

"Poultrygeist: The Hen House Awakens"

Joe Grappé



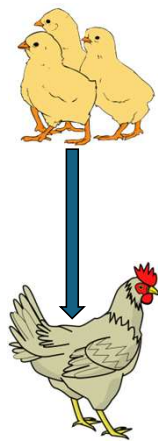
Point on Wave Applications Conference

Chattanooga Tennessee

Chicken houses

Two largest electric
cost per house

-Lighting -Temperature



lbs.= \$

One example of lighting cost per flock (just for grow lights) is given from an Advanced Energy report titled “ A study of LED Lighting in North Carolina Poultry Houses” published on Dec 20, 2013

Light Type	Energy kWh per flock	Cost @\$.08/kWh
Incandescent	2369.0	\$189.52
Dimmable LED	386.2	\$30.90

Table 3 Lighting Programs for Broilers/Roasters

Lighting Options	Flock Age		Light Intensity lux (foot-candles)	Photo Period (hours of light per day)
Option 1	Brooding	(1 - 2 days)	20 (2)	23
	Growing	(2 days - market)	5 (0.5)	23
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	Growing:	(3 - 10 days)	5 (0.5)	8
		(10 - 15 days)	5 (0.5)	12
		(15 - 21 days)	5 (0.5)	16
		(21 - 35 days)	5 (0.5)	18
		(35 - 42 days)	5 (0.5)	23
Option 3	Brooding	(1 - 3 days)	20 (2)	23
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*Source- www.thepoultrysite.com/article/452/lighting-for-poultry-housing/

Chicken houses



- 12 Houses on site
- 4 houses per single phase
100kVA transformer
- 70 Lights per house on dimmer system
- 30 center lights per house not on dimmer system
- Each house is approximately 500ft long by 50ft across
- Almost 13 miles from the substation
- Energy usage ranged from -4539 kWh to 36791 kWh over past 12 months for one transformer

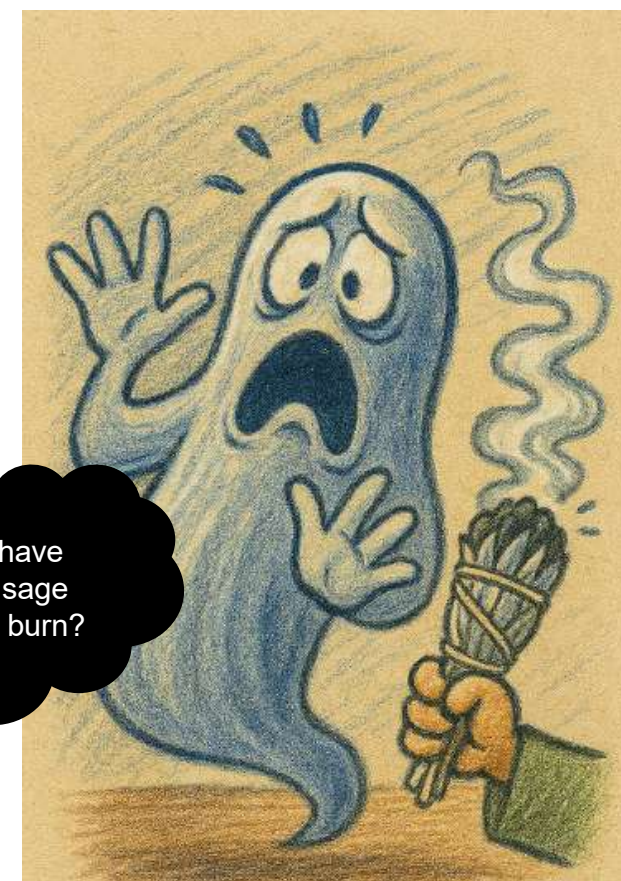
Cost Reduction Opportunity

- Customer was contacted by a company selling LED lighting upgrades to poultry farmers.
- Promised same dimming ability with lower energy cost.
- Turnkey installation.
- Customer was happy after the upgrade everything looked good.

After being installed for a little while the customer gets the first flock of birds in. Everything is going great....
Then.....



11/09/15	09:28	VPC	VOLTAGE COMPLAINT	[REDACTED]
[REDACTED] PLS CHECK MULTIPLE POWER SURGES THROUGHOUT EACH DAY STARTED LAST WEEK,				
11/09/15	11:59	VPC	VOLTAGE COMPLAINT	[REDACTED]
[REDACTED] CUST STATES FLICKER LIGHTS ON/OFF AND POWER SURGES PLS CHCK VOLTAGE, STATED PWR BOX BURNED				
11/09/15	17:57	136	ACCT BAL/ACCT #	[REDACTED]
[REDACTED] CI STILL HAVING POWER S URGES****ELECTRICAN INSTALLED 4 SURGERS & DUKE TECH CAME OUT SDIDN'T S EE ANYHTING, CUST SD HAD ANOTHER SURGE AFTER TECH LEFT				
11/09/15	18:19	500	OTHER	[REDACTED]
ASSISTED SPEC SPOKE W MIRANDA, DCC, ON THE CHECK VOLTAGE WRS (3) [REDACTED] IS TO CONTACT THE CUSTOMER.& EVERYTHING IS GOOD ON DUKE ENG PROG'S SIDE/CAN NOT FIND ANYTHING CAUS'G ISSUE ON DE'S END				
11/09/15	18:19	VPC	VOLTAGE COMPLAINT	[REDACTED]
CUSTOMER CALLED BACK BECAUSE HE KEEPS GETTING POWER SURGES. DOES NOT W ANT TO KEEP MAKING EXPENSIVE REPAIRS. STATED TECH IS BRING METER DEVIC E TO MEASURE ON WED. DOES NOT WANT TO WAIT BECAUSE HE IS LOSING MONEY				
11/10/15	16:50	MBL	RMT MOBILE DEV CMT	[REDACTED]
[REDACTED] SEE COMMENTS SEND TO JOE GRAPPE W/ POWER QUALITY-----JLP				



