From: Bill Kaune <wtkaune@gmail.com>
Date: Monday, March 12, 2018 at 10:44 PM
To: Ken Collins <kcollins@jeffpud.org>
Subject: Re: Itron Response to Bathgate

Hi Ken,

Here are my comments on Mr. Bathgate's presentation.

In general, I don't feel that Mr. Bathgate's presentation is very credible. He conveys a sense to me of a person that is a true believer in his thesis and is only interested in data that supports it. Life is almost always more complex than this.

In slide 6, Bathgate asserts that the useful life of a AMI meter is 5-7 years, because of the inevitable aging of the electronic components. I don't know why he thinks this. Most modern electronic components last for very long times. Computers have lifetimes of perhaps 5-7 years, but that is because either the software they run becomes obsolete or because of the failure of mechanic components such as hard drives or a connectors. Itron claims the lifetime of their meters is designed to be 20 years, and they present data (most of which I did not understand) that apparently supports this claim. I am inclined to accept Itron's estimate of meter lifetime.

In Slide 9, he points out that a ac voltage of 120 volts means that peak voltage of the underlying sine wave is 177 volts. It is actually 170 volts, but that is a small difference. He then asserts that grabbing a energized conductor will result in one's death. This is a considerable overstatement. It certainly is true that a 120-volt shock can kill in certain instances, but mostly it just gives a bad shock. I know from numerous personal experiences as a boy on a farm that one can touch 120-volts and survive. I once touched a 300-volt ac signal and got a really painful shock, but I survived.

Slide 10: In this slide he asserts that the "dirty electricity" (i.e., presence of high frequency transient signals on a 60-Hz sine wave) is a definite health hazard and, apparently, is one (perhaps the biggest) cause of four of the big six diseases. He quotes a study by Sam Milham, MD. I know Sam pretty well and have talked with him about his studies. Sam is completely convinced of the validity of his thesis, but I am far from being convinced. Sam is an epidemiologist who worked for the State of Washington and now lives just outside Olympia. He has published one or two epidemiological studies that support his thesis. However, these studies have been heavily criticized on numerous grounds. Having worked with epidemiologists for about 20 years, I decided that you can never believe a single study. To be convinced that something is real, you need multiple studies by multiple investigators.
Thus, I do not find the dirty electricity thesis at all convincing.

Secondly, Itron says that their meters utilize 5 watts of power to run the electronics in them. Five watts is not very much power, and I find it very difficult to believe that the dirty electricity produced by a power supply putting out 5 watts would be significant.

Also, in Slide 10, Bathgate comments on health risks from the 900-MHz electromagnetic radiation. I have made my view clear on this issue: The levels of radiation are so small compared to current safety guidelines in the US that it seems very unlikely that they could have any health effect. Suppose they did have effects. It seems to me, then, that one could expect that exposure at levels close to the US safety

standard, which occurs for example when a cell phone is used close to the head for a long periods, would have much greater, if not huge, effects. No such effects have been seen.

Slide 12: This slide shows a oscilloscope trace of a sine wave and of high-frequency hash. There is something wrong here. The trace showing the high-frequency hash shows no evidence of an underlying sine wave. I guess this could happen if, somehow, Bathgate was able to filter out the 60-Hz sine wave, but I don't think this would be easy. Furthermore, the two traces suggest that the peak magnitude of the hash is about the same as the peak magnitude of the sine wave. But, I am almost certain that the trace showing the hash was obtained using a much higher gain than the trace with the sine wave, so that the actual magnitude of the hash is correspondingly less (I bet much less) than the sine wave. Furthermore, the trace with the hash does not show much of a pattern--it basically just looks like noise which you will find in all electronic circuits at low level. I think that a switching power supply would produce a pattern to its high frequency switching that I don't see in Bathgate's presentation. Before I believed him, I would have to be convinced that what the trace is showing is not an artifact of the measuring system he used.

In this vein, a couple of years ago Sam Milham invited me down to his home to show me an oscilloscope trace that he was convinced was evidence of dirty electricity. I took my oscilloscope with me, and we compared to two. His did show a complicated high-frequency signal, but mine did not. My conclusion: What he was seeing was an artifact of his instrument.

Slide 16-18. I am no expert on switching power supplies, but I think that any signal generated on the input line to such a power supply by the switching action of the supply would be a differential mode signal, so I don't understand why including a common-mode filter would be of any help.

Slides 23-26: Mr. Bathgate asserts that the switches in a meter used to disconnect power to a home are inadequate for the job. He later says this is the biggest concern about the Itron meter. Itron, on the other hand says the switches can carry continuous current flows of 200 amps, and that his assertion has been confirmed by testing by several organizations. I think you have to go with Itron here. But, the real question, in my mind, is not whether the contacts can carry a current of 200 amps but whether opening the contacts can successfully interrupt such a current flow multiple times, especially with somewhat inductive loads. Presumably Itron has tested this, but they don't comment.

Slide 38: Bathgate presents data that he interprets as indicating the power consumed by a power meter to run its own electronics and other functions is substantial. I have seen this claim before, and it has never made any sense to me. His average power consumed of 2.37 kWh means that power draw of the meter is 99 watts. This simply makes no sense! Itron says the power drawn by their meter is less than 5 watts, a figure that seems much more credible to me. That Bathgate continues to make this assertion raises questions in my mind about his common sense/critical thinking/objectivity.

Finally, meter accuracy. Bathgate speculates about the meter measuring maximum currents, as might occur during the inrush of a starting motor. This has never made any sense to me. The obvious way to measure power in a digital system is for the meter electronics to take very frequent samples of both the voltage and current, multiply the two, and accumulate the sum of these products. Itron says that their meters sample more than 4,000 times per second (I have heard the actual value is 4,096), so I suspect Itron uses the obvious way described above. My opinion is that this is superior to using the electromechanical system in analog meters, so I think digital meters will be more accurate than analog meters.

Some will argue that my argument is too simple because it assumes that what you are measuring are pure sinusoidal voltage and current signals, and that digital meters fail for more complex waveforms, such as those produced by nonlinear loads. I am skeptical of this argument. A digital meter, properly designed, should be accurate for signals with frequency content up to about 2,000 Hz. I doubt that an electromechanical system could respond at these higher frequencies, so my guess is that digital meters will be more accurate than analog meters for complex signals.

I hope these comments are helpful.

Bill Kaune.