

Electricity – Good, Bad and Dangerous

Analysis of Electricity Accidents and Preventive Measures

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Electricity has become a part of our lives with such ease that we tend to neglect its power and all-pervasive nature. We get electricity to work for us by simply pressing a switch. Most of our interactions with electricity is limited to occasional replacing of a faulty bulb or paying the bills issued by the local electricity company. The electricity company builds and maintains the electricity network. It provides electricity connections, periodically reads the electricity meter to record the electricity consumption and issues electricity bills. We call the local electrician to attend to serious electricity problems, and some people complain to the company, when there are issues such as power outage or very high bills.

All of us are connected with electricity in different ways. As consumers, electricity is essential for lighting, water pumping, fans, television, fridge, mixer-grinder or mobile charging in our houses, farms or shops. Factories, hotels, hospitals, panchayats and railways also depend on electricity for delivering goods and services. Thus, electricity has become quite essential for modern living.

On the other hand, we are also aware of the bad effects of coal-based power generation, such as local pollution and global climate change. Three-fourth of the total electricity generation in India is based on coal. The ongoing shift towards solar and wind-based electricity generation is expected to reduce some of these harmful effects. But alternate sources of energy are facing many challenges too, since they require large amounts of land, and power from them is not available all the time.

Further, if not handled with care, electricity has a dangerous side-effect. This unfortunate side-effect is the occurrence of electricity accidents, which claim many lives and cause large-scale property damage. It is important to understand why these accidents occur and how they can be reduced. This article attempts to answer these very questions. To begin with, let us look at some ‘electrically dangerous’ locations.

Figure 1 is a picture of an electricity transformer located in an Indian village. The transformer is mounted very close to the ground. The connecting wires are hanging low and there are many joints in the wires. Any person or animal near the transformer could accidentally touch a bare electrical wire and get a shock. The transformer could get overheated and catch fire, causing injury to anyone nearby.



Figure 1: Badly maintained, unsafe electricity transformer.

Figure 2 shows an electrical pole in an agriculture field. The pole is leaning at a dangerous angle. Because of this, the electric lines are hanging low, and the pole can fall down any time, making this place a dangerous location from the point of view of electrical accidents.



Figure 2: Electrical pole in a field leaning dangerously.

Figure 3 shows a metal electrical pole in an industrial area. It is very close to a tall tree, with branches touching the lines. The line can swing due to wind and touch the pole, making the metal pole dangerous to touch. The line could also break and fall. Such electric poles standing close to trees and those with creepers growing on them can be seen in many places around us.



Figure 3: Electricity pole installed very near a tree.

Figure 4 shows a switch board of an agricultural pump-set, which is placed on the ground, with many exposed conductors. Touching any of these can give an electricity shock.



Figure 4: Agriculture pump switchboard placed on the ground.

Figure 5 shows a 3-pin socket placed very close to the floor. Three multi-plugs are connected to it, with five appliances plugged in, one of them with bare wires and two with metal parts of the plug exposed. A cloth curtain, wooden cot and newspapers have been placed close to the socket. A child touching any open conductor could get a shock. Sparks from the plug or the wires could fall on the papers, curtain or cot, and start a fire.