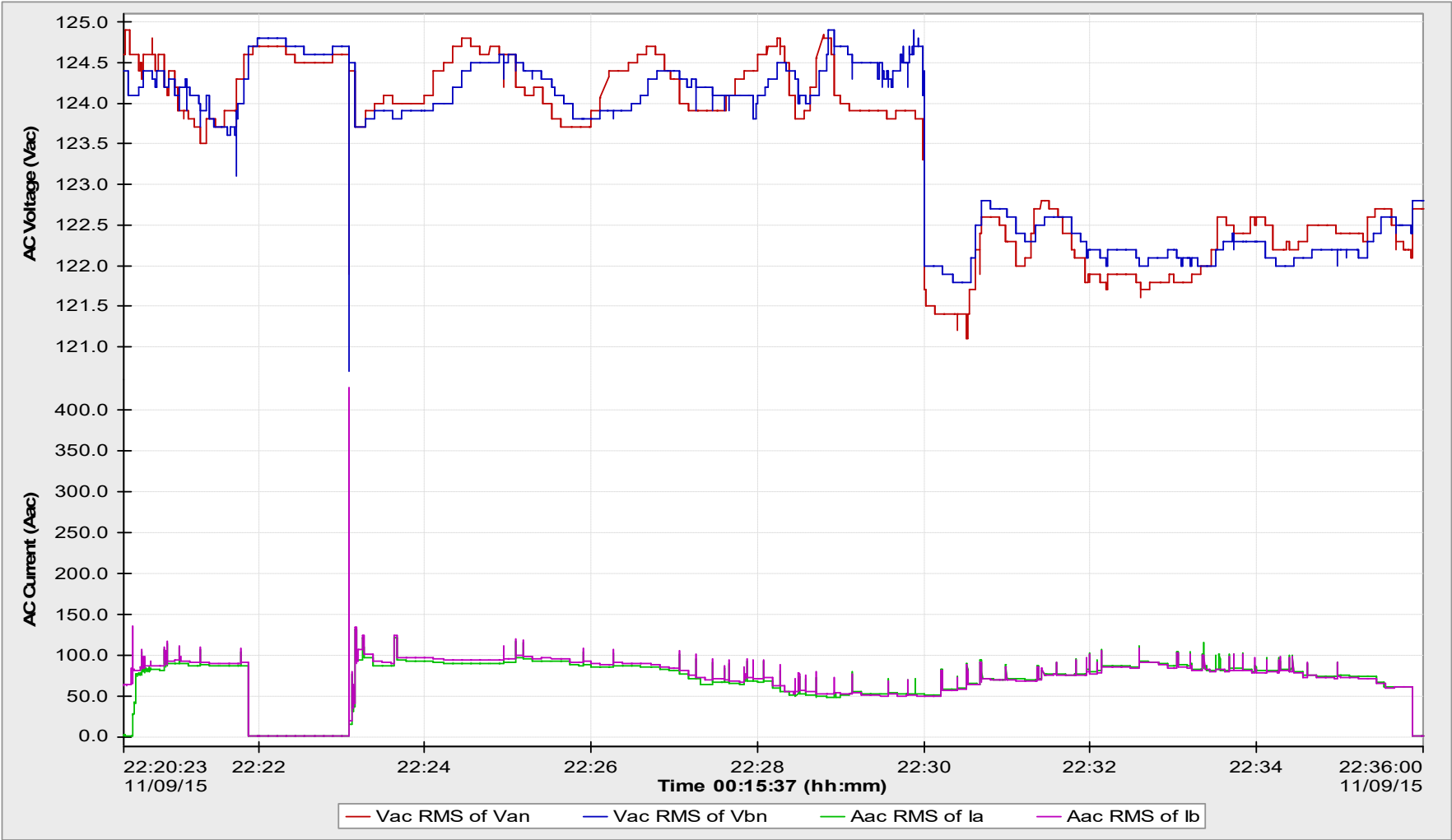
Anyone have
some sage
we can burn?

It was a dark and rainy night.....

