Free renewable energy sources research paper sample

Environment, Electricity

The past couple of centuries saw industry developed at a rapid pace especially following the Industrial Revolution when manual labor was rendered nearly useless when replaced with machines. In order for machines to operate at peak capacity, intense energy use was required. Little has changed over these two centuries in terms of high energy consumption, which has two negative implications. While the most abundant and extractable energy sources, oil, gas, and coal are exhaustible, which means they will run dry at some point in the future, especially seeing as how world population surplus is palpable these days. More importantly than that, these are the main contributors to greenhouse effect, global warming, the rise of world ocean level, floods, water contamination, air pollution and other ecological spinoffs of a detrimental anthropogenic activity. With that in mind, people decided on replacing these sources with renewable and environment-friendly sources of energy. Apart from going solar, that is, using the energy of the Sun, people have mastered the ways of harnessing the energy of wind, rain, waves, tides, and the so-called geothermal energy. However, wind and sunlight are two principal sources of energy supply applied for both commercial and home use.

Babinski (18) notes that wind power generated by wind turbines has a good number of advantages. Turbines are a breakthrough solution to obtaining the potential and advantageous resource of energy available on the Earth. Produced by the atmospheric variations of temperature, sea and land effects, earth rotation, and pressure differentials between different weather systems, wind is impossible to deplete, which makes it a renewable source of energy. Halkema (7) admits that the Dutchmen have taken complete

advantage of wind power, in the sense that 30% of the country was created by use of this energy source. According to Babinski (18), beneficial is that turbines are capable of producing power via mechanical processes, without requiring fuel combustion or chemicals, which makes this energy source pollution-free. Since wind farms need no fuel, wind farms are far more advantageous than fuel-powered plants are. The construction of pipelines for natural gas delivery, mines for coal extraction, and radioactive toxic waste utilization are no longer necessary, with environmentally friendly energy production facilities in place (Babinski 18).

According to “ How to Use Wind Power” (n. p.), coal satisfies more than half of electricity demand in the USA. This energy source is extracted through shaft mining, pit mining, strip mining, and mountaintop removal. Coal burning along with all these techniques produces negative environmental spinoffs, taking ultimate toll on air, water, and ground, to say nothing of the health of employees and neighboring citizens. If implemented and designed in a proper way, wind power, by itself, poses no threat (“ How to Use Wind Power” n. p.). Beyond doubt, it will take people decades, if not centuries, to make a complete shift from conventional power sources to their ecological replacement. Once harnessed to their full potential, they will eliminate the omnipresent fear of nuclear power station explosion due to a terrorist attack, malfunction, or miscalculation.

Halkema (8) suggests that, given correct exploitation, wind turbines may be a driving force for many mechanisms and machines as the generators of electricity for the national grid. They may set in motion mills for cereals and other products, water pumps for the irrigation of various agricultural regions.

Water may also be pumped out of polders, or low-lying tracts of land reclaimed from water and protected by dams. This is the way Holland was created in its time. It should be borne in mind that reliable and heave electricity production would be no more required than serious risks be involved in the event of turbine failure (Halkema 8).

As it stand now, the lion’s share of wind power stems from wind farms mounted onshore. Considering the fact that the most unceasing and powerful wind is to be found at sea, blowing at the speed of 7. 5 m/s, onshore location is exceedingly favorable for the installation of wind farms, but for all that, here comes a small disadvantage. Erecting such farm implies a high capital investment and palpable O&M costs. This notwithstanding, European states are pushing aggressively for the intense production capacity of wind power in attempts to suit the demands of greenhouse gas reduction that is achievable through the instrumentality of effective and long-lasting use of renewable energy. A traditional wind farm is composed of 20 to 30 windmills whose wide rotors and tall structures require plenty of space between each other, which is the reason large geographical regions are the places where experts install wind farms. The advantage here is that such installation leaves a large amount of space unoccupied. Such space has a vast potential in regard to livestock grazing and farming (Babinski 18).