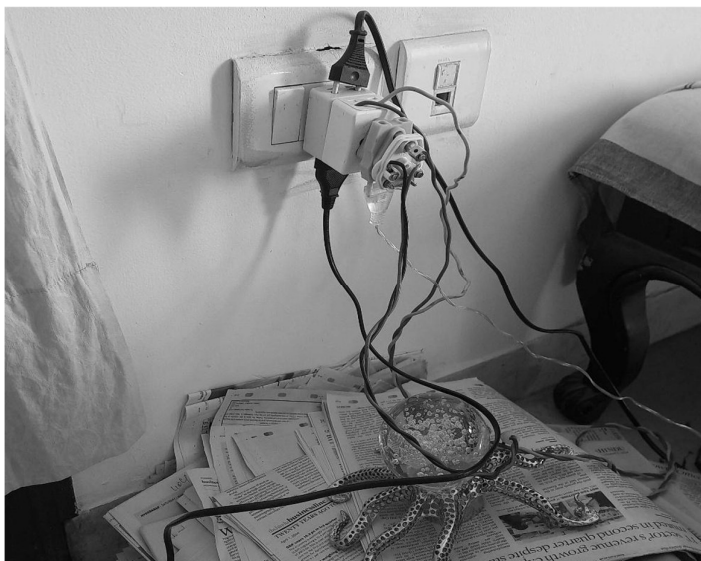


Figure 5: Plug with too many connections.

These examples show that, unfortunately, there are many such ‘electrically dangerous’ locations around us. The deadly consequences of such dangerous locations can be found in recent news reports from across the country.

- In August 2022, eight people died and thirteen were injured in a hospital when a power generator caught fire.
- In September 2024, two school students died from electric shock when they had gone to fetch water from a tank. The accident happened as an electricity line had broken and fallen near the water tank, and the students had accidentally touched it.

- In October 2024, a farmer died due to an electric shock while connecting the pump to the supply line. He mistakenly believed that there was a planned 12-hour power cut and there would be no power on the line.
- In January 2025, a boy died when he was trying to retrieve his kite which was entangled in the wires of an electricity transformer.
- In March 2025, according to a news report, farmers had requested the electricity company to switch off the power during daytime, since this is when they harvest wheat. There are low hanging power lines crossing the wheat fields, which pose great danger due to possible contact, and more so if they break and fall.



Figure 6: News reports in Hindi about deaths from electricity accidents across the country

There are many such news reports from different parts of the country, which makes us ask several pertinent questions - Where do electricity accidents happen? Who are the victims of these accidents? Why do they happen in the first place? What can we do to reduce such tragic accidents?

This article attempts to address such questions. We begin with a brief overview of the types of common electricity accidents, and then take up these questions, one by one.

Types of electricity accidents and their magnitude in India

Electricity accidents are of three types – 1) shock due to contact with current carrying bare conductor, 2) fire due to electrical problems and 3) lightning, which is a natural phenomenon. People and animals can both get injured and sometimes even die due to these accidents. There can also be loss of property due to fires and lightning.

Electric shock

An electric shock is the most common electricity accident which happens when current flows through the body from a conductor to earth. This happens when the body touches a conductor at a certain voltage. The severity of the shock depends on the amount of current that flows through the body, which is given by Ohm's law:

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

Current is measured in Amperes, Voltage in Volts and Resistance in Ohms. It is the flow of current through the body that causes electric shock, and a very small current is enough to give a large shock to humans, as indicated in Table 1.

Table 1: Current and its Impact on Human Beings

Current in milli Amperes	Effect on human body
1	Tingling feeling
1 to 5	Mild shock
5 to 20	Painful shock
20 to 50	Extreme pain. Loss of muscle control leading to injury, possibly death
More than 50	Death due to respiratory or heart failure

Note: 1 milli Ampere = one-thousandth of an Ampere. The numbers given are approximate.

To calculate the current that flows through the human body when it comes in contact with electric wire, we need to know the voltage and resistance. The voltage at most of the consumer locations is 240 Volts between the conductor and ground. The body resistance for humans is quite high at the skin if it is dry, and can be as high as 100,000 Ohms. The rest of the human body is almost 60% water, and its resistance is as low as 300 Ohms. When a person touches a live conductor (through which electricity is flowing) while standing on the ground, there are two points of contact in the path of current flow – hand and feet. If the skin is dry, a current of 1 to 2 milliampere can flow through the human body, giving a mild shock.

Resistance of the skin reduces if it is wet at either the hand or the feet, or if there is an injury. Resistance in the current path is high if the person is wearing rubber gloves or footwear, and thus the current would be less, and shock would be milder.

