

Solutions for the Power Distribution System of Karachi Electric (K- Electric) to Prevent Deaths in Rainy Season

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Abstract

Karachi is the metropolitan city of Pakistan. In rainy or flood season many deaths occurred due to electric shock. For the prevention, we suggest here to K-Electric (Karachi Electric Supply Distribution company) to control death casualties due to electric shock in rainy season. In suggestion paper providing some suggestions to the big power supplier of Karachi (K-Electric) about safety, maintenance, and monitoring for the prevention from deaths occur in metropolitan city due to electric shock. Those deaths occur due to faults in electric pole and touch the fallen live wire. When people touch the pole, they got electric shock in rainy and storm condition due to these electric faults occur in this condition provides enough loss to humans in the form to lose their lives. For the prevention or overcome the loss of life and danger here are giving some suggestions, if do work on following safety, maintenance and monitoring system then get the control on that loss will occur in heavy rain or flood.

Keywords: K-Electric; Rain/storm; Electric Pole Faults; Safety; Maintenance; Monitoring.

1. Introduction

Energy is the basic need for the economy of any country [1]. This is a backbone of development countries [2]. The main part of energy is electrical energy or electricity [1]. It runs the industry of every country [2]. It needs every area of the country, if electricity cut for a minute the industries cannot survive without it and it effect the economic development of that country [3]. Electricity does not harm anyone in normal condition, but it is dangerous in rainy seasons and floods condition [4]. Karachi is the biggest city of Pakistan [5]. The population of Karachi is above 1.5 crore, there are lots of industries [6].

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Contribute More than 50% of overall tax in Pakistan economy and lots of homes are depend on this city[11]. The demanding power to runs this city is 3,300 MW[1]. KE(k-Electric) is the biggest supplier to this city[14]. KE provides 2267 MW, with IPP and national grid 1162 MW and 650MW [7]. As discussed above, we have mention that electricity does not harm anyone in normal condition, but it is harmful for everyone in rainy and floods season because of faults occurring [8]. If we take some restrict actions against these faults, then we got protection in rainy and floods seasons [9, 10]. Underground transmission is an another option K-Electric can use and it can be applied on high voltage transmission lines. There are several lines of more than 230KV are passing through Karachi. K-Electric can discuss this matter with government and solve this issue by planning a GIL (Gas insulated transmission lines) instead of overhead transmission lines. GIL in metropolitan areas can perform, well save and economical [11].

2. Ease of Use

Karachi has many industries that needs electric supply every time. K-Electric is the power supplier company. This company fulfills the electric supply of Karachi. K-Electric have own generation, which provides electricity to consumers through exact path. If this system break from any point, then K-Electric provides continue supply to this city. K-Electric has interconnected power system in Karachi. K-Electric is doing work to system better that and moving all manual system to automatic system. K-Electric should to do smart monitoring of all the system. The system of generation to substation of K-Electric is given below which showing the generation, transmission, distribution, and Utilization of electricity [12].

Distribution system has different substations for remote areas [13]. In substation of every area have own:

- feeders
- distributors
- Service mains

In substation, the feeder is a conductor which connect the substation and transformer with each other, distributor is a conductor which connects the transformer and consumer with tapping[9] and service mains is a small cable which connect consumer to the consumer meter [14].

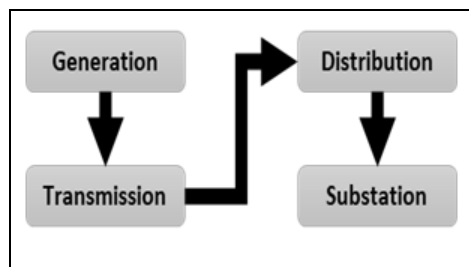


Figure 1: Distribution in Karachi from Substation to Individual Consumer

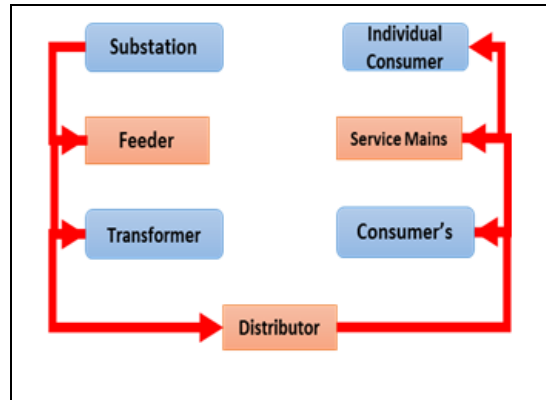


Figure 2: K-electric system from generation to substation

2.1. Reason behind death

In rainy and floods season prevent but control the occurring loss [14]. Different type of the losses occur in Karachi due to the rain and floods in the face of death but most of the death occurred due to different faults or electrical accidents[7]. Different types of accidents occur in Karachi by electricity, but electric shock accidents take the human life. Most of people across the electric pole but no one knows that if anyone touch the electric non-insulated pole, touch the electric live hanged or broken wire or if lightning hits that will lose the life[15-17].

