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# Green Energy as a Hope to Save Earth

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**ABSTRACT:** Green energy is any energy type that is generated from natural resources, such as sunlight, wind or water. As a source of energy, green energy often comes from renewable energy technologies such as solar energy, wind power, geothermal energy, biomass and hydroelectric power. Each of these technologies works in different ways, whether that is by taking power from the sun, as with solar panels, or using wind turbines or the flow of water to generate energy. In order to be deemed green energy, a resource cannot produce pollution, such as is found with fossil fuels. This means that not all sources used by the renewable energy industry are green. For example, power generation that burns organic material from sustainable forests may be renewable, but it is not necessarily green, due to the CO<sub>2</sub> produced by the burning process itself. Green energy sources are usually naturally replenished, as opposed to fossil fuel sources like natural gas or coal, which can take millions of years to develop. Green sources also often avoid mining or drilling operations that can be damaging to eco-systems.

**KEYWORDS**-green energy, earth, ecosystem, natural, renewable, resources

## I.INTRODUCTION

Types

The main sources are wind energy, solar power and hydroelectric power (including tidal energy, which uses ocean energy from the tides in the sea). Solar and wind power are able to be produced on a small scale at people's homes or alternatively, they can be generated on a larger, industrial scale.

The six most common forms are as follows:

### 1. Solar Power

This common type of renewable energy is usually produced using photovoltaic cells that capture sunlight and turn it into electricity. Solar power is also used to heat buildings and for hot water as well as for cooking and lighting. Solar power has now become affordable enough to be used for domestic purposes including garden lighting, although it is also used on a larger scale to power entire neighbourhoods.

### 2. Wind Power

Particularly suited to offshore and higher altitude sites, wind energy uses the power of the flow of air around the world to push turbines that then generate electricity.

### 3. Hydropower

Also known as hydroelectric power, this type of green energy uses the flow of water in rivers, streams, dams or elsewhere to produce electricity. Hydropower can even work on a small scale using the flow of water through pipes in the home or can come from evaporation, rainfall or the tides in the oceans.[1,2,3]

Exactly how 'green' the following three types of green energy are is dependent on how they are created...



#### 4. Geothermal Energy

This type of green power uses thermal energy that has been stored just under the earth's crust. While this resource requires drilling to access, thereby calling the environmental impact into question, it is a huge resource once tapped into. Geothermal energy has been used for bathing in hot springs for thousands of years and this same resource can be used for steam to turn turbines and generate electricity. The energy stored under the United States alone is enough to produce 10 times as much electricity as coal currently can. While some nations, such as Iceland, have easy-to-access geothermal resources, it is a resource that is reliant on location for ease of use, and to be fully 'green' the drilling procedures need to be closely monitored.

#### 5. Biomass

This renewable resource also needs to be carefully managed in order to be truly labelled as a 'green energy' source. Biomass power plants use wood waste, sawdust and combustible organic agricultural waste to create energy. While the burning of these materials releases greenhouse gas these emissions are still far lower than those from petroleum-based fuels.

#### 6. Biofuels

Rather than burning biomass as mentioned above, these organic materials can be transformed into fuel such as ethanol and biodiesel. Having supplied just 2.7% of the world's fuel for transport in 2010, the biofuels are estimated to have the capacity to meet over 25% of global transportation fuel demand by 2050.

#### Why It Is Important

Green energy is important for the environment as it replaces the negative effects of fossil fuels with more environmentally-friendly alternatives. Derived from natural resources, green energy is also often renewable and clean, meaning that they emit no or few greenhouse gases and are often readily available.

Even when the full life cycle of a green energy source is taken into consideration, they release far less greenhouse gases than fossil fuels, as well as few or low levels of air pollutants. This is not just good for the planet but is also better for the health of people and animals that have to breathe the air.

Green energy can also lead to stable energy prices as these sources are often produced locally and are not as affected by geopolitical crisis, price spikes or supply chain disruptions. The economic benefits also include job creation in building the facilities that often serve the communities where the workers are employed. Renewable energy saw the creation of 11 million jobs worldwide in 2018, with this number set to grow as we strive to meet targets such as net zero.

Due to the local nature of energy production through sources like solar and wind power, the energy infrastructure is more flexible and less dependent on centralised sources that can lead to disruption as well as being less resilient to weather related climate change.