If only one part of the body is in contact with the wire (for example if one hangs onto the electric wire), there would be no current through the body, since the circuit is not complete and hence there would be no shock. You would have seen birds sitting on electric wires, without any injury, since only their feet are in touch with the wire, and no part of their body is touching the ground. Another important point to note is that the skin resistance reduces significantly if the voltage is higher than 500 Volts. This is why any contact with high tension wires (11,000 Volts or more) is much more dangerous.

The actual harm due to shock varies from person to person and depends on the path of current flow in the body. When the current flows through the body, it affects our muscles and nervous system. This causes loss of control over muscles, leading to involuntary actions, which we are not in control of. For example, if a person touches a wire, their fingers may become stiff, making it impossible to disengage from the wire on their own, or a person receiving a sudden shock may fall and collide with a nearby object. Such involuntary actions can cause physical injuries, such as fracturing of bones or injuries to the head or the back. What is described here also applies to animals in varying degrees, depending on their size and shape.

Fire due to electrical problems

Electrical problems can cause sparks or overheating, which can lead to large-scale fires. You may have seen sparks when some switches are put ON or OFF, or when electricity lines touch each other or come in contact with trees. Too many connections, with some of them loose (as shown in Figure 5), can cause sparks. Wires and appliances get overheated when they carry too much current for a long time, or are not cooled properly, or are faulty. There would be a burning smell and smoke near such locations, which could be called hot spots. If any material that easily catches fire (such as dry grass, paper or cloth) is near such sparks or hot spots, a fire can start.

For example, fires and explosions often take place on wayside electrical transformers, such as the one shown in Figure 1. Mobile chargers or mobile phones can also become overheated and explode. Many fires in hospitals, cinema theatres, coaching centers, hostels, houses or offices are caused due to such electrical faults and lead to loss of lives and property.

Lightning

Lightning is a natural phenomenon, which takes place when electricity flows between clouds or from clouds to the earth. It is the cloud to earth lightning that is most dangerous. The voltage and current during a lightning are very high - lakhs of volts and thousands of amperes of current. For comparison, the voltage of our home electricity supply is 240 volts, and a typical fan needs just 0.3 amperes to work. The temperature in the path of lightning is thousands of degrees centigrade which is hotter than the surface of the sun!

Lightning lasts for less than a second. But since voltage, current and temperature are very high, it can destroy property or trees and kill people and animals. It can strike power lines, resulting in very high voltage reaching the electricity connections in our homes. This can burn the wiring and appliances in our homes.

There is a thumb-rule that if you hear the thunder within a few seconds of seeing the lightning, the lightning is close-by and can be dangerous. It is best to stay indoors and not be near tall structures during lightning storms.

Magnitude of electrical accidents in India

On an average, around 700 people die each day in India due to different types of accidents, such as traffic accidents, falls, drowning and electricity accidents. Among these, 47 people die each day due to electricity accidents. Figure 7 provides a break-up of the average daily electricity accidents.

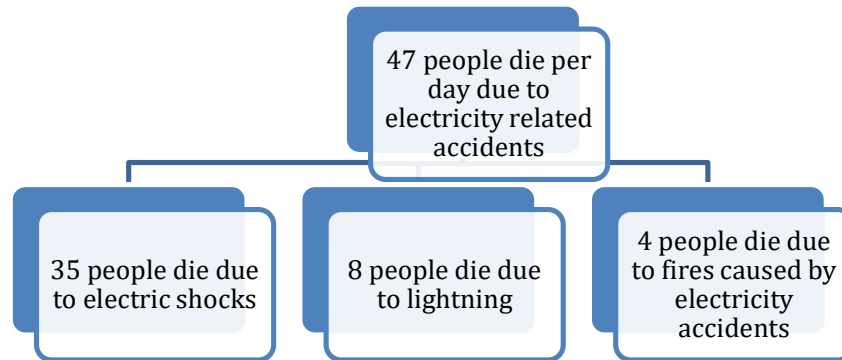


Figure 7: Deaths per day due to Electricity accidents.