In the USA, farmers conclude lease agreements with wind energy operators and obtain a yearly income in equivalent of 100 euros per hectare, as of 2010 or 2. 500 to 4. 500 euros per each MW installed. Land leasing is an excellent way of raising money particularly beneficial during boom-and-bust economic periods, as it is more constant as opposed to agriculture. One of

recent researches conducted by the European Wind Energy Association has pointed to wind power production being a prolific job generator. From 15 to 20 additional jobs are created either directly or indirectly for each megawatt of installed wind power capacity. Wind energy investment promotes diversification and reduces the dependence of a country on fossil fuels (Babinski 19). Energy independence also does grant economic and political self-sufficiency. In other words, opportunistic neighbors will be unable to blackmail such countries into accepting economically and politically unprofitable agreements. Energy diversification through the production of renewable power will certainly make Europe less vulnerable to abusive Russian political misdemeanor. However, the USA in President Obama has already approached Saudi Arabian Sheikhs on the intensification of oil supply to Europe, as well as gearing for shale gas exportation. Wind energy has more potential in this sense, albeit in the long term (Babinski 19).

Whatever the advantages of producing wind power, such energy source has its own disadvantages. Halkema (19-20) states that the production factor of the above-mentioned onshore wind turbines varies from 13% to 25% for up-to-date tall energy production facilities in the areas with more or less consistently strong wind. Rarely can the production factor reach the rate of 30% in coastal regions. The expert goes on to note that people claim wind power an unreliable electricity generator that produces energy in minimal amount unless they represent certain political circles that have a particular interest in having wind power generation facilities built. Hidden political or personal agenda, possibly, prevents people from making this main disadvantage known and regarding wind power as unreliable. To draw

analogy with conventional power sources, a nuclear plant in Holland has the production factor in the region of 94%, which is said to translate into a stable full power for nearly the entire yea (Halkema 22).

According to Babinski (19), more importantly than that, since such natural resource as wind is not subject to control, windmills are fully dependent on its speed. Wind being too weak, turbines will be unable to operate. Conversely, given that the wind is strong, power production facilities will be switched off to prevent them from getting damaged. It is through the interconnectivity between farms that the problem may be handled. Such cooperation may also contribute to energy production and flow increase. With windmills relation to wind speed in mind, wind turbines are put at an operational mode approximately 65% to 80% of the time due to the above-mentioned energy source instability. What is more, normal capacity factors fluctuate between 20% and 40% reaching the upper limits only under advantageous conditions, such as strong winds (Babinski 19).

Halkema (15) also asserts that the generating capacity of wind turbines varies depending on wind speed. Therefore, it is impossible to claim that energy production facilities generate the same medium number of kWh in the course of a particular spell or season. If truth be told, kW and kWh produced differ not only from day to day, but also from hour to hour. The problem is that wind predictability during periods in consecutive years is presented in disfigured statistics in reports to conceal the uncontrollable and unpredictable nature of wind speed and turbines. That there is no place on earth, with winds blowing at the same speed from year to year, proves this energy source unreliable. Even the slightest variation in the speed of wind

changes facility output uncontrollably and harshly (Halkema 16).

According to Babinski (19), as it is, wind energy remains more expensive, as opposed to other traditional power sources. Structurally, windmills are high-rise structures up to 30 meters in size inclusive of rotor blades. Sophisticated and costly materials are used for providing such construction with reliability and strength. The tower itself is made of reinforcing steel while the turbine and carbon fiber rotors are assembled of 4. 000 details. Plenty of wind farms situated in far-off windy regions, energy producers incur additional expenses on transmission lines stretching. Halkema (22) suggests that an average turbine costs somewhere around 1. 3 million euros, with the price tag related to a 100% capacity. However, such mechanism can produce on the whole only about 25-30% of its overall capacity, which means that up to 75% is thrown to the winds.

What is more, the energy generated is of poor quality, making it impossible to supply to single consumers, such as a household, a hospital, or a factory. Nor is this product competitive on the energy market. Besides having to be sold at a lower price, this wind power needs subsidizing at the expense of the general public (Halkema 23). According to Halkema (26), financial challenges associated with wind power generation are particularly palpable in the countries where such unreliable wind energy is distributed over a large area, which necessitates the erection of many new ultra-high voltage 380 kV electric lines along with transformation and switching stations for delivering the exceedingly variable supply of electricity. In Germany, for example, an estimated budget for such constructions amounts to 3 billion euros (Halkema 26). It appears such renewable energy source as wind is not that cheap to

harness.