Green energy also represents a low cost solution for the energy needs of many parts of the world. This will only improve as costs continue to fall, further increasing the accessibility of green energy, especially in the developing world.

#### Examples

There are plenty of examples of green energy in use today, from energy production through to thermal heating for buildings, off-highway and transport. Many industries are investigating green solutions and here are a few examples:



### 1. Heating and Cooling in Buildings

Green energy solutions are being used for buildings ranging from large office blocks to people's homes. These include solar water heaters, biomass fuelled boilers and direct heat from geothermal, as well as cooling systems powered by renewable sources.

### 2. Industrial Processes

Renewable heat for industrial processes can be run using biomass or renewable electricity. Hydrogen is now a large provider of renewable energy for the cement, iron, steel and chemical industries.[4,5,6]

### 3. Transport

Sustainable biofuels and renewable electricity are growing in use for transportation across multiple industry sectors. Automotive is an obvious example as electrification advances to replace fossil fuels, but aerospace and construction are other areas that are actively investigating electrification.

#### Can It Replace Fossil Fuels?

Green energy has the capacity to replace fossil fuels in the future, however it may require varied production from different means to achieve this. Geothermal, for example, is particularly effective in places where this resource is easy to tap into, while wind energy or solar power may be better suited to other geographic locations.

However, by bringing together multiple green energy sources to meet our needs, and with the advancements that are being made with regards to production and development of these resources, there is every reason to believe that fossil fuels could be phased out.

We are still some years away from this happening, but the fact remains that this is necessary to reduce climate change, improve the environment and move to a more sustainable future.

#### Can It Be Economically Viable?

Understanding the economic viability of green energy requires a comparison with fossil fuels. The fact is that as easily-reached fossil resources begin to run out, the cost of this type of energy will only increase with scarcity.

At the same time as fossil fuels become more expensive, the cost of greener energy sources is falling. Other factors also work in favour of green energy, such as the ability to produce relatively inexpensive localised energy solutions, such as solar farms. The interest, investment and development of green energy solutions is bringing costs down as we continue to build up our knowledge and are able to build on past breakthroughs.

As a result, green energy can not only become economically viable but also the preferred option.

#### Which Type Is The Most Efficient?

Efficiency in green energy is slightly dependent on location as, if you have the right conditions, such as frequent and strong sunlight, it is easy to create a fast and efficient energy solution.

However, to truly compare different energy types it is necessary to analyse the full life cycle of an energy source. This includes assessing the energy used to create the green energy resource, working out how much energy can be translated into electricity and any environmental clearing that was required to create the energy solution. Of course, environmental damage would prevent a source truly being 'green,' but when all of these factors are combined it creates what is known as a 'Levelised Energy Cost' (LEC).



Currently, wind farms are seen as the most efficient source of green energy as it requires less refining and processing than the production of, for example, solar panels. Advances in composites technology and testing has helped improve the life-span and therefore the LEC of wind turbines. However, the same can be said of solar panels, which are also seeing a great deal of development.

Green energy solutions also have the benefit of not needing much additional energy expenditure after they have been built, since they tend to use a readily renewable source of power, such as the wind. In fact, the total efficiency of usable energy for coal is just 29% of its original energy value, while wind power offers a 1164% return on its original energy input.[7,8,9]

Renewable energy sources are currently ranked as follows in efficiency (although this may change as developments continue):

1. Wind Power
2. Geothermal
3. Hydropower
4. Nuclear
5. Solar Power

How Can it Help the Environment?

Green energy provides real benefits for the environment since the power comes from natural resources such as sunlight, wind and water. Constantly replenished, these energy sources are the direct opposite of the unsustainable, carbon emitting fossil fuels that have powered us for over a century.

Creating energy with a zero carbon footprint is a great stride to a more environmentally friendly future. If we can use it to meet our power, industrial and transportation needs, we will be able to greatly reduce our impact on the environment.

Green Energy vs Clean Energy vs Renewable Energy – What is the Difference?

As we touched upon earlier, there is a difference between green, clean and renewable energy. This is slightly confused by people often using these terms interchangeably, but while a resource can be all of these things at once, it may also be, for example, renewable but not green or clean (such as with some forms of biomass energy).

