**AUTOMATIC CHANGEOVER POWER SYSTEM**

**by**

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**st/cs/nd/19/439**

**BEING A SEMINAR PAPER**

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**DECEMBER, 2021**

## ABSTRACT

*Power supply in Nigeria and most developing countries of the world is anything but stable. This has adverse effects on the consumers of the electricity and the equipment that are operated from the mains sources of electricity supply in these parts of the world. This paper provides an automatic switching mechanism that transfers the consumer loads to a power source from a generator in the case of power failure in the mains supply. It automatically detects when power has been restored to the mains supply and returns the loads to this source while turning off the power from the generator set. This mechanism has been tested and we recorded a great result. It thus holds an important key in the provision of a continuous power supply through a near seamless switching between the mains supply and an alternative standby source like the generator set.*

## INTRODUCTION

A changeover switch is designed to transfer a house (or business) electricity from the commercial power grid to a local generator when n outage occurs. Also known as “transfer switches,” they connect directly to the generator, commercial power supply or line, and the house. When the homeowner or business owner experiences a power outage, he or she can switch over to the generator via a changeover switch (Hammond, 2008).

Although there are dozens of different types of changeover switches, most fall into one of two different categories: automatic or manual. With an automatic changeover switch, the home’s power is automatically switched over during an outage, eliminating the need for manually switching. But with a manual changeover switch, the homeowner must flip a switch to turn the power draw from the commercial grid to the generator (Nagrath, 2010).

Changeover switches are becoming more and more popular — a trend that will likely continue in the months and years to come. According to some reports, there were roughly 2.5 power grid outages per month in 2000. Fast forward to 2013, and that number has increased by six-fold, with reports indicating that some 14.5 outages have occurred per month on average. Most of these outages have been associated with weather events, including hurricanes and winter storms. Others, however, have been caused by hardware failure (Wallis, 2010).

It’s frustrating when your home loses power. You won’t be able to watch TV, use electronic devices, etc. This can certainly be an inconvenience, but it can also be dangerous. If you live up north and your power goes out during the winter, you may find it difficult to stay warm. This has prompted many homeowners to invest in generators along with changeover switches, as it protects against disasters such as this. Even if the power goes out, the homeowner can continue running his or her electrical devices, assuming their generator runs (Hammond, 2008).

And for businesses, power outages can prove equally as destructive. Businesses lose millions of dollars each year as a result of power outages. But these problems can be prevented with a generate and subsequent changeover switch. If the commercial power grid goes out, the business can continue running thanks to the generator.

Electricity (energy), which plays a major role in economic development of a nation, forms the basis of this study, with interests in human, infrastructural and economic development. In most developing and underdeveloped parts of the world, the supply of electricity for industrial, commercial and domestic use is highly unstable. This gives rise to the frequent use of alternative sources of power supply to meet up with the energy demands. The introduction of these alternative sources of supply brings forth the challenge of switching smoothly and timely between the mains supply and the alternative sources whenever there is a failure on the mains source. There is also the need to reduce drudgery from switching between the two sources on the human side. Solving these challenges forms the focus of this work. The Automatic Change-over switch, automatically switches over to the alternative source of power supply (generator) when there is a power outage. It equally switches over to the mains supply when power is restored and turns off the generator automatically. The automatic power change-over switch is a device that links the load and mains supply or the alternative supply together. This enables the use of either the mains supply or an alternative source when there is outage on the mains source. This can either come in with three phase or single phase. This device maintains constant power supply to the load by automatically activating the generator when there is need. Since the user might not always be in need of the generator, provision has been made to prevent the generator from starting should an outage occur (Shephar & Spence, 2014).

We can’t go on and on to emphasize the importance of power supply to our home and industries, but it is important to mention that the outage of power supply can bring discomfort in our homes and loss of revenue due to down time in the industries. Thus Peter (2012), states that the cost and the depreciation associated with breakdown vary from one application to the other, and in some cases, the user has little choice but to ensure that a stand-by unit is available to take over on event of failure of primary system. Also, in his book, he went further to say that the depreciation caused by such instability reduces efficiency of the organization and leads to a great deal of frustration. Sequel to the rate at which more sophisticated electrical/electronic gadgets are being procured and installed in our homes, hospitals and business premises, there is a justifiable need for a faster and more reliable change-over system in an event of power outage.

Therefore, in view of these considerations, in this project, we aimed at designing and constructing a workable automatic change-over switch with generator starting/shut down functions. This switch turns ON the generator automatically in cases of mains power failure and connects the load to the generator output, alternatively it switches OFF the generator automatically once power is restored and returns the load to the mains power. Thus, in the cause of finding solution to switching over to the alternative sources of supply without delay, undue wear and tear of the man who effects the change to the alternative sources come the importance of our research work (Nagrath, 2010).

## THE STAND-BY POWER UNIT (GENERATOR)

The stand-by generator set is commonly used to supply emergency power to most of the power consumers where the mains supply is unstable. For best performance of the system, we must put into consideration the type of generator, engine type, its cooling system and fuel, the load capacity and the operating environment. Whatever cooling system is used to cool the generator, it is recommended that the heated air be channeled outside through an exhaust pipe while provision should be made to bring in fresh air so that the generating room, where the generator is installed, can be kept from becoming excessively hot, as this might cause damage to the engine of the generating set. Furthermore, the lubrication of the set is much important; the recommended lubricant should be used in order to maintain smooth and prolonged life span of the set by reducing wear and tear of the engine and other parts due to friction. Finally, it is important to determine the correct rating of the mechanical engine to drive a given generator so that it has the minimum capacity necessary to supply the selected load (Wallis, 2010).

