Developmental Report

(Winter ’23)

This report addresses a range of developments, issues and results that have arisen during the preparatory phase to the first research study due to start in February 2024 (see near end of this report).

Updated Circuit V5A

Work has been ongoing to refine the rotor/solid-state pulse system and to provide additional testing options to achieve the highest CoP values, as per the hypothesis of the first research study: that a CoP>1 is both possible and sustainable.

This has resulted in an updated design (V5A) that incorporates 5 channels, as with V5, but with one channel that can be used solely with the additional four single-strand coils (loosely known as Recovery coils) and triggered separately from the other four litzed windings in the main coil using either the rotor based ‘Trigger Coil’ or the PWM unit. In this regard, the V5A can be seen as a combination of the V4 PCB, with its use of a MOSFET and a PWM unit, and a V5 PCB, with its focus on a multi-strand coil and trigger coil used with a rotor. The V5A PCB can supply a Capacitive Discharge (CD) unit as required to test various permutations of pulses and charging regimes, including the interlacing with high intensity capacitive discharges to see if these, mixed with the HV pulses, might provide better performance.

Figure 1 shows the latest PCB with its circuit connections.

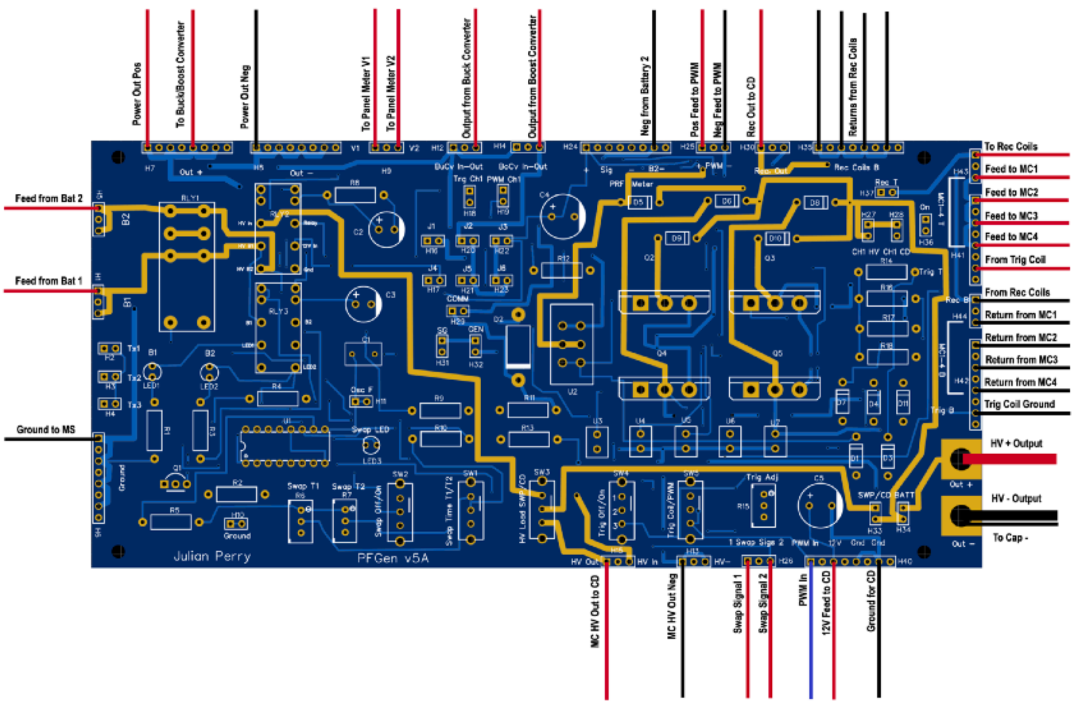


Figure 1: Modification to coil arrangement in solid-state system

Another main difference in the use of this circuit is the pulse output goes directly to the battery and not via a connection hub, which previous experiments found dissipated the energy influx that is presumed to be focused around the conductor surface instead of inside it (as with the Poynting flow - see video 1 at: https://www.kerrowenergetics.org.uk/video-links)

Impedance issues

It has long been stated that operating with a low impedance is crucial to get OU results and this has been borne out, partly by accident.

