ISSN No:-2456-2165

Global Warming Impacts and its Mitigation through Renewable Energy Systems Use

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Abstract:- Due to the significant pollution produced by conventional energy sources, renewable energy is currently one of the most fascinating topics in the energy sector. This paper reviews the global increase in the use of renewable energy and discusses its effects on the evolution of modern society at a time when the world is attempting to address the climate crisis. Despite its high level of air pollution, fossil fuels are still used today, albeit in a depleting manner. To improve living conditions and slow down global warming, people are attempting to find a solution by utilizing clean and sustainable energy sources. This paper review will develop some lines to raise public awareness about the climate crisis and how it relates to the power systems generation used.

Keywords:- *Renewable Energy, Microgrid, Fossil Fuel, Environment, Global Warming.*

I. INTRODUCTION

In developing nations, 1.06 billion people still live in rural areas without access to electricity. Electricity generation continues to be very appealing, but traditional thermal power plants use fossil fuels that pollute the environment and are known for their constant price increases[1]. Ensuring universal access to contemporary energy services is the top priority. One of the main obstacles to enhancing human well-being worldwide is the absence of a consistent and reasonably priced energy source [2].

The world's supply of nuclear and fossil fuels is finite; Figure 1 depicts idealized energy-depletion curves based on current availability and consumption rate. Please take note that, for simplicity's sake, renewable energy resources are not shown in the figure. The curves are generally of a Gaussian nature [3].

The world has a vast reserve of coal among all fossil fuels. The consumption of coal is predicted to reach its peak by 2070 and continue for 200 years at the current rate. By contrast, the natural gas reserve is relatively small and has a 150-year shelf life. According to the oil-depletion curve, it looks to be getting close to its peak right now and should last for about a century. Given the rising demand and diminishing supply, the current trend of rising oil prices is only expected. Of all the fuels, natural uranium (U235) has the lowest reserve and is predicted to last for almost 50 years.[3]

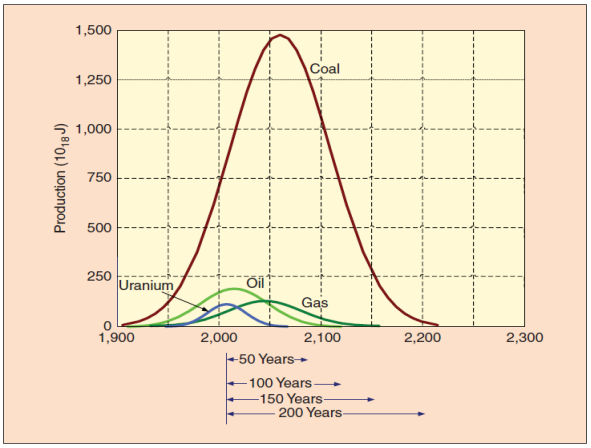

Fig 1: Idealized energy-depletion curves of the world

Financial, technological, and societal behaviors are merging. The effects of climate change are being felt by industries, governments, and citizens, and awareness that a move away from CO2 is urgently needed is growing. Are the only people convinced of the urgency by climate scientists? [4]

The most appealing way to transition from a fossil fuel-based system to one that runs entirely on renewable energy appears to be through the use of renewable energy (RE) technologies. These days, researchers all over the world are devoting time and resources to studying this energy.[5] In addition to helping to lower greenhouse gas (GHG) emissions, they can also produce flexible and clean energy, opening up new business opportunities. International and regional collaboration and cooperation are required in response to climate change. The number of initiatives addressing energy and climate change has increased since the United Nations Framework Convention on Climate Change (UNFCCC) was ratified in 1992. The energy supply system can make use of a variety of RES (Renewable Energy Sources)[6].

The characteristics and control needs of the electrical grid are undergoing a significant change due to the quick development of renewable energy generation and HVDC transmission[7].

