there. Industries can buy these carbon credits from individuals in the form of tokens. These individuals will be reducing their allowed carbon footprint consumption with the purpose of selling these credits to the industries.

CHAPTER 3: RENEWABLE ENERGY BANK PROJECT

1. What is Renewable Energy Bank?

The Renewable Energy Bank project was formed with the criterion of creating and developing a system to connect, store and transmit Clean Energy globally in a decentralized manner, applying private Blockchain technology in manage, operate and coordinate project activities.

While fossil fuel sources such as coal, oil, etc. are becoming increasingly depleted, causing serious environmental pollution, which is one of the factors that increase the greenhouse effect, climate change, etc. Variable Renewable Energy (VRE) such as solar energy, wind, water..., especially solar and wind energy, are being considered as the best choice of the energy industry today.

With many outstanding advantages such as being renewable, extremely large reserves, which can be considered inexhaustible, environmentally friendly, low carbon emissions in the process of production and conversion, abundant and exploitable. The development of renewable energy plays an important role in the sustainable economic development of countries around the world.

However, in addition to building and developing production plants that provide clean energy, the problem of energy transmission and storage ensures stability and sustainability, making the most of energy. from nature, is a problem that countries as well as production units focus on researching to find suitable solutions.

Therefore, our Renewable Energy Bank project focuses on investment, research and development of solutions for better storage and transmission of renewable energy, contributing to the development of renewable energy. clean energy sector and the goal of being carbon neutral around the world.

The items we will deploy in the Banking ecosystem include:

1. Research and manufacture solid-state safe energy storage batteries.

2. Producing and supplying inverters to convert, transmit and store clean energy created and managed by private Blockchain technology.

3. Manage stored assets using Blockchain technology.

4. Cast the corresponding NFT for each stored asset.

5. Establish international trade using ESB Tokens.

6. Connect, share battery usage globally.

7. Cooperation in the purchase, sale and lease of energy storage properties.

8. Research, apply and combine distribution of forms of permanent energy in accordance with the development of the world.

2. Project activities.

2.1. ESB Token.

Mainstream of original know-how on blockchain technology linking DLT with cryptocurrency, such as Bitcoin or Ethereum as it is one of the most recognized applications of blockchain in general:

ESB token is the new token in the renewable energy industry. It acts as a low carbon energy production engine, and thus can increase investment in clean energy. Furthermore, ESB tokens can be used to tokenize resources, which creates new market-shaping possibilities and innovative business models, based on asset division and ownership.

ESB Token is a digital currency used in the ecosystem of the Renewable Energy Bank project with the main roles:

- Participate in the process of exchanging and making commercial payments for the project's products, increasing the surplus value in the process of using products that create clean energy sources.
- Token is also the initial bridge to attract capital to contribute to the establishment and development of the Renewable Energy Bank Project.
- ESB Token is an asset associated with the development value of the project, the better the project develops, the higher the value of ESB token that customers hold.
- ESB token is an effective tool to apply blockchain to manage indicators of customers' renewable energy use, gather necessary parameters to participate in P2P transactions on clean energy.