Green energy is that which comes from natural sources, such as the sun. Clean energy are those types which do not release pollutants into the air, and renewable energy comes from sources that are constantly being replenished, such as hydropower, wind power or solar energy.

Renewable energy is often seen as being the same, but there is still some debate around this. For example, can a hydroelectric dam which may divert waterways and impact the local environment really be called 'green?'

However, a source such as wind power is renewable, green and clean – since it comes from an environmentally-friendly, self-replenishing and non-polluting source.

Green energy looks set to be part of the future of the world, offering a cleaner alternative to many of today's energy sources. Readily replenished, these energy sources are not just good for the environment, but are also leading to job creation and look set to become economically viable as developments continue.

The fact is that fossil fuels need to become a thing of the past as they do not provide a sustainable solution to our energy needs. By developing a variety of green energy solutions we can create a totally sustainable future for our energy provision, without damaging the world we all live on.



TWI has been working on different green energy projects for decades and has built up expertise in these areas, finding solutions for our Industrial Members ranging from electrification for the automotive industry to the latest developments in renewable energy.

## II.DISCUSSION

According to the Environmental Protection Agency (EPA), green energy provides the highest environmental benefit and includes power produced by solar, wind, geothermal, biogas, low-impact hydroelectric, and certain eligible biomass sources.[10]

These renewable energy sources enter the power grid and are indistinguishable from conventional energy sources when you flip a light switch or charge your phone. Although renewable energy encompasses the same sources as green energy, this energy more broadly includes technologies and products which can have a considerable impact on both the local and global environment. Essentially, when you buy green power, you're also supporting various renewable energy projects and the investment in technologies that help them grow.

It's important to understand that the energy you consume will be a mix of green, renewable, and conventional energy regardless of which product you purchase. This is because all energy sources in the electric grid are mixed together when they enter the power transmission grid. From here, electricity travels to homes and businesses via the handful of regional grids that stretch across Canada and the United States.

So by buying green energy you are not directly purchasing green power for your home, but are instead paying for a small premium that covers the costs of putting more renewable energy into the grid. For those keen to go green at home who don't have space or funds for a solar panels array, this is the best way to measurably reduce the carbon footprint associated with your energy consumption. It's also the most affordable way to increase large-scale renewable energy investment and it gives more households and businesses access to green energy.

If you're with a green energy supplier like Just Energy, you will pay a very small premium to buy green energy products—this is often akin to the price of a coffee a week or a movie ticket in most markets. This cost contributes to green energy projects, such as the development and maintenance of solar fields—so that we can move towards a cleaner, greener future together. As this movement gains more traction and funding, less of the energy that we consume will be produced by conventional methods which are unsustainable, contribute to air pollution, worsen global warming, and harm the environment.

### Types of Green Energy:

There are many types of green energy coming from a wide variety of sources. Some of these types are better suited to specific environments or regions, which is why there are so many renewable energy that filter into the energy grid.

#### Solar Energy

Solar is a clean source of energy which comes directly from the sun. Stars, in general, produce an unimaginable amount of energy via nuclear fusion—the process by which smaller atoms are fused together by heat and pressure to create heavier atoms—with a whole lot of energy emitted in the process. This energy then reaches us via solar radiation, which we can collect and convert it into usable electricity.

Solar panels are perhaps the most common form of solar energy harvesting. These are panels full of things called photovoltaic cells. When the light from the sun hits these cells they create an electrical current through the photoelectric effect. [1] The current is then passed through an inverter to turn it into an alternating current. From here it can be used to power your home or added to the national grid mix.

#### Wind Energy

Wind energy is actually another energy source powered by the sun. That's because winds are caused by the uneven heating of the atmosphere. This unevenness is affected by the topology of our planet, its spin, and how we orbit around the sun. Winds are further modulated by the surface they are passing over—either land or water. Three blade wind turbines are most commonly associated with wind power. Unlike solar energy, these work on a rather simple principle. Wind turns the blades of the turbine, which turns an internal rotor. This rotor then moves the main shaft, which spins a generator and creates electricity.

Although wind may seem powerful, expansive wind farms are required in order to generate enough electricity to make an impact.