To support the development of the smart grid, future power systems must be able to deliver an electricity supply that is more safe, dependable, clean, and of superior quality. The future is predicted to see a significant increase in the penetration of distributed generation using renewable energy

resources like wind, solar, and tidal power systems due to the growing demand for environmental protection, energy conservation, and sustainable development. Future alternative power sources will likely come from renewable energy sources (RES) due to their rapid technological advancement and falling costs, such as solar, wind, and fuel cells[8]. The photovoltaic industry reached 6 GW of installed capacity globally by the end of 2009, growing at a rate of 30% annually, while the wind power industry reached 38.3 GW, growing at a rate of 31.7%. The international energy agency EURO-JRC predicts that by 2050, the share of renewable energy in the world's energy structure will surpass 50%. The emergence of distributed renewable energy resources (DRER) in power systems has been greatly aided by growing environmental consciousness and the development of successful small-capacity distributed generation technologies[9].

II. DRER

In general, distributed energy resources (DRER) are load-closed configurations of small-capacity power generation facilities that use a range of renewable energy sources, such as solar, biomass, small wind, small hydro, and tidal energy. These systems are expected to function as an efficient complement to centralized power systems, meet specific customer needs, and produce power that is affordable, reliable, and efficient. Large-scale distributed power can reach megawatts, while small-scale power is typically within a few hundred kilowatts. These days, photovoltaic power generation, wind power, and other DRER technologies are commonly used. As seen in Figure 2[9][10], the DRER system is made up of energy conversion devices, a control system, and an electrical interface that is connected to an external distribution network.

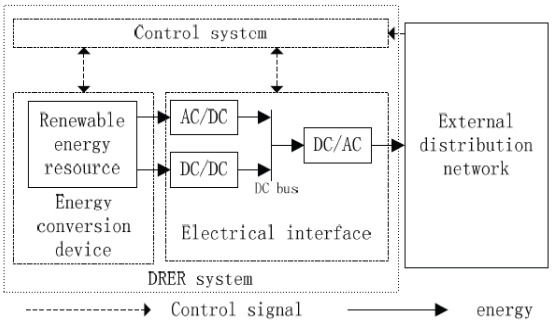

Fig 2: Configuration of the DRER system

Because distributed power must immediately shut off in the event of a power system failure, as specified by IEEE P1547, distributed resource energy management (DRER) is still not widely adopted by the power industry, despite its many potential benefits. This not only severely restricts the industry's ability to fully develop in distributed energy but also indirectly restricts the application of new energy sources. The idea of a microgrid was proposed to fully explore the advantages and value of distributed energy to reconcile the conflict between the power system and DRER.

III. MICROGRID

Microgas turbine engines, fuel cells, solar power generation groups, flywheels, supercapacitors, batteries, and other energy storage systems are examples of distributed power in the low-voltage distribution side of a power system that makes up a microgrid. Controllable loads are managed by a single central energy management system that can operate independently or in conjunction with an external power system [9].

A microgrid can be viewed as a small power system that satisfies all power transmission and distribution needs to optimize energy and achieve a balance between local power. The primary distinction between DRER and microgrid is that the latter operates more effectively in isolated or integration modes. Macroeconomically speaking, a microgrid can be thought of as a single cell that can be managed like a straightforward schedulable load and react quickly to meet the demands of a conventional system[9]. Instead of choosing each micropower, the criteria for microgrid integration with power systems only choose the point of common coupling (PCC) between them.

The basic structure of the microgrid is shown below in Figure 3.

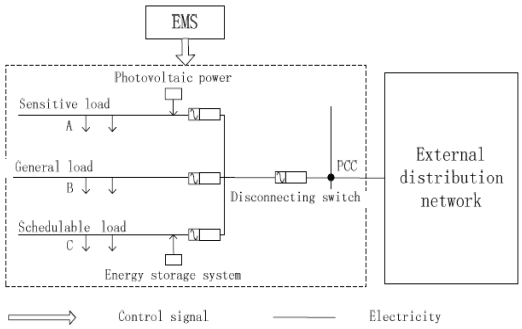

Fig 3: Structure of microgrid

The benefits and drawbacks of DRER were discussed in the previous section. To coordinate the conflict between the power system and DRER, the concept of a microgrid was proposed at that time. With only one interface between the microgrid and the external network, a microgrid can be thought of as a cell that can be managed as a straightforward schedulable load and accomplishes a smooth, flexible switch between integration mode and isolated mode. Thus, the development of DRER in the power system is suggested through the use of microgrids.