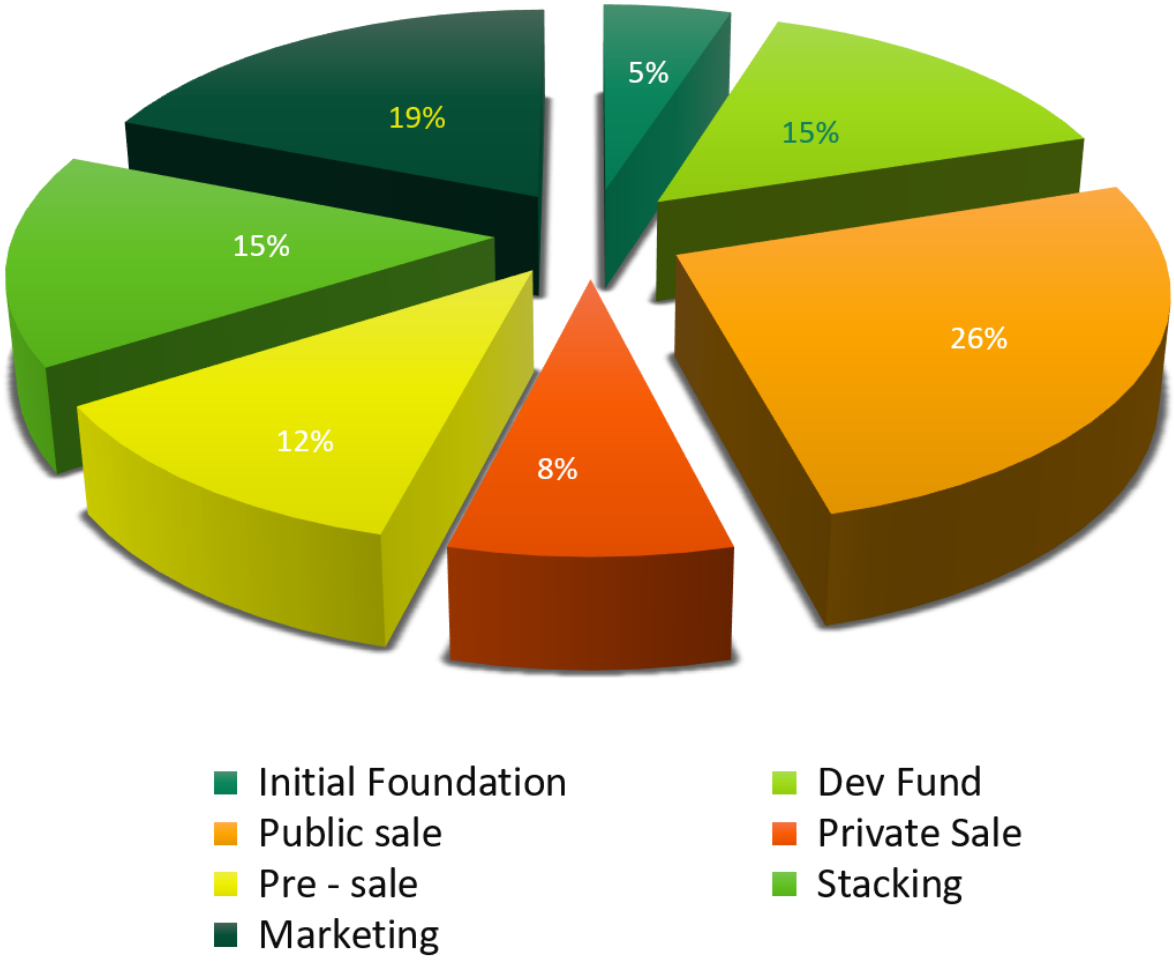
Information about the ESB Token

Token symbol: **ESB**

Total Supply: **200.000.000**

Token Type: **BEP20**

Token Allocation



Token Pre- Sale Metrics

ESB for Pre- Sale: 24.000.000 (12% Total Supply)

	ESB TOKEN	PRICE ($)	%	VESTING	BONUS
ROUND 1	4.320.000	0,26	18	Receive 15% immediately, the rest receive monthly within 16 months	10%
ROUND 2	12.960.000	0,38	54	Receive 15% immediately, the rest receive monthly within 18 months	-
ROUND 3	6.720.000	0,68	28	Receive 5% immediately, the rest receive monthly within 24 months	-

2.2. ESB Blockchain for Renewable Energy Bank project.

Realizing the effectiveness of the application of Blockchain technology in the development of renewable energy, the Renewable Energy Bank project is oriented to establish a separate Blockchain system with the following characteristics:

- Use less energy in the processing of transaction information to reduce carbon emissions. Through the creation of ESB Token - the cryptocurrency used in the entire project's ecosystem; this is considered a green, environmentally friendly cryptocurrency when applying equivalent technology like Solar coin. That is instead of being generated by solving algorithms like Bitcoin and consuming about 110 terawatt hours (TWh) of electricity per year, roughly equivalent to 0.5% of the world's annual energy production, the ESB token will be generated during the user's use of renewable energy by generating or storing each megawatt of electricity. This encourages the use of renewable energy, while reducing carbon emissions for miners, investors, and renewable energy advocates.

