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Alternative Energy

HANI BOJER

INTRODUCTION

To sustain and keep alive all the major activities and processes in the world, a constant and reliable flow of energy is essential. Human life depends so much on energy in form of electricity, which is used to run industries, hospitals and homes. These are any sources of energy such as, nuclear, which have no undesired consequences. Also referred to as free energy, such sources are renewable in that they are constantly replenished for instance: geothermal, wind, solar and hydroelectric power. Other sources have also been discovered in recent times, for instance biomass energy from wood and crops is one good example. Non-renewable sources of energy come from sources that cannot be replenished. Therefore, once a particular site has been exhausted, a different location for the same energy source must be found in order to fill the gap created by the depletion of the previous mine. Over time, the non-renewable forms of energy have proven to be detrimental to the environment. For this reason, scientists have come up with alternatives to reduce the dependence on such forms of energy while also coming up with ways to phase them out completely. These two sources of energy are in use in everyday life from powering vehicles to providing light and heat in homes and offices as well as powering machines. The costs of these forms of energy vary though some may seem free, harnessing, collection and transportation costs are encountered. These are some of the reasons why some energy sources took time to be used and why most of the world is dependent on others.

Sources of Renewable Energy

As stated above, renewable energy is energy that comes from sources that can be replenished or cannot be depleted.

I. GEOTHERMAL ENERGY

This is basically energy in the form of heat that comes from the earth. Underground water sometimes comes close or in contact with magma, making it boil and eventually turn into steam. This steam and hot water finds its way to the earth's surface via cracks on the rocks. Once on the surface it becomes a hot spring and can be used to generate electricity. It can also be tapped directly from its source in the underground hot spring before it finds its way to the earth's surface. The system used to tap it from the ground also pumps it back into the reservoir once the water has cooled. This creates a cycle that if used well, should make sure that the particular hot spring never runs out of water, thus making it beneficial to humans and the environment. (Union of Concerned Scientists Website, 2009)

II. WIND ENERGY

Wind energy is among the oldest forms of renewable energy that has been in use for centuries. Wind is defined as moving air usually from areas of high pressure to those with low. Energy is generated by wind turbines that are rotated by wind as it blows. Basically, the kinetic energy contained in the wind is directly translated to electrical energy that can be used by machines and for lighting houses and offices (WWEA, 2006). In previous times, windmills were mostly used to pump water from their source to tanks or reservoirs that could be easily accessed for use. These windmills however, did not generate electricity, they use wind energy in its most raw form. Nowadays they have built in turbines that once rotated by the force of the wind, generate electricity that is harnessed for use. There are huge areas known as wind farms that are demarcated for building of many windmills that supply electricity to the national grid. Setting up of these wind farms is expensive but future costs are cheap and benefits make it a valuable source of electricity. Current initiatives that are in place to improve the performance of wind turbines include; avoiding problems prior to installation, rapid problem solution and constant monitoring of performance. (Renewable Energy World Website, 2013).

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III. Solar Energy

This type of energy involves collecting the light energy radiation from the sun and converting it into an electric current. Solar energy is divided into two, namely: - Active and Passive. Passive is collected without the use of mechanical gadgets. This is mostly used in providing light and heat during the daytime. This is achieved by building houses or offices in a way that it is fully illuminated by the sun during the day without the need for lighting any bulbs in any room. Active is energy collected using mechanical devices. These devices convert solar power into energy in two ways, namely; Photovoltaic conversion where solar power is converted to electricity by the use of photovoltaic solar cells and Solar Thermal conversion, which converts the solar power directly to heat. The use of solar energy is used all over the world and it is done in large scale in some countries in what are called solar farms. . (Wise Geek , 2003)