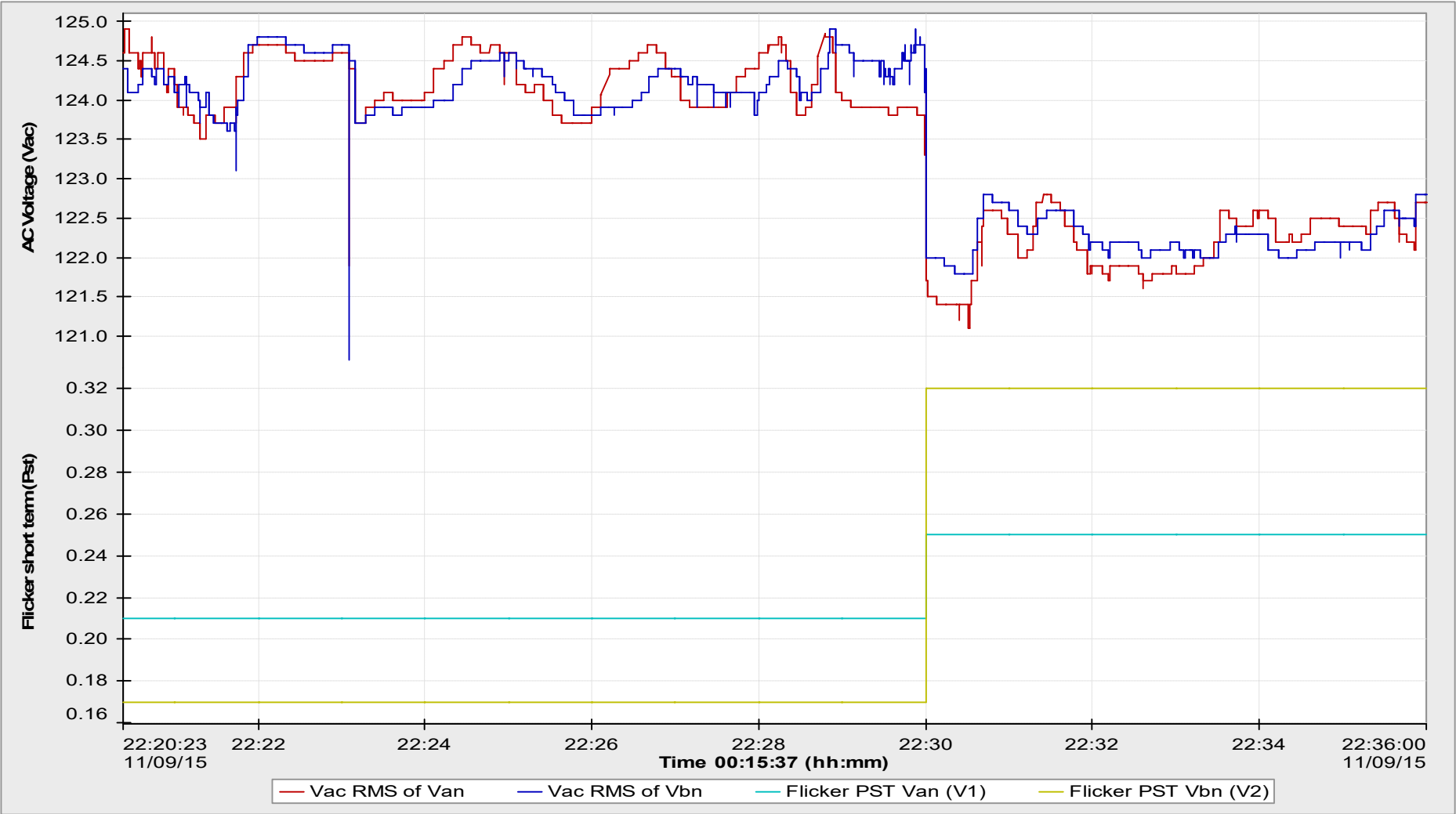


Also, by the time I arrived on site the customer stated that a few of the boards on his generator had failed as well.

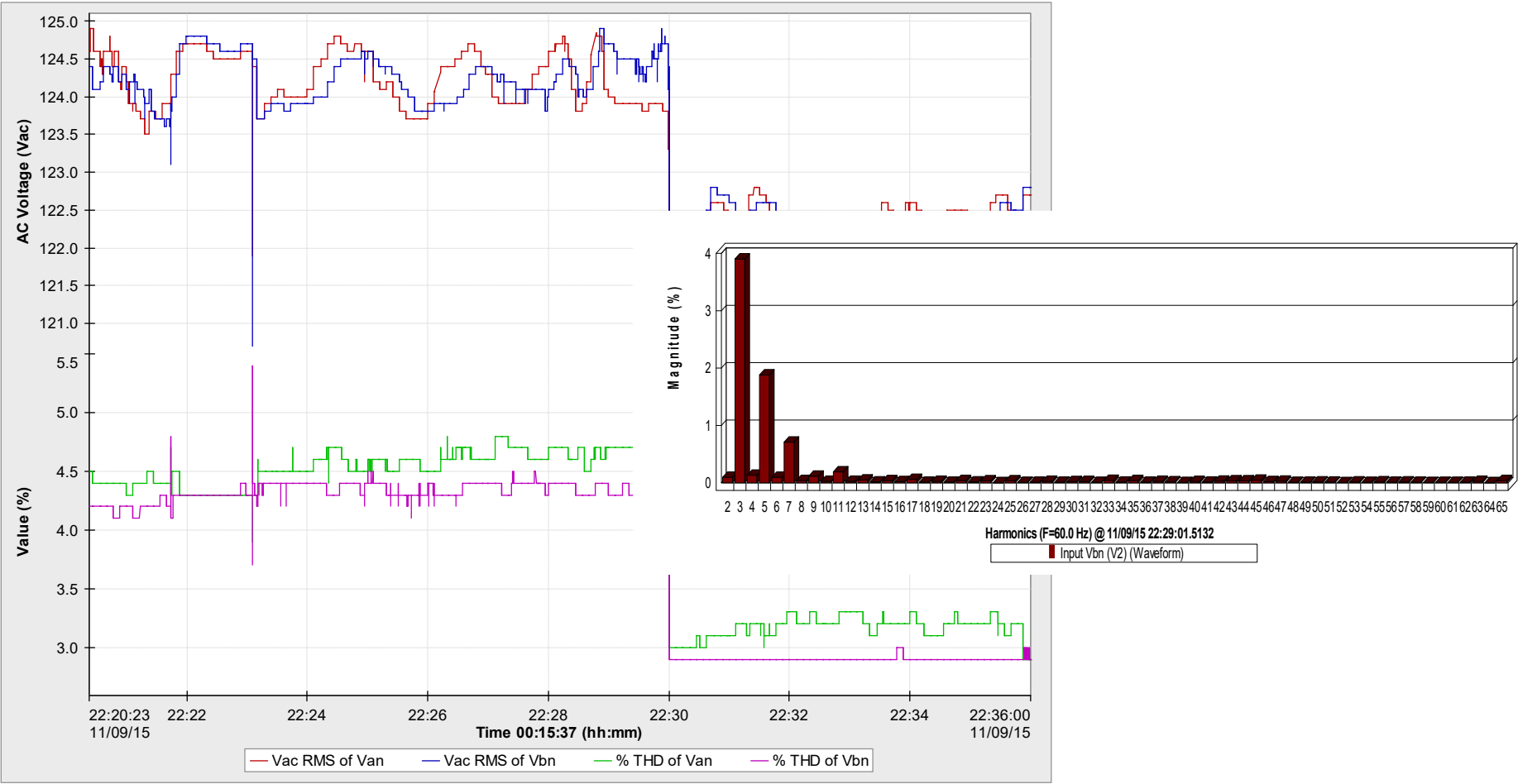
RMS plots of Voltage and Current....