During tests to see the effect of having a third battery in parallel with the charging battery, and where I had used an old 80Ah AGM battery for that purpose, I saw a large jump in the CoP.

Previously I had obtained around 1.3 with a 40Ah car battery but now this jumped to 1.82 with the third battery in parallel. By elimination I found that the large increase was due to the inclusion of the 80Ah AGM battery and not because it was connected as a form of REAC (Radiant Energy Accumulator and Converter). Further tests with various parameters pushed this up to 2.56 and then it settled down to 1.8.

Measurements of the internal resistance using the CBA gave a value of around 80-100mΩ. Discussions with a battery specialist reported that the AGM design, with its thicker plates for use with 'Stop-Start' cars, that require frequent short charge and discharge cycles, typically possess a lower internal resistance than fluid filled batteries. With this in mind, and based on new results, I have undertaken much more testing using the 80Ah battery and have now also obtain a 92Ah AGM battery for comparisons. This will be used in the first study, along with an identical control battery, to see how the 15% increase in capacity and the observed reduction in IR affects the CoP performance. The newer and larger capacity battery will require further tests to determine the optimum point on its charging profile for its greatest receptivity to any 'energy influx'.

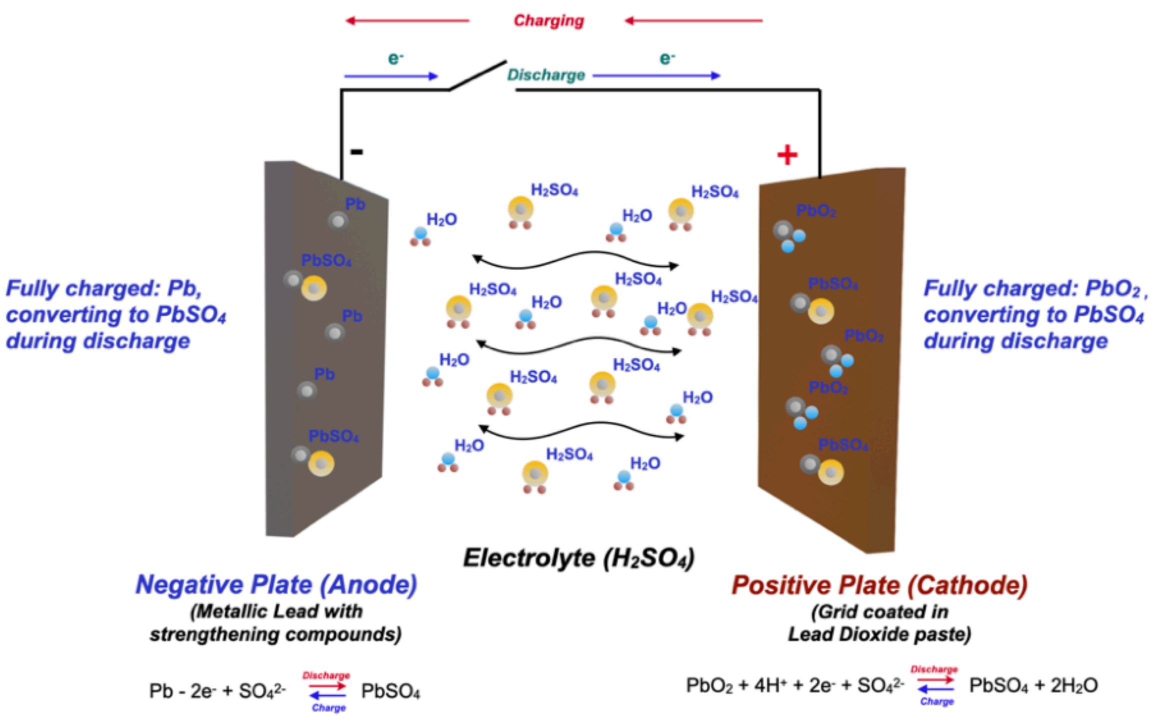


Figure 2: Redox reactions in Lead Acid batteries

So far the best CoP values have been obtained with this 6 year old 80Ah battery is 3.09 and which has not yet been rejuvenated with any form of dedicated pulse charger, but only subjected to the pulse charging test cycles. These do reduce the level of sulphation, as part of the normal reversible chemical reactions, (as indicated in Figure 2 below), and so it is expected that the IR will rise and fall with charge and discharge cycles. The optimum point on the charging profile to undertake pulse charging will be a 'sweet spot' between the most receptive point on the charging profile and the reducing IR as a battery reaches full charge.