#### Hydroelectric Energy

Hydroelectric energy is produced by capturing the energy contained within flowing water. This is best achieved by forcing water to flow through a narrow path, thereby increasing its energy per square meter. This is



commonly achieved by storing water in a reservoir or dam and selectively purging the water by opening an intake.[11,12]

The gravitational potential energy stored by holding water higher up in the dam forces the water through the intake at incredible speed. When released, the flow spins a turbine which once again activates a generator, creating electricity.

Due to its efficacy, hydroelectricity is one of the most popular forms of green energy. In 2017 alone it is estimated that 4 billion tonnes of greenhouse gases were not released into our atmosphere by generating electricity from hydropower.[2]

#### Biogas

The beauty of biogas, if it can be described as such, is that it is not only a green energy source but that it makes use of our waste products. Produced as a byproduct when organic matter decomposes, biogas comes from materials such as sewage, food, agricultural waste, and manure.

These materials are stored in containers without oxygen, causing them to ferment and produce methane and carbon dioxide as well as other gases. The methane produced can then be sold on and used to heat homes, produce electricity and fuel vehicles. At the same time, the waste placed in a biogas digester becomes nutrient-rich fertilizer, perfect for farms and even home use.

#### Biomass

Just like biogas, biomass is a source of green energy that comes from plants and animals—both of which contain energy stored from the sun, often in the form of sugar or cellulose. In fact, when it comes to converting biomass into usable energy, much of this material is made into biogas as well as liquid biofuels including ethanol and biodiesel. Other solid materials such as wood can be burned by themselves in order to heat buildings as well as to produce electricity. According to the EPA, around 5% of the total energy consumed in the US in 2017 came from biomass fuels.[3]

#### The Main Benefits Green Energy

Reducing carbon emissions, preventing further environmental harm, and creating jobs are just some of the opportunities provided by investing in green energy. And by buying green energy, you are helping bring that future closer.

Every day the sun provides the earth with more than enough energy to power the entire planet, but there's a problem. The current technologies we have in place are not efficient enough to convert enough of it into electricity, and for many, it's more cost-effective to use other traditional sources. Going green means greater funding to solar, wind, and other renewable energy projects, creating technologies to better harness the renewable sources around us and make them more affordable and accessible to everyone.

Traditionally we have relied on materials such as coal, oil, and even kerosene to provide us with the energy we need. However, these fuels are non-renewable and expel pollution into our environment and atmosphere. As such, these sources will eventually run out, causing fears about shortages and access to them. But what's worse, is the environmental harm they inflict.

Burning these conventional sources of energy fuels global warming. Coal and oil pour toxic gases into the environment, impacting general health, and causing respiratory issues, and reducing live expectancies.[4] Simply extracting oil and coal can destroy areas environments, economies, and livelihoods in the form of devastating oil spills.[5]

Green energy will help us mitigate and sidestep at least some of these issues, and the quicker we move to renewable energy sources the better.

### III.RESULTS

#### Green Energy Projects

Projects that are creating a cleaner, greener future by reducing greenhouse gas emissions and promoting sustainability. Providing communities with access to clean, renewable energy.

#### Discussion Space

Members can engage in discussions, ask questions, and share their knowledge. The forum provides a platform to connect and learn from one another and offers a space for open discussion about renewable energy and sustainable living.



### Green Energy Magazine

Our green energy magazine provides valuable insights and information about renewable energy and sustainability. A source of inspiration and education for anyone looking to make a positive impact on the environment and build a cleaner, greener future.

The rush to achieve net zero is driving massive global investments in renewable energy. Surges in energy prices as a result of the conflict in Ukraine make the green energy transition even more pressing and may further increase the benefits for investors.

No one needs a net zero world more than the almost two billion people who live in fragile and conflict-affected places: for them, the climate emergency can be literally a matter of life or death. And many of these places have huge potential for green transition investments, whether in energy sources such as solar, hydro or wind, or as vital sources of the minerals on which green technologies rely.

But green energy projects can cause or exacerbate conflicts and tensions, nowhere more so than in the world's most fragile areas. If investments are not done right, there is a significant risk of the world's green transition coming at the expense of higher levels of conflict and suffering. This report examines three case studies: the cobalt mining industry in the Democratic Republic of Congo (DRC), and wind and solar projects in Kenya and Morocco.