IV. Biomass Energy

This is the use of any biological materials that can either be burned or otherwise converted to another form for the purpose of creation of energy. The most common form of biomass is wood that comes in chips, pellets and low-grade wood wastes. Nowadays, biomass fuel can be derived from crops. The common way of deriving energy from biomass is by burning the wood though there are crops nowadays that can produce eco-friendly oil that can be used in machines and vehicles as a substitute to fossil fuels. Use of biomass is friendly to the environment since it does not contribute to the increase of greenhouse gasses. However over exploiting it leads to deforestation, which has dire consequences to the weather in that particular area. This means that in order for biomass to be renewable, more trees should be planted at the same time that others are being burned for fuel. (BERC,2013)

V. Water energy

Water has two kinds of energy; kinetic and potential energies. Kinetic energy is from the fact water is always in constant movement. On the other hand the potential energy is contained in the fact that water contains tremendous energy that can be extracted from it. Water is the main source of hydroelectric power. Hydroelectric power is harvested from water when it passes through waterfalls its kinetic power is increased. The increase in the water kinetic power is used to turn and propel turbines that produce electric power. However, for this process to occur there has to be a high dam built on the site. The dam is important since it creates a reservoir of water that helps in a steady supply of water. Water energy has been termed as among the most sufficient sources of energy. The reason for this assertion is because water energy is a natural source of power and it has not been associated with environmental pollution. The other reason is that water is a reliable source of energy since it is renewable. Hydroelectric power is clean and efficient, hence among the best sources we have in the world today.so, there are two kinds of Hydropower energy power Tidal power the Power obtained by catching the energy of moving water masses due to tides. The water flows through tunnels in the dam when the tide goes in and out. This power used to push air through a pipe, which then turns a turbine. Also, Wave power the concept of capturing and converting the energy available in the motion of ocean waves to energy the waves arriving cause the water in the chamber to rise and fall

Sources of Non-renewable energy

I. Nuclear energy

Nuclear energy is another sources of energy that is greatly depended on in the world we exist in. nuclear energy is a form energy derived from the splitting of uranium atoms in a process known as fission. Fission is the process used to generate heat in the production of steam in a nuclear power plant. The steam is used top propel turbines which in return generate electricity. This source of energy is very reliable since uranium is easily available on the earth's crust. Uranium has been termed to be 40% more available than silver, hence its use in the production of energy is reliable. Nuclear energy can either be natural or man made. Man made nuclear energy is the most available form of energy that is used in electricity production.

Nuclear energy is reliable because of the following reasons:

It produces a lot of energy in comparison to wind and hydro energy

It does not produce carbon dioxide or any other air pollutants in its production

The use of uranium as its main raw material makes its production efficient since it is abundant and easily available on the earth's crust

Despite the advantages of this type of energy it has numerous disadvantages. These disadvantages include:

It is feared that it can be used in the expansion production of nuclear weapons which may cause large-scale devastation

In its production it requires large capital costs

Its waste materials are highly unstable and they can be highly radioactive

Nuclear energy has been termed to be highly dangerous to the environment and human health and safety

The major concerns related with the production of nuclear energy are the health and safety issues because it uses potentially hazardous sources.

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GLOBAL WARMING

Global warming is a term that nowadays comes up a lot when talking about the weather. Global warming is abnormal changes in weather patterns, which also bring about extreme climatic conditions and natural disasters. These disasters have caused the loss of many human lives and insurmountable damage of property that has run into billions in the recent past. Scientists all over the world warn of a bleak future if the weather goes on with the massive changes being experienced worldwide. Scientists are in unison claiming that the reason for global warming is greenhouse gasses that come from the over use of fossil fuels. For this reason, there are ongoing studies on alternative forms of energy to replace fossil fuels, lest we kill the world and ourselves with it. Some of the alternative sources of energy are renewable and have been in use for a number of years though, in a smaller scale than they can be applied to nowadays. Many domestic and international non-governmental organizations are lobbying for the increased use of renewable sources of energy and reduce the world's dependence on fossil fuels. Replacing fossil fuels is however, still taking time since the alternative renewable energy sources are yet to replace the systems existent on fossil fuels. Global warming is now not only affecting the climate, but also negatively impacting communities, economies and the health of people all over the globe. The frequency of natural disasters is increasing in an alarming rate therefore; something has to be done now to curb this particular pandemic.