Maybe even more surprisingly Pst.



What about harmonics?

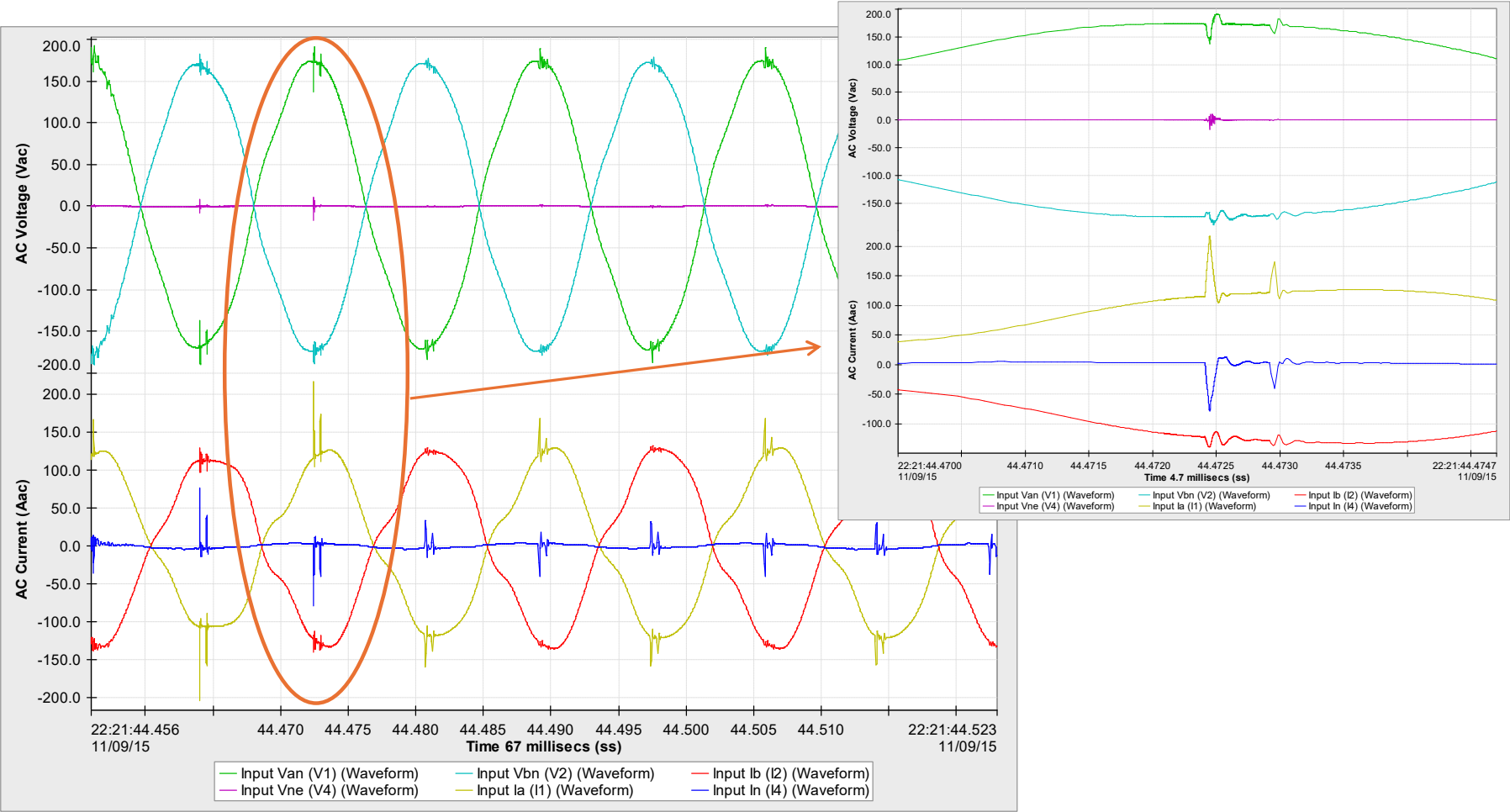


Was it Solar?... The customer thought so...



- Customer was concerned that it might be solar that was causing the flickering lights, as that was the only thing he could think of that had changed recently.
- To prove this was not an issue and there was no interaction going on with the farm and the solar sites I had the utility control room open the reclosers at the solar sites remotely.
- Opening the reclosers had no effect on the lights flickering.

Waveforms...



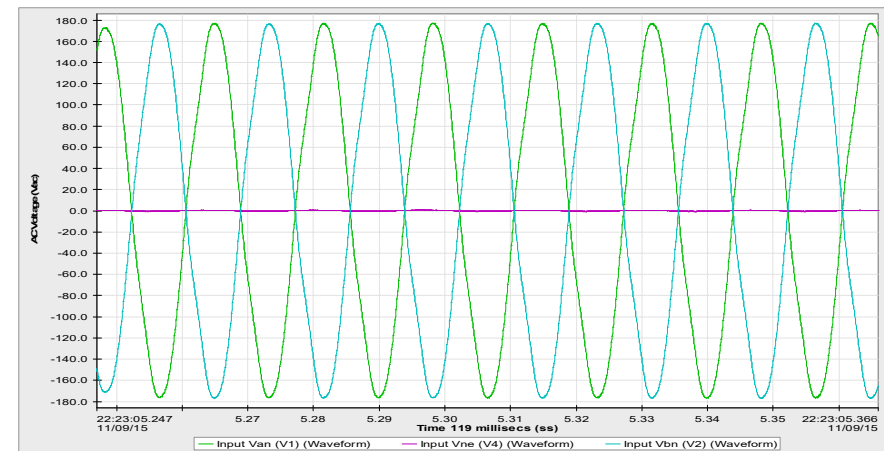
Bingo... now what is causing it

Investigation



- It must be driven by the load attached to the transformer since it went away.
- Turned off individual breakers and turned back on main.
- Go one by one to see if it shows up and when.