- ESB token is increased transaction processing speed, so the process of payment and service exchange with ESB token is fast, convenient and efficient.

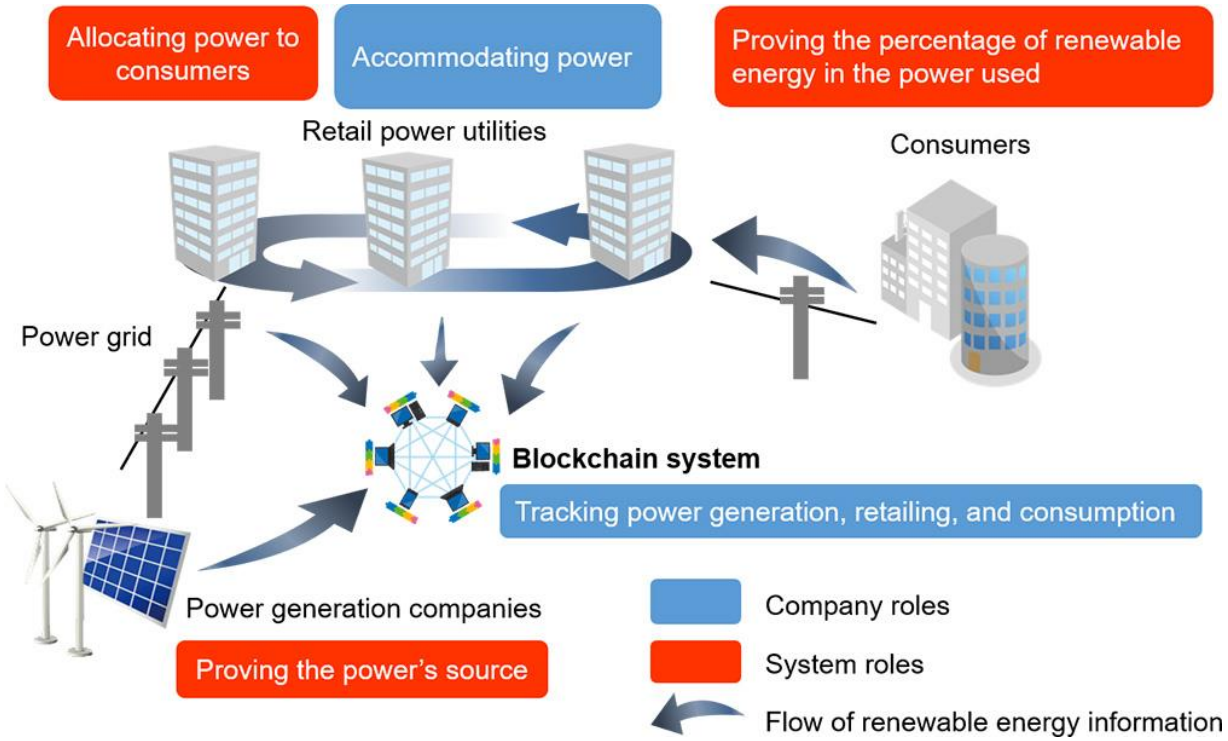
- The ESB blockchain system is installed into the customer's renewable energy grid system to record all relevant parameters in the most detailed, clear and transparent way. It is data about the location of the energy generating equipment, the amount of renewable energy generated, the amount of electricity consumed, the

amount of electricity stored in the storage devices, the amount of electricity connected to the grid, the amount of electricity exchange with other customers.... The metrics recorded by the blockchain are accurate and immutable, so customers are fully active in their energy use and redistribution.