A profound study is needed in order to identify a suitable location for farm installation and gauge wind speed as well as the amount of energy output received from it. Spain, Germany, Denmark, Ireland, and Great Britain are among five countries that may be seen investing into wind power heavily. Over the years, there have emerged plenty of arguments as to windmills posing danger to bats and birds that may be caught in rotor blades while flying. Still, several studies demonstrate that the number of birds killed by windmill blades is much lower than that of birds perishing from colliding with buildings, windows, or planes. Approximately 1 in 30. 000 bird deaths is attributable to windmills.

In addition, it is worth noting that communities would issue complaints about the rate of noise produced by such turbines years ago. Presently, technological advancement in the field of engineering has allowed minimizing turbine-induced noise by operating to such a degree that it is comparable with the one produced by a freezer or a kitchen refrigerator. Windmills also create another problem by casting a large shadow on buildings situated in the immediate proximity to the construction. Mounting windmills may have a negative impact on land value since a lessor usually signs a 30-year lease contract not to be violated. Some naysayers consider windmills as such that spoil the entire landscape, thus clamoring against their construction. The only thing people can do to make a compromise with local citizens is place windmills in unpopulated regions in the neighborhood of cities and towns (Babinski 20).

As has been mentioned above, wind power is used by single consumers, that

is, households despite claims as to the lack of viability in terms of product quality. According to “ How to Use Wind Power” (n. p.), people of the USA value financial independence no less than freedom itself. In using wind-electric systems, local communities, especially in rural environment, can reclaim the control of bills and energy production and minimize their dependence on state utilities, local governments, and charities. Certain hybrid wind-electric systems combined with solar-electric batteries and arrays are capable of supplying people with reliable electricity. Important is the fact that people with various medical conditions, public service organizations, and businesses with critical loads are able to go on operating during mechanism breakdown, storms, and other weather emergencies. Grid-tied wind-electric appliances contribute to utility grid stability and, apart from providing owners with electricity, supply neighbors with energy surplus by means of the grid. Wind-electric systems may be beneficial from a financial perspective. The owners of off-grid systems have the unique opportunity of getting the first-hand knowledge of wind electricity being much more cost effective unlike increased generator application or utility line extension. Living on-grid will require the mixture of high utility rates, a good wind resource, and decent stimuli to vie with subsidized dirty energy. According to “ How to Use Wind Power” (n. p.), four principal types of wind-electric systems are available for home users. Wind-electric water pumping links an electric pump to a wind generator by means of electronics. Such system type is particularly viable when remote water pumping is required in windy regions. Solar electric systems and wind-mechanical equipment, or water-pumping windmills, serve this need since the complete system

packages of wind-electric water pumping is hardly available for this application. Direct heating systems are another option; however, users are discouraged because this heat only one-dimensional system provides an unnecessary year-round energy supply. Speaking of other appliances producing excessive energy, off-grid wind-electric systems utilize batteries, comprising back-up generator and a solar-electric array. With utility electricity not desired or available, such systems are to provide all electrical supply needed, that is to say, they will generate much more energy than actually used in that they are required to keep battery bank charged and that there will be the periods of excess winds where it is impossible to use surplus. An off-grid system configuration resembles that of a battery-based grid-tie system, another mode of using wind energy at home.

Besides similarities, it contains a grid connection as well as the ability of selling excess energy to local utilities. Being of the battery bank, such systems have the advantage of providing restricted backup during utility breakdowns. Utility outages induced by storms in wind-abundant regions make wind-electric back-up systems very functional. The most environmentally friendly, efficient, and least expensive are battery-less grid-tie wind-electric systems inasmuch as they do not utilize batteries as well as operating at higher voltage. They generate grid-compatible electricity not only to supply house, but also to sell surplus energy back to the utility, which allows putting all energy to good use. This way of harnessing wind power for home use is perfect save that is cannot be used during utility outages, much less provide back-up protection (“ How to Use Wind Power” n. p.).