- There were three different transformers.
- Waveforms looked the same on every transformer.
- Every chicken house on the property was seeing the same flickering effect but nowhere else along the distribution system.
- Turn a main breaker off and see if it is still there.



So, what all does the panel inside the chicken house serve?



- Remember the slide from earlier about the electric loads in a chicken house... mainly lights.
- Why were the lights suddenly having an issue
- Remember this guy...



I have a thought...



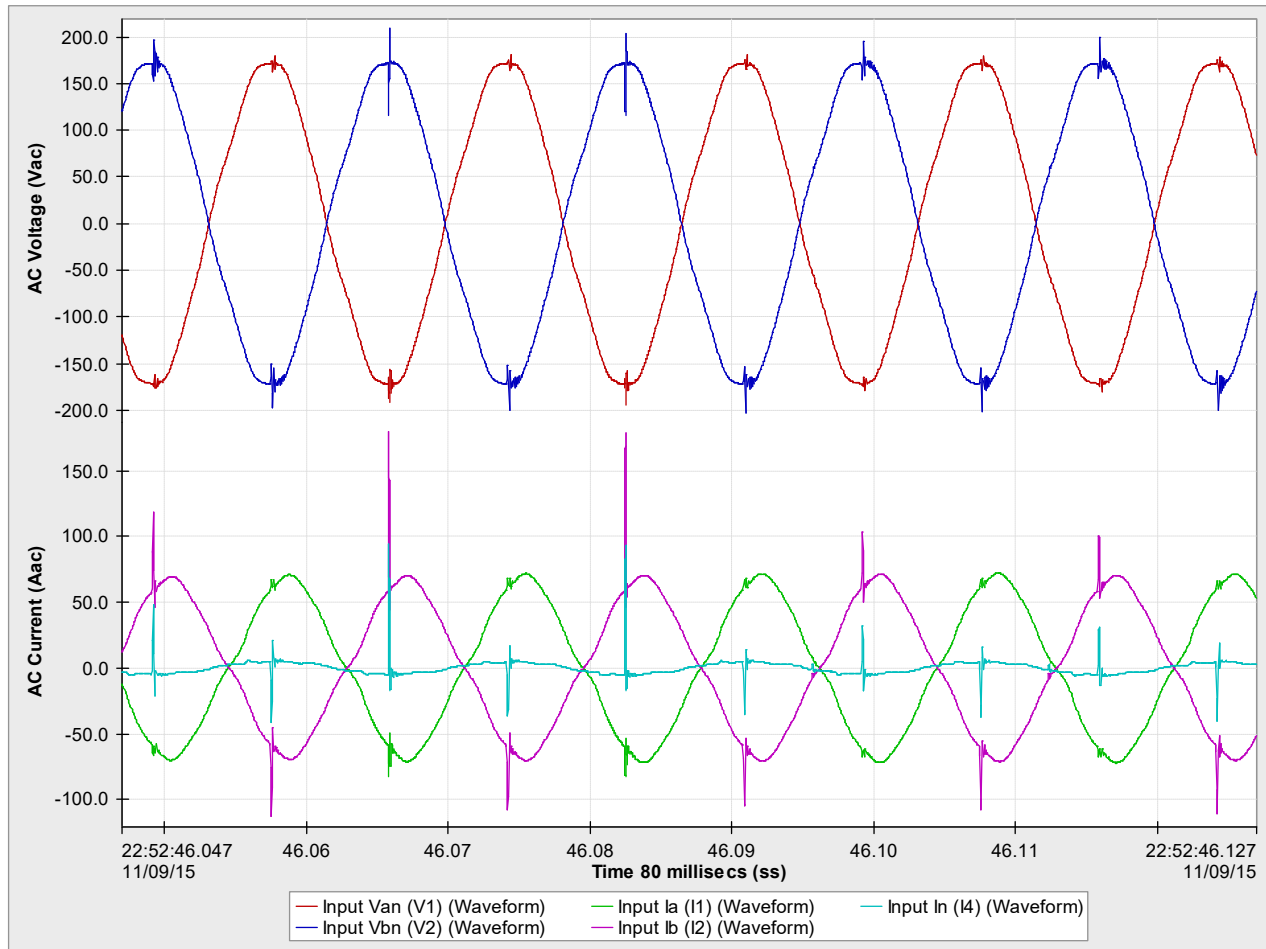
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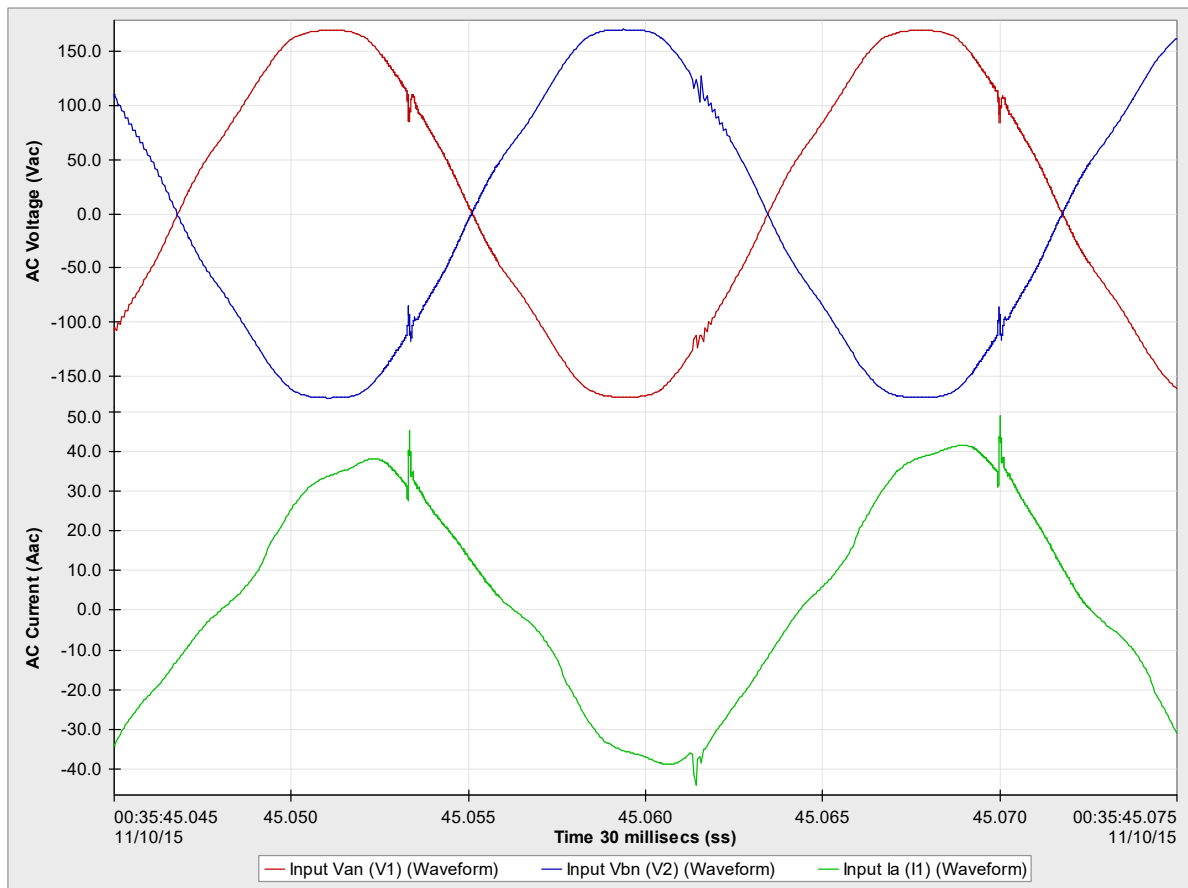
- Remember the light intensity is varied as the chickens get older.
- The chickens had been in the house long enough to where the light was now down below 50% intensity from full on.
- When the intensity was raised the flickering stopped.