THE EFFECTS OF HUMAN ACTIVITY AND GREENHOUSE GASSES

Greenhouse gasses absorb and emit radiation in the range of thermal infrared allowing direct rays of the sun to come to the earth's surface without being shielded by the ozone layer. The ozone layer is an invisible gaseous membrane that protects the earth and its inhabitants from the direct rays of the sun. Smoke from fossil fuel burning industries and vehicles are detrimental to the ozone layer, making in thin in some areas and in some creating gaps that allow direct sun rays and radiation to reach the earth. Greenhouse gasses are comprised of carbon dioxide, nitrous oxide, methane, ozone and water vapour. The amount of energy sent from the sun to the earth in form of heat and radiation should be in equal proportion to the one being reflected back to space, thus maintaining a constant temperature (more or less) of the earth's environment and surface. This should be the case were it not for the interference of human activity into greenhouse gasses. The greenhouse gasses absorb the infrared rays that are reflected back to space by the earth's surface, effectively trapping the heat here that should not occur in the case of low levels of greenhouse gasses. This in essence makes the earth warmer than it is supposed to be.

A great contributor to increased greenhouse gasses is human activity. These activities include deforestation, some agricultural practices and smoke and fume from industries, vehicles, trains, ships and planes. These fumes are as a result of burning fossil fuels or using coal furnaces to make their engines work. Studies have proven that three quarters of CO2 emissions responsible for global warming are as a result of human activities. Being that the human race is the greatest beneficiary of a safe and clean environment as compared to other occupants of planet earth, it beats reason why they are the same organisms that are working towards destroying the same environment that keeps them alive. In any way of putting it, it stands to reason that humans are their own worst nemesis. The carbon dioxide levels have been on a constant increase in the last two and a half centuries. In terms of development, the human has come a long way since the seventeen hundreds. Here, one question is evident. Has this really been for the good of mankind or a clear path to destruction?

EFFECTS OF GLOBAL WARMING

Effects of global warming are evident all over the world. For instance, the ice surface in the Antarctic and glaciers in the Arctic Circle are melting as a result of increased average temperatures in the North Pole. The breaking up and melting of the glaciers brings about a rise in the ocean and sea levels to above normal levels. Current data predicts that the ocean and sea levels will have risen by 23 inches by the end of the century. Water levels are not the only ones affected by global warming. Wildlife numbers are dropping rapidly all over the world as the years go by and will continue reducing until something is done to curb the effects of global warming. Animals are a very important part of the ecosystem and their extinction can easily spell the end of the world as we know it. Animals like the Adelle penguins of Antarctica are on the brink of extinction with their numbers falling from 32,000 breeding pairs 30 years ago to 11,000 currently. Similarly, the weather has also experienced some harsh changes. The number of hurricanes, typhoons, floods, snowstorms and many more are on the rise. The US and Britain for instance, have lost hundreds of lives and billions of dollars as a result of extreme floods and storms. The numbers of hurricanes have been steadily increasing every year from 1905 to 2005. Studies show an average of 3.5 hurricanes per year from 1905 to 1930, 5.1 from 1931 to 1994 and 8.4 from 1995 to 2005. A hurricane can be defined as an intense tropical cyclone with winds travelling more than 64 knots or 119 kph. It is usually characterised by heavy rains and usually originates from the east of the Pacific Ocean or the equatorial expanse of the Caribbean Sea or Atlantic Ocean.

