

# The Effect of Distributed Generators on Environment toward Sustainability



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## Abstract

Traditional sources of energy are not enough to meet all the growing demand of energy. Energy resources are shrinking over the time while, the global population has an increasing trend. Over the last decades, renewable energy resources have been emerged as the best alternative for the conventional sources of energy. The damaging impacts of renewable energy resources are very low compared with traditional resources. Zero carbon dioxide emission and zero green-house gas emission during the operational lifetime are a couple of examples of their benefits to the environment. Distributed generators bring the point of generation closer to the point of consumption which significantly reduce the loss and improve the efficiency of the network. Solar PV panels and wind turbines are the examples of most mature renewable energy technologies. These two sources of energy are highly depending on the weather conditions. The application of the energy storage devices is critical due to the intermittent nature of the energy resources. The roof top installed solar PV panels can clearly depict an increasing trend over being more sustainable. On the other hand, the possible negative impacts of the renewable energy resources should also be considered before any large-scale application. The excessive land usage, ecosystem, and habitant are a few examples of the environmental concerns.

**Keywords:** Environment; Renewable Energy; Distributed Generators; Sustainability

**Abbreviations:** ESD: Energy Storage Devices; DG: Distributed Generators

## Introduction

An increasing trend of the population and energy consumption per capita endanger the energy supply network. Statistics show that the households have more electronics devices compared with a few decades ago. Although, the efficiency and energy usage of the devices have been improved, but still the energy demand per capita is gradually growing [1-3]. The published researches and reports aware most of the people around the world about this upcoming energy shortage [4,5]. The traditional sources of energy are still among the main source of energy for meeting the demand but, in the near future, they will run out with this consumption behavior. They need a few centuries to replicate themselves while the energy withdrawal is more than the replication [6]. On the other hand, the negative effect of traditional energy resources on the environment is still concerning for most of the policy makers. The pollution of the traditional energy resources is very higher than renewable energy resources [7,8]. In addition to that, the traditional energy resources generation point is centralized and sometimes, very far away from the consumption points. A large amount of the energy will be lost due to the long transmission and distribution lines. Therefore, a considerable portion of the generated energy will be wasted in the network [9]. Renewable energy resources have got a lot of attention over the last decades. In this study, wind

turbine and solar PV panels are the main point of the review. These two sources of energy are mature and commercial being used all around the world [10]. The sources of energy are clean and free but, not always available. For instance, the irradiance is not always high to make the system able to generate the scheduled amount of energy or the wind speed is not always as high as predicted for energy generation [11]. Another reason for focusing on these two types of renewable energy technologies is their complimentary peak periods. Most of the time, the peak time of the irradiance is around the noon when the sun is high in the sky while, the peak period of the wind speed is mostly around the midnight when there is no irradiance [12-14]. Therefore, the solar PV generation could be more efficiently used for the day usage while the wind turbine generation could be used for night consumption [15]. The intermittent nature of the energy resources makes them vulnerable. The reliability of the renewable energy resources is still concerning for most of the researchers. For this reason, most of the Distributed Generators (DGs) are still grid connected to make sure that the demand will not be unmet and shortage will not happen [16,17].

## Discussion

Energy Storage Devices (ESD) are mostly used to store the energy for the future uses. ESDs Play an important role to

face with the intermittent nature of the energy resources to increase the reliability and efficiency of the system. ESDs can store the energy in the periods which the generation is more than consumption and the release it to the system when the renewable energy generation is less than demand [18]. For instance, this scenario can easily happen that the wind turbine generation store in the peak periods during the midnights and released in the morning. Different types of the energy storage systems can be used for various purposes with divers options for the size and application. Some of them can be used for short-term while, others can be applied for long-term storage [19,20]. Another application of the energy storage devices is for economic purposes. The price of the electricity is not the same for all the periods and it fluctuates a lot. The energy can be stored in the periods which the prices are lower and then released for the future periods when the prices are higher [21]. In order to economically use the ESDs, different features such as maximum number of cycle, lifetime, depth of discharge and etc. should be considered [22]. The renewable energy generation is highly depending on the weather condition. Most of the time, generators and utilities would like to know their one-day ahead schedule. As a result, an accurate forecasting model can significantly change the schedule of the generation. There is always a possibility attached to the forecasting methods and hence, a backup energy is always needed in the system since the shortage is not desirable. Various parameters can affect the day-ahead schedule of the system which most of them should be clearly considered for each case [23]. These predictions can affect the schedule for charging and discharging the ESDs and also the amount of energy which should be met using the grid generation.

The main benefits of the renewable energy resources and distributed generators can be summarized in two main categories as economic and environmental. The final price of the generated electricity from the solar PV panels and wind turbines is decreasing gradually. In addition to that, the latest technological development on the solar PV panels and wind turbines design and manufacturing could significantly increase their efficiency. Another economic impact of the distributed generators can be clearly seen for household application. Rooftop solar PV panels make them able to meet a considerable amount of their demand with their own generation. They are also able to sell their excessive amount of the generated energy to the neighbors. There are a lot of ongoing researches toward the optimize generation and cost function prediction for the houses. Application of the smart devices for the distributed generators is critical. They can monitor the generation and consumption close to real-time. The developed appropriate algorithm using Machine Learning (ML) techniques significantly affect their performance. Least, the households which installed the solar PV panels are able to use some tax incentive. Renewable energy resources have very lower negative environmental effects compared with the traditional sources of energy. For instance, the pollution is close

to zero during the operational periods. Furthermore, they use a clean source of energy which is free and will not deplete or shrink over the time. Excessive land use of the on-shore wind turbine is one of the concern which might significantly alter the ecosystem. Cumulated dust of top of the solar PV panels or wind turbine can decrease the efficiency of the system. Water use for cleaning purpose is one of the other challenges. In addition to that, sometimes hazardous materials are being used in production periods which can be harmful during the lifetime and at the time of the recycling. Therefore, before the application of the renewable energy resources, a comprehensive analysis is needed to make sure that the benefits of installing the facilities is way more than their negative impacts.

### Conclusion

Renewable energy resources are the best alternative for the traditional sources of energy which are not enough to meet all the growing demand of energy. The negative impacts of renewable energy resources on the environment are very low compared with traditional resources. The application of the Distributed generators brings the point of generation closer to the point of consumption which significantly improve the overall efficiency of the system while, improving the environmental factors. Energy storage devices plays a critical due in the network due to the intermittent nature of the energy resources. All the possible negative impacts of the renewable energy resources should be taken into account before any application. Last, renewable energy resources can be very helpful toward being more sustainable by affecting the environmental and economic parameters.

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