

**Talk on “LLL and GoT”**

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A talk on “LLL and GoT” was successfully organized by Electrical Engineering Technical Division at Wisma IEM on 1st October 2016. The speaker was Ir. Lee Chong Kiow, the director of VI Power, which specializes in providing technical training on electrical equipment and performing power system studies. The acronym “LLL” stands for Life Long Learning while the term GoT stands for “Google of Things”. Ir. Lee started the talk by outlining the list of questions which intrigue electrical engineers. The history of electricity was interestingly retold with the help of online videos by centralizing on the depiction of the infamous “War of the currents” between Thomas Edison and Nikola Tesla with the former a strong proponent of DC while the latter, the contributor of the design of the modern alternating current electricity supply system. With the support of George Westinghouse, AC subsequently triumphed over DC in terms of modern electricity supply system. Ir. Lee also introduced interesting inventions such as Tesla’s egg of Columbus which is essentially powered by a 2 phase AC source and one of the simplest motor design called the homopolar motor.

The next question to answer is whether AC or DC is more dangerous to human beings. Ir. Lee narrowed down the question to which type of source requires less amount of current to be potentially fatal to a human being and he concluded that it only takes 30mA of AC (rms at 60Hz) to cause fibrillation whereas 300-500mA of DC is required for similar effect. He also referenced IEC 60479-4 on the effect of AC on human to substantiate his answer. A 600V electric eel is more dangerous than a 50kV taser or a 2MV Van de Graaff generator. The current required to start a typical car could be 150-200A or 400-500A. and Ir. Lee also demonstrated videos on how a car battery can actually be started using AA batteries. Car battery is an AC generator as it is a 3 phase alternator and it usually fails due to buildup of internal resistance.

The next question on what is the frequency used in an aeroplane generator was answered with a specific 400Hz. The underlying reasons can be found by revisiting the transformer electromotive force (emf) equation:

$$v = 4.44BfAN$$

Where v is the emf

B is the magnetic flux density

f is the frequency

A is the area

N is the number of turns

Weight is an essential quantity which an aeroplane has to minimise and based on the equation above, one can clearly decipher that it can be done by increasing the frequency of the generator so that a more compact and smaller iron core can be used. Ir. Lee also commented that 400Hz is not feasible in the conventional power supply system as the increased frequency will result in higher reactive power losses, copper losses and core losses.

Ir. Lee then summarized the difference between Earth Leakage Circuit Breaker (ELCB) and Residual Current Device (RCD) as shown in Table 1:

Table 1: ELCB vs RCD

ELCB	RCD
Detects voltage at the earth wire connected to the metal frame of electrical equipment	Detects unbalance current between line and neutral conductors
Voltage operated	Current operated
Has earth and frame terminals which means that it can be tapered by disconnecting to prevent nuisance tripping	No earth and frame terminals which means that it cannot be tampered
During testing, it checks the continuity of the earth wire from the nit to the earth electrode	The test uses an unbalance Live-Neutral current without creating any earth fault
Will not work if the leakage current does not return through earth wire	Will work as long as there is an earth leakage current

Ir. Lee then proposed a series of safety tips for all:

1. Test the main RCD at least once every six months
2. Test the continuity of earth wire from every socket outlet yearly or after renovation/rewiring
3. Carry out a toolbox talk with your family
4. Ensure that family members know the location of the main switch
5. Label the main switch
6. Replace metal hoses of the water heater (if any)

The session ended with the presentation of a token of appreciation from EETD subcommittee, Dr. Siow to Ir. Lee as shown in Figure 1. Figure 2 illustrates the strong crowd which attended the talk.



Figure 1: Token of appreciation from EETD to Ir. Lee



Figure 2: The participants