**SIGNIFICANCE OF AN AUTOMATIC CHANGEOVER POWER SYSTEM**

Recurrent power outages in developing countries in which Nigeria is one have compelled the need for design and implementation of an intelligent switch to change over the supply from the power utility to that of a stand-by generator. The automatic change-over switch monitors the three phases of the public power supply and initiates the turning on of the generator and changing over of the supply whenever either of the phases of the power utility is delivering below the normal voltage or completely off; and switching back to the public power supply, whenever the normal phase voltages are restored (Thereja & Thereja, 1995).

Though the era of fluctuation and failure in the supply of electricity is long forgotten in many industrialized nations of the world, many developing countries still suffer setbacks arising from incessant power failures. The provision of alternative power source (generators) has no doubt brought succour but not without an attendant challenge associated with manual operation of the changeover therefore, the need for an automatic changeover. Automation of power generation is required as the rate of power outages becomes predominantly high (Peter, 2012). If the processes of the changeover are manual, time is wasted, mal-operation and equipment damage can also result from overloading at the changeover. In order to eliminate downtime, an automatic changeover switch is required (Nagrath, 2010).

The need for a steady source of power has called for an alternative source of power especially in Nigeria where power failure is prevalent. The introduction of these alternative sources of supply brings forth the challenge of switching smoothly and timely between the mains supply and the alternative sources whenever there is a power failure. There is also the need to reduce drudgery from switching between the two sources on the human side. Solving these challenges forms the focus of this work. The automatic power change-overs witch is a device that links the load and mains supply or the alternative supply together. This enables the use of either the mains supply or an alternative source when there is an outage on the mains source. This can either come in with three-phase or single phase. This device maintains a constant power supply to the load by automatically activating the generator when there is a need (Hammond, 2008).

Due to the inherent features of the switching devices, this paper presents the design and implementation of an automatic changeover switch with generator trip-off mechanism, which switches electrical power supply from public supply to generator, in the event of a power outage. The system uses an electronic control circuit involving integrated circuits, transistors and electromechanical devices.

**ADVANTAGES OF AUTOMATIC CHANGEOVER**

In modern times when the use of electronic appliances has enormously increased, it has become necessary to have an alternative source of electricity for the electronic equipment. Moreover, in many places disruptions of power cuts also occur frequently for which a backup power source is necessary for smooth functioning and keep productivity at it's highest. The most common alternative power sources are either a generator or a battery backup (Wallis, 2010).

It is technically a difficult task to connect each of the different sources of electricity. In this respect, the use of changeover switch can make the task easier. The idea of using a change over switch is to change the source of electric supply in minimum time and as easily as possible. In other words, the task of a changeover switches to transfer (the house or business) electricity from the commercial power grid to a local generator when there is the power cut. They are also termed as transfer switch that connects directly the commercial power supply, generator and the house. If a home or business owner face a power outage, she or he can switch over to the generator by the means of a changeover switch.

Although there are different types of changeover switches the most common variety are- automatic and manual. As the name suggests, automatic changeover switch enables the home's power to automatically switch over during an outage. As it is automatic, there is no need of manually switching it on. On the other hand with a manual changeover switch, a homeowner must turn on a switch to transfer the power from the commercial grid to the generator. No matter automatic changeover switches are highly preferred by users, manual changeover switch has some great user benefits. Let's have a look at some of the basic advantages as outlined by Shephard and Spence (2014).

**Unfailing in Extreme Conditions:**

Manual changes over switches are extremely suitable for applications during heavy duty. Despite being able to support the maximum load, they are simple.

**Energy Saving:**

Most of the manual transfer switches are available with a real one pole construction even in higher ratings. This enables to save energy in terms of consumption by reducing the loss of power. This single pole constriction eliminates the need to use unnecessary fixing sets to allow connections.

**Best for Home Use:**

Manual transfer switches are extremely handy and best for using at homes or other spaces when there is no need of super-fast transfer to generator power during load shedding.

**Optimizes Space:**

Many brands design manual transfer switch using flexible and modular designs. Be it about arranging the poles and handles or sometimes including an adjustable shaft, the versatile construction offers unique space saving options.

**Available Globally:**

Manual changeover switches are mostly preferred all around the world for which it is available with different brands. Here are also different designs with the manual changeover switch which can be opted for the much easier application.

**Resistance Power:**

Manual changeover choice is resistant to high voltage and possesses high mechanical endurance. Such switches are not easily affected by the frequency variations. They are truly a reliable option with security.

**Durability:**

In comparison to other transfer switch options, manual changeover switch has a longer lifespan. No matter durability greatly varies from brand to brand, but in most cases, it has been found that manual transfer switches have a longer life.

No matter manual or automatic, changeover switches are becoming increasingly popular and can be expected to be in the trend that will continue for months and years to come. From industrial sectors to public buildings and homes, changeover switches have made life easier. However, buyers should always give priority to safety while buying changeover switches. There are different brands that are coming up with advanced models of such switches. Prices vary according to the design and brand. Users must read the user manual to avoid any kind of inconvenience (Ragnar, 2015).

## CONCLUSION

Automatic change over switch with generator starting/shut down facility has been designed to help man reduce the stress and loss of time associated with the starting and shutting down of the alternative sources of supply (generator). It is worthy to note that this project is subject to scrutiny and further development.

**RECOMMENDATONS**

This seminar paper recommends that for future development an overload protection system be included.

It also recommends the system be used in the entire field where electricity is highly needed and even to the small and medium entrepreneur that the automatic change over switch with generator starting/shut down facility will help them. To the government, the paper recommends they encourage the mass production of this system.

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