Current Limiting

It has been stated many times, by Robert Adams, John Bedini for example, and many others, that to obtain OU results we need to keep the supply current at a minimum while allowing an energy influx to occur unimpeded.

Paraphrasing Adams (from https://waveguide.blog/adams-motor-generator/) he said that: "using stator coils of low resistance is the main reason many experimenters see lousy results since the cardinal mistake being made here is that most of these experimenters are concerned about I^2R losses!"

The question is how do we reduce the current and losses while maintaining the magnetic field and any so called 'scalar waves' that are crucial to strong flyback pulses and a good influx of additional energy?

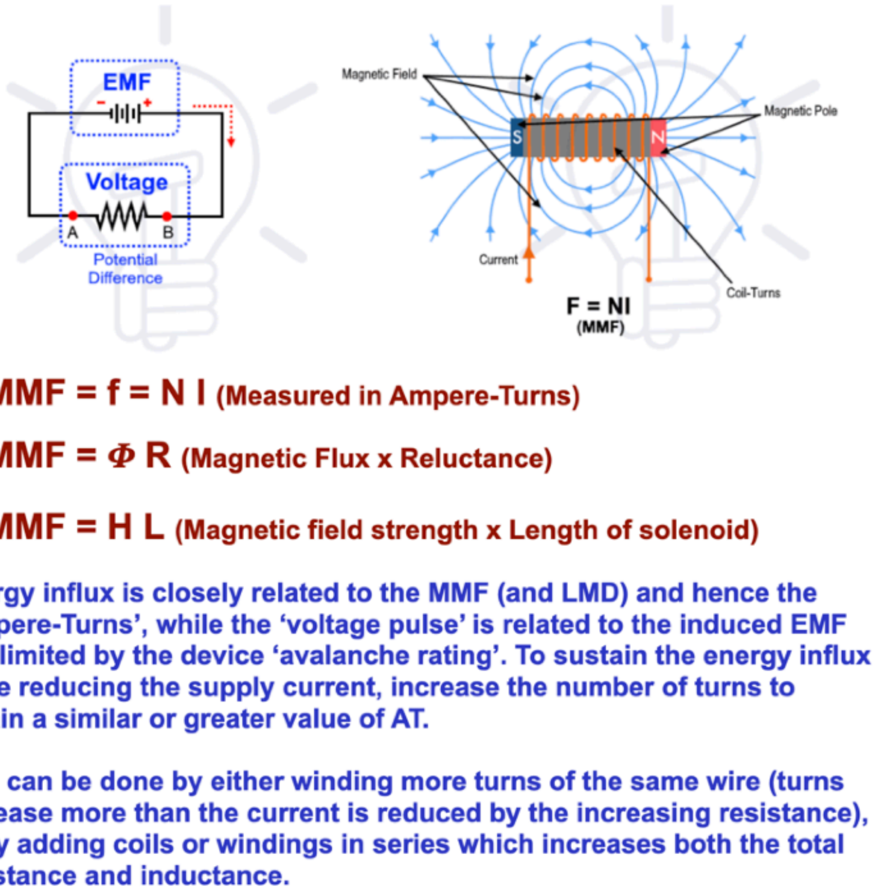


Figure 3: Magneto Motive Force

If one simply increases the resistance of the coil, perhaps by putting a resistor in series with it, then the current will be reduced but so will the magnetic field strength, which will give poorer results. Alternatively, we might try winding the same number of turns of a smaller gauge wire and which will give a higher coil resistance and smaller supply current; but again a smaller magnetic field and so will impede any energy influx.

What is required instead is a situation where we maintain the magnetic field strength, or more specifically, both the Magneto Motive Force (MMF) and the Longitudinal Magneto Dielectric (LMD) that is proposed to be generated as a scalar wave across the coil axis.

This can be done using a higher number of turns of whatever gauge wire you are using such that the number of turns increases at a higher rate than the resistance increases thereby bringing the current down in the direction we want. In this way we resolve the energy input while maintaining the field strength. We will than have a coil that will draw lower current but which, due to its greater number of turns, will result in a stronger magnetic field to maintain the MMF/LMD.