Depending on wind generator size and resource availability, wind electricity

can power the majority of electrical loads. Direct heating systems and water pumping are dedicated to specific loads. The better part of systems supply electricity for different purposes, including home appliances, lighting, office equipment, et cetera. Small and home-scale wind generators are utilized on boats, navigation equipment, businesses, remote communication sites, and other facilities. Overall, having the prevalent source of wind allows people to run lighting and appliance loads and heat homes and other types of buildings through a heat pump or direct electrical heat. Besides, wind applications corresponds with the heating system, which converts a heat-stealing factor into a useful force applied for heating (“ How to Use Wind Power” n. p.).

Solar energy is another widespread renewable power source that has plenty of advantages worth considering. According to Theel (n. p.), the USA abounds with territories that have more intense direct sunlight owing to low humidity and clear skies have an immense solar production capacity, with Northwestern states alone surpassing Germany in this respect. Sunlight energy is less polluting since it emits far less amount of greenhouse gases, as compared to fossil fuels. A study conducted by the Department of Energy’s National Renewable Energy Laboratory suggests that from 87% to 97% of sunlight power produce no pollution. To save energy takes a lot of energy. In other word, photovoltaic system of power generation has to operate a lot to recoup for energy spent on system creation. Moreover, to create such energy producing system, it requires generating polluting emissions, which points to one of its disadvantages.

Solar power proliferation meets climate objectives, one of which is reducing global warming to 2 degrees Celsius from the pre-industrial level. The

principal formulated at the UN Climate Change Conference in Mexico back in 2010 is in line with solar power that is predicted to satisfy 10% of global electricity needs by 2050. The IEA has remarked that, sunlight electricity will be topping 25% of global electricity production in mid-21st century. As of 2050, about 7 billion individuals will be living in warm and sunny countries, as opposed to 2 billion living in colder ones. Such proportion will allow the majority of global population from most of Europe, the USA, part of China, and Russia to take advantage of the omnipresent source of renewable energy. Photovoltaics and concentrated solar power will be accountable for a critical amount of energy production (Theel n. p.).

Another advantage is that solar energy does not require extensive amounts of land on contrary to multiple statements made by the Wall Street Journal, the New York Times, the Los Angeles Times, and the Investor’s Business Daily, trying to prove the contrary. Interestingly, approximately 90% of desert land, such as industrial sites, can provide space for energy production facilities. Thus, for example, a 100-by-100 mile land tract of Nevada could potentially supply the entire American territory with electricity. If such energy production system should be spread throughout the cities of the country’s 50 states, they should require a territory of 17 by 17 miles per each city, with appliances placed on rooftops, parking lots, and unoccupied land. As much as 90% of the USA’s present energy needs could be provided by solar electric systems mounted on an estimated 5 million acres of deserted industrial sites in all American cities (Theel n. p.).

According to Theel (n. p.), an interesting fact suggests that placing photovoltaic facilities on 4% of desert areas worldwide could meet the

electricity demands of the entire world. The Gobi Desert itself has the potential of supplying the whole world with electricity. To buttress the argument of solar energy facility space benefits it is essential to note solar photovoltaics in the Southwest of the country utilizes far less land than surface-mined coal does, without polluting and disrupting ecosystems of neighboring areas by fuel-cycle-related accidents. The less amount of land required can be explained in terms of rooftops providing excellent equipment deployment opportunities. It is perfectly possible to use land where solar panels are deployed for a variety of other purposes. To quote an example, people may use such occupied tracts of land for grazing, shading, and power production purposes.

Another advantage is that the costs of installing solar systems is dropping swiftly. The coming years will most likely see prices fall. In the USA, the cost of solar energy per watt reduced by 50% in the period between 2008 and 2009 due to lower electrical conversion losses and cell efficiencies contributing to better performance and a number of other reasons. As per experts' opinion, sunlight energy will have become as cheap as the current American electricity by 2020 (Theel n. p.). The director of CleanTechnica, Zachary Shahan (n. p.) notes that solar power is a good money-saver, sparing billions, if not trillions, dollars of a society. If the global warming goes unrestrained, it is sure to cost the world trillions of dollars. That being said, combating the dangerous ecological trend with environmentally friendly solar energy will be a huge money-saver. People themselves can economize on energy costs by installing photovoltaic panels on rooftops and saving thousands of dollars. As per 2011 estimates, those going solar can save up

to 20. 000 dollars over a 20-year period. In populous states, such as California, New York, and Florida, projected savings reached 30. 000 over the analogical period while in Hawaii such economy can generate as many as 65. 000 dollars. However, it is through successful household design choices and proper planning that such saving is achievable.