In DRC, the rapidly increasing demand for cobalt poses risks to the stability of mineral-producing regions already characterised by weak mining sector governance and histories of human rights violations.

Meanwhile, the Kenya and Morocco wind and solar infrastructure projects studied in this report highlight several ways that green energy transition projects can cause conflict and escalate tensions.[13]

A consumer green energy program is a program that enables households to buy energy from renewable sources. By allowing consumers to purchase renewable energy, it simultaneously diverts the utilization of fossil fuels and promotes the use of renewable energy sources such as solar and wind.

In several countries with common carrier arrangements, electricity retailing arrangements make it possible for consumers to purchase "green" electricity from either their utility or a green power provider. Electricity is considered to be green if it is produced from a source that produces relatively little pollution, and the concept is often considered equivalent to renewable energy.<sup>[1]</sup> Although electricity is the most common green energy, biomethane is sold as "green gas" in some locations.<sup>[2]</sup>

In many countries, green energy currently provides a very small amount of electricity, generally contributing less than 2 to 5% to the overall pool of electricity offered by most utility companies, electric companies, or state power pools. In some U.S. states, local governments have formed regional power purchasing pools using Community Choice Aggregation and Solar Bonds to achieve a 51% renewable mix or higher, such as in the City of San Francisco.<sup>[3]</sup>

By participating in a green energy program a consumer may be having an effect on the energy sources used and ultimately might be helping to promote and expand the use of green energy. [17,18] They are also making a statement to policy makers that they are willing to pay a price premium to support renewable energy. Green energy consumers either obligate the utility companies to increase the amount of green energy that they purchase from the pool (so decreasing the amount of non-green energy they purchase), or directly fund the green energy through a green power provider. If insufficient green energy sources are available, the utility must develop new ones or contract with a third party energy supplier to provide green energy, causing more to be built. However, there is no way the consumer can check whether or not the electricity bought is "green" or otherwise.

In some countries such as the Netherlands, electricity companies guarantee to buy an equal amount of 'green power' as is being used by their green power customers. The Dutch government exempts green power from pollution taxes, which means green power is hardly any more expensive than other power.





Those not satisfied with the third-party grid approach to green energy via the power grid can install their own locally based renewable energy system. Renewable energy electrical systems from solar to wind to even local hydro-power in some cases, are some of the many types of renewable energy systems available locally. Additionally, for those interested in heating and cooling their dwelling via renewable energy, geothermal heat pump systems that tap the constant temperature of the earth, which is around 7 to 15 degrees Celsius a few feet underground and increases dramatically at greater depths, are an option over conventional natural gas and petroleum-fueled heat approaches. Also, in geographic locations where the Earth's Crust is especially thin, or near volcanoes (as is the case in Iceland) there exists the potential to generate even more electricity than would be possible at other sites, thanks to a more significant temperature gradient at these locales.

The advantage of this approach in the United States is that many states offer incentives to offset the cost of installation of a renewable energy system. In California, Massachusetts and several other U.S. states, a new approach to community energy supply called Community Choice Aggregation has provided communities with the means to solicit a competitive electricity supplier and use municipal revenue bonds to finance development of local green energy resources. Individuals are usually assured that the electricity they are using is actually produced from a green energy source that they control. Once the system is paid for, the owner of a renewable energy system will be producing their own renewable electricity for essentially no cost and can sell the excess to the local utility at a profit.[15,16]

#### IV.CONCLUSION

Adani Green Energy Limited (AGEL) is one of the largest renewable companies in India, with a current project portfolio of 20,434 MW. AGEL is part of the Adani Group's promise to provide a better, cleaner and greener future for India. Driven by the Group's philosophy of 'Growth with Goodness', the Company develops, builds, owns, operates and maintains utility-scale grid-connected solar and wind farm projects. The electricity generated is supplied to central and state government entities and government-backed corporations. On the back of long-term Power Purchase Agreements (PPAs) of 25 years with central and state government entities, AGEL has leveraged its capabilities and expanded its presence across 12 Indian states. The Company deploys the latest technologies in its projects. With a portfolio of 54 operational projects and 12 projects under construction, AGEL is driving India on its renewable energy journey.[14]

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