In some countries, droughts have increased and are more common than they were 15 years ago. The Quelccaya ice cap that is responsible for fresh water for drinking and production of hydropower to millions of people in Peru is melting at an alarming rate meaning that it will soon dry up. Harsh climatic occurrences like heatwaves are also being experienced more often. Arid and semi-arid areas in Africa and other continents are expanding to areas that were initially arable. As a result, many people are

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suffering from hunger and since they cannot farm on their lands due to harsh weather, they depend on food aid from other countries and well-wishers. Rivers and lakes are also drying up, extending the effects of global warming to marine life and animals that depend on them for survival. In 2003, a heatwave in Europe cost an estimated 50,000 people their lives. Other surprises of Mother Nature that are on the rise are tsunamis, earthquakes and avalanches.

Engineering responsibility to the Planet

For the sake of future generations on this earth, human beings must take responsibility for the degradation of the planet. A solution has to be found on how to reduce the effects of human activities that are reducing the life expectancies of humans, animals and plants all over the world. Since there is still need for energy, scientists and researchers have to find alternative sources that are not detrimental to the environment and living things, to replace the existing ones that are. People also have to be educated on the practices that promote environmental health. Compared to the current statistics, the future of this world seems bleak, therefore, changes have to start now otherwise there will be no future to look forward to.

Renewable Energy

The International Energy Agency (IEA) defines renewable energy as; energy from natural sources that are constantly replenished. These natural sources include the sun, wind, tidal waves, hydro and geothermal sources, and many more. Each of these can be used to generate electricity in a way that is safe and causes little effect to the environment. Being that they are constantly replenished means that they can go on to provide power for many generations to come. Since time immemorial, biomass as fuel for creating fires, were used as the sole source of renewable energy at the time. Things have however, improved in recent times. More renewable sources have been discovered are in use in this day and age.

The availability and cost effectiveness of renewable energy sources vary all over the world. Some of these sources like water seem free and easily accessible, but in order to harvest power from them some investment and ingenuity must be employed. In order to generate electricity from water, one must first find a large body of water to which a dam has to be built. Large turbines, electricity generators and power transmission lines have to be built in the dam so that electricity can be generated. There are a number of such dams in the US like the Hoover dam, which took billions of dollars to be completed.

The increased power output of renewable energy sources since 2004. it does not show hydroelectric power but it a flat line when it comes to geothermal power. This means that that particular source has not been exploited to its maximum ability. There could be many reasons for this one of them being the laxity of the responsible departments in employing more research into this means of generating additional safe environmentally friendly power. Another reason could be lack of resources that can be channelled into exploitation of the naturally occurring resource. Biomass and solar power also have very slight increases in the 7 year period depicted in the graph. This means that more should be done in utilizing these energy sources.

Types of Renewable Energy

Geothermal Energy

This is heat energy that comes from the earth's crust. Every hundred or so meters below the earth's surface, the temperatures increase by 3 degrees compared to the surface temperature. This is because; deep below the earth's surface rests extremely hot magma that covers the earth's crust. Below the surface there are streams of water that are constantly flowing towards larger water bodies. Sometimes the water collects in a large area especially when it finds an impermeable rock called an aquifer. These waters are heated to boiling point and above when they come in contact with magma or very hot rocks around it. The heat is trapped in the earth's surface and the water does not turn into steam unless it comes into contact with air. The water keeps on boiling for many years and as a result builds up a lot of pressure. In the event that there is a crack in the rocks below the earth's surface leading to the water, the boiling water jets out to the surface resulting in what is called a hot spring. The pressure of the hot spring is very high which makes the water shoot up very high. It is therefore not advisable to be around one without proper protective gear. One such spring is the Yellowstone National Park's Emerald Pool in the United States of America illustrated. There are many others all over the world.