IV. RENEWABLE ENERGY AND ENVIRONMENT

Because of the growing global population and our pursuit of a higher standard of living, there is a dramatic increase in the amount of energy consumed globally. Fossil fuels, from which the majority of our energy comes, are burned to create environmental issues, most notably the problem of global warming. In addition to increasing hurricanes, tornadoes, and floods, global warming also causes the sea level to rise, brings drought to tropical areas

close to the equator, and spreads disease. The repercussions are dire and could cause widespread instability worldwide [3].

Any credible model of climate change demonstrates the grave dangers to life, food, and habitat that would arise if we kept using fossil fuels to generate heat, electricity, and transportation. Burning fossil fuels has a more notable consequence in the form of the global warming issue, which is mostly brought on by CO2 (also known as GHG), which traps solar heat in the atmosphere (also known as the greenhouse effect). The effects of climate change are being felt by governments, businesses, and citizens, and awareness that a move away from CO2 is urgently needed is growing.

As was previously mentioned, an increase in the amount of greenhouse gases (GHGs) in the atmosphere causes solar heat to accumulate and the temperature to rise. According to historical data and projections made by climate scientists, the average increase in temperature occurs every 100 years by a few degrees. Nonetheless, global warming has extremely detrimental long-term effects that can be summed up as follows:

- Low-lying parts of the planet will be submerged due to the glaciers and polar ice caps gradually melting. Since 100 million people on Earth live within three feet of sea level, this effect is extremely concerning.
- Severe droughts harm crops and agriculture in equatorial tropical nations like Africa and India, and they exacerbate the issue of freshwater scarcity.
- Hurricanes, tornadoes, torrential rains, and floods will increase as more air with high moisture content circulates. Diseases will spread more readily in a tropical climate with higher levels of moisture. There is a chance that certain animal species—like corals, penguins, and polar bears—will eventually go extinct. There is a chance that breaks in the Gulf Stream's warm water in the ocean water conveyor belt will result in freezing weather in certain regions of the world.
- The elevated acidity of seawater brought on by carbonic acid (dissolved CO2) is another negative consequence that, over time, endangers marine life. In this aspect, systematic scientific research has started[3].

V. GLOBAL WARMING MITIGATION

The United Nations convened several international conferences to address the issues raised by rising global temperatures and climate change in light of the dire consequences. Ultimately, the outcome was the 1997 emergence of the Kyoto Protocol, an international agreement. This treaty mandates that many industrialized countries cut their GHG emissions by 5–8% below 1990 levels by 2012 [11]. As new housing estates are developed, some countries are actively promoting tree planting. It is difficult to manage the population of people and animals to lower GHG. Since people need energy to maintain their standard of living and release carbon dioxide into the atmosphere, population control benefits society in two ways.

Promoting environmentally friendly renewable energy sources (hydro, wind, solar, geothermal, and fuel cells) can meet a significant portion of the world's energy demand, and their vigorous exploration is currently the global trend. If clean energy is utilized to create hydrogen fuel, then a fuel cell can be considered clean. According to recent studies, all fossil fuels can be replaced by hydro, wind, and solar technologies—possibly with sufficient storage—to produce 100% of the energy needed for the planet. Electric vehicles (EVs) can replace internal combustion engine vehicles (ICEVs), with hybrid electric vehicles (HEVs) using biofuels as a transitional option. GHG pollution will be reduced if electricity is produced from clean sources. encouraging the use of trains for mass transit, as is the case in Japan and Europe, will mitigate the global warming problem [3]

VI. CONCLUSION

Humanity searched for alternative energy sources due to the lack of access to electricity and the long time required to burn fossil fuels. These days, the greatest solutions to issues about the depletion of fossil fuels and the emission of greenhouse gases come from renewable technology sources. We examined global warming and its impacts in the pages above, as well as potential strategies to boost the usage of renewable energy, particularly through the use of microgrids and DRER devices.

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