- In addition, when locating and having accurate statistics, each storage device of each household at the same time becomes a portable charging station for vehicles that other customers have demand for, minimize the cost of building charging stations, make the most of the stored energy as well as maximize profits for everyone.

- ESB blockchain can be used to track individual activities and provide real-time authentic data on how these activities are affecting the climate. For example, if a person could find that his daily car use is contributing 0.01% to the reduced air quality index in his area, he would be tempted to reduce personal use.

More importantly, if the carbon emissions of industries are seen with credibility by the public, it will force industries to use sustainable energy sources to attract customer interest.



Thus, ESB blockchain is the focus of development and construction of the Renewable Energy Bank project to solve the problems of clean energy storage, transmission and distribution, strongly develop a decentralized P2P transaction network. focus and an effective tool to participate in the global carbon credit market towards Net zero.

3. Objectives of the project.

3.1. Develop and deliver clean energy storage solutions.

Today, the world is witnessing many changes, geopolitical risks and the rapid recovery of economies after Covid-19 have shaken the market, pushing oil and gas prices to the highest level. for nearly a decade and forced many countries to rethink their energy supplies.

According to CICC research, the estimated theoretical size of global home storage is about 1,300 GWh in 2030, and as of 2021, the installed capacity of global home storage is only about 20 GWh, so the potential for growth is huge. It is believed that factors such as growing electricity price differentials, falling energy storage costs, and expiring FITs will boost home storage even more. It is expected that in the normal situation and the rapid development of VPP (virtual power plant), the global installed capacity of home storage will reach 18/35 GWh in 2025, corresponding to a CAGR is 29%/52% in the period 2021 – 2025.

The renewable energy bank project focuses on researching new efficient storage methods such as lithium battery application and installing inverters with ESB blockchain system installed to optimize value in creating and using. renewable energy use of each household as well as businesses, especially manufacturing enterprises.

3.2. Developing a global decentralized P2P clean energy trading system.

As mentioned above, decentralization is one of the key features of blockchain technology. The ESB blockchain removes intermediaries from the transaction process smart contract for automatic verification and enforce contract rules. Therefore, it ensures security and increases the reliability of transactions.

ESB blockchain make it possible customers to transact renewable energy peer-to-peer between a community or another community nearby. Peer-to-peer energy trading allows the users to decide to whom theelectricity can be sold, and from whom they can purchase elec-tricity. The information related to the trading will be stored in theimmutable ledger that can be only accessed by the developer andone with credentials.

Customers of the Renewable Energy Bank project can not only exchange energy with each other, but also exchange and lease energy equipment such as batteries, inverters, and energy-using equipment... easy because all parameters have been provided transparently and accurately.

In addition, the use of ESB tokens in all commercial, exchange, and rental transactions makes transactions fast, convenient, safe and unlimited in scope.

These factors are synchronously applied to optimally support the P2P trading process. Therefore, the project has a strong spillover to become a leading decentralized clean energy exchange system in the world.

3.3. Building the basis for Green Certification and carbon trading

According to recent statistics, the price of carbon in the European Union's carbon emissions trading (ETS) exceeds 99 euros per ton, a record high. During the same period, carbon prices on the UK's separate carbon exchange market also surpassed historic highs, reaching more than 97 pounds per ton. The industry as a whole blame the lack of carbon emission quota permits as the main reason for the current high carbon prices.

Towards the goal of being carbon neutral through today's thriving carbon credit exchange market, the Renewable Energy Bank project uses ESB blockchain technology to control the entire process of generating, saving, and saving. Energy storage and distribution will be the supplier of accurate and reliable green certificates to every customer. This is an important factor in proving clean energy source, volume, location and all the elements required for green certification.

Any small customer or clean energy company with an ESB blockchain application can easily participate in the global carbon credit trading market.

For reasons of information security and long-term orientation, some important contents of the Renewable Energy Bank project have not been included in the white paper at the moment.

We will continuously update the white paper according to the specific development stages of the project in the following sections.

Thank you for accompanying us to build a greener world.

Best regards!

ESB Team