Hertz

Cycles Per Second

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Derivation: Named for Heinrich Hertz, a German physicist who verified the existence of electromagnetic waves in 1887.

Alternating current (AC) electricity is cyclical, and ideally takes the form of a sine wave. One "cycle" of AC is a complete waveform—the voltage and amperage start at zero, climb to a maximum (positive peak), drop again to zero, and then dip to a minimum (negative peak) before returning to zero and beginning the next cycle.

Voltage and amperage change direction many times per second. Frequency is the number of complete cycles per second in any sort of wave motion, such as AC. Until the 1960s, "cycles per second," or cps, was the standard term for AC frequency. Today, frequency is measured in hertz (Hz). So "20 Hz" means "20 cycles per second."

The frequency of household electricity in North America is 60 Hz. This was apparently a compromise between efficiency (early motors were more efficient at low frequencies) and avoiding flicker in lightbulbs (too slow a frequency allows the filament to cool and darken between peaks).

Many parts of the world use 50 Hz (see map). There is some disagreement about why this frequency was settled on. One prevalent view is that it fits into the metric system better than 60 Hz.

One device that generates alternating current is called an alternator. Frequency is determined by the rotational speed of the alternator and number of magnetic poles. Speed is steady in most AC alternator applications, so frequency is relatively constant. Regulators hold the speed (and therefore frequency) constant.

In the renewable energy world, there are a few interesting frequency wrinkles. AC hydroelectric systems are regulated so that the frequency and voltage stay within a tight range. If something happens in the system that allows the frequency to wander, an electronic controller can add or subtract loads from the system to alleviate the problem. And as a last-ditch safety feature, a separate controller can drop a deflector in front of the water jet, stopping the turbine until the operator can correct the problem.

Small wind turbines run at variable voltage and frequency, directly dependent on the wind speed. But the variable frequency is not an issue, because rectifiers convert the electricity to direct current to charge batteries or to be inverted to grid-synchronous voltage and frequency.

Electrical frequency isn't something we have to think about in our daily lives, unless we work as electrical engineers. If we buy our appliances in the part of the world where we're going to use them, we're all set. When we travel, we may need transformers and adapters to convert to varying voltages, or appliances that can handle either 50 or 60 Hz.

Access

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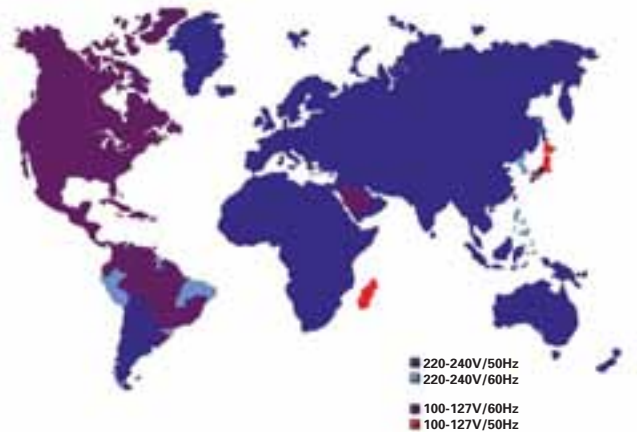
Voltage & Frequency Around the World



Courtesy of Conrad McGregor
http://users.pandora.be/worldstandards/index.htm

AC Wave Form