To explain more about the MMF, I refer to Figure 3 where it shown as being analogous to the EMF in conventional circuits. The crucial value is the ampere-turns (AT) and will determine the field strength that is closely linked to the energy influx and this is certainly what recent tests indicate. The role of the LMD here is not clear but increasing the MMF will also serve to increase the LMD.

As Adams said: "A 10 Ω coil with many turns of thicker (lower resistance) wire will establish a much stronger magnetic field for the same amount of current draw than a 10 Ω coil with a few turns of thin (higher resistance) wire, and will result in a much stronger flyback EMF from the collapsing magnetic field, which we can use to recharge our battery."

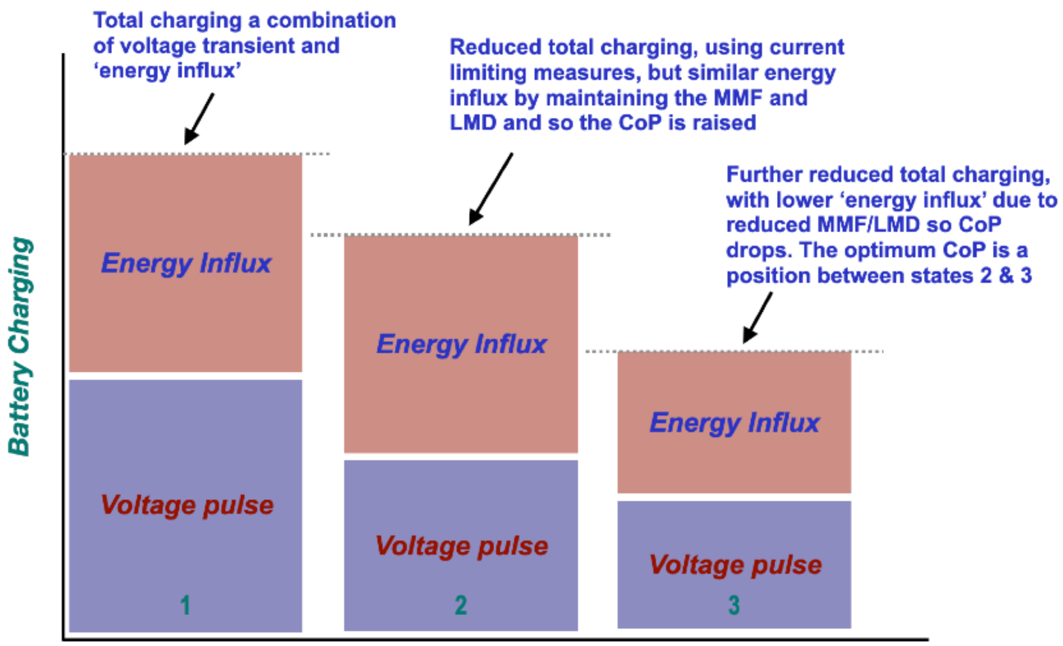


Figure 4: Effect of current limiting measures

Ampere-Turns (AT) is therefore of great importance in keeping the current down and the resulting flyback pulses strong enough, in more ways than just their peak voltage as shown on a scope, to help recharge the battery.

Figure 4 depicts the logic behind this and my personal take on why I have been able to obtain a CoP of 3 using this approach (see 'OU results' below). What has become apparent from recent results is that there are two main components to the total energy that results in battery charging; the charge liberated directly by the flyback pulse itself and also the additional energy induced into the circuit by certain properties of that same pulse and which are related to the MMF and LMD. While these two components are clearly related to each other they are not the same, i.e. battery charging is ***not synonymous*** with any additional energy influx, although it is of course affected by it.

From various test results it is reasonable to deduce that any additional energy influx is due more to the MMF/LMD from the coils than just the high reverse flyback voltage induced by the collapsing magnetic fields, although there is of course a relationship between these two processes.

In scenario 1 in Fig 4 we see the combination of these two components that results in a specific rate of battery charging. In number 2 we have reduced the supply current, that also shows as a reduction in the battery charging, but we have the same degree of 'energy influx' by maintaining the MMF/LMD via the AT of the coils with a modified coil configuration. The reduction in energy supplied while still maintaining the additional energy influx, results in a raised CoP value; despite the fact that the battery charging rate has reduced.