When the lights in all four houses were at min output.



- The dimming of the LEDs created a transient on the waveform that in turn created a flicker effect response in the lights
- It should also be noted that the customer had a surge protection device that displayed counts, and it was climbing steadily.

Waveforms at 50% As Measured at the Main Panel



- At 50% the repetitive transient on the waveform shifted from the crest of the waveform to just beyond it.
- After testing at the customer site, it was determined that the 50% mark was the lowest the houses could operate without having the flicker issue.

Issue may be more prevalent than you think.

Advanced Energy report titled “ A study of LED
Lighting in North Carolina Poultry Houses”
published on Dec 20, 2013

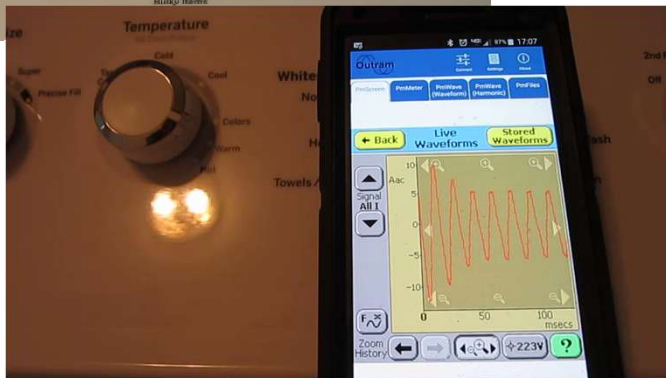
For the majority of flock duration, “grow” lights are dimmed to various extents of their full brightness. **Modern dimmers, using pulse-width modulated circuitry, tend to produce unwanted flicker in LED lighting.** Optimization of LED light/dimmer interaction is being addressed in the market but, to date, this has not been successfully employed in the farm automation systems at the farms included in this study. As such, in order to reduce “grow” light LED flicker associated with dimming “grow” light output, two 75 W incandescent lights were placed on each side of the poultry house so that each “grow” light circuit drew sufficient current to offset the LED flicker. Although not optimal, this solution appears to have reduced LED light flicker to tolerable levels during the testing performed. New dimmer products are entering the market that attempt to address problems encountered using traditional dimmers with LEDs. Several companies have introduced dimmers that may significantly improve light output consistency obtained using dimmable LED bulbs.