Sunlight energy is one of those sources that are easy to predict. Both rising and the setting of the Sun are consistent processes throughput the world, which makes solar energy a very reliable renewable power source. Although clouds availability is less predictable, weather forecast services can make daily and seasonal predictions, projecting the amount of sun received. More importantly than that, sunlight provides energy security and independence, since there can be no monopoly on this source of energy unlike conventional power sources, such as coal, oil, and gas unevenly distributed across the globe. Anyone can obtain it by simply mounting solar panel on rooftops. Zachary Shahan (n. p.) goes on to admit that, while on a visit to Ukraine, he noticed the country had implemented multiple projects and initiatives related clean technologies. This has allowed the East European country to save almost 3 billion dollars in decreased gas and oil imports from neighboring Russia owing to solar energy plants built by a single developer. It is important to note that solar-energy-related jobs have increased more than twice, as opposed to the rest of the American economy, which implies that this area is a major employment provider. In the timeframe between 2003 and 2010 jobs in the field of solar thermal industry rose by 18. 4% on a yearly basis, with photovoltaic industry accountable for 10. 7%. The national economy demonstrated the growth level of 4. 2% over the comparable

period (Theel n. p.). Shahan (n. p.) also admits that solar energy is a prominent employment powerhouse. Solar energy money creates twice or thrice as many jobs as natural gas or coal money does.

Speaking of solar power disadvantages, there are not so many of them. The first one is that the Sun is not available 24 hours per day. Solar photovoltaic panels cease producing electricity whenever the sun goes down or clouds or celestial bodies shade it. Once energy supply interrupts, people will need the alternative sources of electricity. This means that solar panels, unfortunately, cannot provide 100% of energy needs. Batteries storing electricity generated by solar panels may be a good solution to this issue, compensating for the temporary loss of power source. It is also important for people to consider that the sun does not shine when they need energy most (Shahan n. p.). Whitburn (n. p.) also notes that sun availability declines during winter months when the number of sunlight hours is less intense than it is over summer months, which adds season to the already described daily fluctuations. The expert tend to believe inefficiency of sunlight to be one of disadvantages, claiming a solar panel is capable of converting sunlight into electrical energy at the rate of 22% that is the reason this technology may require more space.

The technology of storing solar energy has yet to be developed to its full potential. Though available, plenty of solar drip feed batteries are bulky and expensive, and much more appropriate to small-scale home solar panels rather than large-scale solar farms. Surely, researchers have elaborated thin-film solar modules that are more technologically superior and less bulky than their predecessors are. The newly developed applications comes in the

shape of “ amorphous” flexible solar modules and solar roof tiles. Still, thin-film technology is inferior to the one that uses crystalline wafer solar. There are allegations that it costs a lot to build a solar farm or install panel for energy production. However, after being installed these expensive systems start generating free energy. The disadvantage may consists in solar panels starting to justify expenses with time, which makes such money investment somewhat questionable especially during the periods of economic recession. Now that solar technologies have made a major headway, a megawatt hour of solar energy costs more than double a megawatt hour of traditional electricity. Of course, the price depends on facility location. A stroke optimism comes with the assumption that nuclear power had been costly before the industry received subsidies (Whitburn n. p.). Seemingly, the same applies to solar technologies, whose high cost may remain such until world countries increase their investment.