From Figure 7, it is clear that the maximum number of human deaths due to electricity accidents occur due to shocks. This article will focus more on accidents and human deaths which occur due to shocks, since the people who die are often the bread winners of their families.

Sadly, these accidents are not just limited to people. Over 10,000 animals also die every year due to electricity accidents. Death of domestic animals seriously affects the livelihoods of many people.

Where do electricity accidents happen and who are the victims?

Let us examine the geographical and electrical locations where most of the electricity accidents occur, and who are the victims of these accidents. The geographical spread can be examined across states or districts, as well as across rural and urban areas. The statistics reveal that a higher number of shock accidents are reported from rural areas. As for fires due to electrical problems, more cases are reported from urban areas, perhaps because the number of public places where crowds gather are higher in urban areas.

To understand electrical location, it is necessary to understand how electricity reaches the consumer. Figure 8 gives a broad idea of the process by which electricity reaches the end consumer.

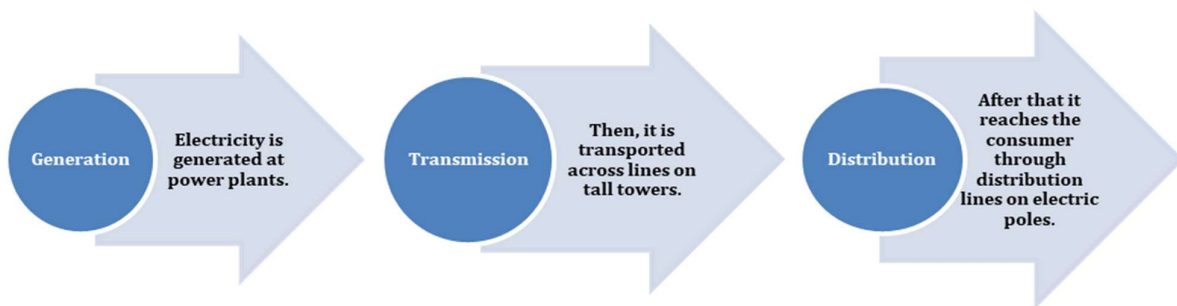


Figure 8: The process by which electricity reaches the consumer location.

Electricity is generated at power plants spread all over the country. It is then transported across hundreds of kilometers through transmission lines mounted on very tall towers. The voltages of these lines are as high as 220,000 Volts or 400,000 Volts. Transmission lines are connected to distribution substations, where the voltage is reduced to lower levels (such as 33,000 Volts, 11,000 Volts or 415 Volts) and then connected to the consumers through distribution lines over electric poles. Thus, generation (electricity is generated), transmission (bulk transport of electricity) and distribution (provides electricity to consumers) are the three major parts in the route to providing electricity to consumers.

Over the years, electricity accidents in the generation and transmission parts have significantly reduced. Today, most of the accidents (60% to 70% of the total) occur in the distribution part, at lower voltages (11,000 Volts, 415 Volts or 240 Volts) and at small consumer locations.

Who are the victims of accidents?

Most deaths happen at public places and at the locations of small consumers. What we mean by small consumers are people living in small homes, running small shops, and farmers with agricultural pump sets.

The number of deaths vary across states, due to difference in population, spread of electricity network and its quality, as well as public awareness of safety. Ten states (Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh, Andhra Pradesh, Bihar, Karnataka, Gujarat, Tamil Nadu and Telangana), report 80% of the total deaths.

As a country, India reports a very high number of deaths due to electricity accidents. This could also be due to the high population. A parameter called “fatality rate” is used to compare across countries, or states in India. It refers to the number of deaths per lakh of population in a year. As per available information, the fatality rate in India due to electrical shocks and fires is around 1. This means that one person for every lakh of the population dies in India every year due to electricity accidents. This is quite high in comparison with developed countries. For example, the fatality rate is 0.03 for the USA and UK. In developing countries, Brazil is at 0.3 and South Africa is at 0.7. Clearly, India’s fatality rate is much higher than these countries. As for Indian states, there is variation in terms of population and number of deaths.