It is apparent here then that the additional 'energy influx' is rendered reasonably consistent by maintaining the level of MMF/LMD, while the supply current and the derived voltage pulse are being reduced to minimise the input energy. As such the CoP will increase even though the charging rate will decrease accordingly. In other words, the additional 'energy influx' appears to be decoupled from the charge directly liberated by the pulse such that one component reduces while the other remains the same.

In scenario 3, we have reduced the current to such a degree, perhaps by also reducing the coil voltage, that has also reduced the MMF/LMD, despite the increased Ampere-Turns of the revise configuration. As such we see a fall in both the battery charging and the additional 'energy influx'. This results in a decreasing CoP. So the aim here is to find the 'sweet spot' between state 2 & 3 for maximum CoP and before it starts to decline.

However, achieving a CoP>1 does not mean that the energy output of the device as a whole (this must include the batteries where the energy gains are occurring) is the CoP times the input energy. Clearly it depends on what your generator is aiming to achieve as to which outcome you need to focus on. If battery charging rate is most important then your CoP will reduce and will often fall below OU.

Tests so far have indicated that the ratio of charging rate to CoP (ChR/CoP) is best for a rotor based system, with multi-strand litzed coils and a trigger coil, compared to single strand coils and a PWM driven MOSFET. Despite this, ways are being explored to deliver a rotor based performance with a solid state system through analysis of the output waveforms and then devising ways to replicate these by solid-state means.

Having provided a theoretical framework for how and why it is possible to obtain a CoP >1 using different coil configurations, let me explain how this has been done using my solid state system.

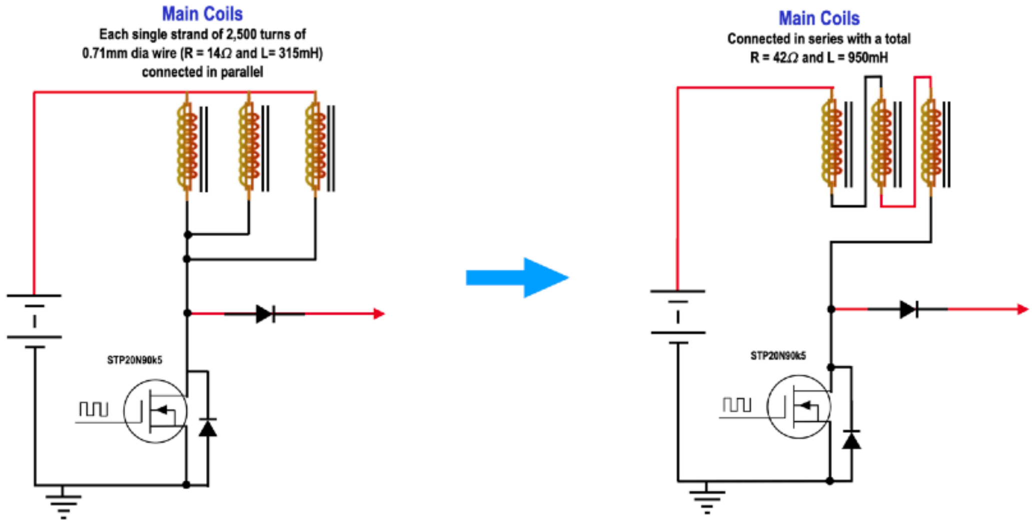


Figure 5: Modification to coil arrangement in solid-state system

With the V4 PCB and associated ‘Assembly and Guidance’ manual provided earlier this year, while good CoPs were achieved, they ultimately proved of less value than predicted as they arose largely from high levels of surface charge arising from the 1 - 4.3kV spikes. This is also most likely linked to the fact that the coils were not generating a sufficient LMD on account of the lack of coil capacitance coupling, a detail yet to be unravelled.

In a move to reduce the supply current, as per the above described logic, I decided to run my coils in series instead of in parallel as normal. This had the effect of increasing the combined coil resistance and also the effective number of turns and inductance. Figure 5 shows the change in coil arrangement from parallel to series.