This hot boiling water and steam can be harnessed to produce clean, safe and renewable energy thanks to the ingenuity of the scientists and engineers. They start by researching on areas that may have water that has come into contact with molten rock. Once the area is located they have to pinpoint the exact area where it is guaranteed to release the pressurised boiling water. On locating it they start by drilling holes deep into the earth to the reservoir holding the hot boiling water. Since the boiling water is pressurized and will immediately jet out once it finds a weak spot, pipes are used hand in hand with the drilling so as to direct the boiling water once it jets out. This minimizes the loss of water plus making sure that the boiling water does not accidentally burn the personnel on the job. The heated water comes up through the pipes to the geothermal generator without application of any external force. The boiling water is directed to special turbines that are rotated by the force of the boiling water. The turbine motors are linked to generators that subsequently produce the much needed electricity whenever

they are rotated by the hot water. The boiling water does not maintain its temperature for long, it eventually cools down. This same water once cool is pumped back to the underground reservoir from which it was tapped to be reheated and start the process all over again. No water or energy is lost in this system since the pressure difference pumps the water to the generators and gravity pulls it back down to the reservoir thus emitting constantly replenishable energy. It is a very efficient machinery and if well maintained can go on to produce electricity for decades.

The heated water has many other uses other than this for instance in SPA swimming pools in health clubs and in heating buildings during winter. A perfect example exists in San Bernadine, Southern California where the boiling water is pumped to a number of public buildings like City Hall, retirement homes and the like via miles of insulated underground pipes. This particular system was put in many years ago and has been working efficiently ever since.

The institution and use of geothermal power has however not gone without its fair share of challenges. Some major issues faced are; issues of allocation and ownership, exploration and exploitation permits, royalties and the extent to which planning and environmental laws have been incorporated into geothermal energy. These issues mainly stem from the fact that some of the advantages of the boiling water are felt beyond the borders of the county or state from which it was tapped. This becomes an issue because each state has different laws concerning energy and many other things, and these laws must be followed to the latter. Issues have also crept up on the overlap of geothermal exploration into petroleum or mineral tenements. This has always been a problem since it is well known that petroleum companies have been making a lot of money for many years since the discovery of oil and its benefits. Geothermal power is fast coming to replace petroleum or diesel use in large industries, which spells a huge loss for the oil industry. As a result seemingly small issues always creep up whenever cheap, renewable alternative energy sources come in to replace fossil fuels. There are also legal issues concerning the framework for backing of renewable energy assists as far as innovation and development of the industry is concerned. This is the main drawback to renewable energy implementation and use. (UCS ,2009).

WIND ENERGY

Wind energy is among the safest forms of alternative energy that has been in use for many years. In not-so-ancient times primitive windmills were used in pumping water for irrigation and drinking as well as grinding grain. It is not used to generate power for any other use that is until recently.

Windmills nowadays are slightly more efficient than their predecessors being that they employ the use of turbines to generate electricity. Solar power has a major role in assisting in generation of wind energy. Heat from the sun, heats the surface of the earth which in turn warms the air as it is being reflected back to space. Once the air is heated, it rises leaving the cooler air to move in below to replace the space left. Hot air is usually lighter than cool air because once it is heated it loses moisture that is a major component of the air we breathe. The elimination of one major component essentially makes it lighter thus it rises while the heavier air lowers to replace the vacuum left. This particular process is made possible by atmospheric pressure. The warm air above will eventually cool and move back to the bottom to create space for more warm air that is rising. This cycle effect creates movement of air, which in essence is wind. The blades on the windmill are rotated by this movement of air, which in turn rotates the turbines that effectively generate electricity. The electricity generated is directed to the ground for storage and supply. The size of the turbines, dictate the application of the windmill in terms of the electricity output. For instance, small turbines that produce hundreds of kilowatts can be used in pumping water, powering small homes and communication dishes. Large turbines that generate power in megawatts can power towns or industries depending on their location. Sometimes, small turbines can be connected to fuel, battery or photovoltaic powered generators in order to generate electricity. This is classified as a hybrid wind system, which is usually employed in areas that are remote with no utility grid available. The largest drawback to wind energy is noise pollution. The noise generated by its turbines is too loud and irritating. In addition to this, many birds fall victim to the blades of the windmill as they rotate. As a result, most wind farms are located in far remote areas so as to contain noise pollution and bird casualties to a bare minimum. (West ,2013)