The Outside light



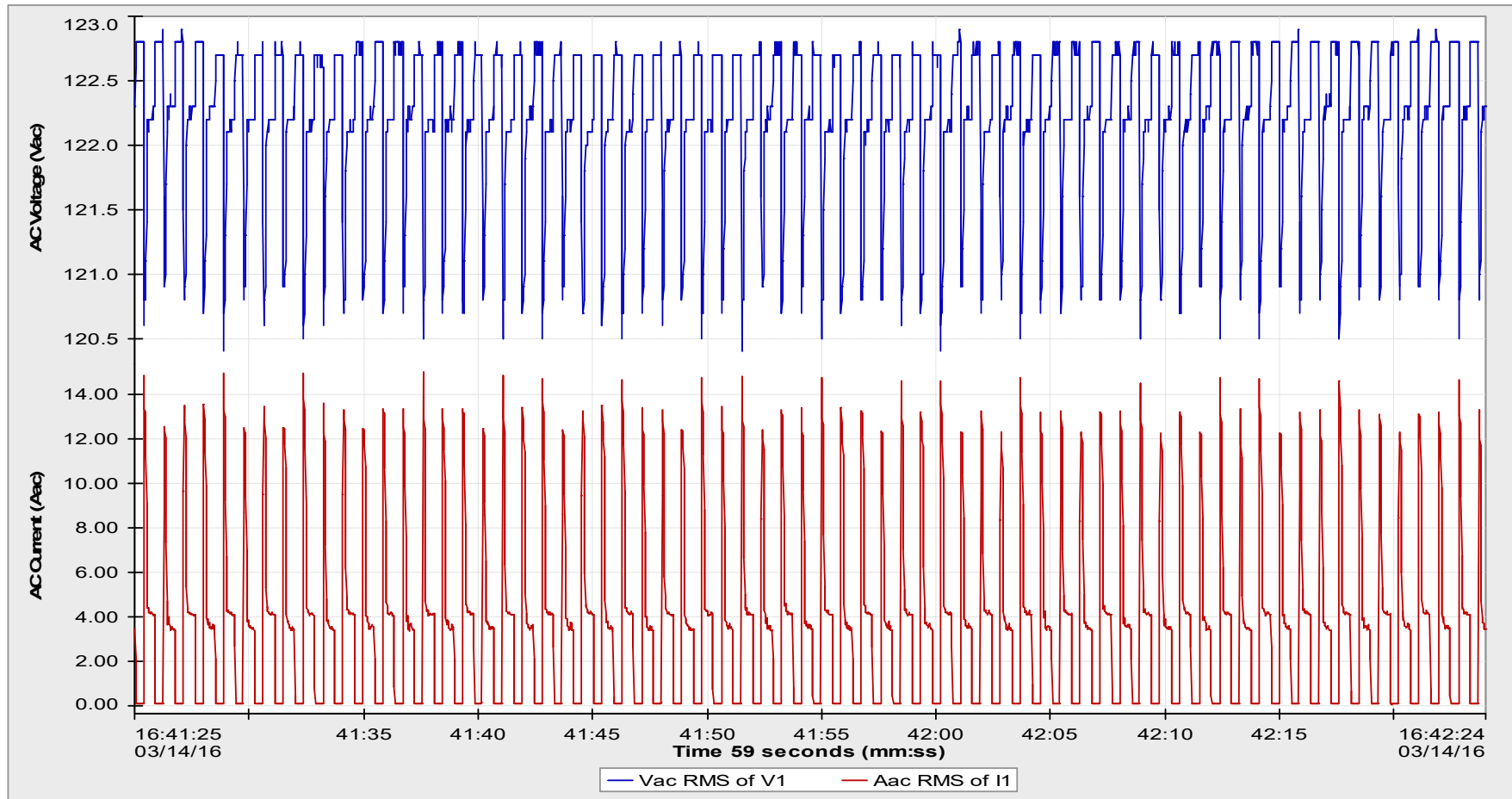
- I have been asked if the outside light was on the same dimmer circuit or not and what type of light it was.
- The outside light was an LED light as well.
- It was not on the dimmer circuit at all but was out of the same main panel.

New Washing Machine



- A similar type of incident occurred just a couple months after the chicken house
- A customer had purchased a new washer
- When it would go into the agitation cycle it would cause the lights in the home to flicker.
- The current was Jumping from 0-15 Amps many times a minute thus causing the voltage to rapidly fluctuate.

