Conclusion

The current community and environment are inextricably connected to its other half; energy. As a result, the importance of the backup power has recently become a high profile. Hence, in this report the backup power synchronous diesel generator discussed and depicted in details. This project is aimed to simulate and design a three synchronous backup power diesel generator that is connected to critical load such as; hospitals, plants, banks, etc. The project is composed of many parts to deliver the required power to the load. Each one of the diesel generators that has been used has a capacity of 600kw and the connected load’s capacity of 500kw. Also, there are three cooling units that connected to each diesel generator in order to maintain the temperature at a fixed range. In addition, there is an automatic transfer switch (ATS) that’s function is to switch the power source from the main grid power station to the backup power when occurring any outage to sustain the delivered power to the load. Furthermore, the safety measurements have been taken into account so the circuit breakers have been used to prevent any system failure. The synchronization process is considered in this research project in order to maintain the three back up diesel generator at the same phase and frequency so the load gain is at the same level. Furthermore, the mechanical parts; the governor and the exciter that used were essential since the exciter is mainly used to provide the main power to the electromagnetic that form the poles of the rotor and the governor’s function is to maintain the rotary speed of the motor within reasonably close limits. Also, the wifi feedback system has been used to receive and transmit the signal to monitor the working of the load and the backup power system. The monitoring system has been used and connected to the backup power generators to provide us with the updated results to sustain the electrical power. The diesel is used as a fuel power source to the generators since it’s burned at a high temperature so it provides the generators with more power and it’s more efficient compared to the other sources. In summary, this project has proven that it’s crucial not only luxury to use a backup power system to any critical load especially in these conditions since it doesn’t only cost money, but it highly costs more than that it costs people’s lives.

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**Several** selections among the general design especially in parameters of the block have a contribution with the simulation process in a way or another.

The important characteristic associated with the simulation process in the entire system is having the possibility of simulating under several circumstances, and this advantage came from the blocks by containing certain functions related to the control of the blocks, and the other advantage is simulating the entire system under chosen time in seconds. In other word, once we click on the run command from the tab in the upper screen, the simulation operates within a specific time as given in the upper bar of the screen, and this is important for our system in order to get high efficiency, ordinary values, and maintain the stability till the end of the limited time. In order to get the needed results in general through the simulation procedure, we need to fill the blank referred to stop time, which is located at the left side of the run button, with at 24 seconds of the time, which is basically an analogy into 24 hours.

Now let’s talk about the several cases that could happen in general which some of them view the changed result by the display and scope block.

The first case that happen at the beginning of the simulation is having the main source (grid) operating and able to supply a 500 KW to the critical load as seen in figure below, at meanwhile the generators will be almost zero and no distribution of power is among them also seen in figure below.

The second case is making the main source (grid) stops at any time of the 24 seconds during the simulation, and this leads the generators to begin functioning. This case is contributed with the switch button which is connected to a constant value that represents the situation of the main source, as we said before, ON represents the action and OFF as nonfunctioning. After the main source is completely shut down, the automatic transfer switch will be activated and quickly delivers signals to the three generators to begin operating.

The connections of the cooling system outputs into the generators inputs will state each situation of every generator through the 24 seconds.

The source components connected in the interior block of the cooling system is sequence block, there are three of them with each one delivering the specified case into a specific generator, and each one delivers certain order of functioning through time.

The time sequence of each generator is stated in the table below as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Time (sec.) | Generator 1 (KW) | Generator 2 (KW) | Generator 3 (KW) |
| 0 to 8 | 0 | 250 | 250 |
| 8 to 16 | 250 | 0 | 250 |
| 16 to 24 | 250 | 250 | 0 |

From the table above, by the time process in seconds and generators in kilowatts, we can see that every generator should have 8 seconds break for cooling, and also every generator will maximally operate for 16 seconds. By using this process, we are able to have a balancing distribution of the power among the generators by each one supplying 250 KW through whole day and importance of the critical load lies on the stability.

The third case is when the main source (grid) restores power. In this case, after the automatic transfer switch also restores the specified value, it will directly change the direction of the supplying source and will restore it again into the grid in order to deliver 500 KW fully. After restoring the supplying source to the grid, the three generators will apparently reach within zero value and by this process we ensure stability for the main source, the three generators, and especially the load which is most important thing.

All the cases stated above can be done also by a specific designed connection between an internet link and the entire system.

**The working process** of the simulation by the control unit referred into an internet link is done by opening the link below, and we can control the simulation through the buttons designed inside it such as start, stop, continue, and pause options.

The web page screen in the figure below.