The fatality rates in Indian states vary from 0.2 to 2.43. Figure 9 gives the fatality rate of a few Indian states – some are close to the national average, some with lower and some with higher values.

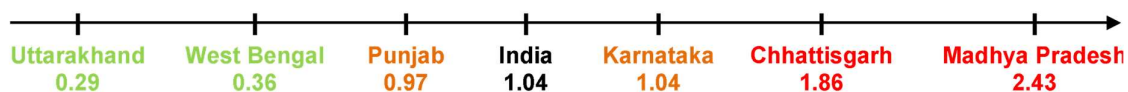


Figure 9: Fatality rates in a select few Indian states.

Why do the number of accidents or fatality rates vary across countries or states? To understand this, we need to examine why electricity accidents happen and how they can be prevented. We address this in the next section.

As mentioned earlier, electricity accidents also lead to around 10,000 animal deaths every year. Domestic animals such as buffaloes, cows and goats are the most affected. Wild animals also become victims of electric shocks. One estimate suggests that 1,300 wild animals died due to electric shock between 2010 and 2020. This included 500 elephants, 220 flamingos, 150 leopards and 46 tigers.

Why do electricity accidents occur and how to prevent them?

The previous section discussed accidents due to shock, fire and lightning. The immediate reason for these accidents was also explained – contact causes shock and faults lead to fire. Direct strikes of lightning cause death due to shock and burns. Lightning is a natural phenomenon, and methods such as installation of lightning arrestor and some precautions could prevent accidents. We will not elaborate on this aspect in this article. Our focus is on contact with live wire and electrical faults, since these happen due to avoidable human errors.

Contact with live wire or faulty appliances

Why do we come into contact with a bare conductor (also called live wire) through which electricity is flowing? This usually happens when the conductor is less than six feet from the ground or less than three feet from buildings. The simple act of moving the hand or swinging a metal object (such as a ladder or a metal rod or a pipe) is enough to make contact with a live wire.

And why do wires hang so low? This is due to poor construction or maintenance by the electricity company. Many times, buildings are constructed near wires, which is not to be permitted by the panchayat or the municipality. If a building has been constructed close to electricity wires in violation of the law, as a temporary measure, the electricity company could insulate (with a coating of rubber or plastic) the wires which are very close to buildings. Ideally, the wire should be shifted to a safer distance. Transformers and switches on electric poles should be constructed at a suitable height with no accessible metal contacts, so that there is no accidental shock. Transformers should be fenced so that people and animals cannot go near them.

Contact with live wire can also happen when the wire snaps or pole falls. This happens due to poor construction or bad maintenance by the company. The electricity company is expected to periodically inspect for low hanging wires, wires close to buildings or trees, wires with too many joints, wires which are very old, leaning poles and sparking joints. People in the neighborhood can also alert the company about such issues. Necessary replacement or repair should be done in time.

Carrying tall objects in vehicles, and sitting on top of tractor-trolley, truck or bus roofs could also make one come close to electric wires. This is to be avoided by the public and caution must be exercised when traveling through places where electricity lines cross the path.

Even after all the precautionary measures by the company and the public, if there is an accidental touch of a live wire with any object (including people), there should be an arrangement at the electricity company to immediately switch off the electricity supply. Many accidents happen because the supply is not switched off in time.

At the consumer locations (home, shop or agriculture pumpset location), the consumer has the main responsibility to prevent accidents. Electrical wiring should be done by qualified electricians only and if there are any sparks or smoke anywhere, necessary repairs should be carried out. Switches and plugs should be covered and installed beyond the reach of small children. Too many appliances should not be connected into the same socket using multi-plugs, because this increases the risk of a short circuit and/or overload.