Since the energy of sun has so many advantages over conventional sources of power, it is used in buildings for multiple sources. According to “ A Homebuilder’s Guide to Going Solar” (2), solar water heating systems are elaborated to heat water for home use. Such appliances are composed of collectors, a storage tank, a controller, a delivery system, and freeze protection. The active type of the system has controls and circulating pumps while the passive type does not. The majority of such SWH systems need a properly insulated storage tank with an additional inlet and outlet linked to and from the collector. Such systems are both economical and reliable, justifying expenses within several years. Solar electric or photovoltaic systems are composed of specific modules that comprise PV cells producing

direct current electricity whenever exposed to sunlight. An inverter converts the direct current power to the alternating current electricity needed to power the house. Such photovoltaic systems have undergone multiple trials by private and public organizations, testing them to strict standards. Such systems are exceedingly convenient, as they require no particular maintenance, have no moving parts, and can retain their durability for years. Even in 25 years such appliances produce the same output. There are different configurations and efficiencies of modern photovoltaic systems. Those whose modules are installed on rooftops are among the most widespread; still, building integrated photovoltaic systems are adding to their popularity at a rapid pace. In such systems, modules perform a double duty by replacing conventional building materials, as window awnings and roof shingles, and producing electricity (“ A Homebuilder’s Guide to Going Solar” 2).

According to “ Solar Power: Generating Electricity at Home” (n. p.), passive solar homes is another popular way of harnessing the energy of the sun, with house walls, windows, and floors made for gathering, storing, and spreading energy that heats an apartment in winter and cools it over a summer period. Such building design does not imply the use of mechanical systems for energy collection and conversion. Rather, it southern windows, heat-collecting materials, and various types of the environment are used to the best advantage in such a way that heat can be stored in thermal mass for further distribution throughout the apartment over time. However, the majority of people opt for traditional systems of solar energy. Apart from the above-mentioned photovoltaic systems used for electricity generation, and

water heating system, there is an appliance that heats water in swimming pools. The most obvious reasons that keep homeowners from installing such systems may be the initial costs. Still, federal and state stimuli and subsidies can resolve this problem. Anyway, solar systems do a lot to decrease electric bills, make homeowners more self-sufficient, and provide households with years of reliable service (“ Solar Power: Generating Electricity at Home” n. p.).

Overall, nowadays the problem of depletion of traditional natural resources as well as climatic changes induced by emissions they produce has caused scientists to develop alternative renewable and environmentally friendly energy sources. Experts have come up with the idea of harnessing the energy potential of the sun and wind and other power sources. Wind turbines have proved quite environmentally safe, as they require neither chemicals, nor fuel combustion that would have a negative impact on the ecology. There is also no need for people to recycle or conserve toxic waste or deteriorate the landscape. Wind power production grants energy independence and eliminates the possibility of nuclear explosions or terrorist attacks. Energy diversification is an important advantage because countries are no longer prone to unfavorable economic agreements, employing renewable sources of energy, on which opportunistic countries have no monopoly that would allow imposing not so optimal conditions. Still, wind power generation takes people plenty time to technologize wind power generation.

Installation processes implies a palpable capital investment since reinforcing and other materials used to assemble windmills are expensive. In recent

decades, people have started building onshore wind facilities. Apart from performing power production functions, wind farms are suitable for grazing and farming. Besides, landowners tend to conclude multiyear deals with whoever sees interest in leasing the track of land from wind farm proprietors. Of course, wind instability and scarcity in certain regions make it a somewhat unreliable. More than that, the technology remains expensive. Large windmills with huge rotor blades kill bats and birds. They also cast shades on adjacent buildings, which may not be tolerated by local citizens complaining also about noise produced by the turbines. The systems that convert wind energy may be used for water pumping, heating, and other purposes.

Solar energy is also ecologically safe and economically profitable, although it does justify expenses with time. State subsidies and local incentives can lift some barriers. Building solar systems will not clutter the area that can also be used for purposes, such as grazing, shading, and power production. Some expert believe that solar system are great money-savers, sparing thousands of dollars in the long term. Of course, their major disadvantage is the availability of the sun; however, the solution comes in the shape of specific batteries for energy storing. Solar energy may be used for various purposes, such as swimming pool, water heating, and building the so-called passive solar homes. Overall, the energy of both the sun and wind have both advantages and disadvantages that will be surmounted once new technologies emerge, making these renewable sources of energy more cost effective.

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