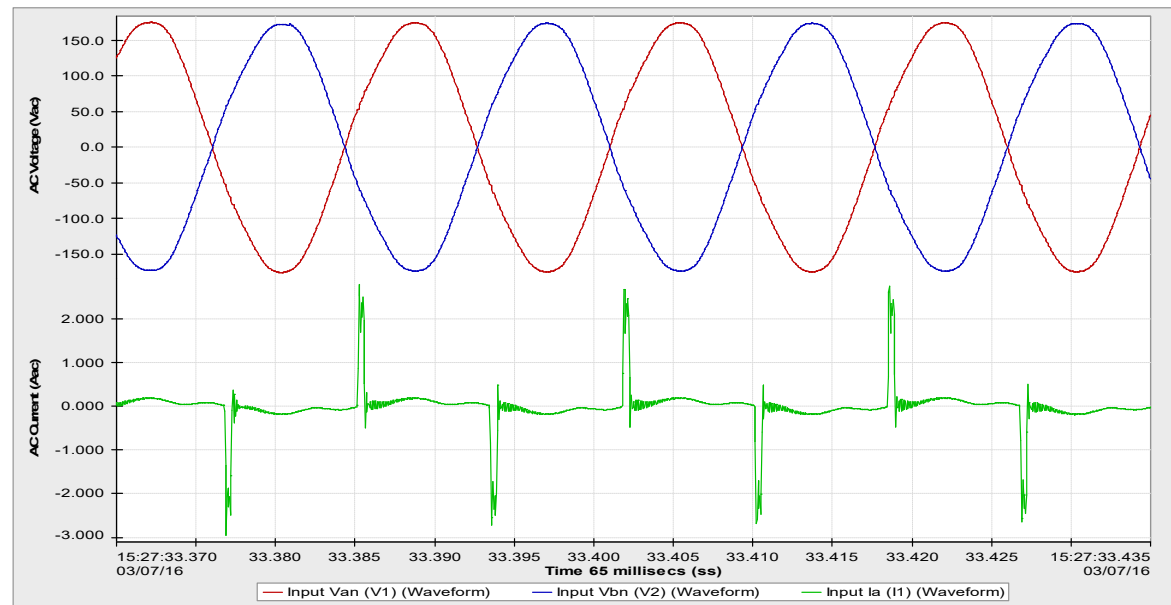
59 seconds of Agitation



Back to the Chicken Barn

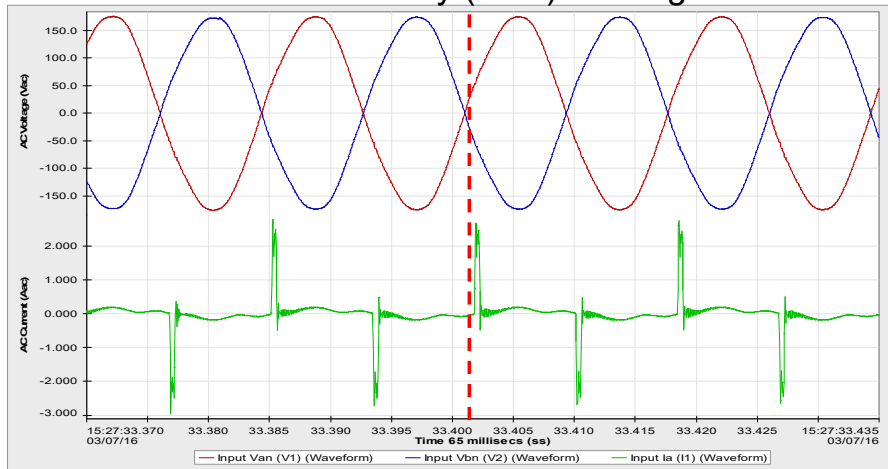


- As a follow up I stopped by the customers facility.
- He had originally talked about going back to a traditional bulb
- Instead, he changed to a different type LED bulb and has no longer had any issues even when the lights are at the minimum setting.

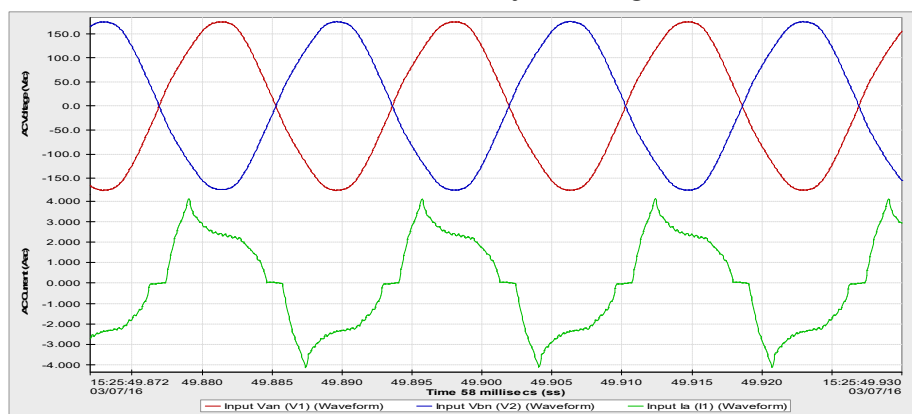


As Measured On Just The Light Branch Circuit

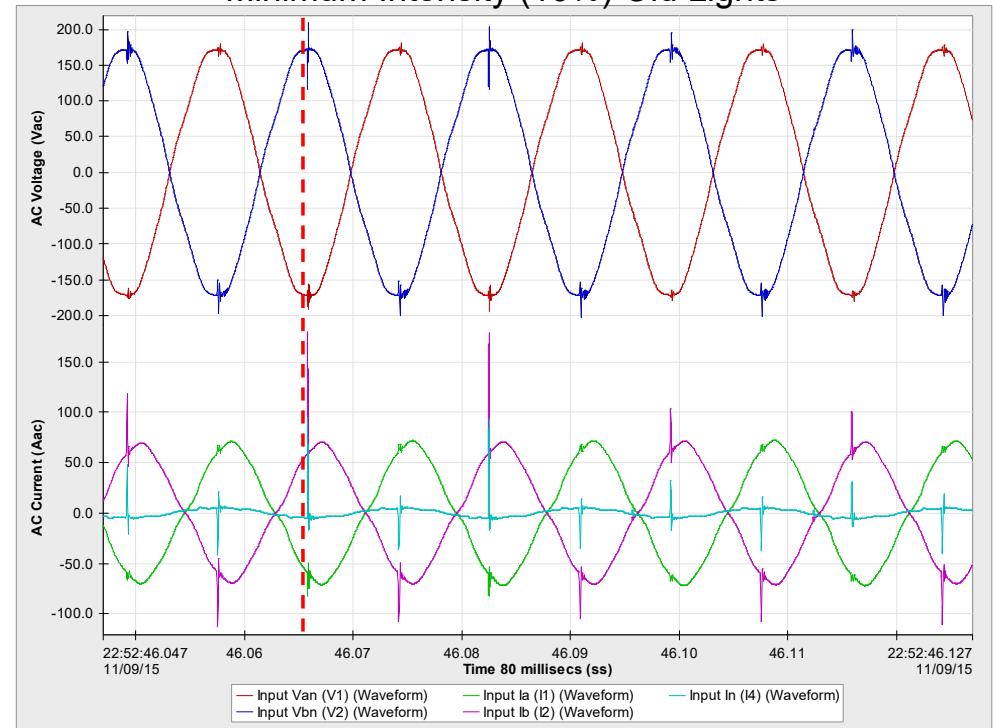
Minimum Intensity (10%) new lights



Maximum Intensity new lights



Minimum Intensity (10%) Old Lights



Things To Think About

- As stated earlier, the Pst index did not pick up the flicker issue in the lights.
- The current flicker standard is primarily based in RMS measurements and predicated on the 60w incandescent bulb
- Lumen output is typically never measured when determining flicker.
- EPRI has done research on flicker in new lighting technology Document number 1024564 .
- EPRI has also written a good article on Human perception of flicker Document Number 1018833
- Flicker in the customer's chicken house caused a slightly higher mortality rate of the flock.

Summary

- Sometimes the RMS voltage and current doesn't tell the whole tale
 - Given the tool available to our line and service personnel they would not have been able to identify the problem.
 - Nor would the customers electrician.
- Be aware of what products you are being sold or selling..
 - So who sold the customer the LED system? The utilities energy efficiency program.
 - When testing a system it is usually a good idea to go through all the stages you will be using before okaying (Commissioning).
- Last but not least.... just because there is a new solar site doesn't mean it is the cause of the issue... well this issue at least.