Three-pin plugs should be used for all high load appliances (fridge, water cooler, water heater etc.). The third pin in the plug (with the thickest pin) should be connected to the earth pit. This reduces the chance of shock when someone touches the body of a faulty appliance. There is an equipment called

Residual Current Circuit Breaker (RCCB, previously called Earth Leakage Circuit Breaker – ELCB), which switches off power if any wiring fault is detected. It is preferable to install this in all consumer locations, especially those with multiple appliances.

If any repair must be carried out, it should be done only after switching off the main switch. Repair should ideally be done only by a qualified electrician. If any urgent work is to be done (replacing a fuse, bulb or any such minor work), it should be done with caution – switching the main switch off, using the correct tools, wearing rubber footwear, ensuring that your hands are not wet, etc.

People can get a shock even after following all these precautions. If you see someone getting an electric shock, the first thing you should do is to switch off the power supply immediately. If that is not possible or if that would take time, separate the person from the source of electricity, using wood, plastic or a similar non-conductor of electricity. If the person faints after receiving a shock and is no longer in contact with any wires, they immediately need first aid. This should be followed by hospitalization.

Fires due to electrical faults

These fires happen because of sparks generated due to overloading or loose contact, and the presence of combustible material (dry leaves, paper, cloth etc) nearby. Transformers can heat up, and the oil inside can catch fire, leading to an explosion. Electricity companies should ensure that the transformer is capable of supplying electricity to all the consumers it is connected to. It should also periodically monitor them to check for any sparks, oil leakage or overheating. People can also alert the company if they notice smoke or spark on lines or transformers.

Consumers should ensure that electricity wires are capable of supplying power to appliances without overheating. They should be alert to any sparks or overheating of any appliances. Fire extinguishers and emergency fire escapes should be installed at consumer locations such as hospitals, theatres, offices, big shops etc.

What should be done?

The high number of electricity accidents is a serious social issue, largely affecting the ordinary public and small consumers. There is a saying: “accidents do not just happen but are caused”. This is true for electricity accidents as well. All the concerned actors - government, electricity company, consumers and the public - should realize that each has some responsibility for the current situation and also have some role in improving it. The fact that accidents have reduced in generation and transmission of electricity, as well as many consumer locations, indicates that it is possible to reduce the accidents, if there is a will to do it.

The first step is to realize that accidents can be reduced if all actors do their part in a constructive fashion. This is not easy and would take time, but it is important to make a beginning. There have been government-led programs with clear targets, to provide electricity connections to all houses in the country. Today there is a target to ensure net zero carbon emissions by 2070, and many programs to meet it. Similarly, there should be a clear target for “zero accidents” and government-led programs to reduce electricity accidents.

Electricity companies must ensure quality construction and regular safety checks. They should study accidents to arrive at the major reasons for accidents. There should be dedicated safety officials at

state, district and block levels, with safety as their high priority. They should listen to the public to understand their safety concerns and to implement their suggestions.

Currently, there is an arrangement to provide nominal compensation to accident victims or families. Till the accidents reduce, as a humanitarian gesture, electricity companies should show more empathy to accident victims. They should ensure that the procedure to provide monetary relief to all victims is prompt and simple. Most of the electricity companies are government owned and hence the government should provide the required support for all these.

Consumers and the public should be more safety conscious to handle electrically dangerous locations or situations. Switch off power when plugging in devices or repairing. Do not handle electricity with wet hands or while standing on wet floor. Consumers should alert the electricity company if they spot any electrically dangerous locations in their neighborhood. This could be done in-person, using mobile application or using the common help line - 1912.

All of us need to work together to overcome the challenge of electricity accidents, an unfortunate side-effect of electricity use.

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Sreekumar Nhalur and Vardhan Gupta are with Prayas (Energy Group), which is a voluntary organization based in Pune, working on policy and governance issues in the energy sector.

For further information, please visit the website of Prayas (Energy Group):
<https://energy.prayaspune.org/>

For the sources of the information and data used in this article, please refer to the list below.

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