Employing wind energy as a means of producing electricity in a safe eco-friendly way is not a cheap affair. The venture needs high initial investment for it to be set up and begin functioning. On average, up to 80% of the total cost of setting up a functioning wind electricity generation plant is used to pay for the machines only. As a counter to the high initial investment required to start such a plant, maintenance costs are low since the apparatus do not break down frequently. However, in comparison to fuel-generated electricity, wind power is still much cheaper and safer to install and use. All said and done, wind electricity is the cheapest form of alternative energy available nowadays especially due to the low operating expenses. More should be done to exploit this alternative source of power to reduce the effect of greenhouse gasses brought about by increased use of fossil fuels and non-eco-friendly fuels. (U.S. Departmet of Energy, 2013)

SOLAR ENERGY

This alternative source of power involves converting radiation energy from the sun into an electric current. Solar energy comes in two diverse versions; solar thermal conversion and photovoltaic conversion. Photovoltaic conversion involves converting direct sunlight into electricity. Solar thermal conversion on the other hand, converts the same direct sunlight into heat.

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The use of solar energy has increased exponentially especially in the 20th century. When it comes to solar energy, the most common way to harness it is with the use of solar panels to trap the rays of the sun, and batteries to store the electricity generated.

Solar panels consist of small cells made from silicon, put together in an orderly fashion in a solar panel assembly plant. The solar panels absorb radiant light into their cells, which are responsible for generating electricity once excited. The excitement is brought about by the potential difference created between the N type emitter & P type base. This creates electricity, which is in turn directed to the batteries for storage via wires. Not all electricity is stored immediately, since it can still be used directly to power some appliances around the house or office. The excess electricity that is left from what is being used by the appliances is stored in the batteries for later use during the night. The current generated herein is referred to as Direct Current (DC), which can be converted to AC (Alternative Current) when the need arises. Some devices work better with direct current while others work only with alternative current. To change this current one will need to use a converter to change the current.

Solar energy is mostly used in powering houses especially applied in lighting, heating and cooling. Setting up solar energy is expensive initially when setting up but cheap in the long run when it comes to maintenance. Solar power is not only used after conversion to electricity, it can be used in its raw state. For instance, some houses are designed and built in a manner that they are fully lit by the sun during the day while remaining reasonably temperate. A similar application is evident in greenhouses where sunlight passes through a transparent membrane providing a warm conducive environment for plant growth while still allowing in sun light to assist in plant growth. The most common use of solar electricity in homes .

Once such a solar power set up is installed, there is no need for monthly electricity bills. This is because the solar power in use here, does not come from the electricity grid, but is generated directly from the building itself. As an additional advantage, the excess electricity can be supplied to the grid meaning additional income can be attained from this venture. (Liden, 2013)

BIOMASS ENERGY

Many people are oblivious about the benefits of this particular alternative energy source that has been in existence for centuries. Biomass refers to any biological material that can be converted to energy either as fuel to be burned or processed in one way or another. The most common sources of biomass are derived from wood and crops. Studies show that biomass is yet to be exploited to its full capacity despite the fact that its use dwarfs that of solar and wind energy combined. Use of firewood and charcoal as fuel for fire when cooking or doing anything that requires heat has been the most basic and common use of biomass since the discovery of fire.

Biomass produces carbon dioxide when burned, though it is still safe for the environment. Plants and trees utilise carbon dioxide in order to grow during the day while they create oxygen to sustain human life. At night it does vice versa and the cycle continues with each passing day. In a sense, Carbon dioxide emissions are good for the environment, provided it is in equal measure with oxygen.