2.2. Types and reasons of faults

Short circuit is that the circuit should be grounded without follow complete path. In short circuit, symmetrical and Asymmetrical fault occurs due to many reasons [10]. The First fault is that in thunderstorms feeder and distributor live electric conductor swing and can attract to each other due to attractive properties [4]. The second is that in heavy rain the pressure of water and air is high and overhead cables are not able to bear high pressure of rain and air, due to high pressure cables lose the strength and make new connection with ground or other wire. The third is that, water fall in heavy rain is high, it passes from one wire to another and make a path between two wires and reason of short circuit occur [14]. Insulation Failure in normal condition due to corrosion, moisture and dust which is connected between live wire and pole[12]. When insulation failure the current begins to flow from live wire to pole [2,3,4,12]. In rainy or storm condition insulation failed due to lack of maintenance [18]. When lightning strike on the insulator the voltages excessive from its limit, insulation becomes failed and insulator cracking occur due to low quality material. Connection loose is the biggest issue and in rain of flood season it gives rear effects. In rainy weather, high pressure rain hits the live wire and that lost the connections from joined or insulator and fault have to be occurred. The other reason for loose connections is thunderstorms and less maintenance [6]. Transformer can be down in any situation but in rainy season become headache. In rainy or storm condition transformer down for the reason that of low maintenance and rainwater penetrate transformer due to penetration, oil cracking occurs, and transformer has to be down [19].

2.3. Safety from electric shock

Touch the Electric Pole: According to the above discussion two main possibilities that the current completely

spread in the electric pole. The one thing is lightning fall on the pole and someone touching to pole while the other one is doing same thing, but insulator fails between the live wire and electric pole. In both reasons touching person get shocked and got death at that time. For protection in above both cases must need to upgrade the grounding system to connect one wire at normal height of pole with ground [20]. The other suggestion is that to cover all electric pole from wood sheet or insulator type material at normal height where human could not reach easily.

Touch the Electric Live Wire: According to the discussion there are two main possibilities, a human can be harm from live wire. The first is that live wire fall on ground at dry surface while other is live wire fall on ground at water filled surface. The suggestion is that, for protection in both cases needs to hang a warning board on every pole at normal or visible height. One more suggestion for both cases is that a buzzer produce a sound when any wire lose from the pole.

Lightning Strike: In the lightning have two different possibilities, a person is under any shelter otherwise a person is without shelter. If a person without shelter the suggestion is that to go into shelter as soon as possible, if not possible to go into the shelter so a person needs to sit on the floor as much but do not lay down on the floor while the person is in the shelter but shelter did not get a proper grounding so the suggestion is that to do the proper grounding of that shelter.

2.4. Maintenance of electrical equipment

Maintenance is necessary for each kind of electrical equipment. If maintenance has not been provided on time the life should be less automatically. In safety study of electrical engineering the responsible authorities must check each equipment after specific a period [8]. Just like: poles, pole grounding wire, insulators, live overhead wires, joints, transformers etc. The suggestions for fault producing equipment's are below to provide maintenance on time and safe humans life.

Poles: In pole maintenance a service man have to check that the pole is not broken and not loose from any point because more deaths occur when pole fall on the floor in rain and storm conditions.

Pole Grounding Wire: In pole grounding wire maintenance a service man needs to check the grounding wire grounding, conductivity and check that the wire is joint with pole or not because more deaths occur when grounding of pole not proper[17].

Insulators: For insulator maintenance, service man needs to check insulators after specific time. Insulators not getting service after a specific period reason of lacking in maintenance on time, different types of faults occur, and insulator should be changed into conductor.

Live wires: Live wires mostly break or fallen because of loose connection. The maintenance of live wires is most important after specific period. A service man must check the joints or connections of wires.

Transformer: *The maintenance of transformer is necessary because if transformer gets wet then oil cracking*

will occur with different types of faults [13]. So, service man must need to check every part of transformer according to company maintenance period.

2.5. Monitoring

The world is being digitalize and everything is being under control. Monitoring is the main part of every digitalize system. For monitoring needs to change the manual system into automatic. Monitoring of Electric pole is doing by European companies. The monitoring system in Europe and other developed countries is being but not completed yet. Suggestions for monitoring in Karachi is a big task. In Karachi, K-Electric must take restrict and immediate action to convert this local system into smart form. For monitoring of live Wire, electric pole, and insulators we are suggesting that to install a system that capable to cover above three portions. If live wire should be loose or break , current flow from electric pole more than 0.1A and insulator get corrosive or break or get any other fault then the design system generate an alarm on that pole continuously till resolve the problem or it can be close manually and send a generative message through IoT to the monitoring department or closest substation and the system should be cut off automatically in two seconds[15,16,20]. The model of suggested system is below:

