Why Smart Meters Produce Higher Bills

By Ted Twietmeyer
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Much has been talked about in recent months regarding higher electric bills with new digital meters. In order to understand why this will always be an issue with smart meter technology, we need to look at the principles used by each type of meters.

Oklahoma TV station KOCO report on higher electric bills almost gets it right

Both older electric meters and newer smart meters use basic magnetic principles. However, which of the two principles they utilize to sense the magnetic fields created while you consume power is what actually determines the size of your bill. You will see exactly why your bill will almost always be higher with a new "smart" electric meter and why electric companies are so eager to install them.

We'll first explore the two magnetic principles used in detail while leaving out complex equations.

OLDER ELECTRIC METERS

This type of electric meter works on the eddy current electrical principle. The silver disk you see protruding through the slot with black bars is actually made of aluminum. This disk is the visible part of an electric motor inside the meter known as the rotor. In electrical motors the rotor is made of a magnetic steel alloy which is required for the motor to rotate. Yet in older electric meters the rotor is not magnetic. So how can it work at all?

A simple analogy of the eddy current principle is to think about a calm

puddle of water. If you move your finger through the puddle and keep it moving ripples will continue to form. If you hold your finger absolutely still, nothing happens and the puddle of water will return to a mirror-like surface. Aluminum cannot be magnetized, but is affected by any changing magnetic field passing through it. This characteristic is known as paramagnetism. Like the puddle, as long as the magnetic field is changing eddy currents will continue to form in the aluminum and keep forming temporary magnets. With older electric meters, all power in your home passes through coils inside the meter. These coils create a magnetic field which penetrates the aluminum disk, creating eddy currents. These eddy currents form tiny temporary magnets in the aluminum disk.

Remember the law of magnets - repelling of like poles and attraction of unlike poles?

Temporary magnets in the aluminum disk formed by eddy currents have enough force to make the disk to rotate. When the disk rotates it turns a series of gears behind the meter's faceplate. These move the hands which show power consumption in kilowatt hours. A 1,000 watt load running for an hour = 1 kilowatt hour.

SMART ELECTRIC METERS

In smart meters there are no moving parts and no aluminum disk to rotate. A simple solid-state sensor works on a principle known as the hall effect. The stronger the AC field created by the total power of all loads in the home, the stronger the AC field the sensor detects. This analog signal is digitized by a convertor and stored in protected memory, is calibrated in kilowatt hours and appears on the meter's display. There is a temperature sensor in smart meters to keep the meters calibrated with temperature changes.

In older electric meters, the power line's 60 cycles/second are averaged together to rotate the disk. The aluminum disk is incapable of detecting each cycle in the 60 cycles/second. In smart electric meters, EACH cycle in the 60 cycles/second power consumed is measured. Nothing is missed.

HIGHER READINGS

So why do smart meters produce higher readings? Is it a plot to help flatten your wallet? In fact it's related to what appliances you have in your home. Mainly, this has to do with electric motors. With furnace fans and compressors used in refrigeration, there is a very high starting current. With a small window or table top electric fan starting current is relatively insignificant. For refrigeration appliances, window air conditioners, furnace blowers or central air conditioning starting current is quite high often several times higher than the running current listed on the nameplate or label.

What can be the reason for higher starting current than running current? In

refrigeration appliances, motors must overcome the refrigerant already in the compressor to start rotation. In the case of a forced-air furnace fan or central air-conditioning fan, blower wheels act like large flywheels which must be brought up to speed.

In washing machines, starting current is highest when the spin cycle starts after the wash cycle. It takes many seconds to get the heavy basket with about 30 gallons of water and heavy laundry up to full speed before current consumption drops down to what machine's nameplate shows. A fully loaded basket with water and clothes weighs in well excess of 100lbs. The washer motor is stalled whenever the washer's timer starts it, causing the motor to draw almost 20 amps of power.

Only after any motor reaches full speed will current consumption reduce to the values listed on the nameplate or label.

National electrical codes require high starting-current appliances like washing machines, dryers, furnaces etc... to be connected to their own circuit breaker. This is to insure full power is available for high starting currents. In engineering terms this is called "in-rush current."

Heating elements in electric ranges, water heaters, clothes dryers and baseboard electric heaters all draw heavy current when first turned on. Heating elements are similar to electric motors. A heating element (and filament light bulbs) are almost a dead short when cold but as soon as power is applied these begin to heats up. As a heating element or incandescent lamp gets hotter it draws less current. After a period of time equilibrium is reached producing no further increase in temperature and power consumption is stabilized. Older electric meters respond fast enough to heating elements to add that in-rush current onto the electric bill.

To summarize, high starting current motors often draw very high currents only for a fraction of a second. Due to inertia, older mechanical disk electric meters cannot respond quick enough to register large motor starting current. But smart meters have no problem registering the brief, high power consumption from electric motors as these meters have no moving parts.

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