Two main aspects come into mind when thinking of Biomass as the ideal alternative to fossil fuels; the means of production and the effects of the plants. Biomass as compared to coal emits less carbon dioxide hereby reducing greenhouse gasses. On the other hand, overuse of wood as a primary component of biomass can lead to deforestation that has long-term effects on the environment. This situation, commonly known as a 'catch 22' is what the world is facing right now as far as biomass is concerned. (Alternative Energy Website,2013)

OTHER ALTERNATIVE SOURCES OF ENERGY

Almost every other person can attest to using, operating or benefiting from devices and machinery that rely solely on fossil fuels. One major activity that contributes to burning of fossil fuels is transportation. A majority of transportation modes for instance roads, air and sea, burn fossil fuels to operate. Studies have repeatedly shown that burning of fossil fuels contribute significantly to the increase of greenhouse gasses. Greenhouse gasses degrade the environment and are the main cause of global warming. Scientists have been trying and testing new innovations on efficient running engines that do not rely on the use of fossil fuels. One success story out of the scientists toil is the electric vehicle. The electric vehicle uses rechargeable electric batteries to run their engines. The battery of this vehicle is charged using normal electricity that we use every day in homes and offices. A number of vehicle manufacturing companies followed suit and have begun manufacturing electrical vehicles to be used on everyday roads across the globe. One such company is Chevrolet who introduced the Chevy Volt recently. The Chevy Volt runs on an electric battery for several miles before switching to regular fuel combustion. Many other companies have revealed new products each boasting of a longer lasting charge which covers a longer distance than the other .

Despite the fact that the electricity that is used to charge the vehicles comes from carbon dioxide emitting, fossil, coal or gas powered electricity generators, the carbon dioxide produced by the electric car is a third compared to the one of a regular fossil fuel vehicle. When the electric car is running on its charged battery, it produces close to zero emissions. Once the vehicle reverts to fuel, it uses much less fuel than other vehicles which run fully on fuel. Other new inventions such as hydrogen engines, are still being researched and tested as a means of further reducing dependence on fossil fuels.

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CONCLUSION

In order for future generations to have a world to call home, dependence on fossil fuels must be reduced, if not done away with completely. Global warming has done its fair share of destruction to the environment and no being other than human beings are to blame. Scientists must go on searching for cleaner and safer ways of producing energy so that the planet can have a fighting chance to heal itself. Other than saving the world, alternative energy sources are cheap and renewable.

REFERENCES

Dahl, P. F. (1999). Heavy water and the wartime race for nuclear energy. Philadelphia [u.a.: Institute of Physics Pub.

AltEnergy. (n.d.). Biomass Energy. Alternative Energy Website. Retrieved November 17, 2013.

Farret, F. A. (2006). Integration of Alternative Sources of Energy. Hoboken: John Wiley & Sons.

BERC. (n.d.). FAQs. Biomass Energy Resources Center Website. Retrieved November 17, 2013

REW. (n.d.). Wind Energy. Renewable Energy World Website. Retrieved November 17, 2013

Johansson, T. B., & Burnham, L. (1993). Renewable energy: Sources for fuels and electricity. Washington, DC: Island Press.

U.S. Departmet of Energy . (n.d.). How Do Wind Turbines Work? U.S. Departmet of Energy Website. Retrieved November 17, 2013.

UCS. (2009). How Geothermal Energy Works. Union of Concerned Scientists Website. Retrieved November 17, 2013

West, L. (n.d.). What is Wind Power and How Does It Work?About Website. Retrieved November 17, 2013.

Wind Energy Development . (n.d.). Wind Energy Basics. Wind Energy Development Website. Retrieved November 17, 2013.

Wise Geek. (n.d.). What Are the Most Common Solar Energy Applications? Wise Geek Website. Retrieved November 17, 2013.

Wise Geek. (n.d.). What is Solar Energy? Wise Geek Website. Retrieved November 17, 2013.

WWEA. (n.d.). Wind Energy Technology: An Introduction. World Wind Energy Association. Retrieved November 17, 2013.

Michaelides, E. (2012). Alternative energy sources. Berlin: Springer.