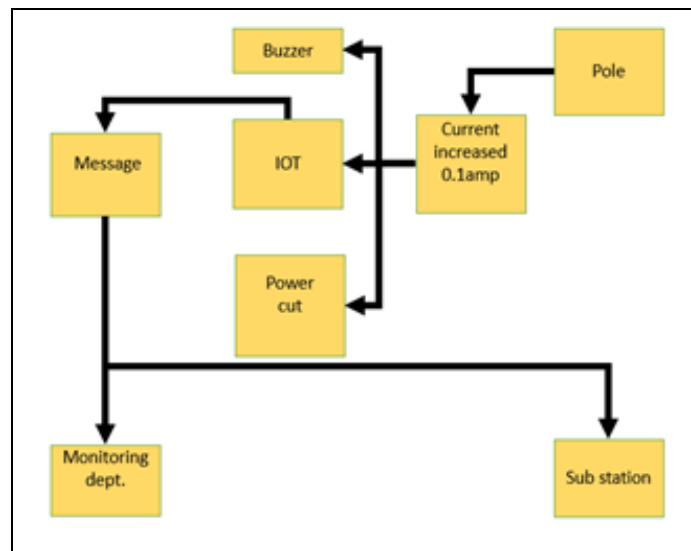


Figure 3: Karachi Electric Pole Monitoring System

3. Results

Due to heavy rains and storms people face loss. In this loss they face deaths of beloveds. To overcome the loss of death in Karachi has given some suggestions to k-Electric in above discussion. Here is comparison of deaths occur in different era. Fault Death Ratio in 5 Years due to Rain: In the above graph, shown that deaths occur in last five years due to rain and in that have also given number of deaths occur in each year [18].

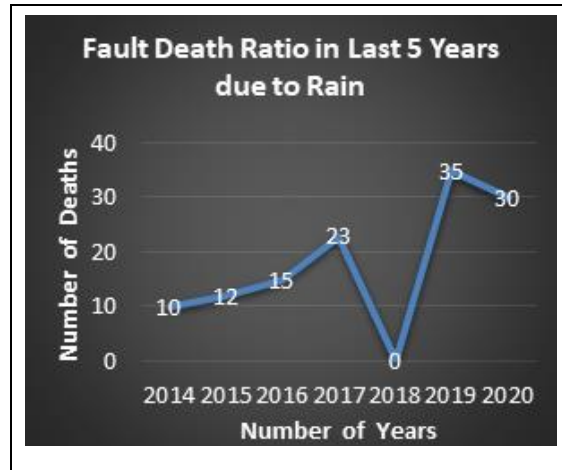


Figure 4: Fault Death Ratio in Last Five Years Due to Rain

Faults Death Comparison: Here is the above graph, discussing death ratio in different conditions in Karachi [18]. In rainy condition number of deaths occurred but mostly death occur due to electric shock[10]. In the following graph showing that mostly people died due to electric shock instead of other reasons in rainy or storm condition.

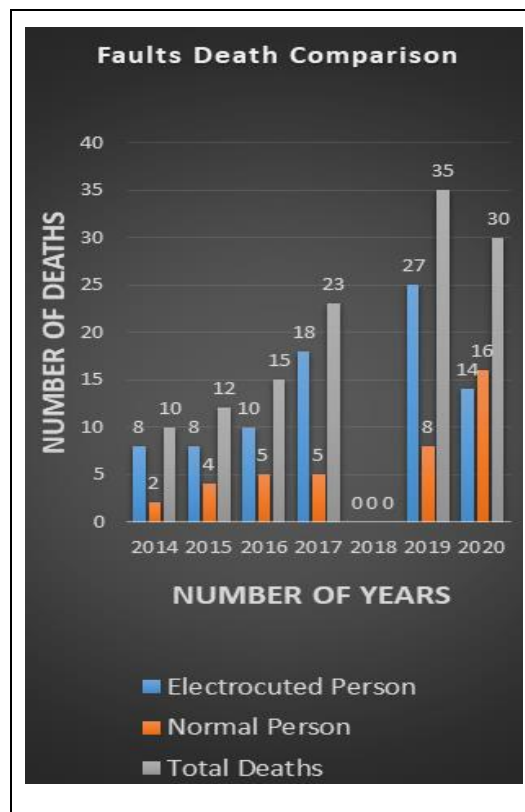


Figure 5: Fault Death Comparison in Last Five Years for Normal and Electrocuted Person

4. Conclusion

In this suggestion paper, have discussed reasons of deaths occur in rainy and storm condition. In rainy and storm condition many people have lost their lives in metropolitan city Karachi. For prevention from this disaster have

given some suggestion to K-Electric about safety, maintenance and monitoring in rainy condition. K-Electric is the most power supplier of Karachi city. In the end, have given graphs are related to deaths occurred in this city. In these graphs the ratio is showing the death of persons from last five years due to electric shock and other reason.

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