This new configuration has brought the total supply current down to around 110mA but has maintained the MMF/LMD due the raised inductance and AT. In this case the FET was driven by the PWM at 50Hz and a 35% duty cycle and used to charge the 80Ah battery. The data from this test run is shown in the following section, achieved a CoP of just over 3 and is compared with a rotor based run of 1.8, albeit with better battery charging.

Since the V5A PCB can be operated in a ‘V4 mode’, with a single channel used for the PWM - FET arrangement, this means that the earlier V4 PCB can now achieve what it was designed for - to show that a CoP>1 is possible. It was not designed to be a useful power supply, for example to go off-grid, and as yet it is not fully clear how to upscale such a device, or any other, to a degree to achieve that goal, without using a very large and bulky system. That exploration will come later.

Figure 6 shows three coil arrangements alongside various parameters and derivations. With the single coil the value of T was recorded when the coil was wound at 2500 turns. The value of resistance and inductance is measured using a common LCR meter and the current recorded during use with a single MOSFET and the PWM set to 50Hz and 37% duty. From these known parameters the AT and L/AT can be easily calculated.

With three coils in series the value of T is the sum or the individuals coil turns (as resistors and inductances in series are summated) and the other values are measured as before. When it comes to the three coils in parallel, then the effective total turns is most simply derived as 2500/3, although in practice other

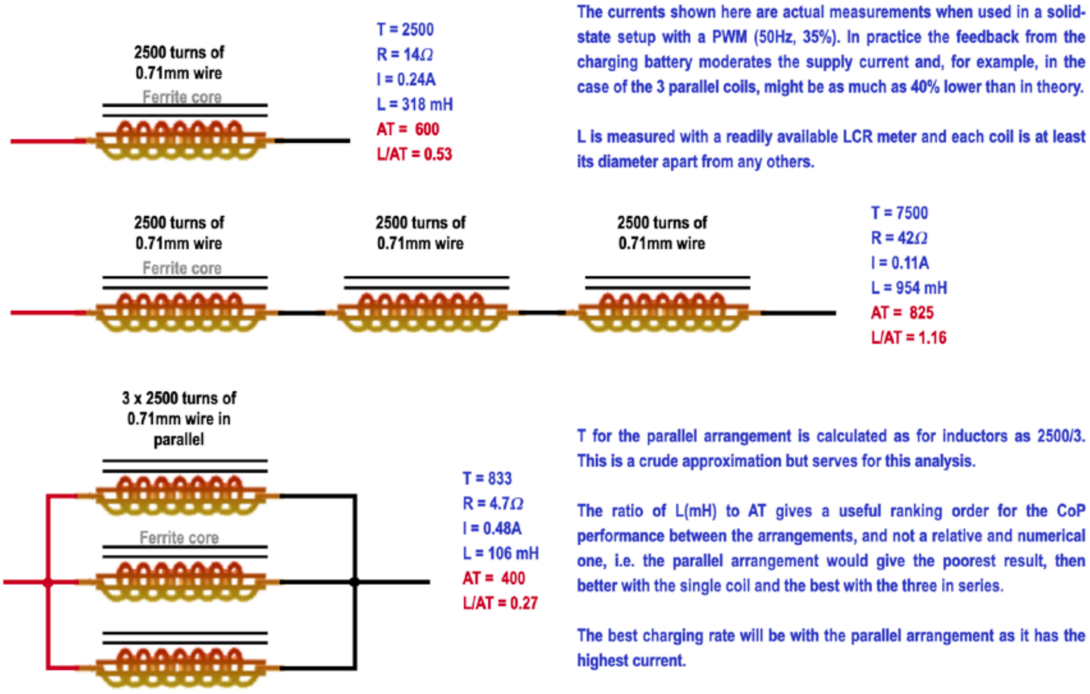


Figure 6: Modification to coil arrangement in solid-state system

factors ,such as mutual inductance, can change this value. However, for the purpose of this analysis the T = 833 figure works fine. Once again the current is measured and in fact lower than might be expected from theoretical calculations. Once again there is a feedback occurring with the battery that impacts the supply current involving impedance and transient effects.

A particularly useful figure here is the ratio L/AT as this provides a ranking of the CoP performance of each setup. Here it can be seen that the 3 coils in series have the highest ratio and have increased the AT, and hence the MMF/LMD component, while reducing the supply current and thereby increasing the CoP value. Nevertheless, the lower current will result in a lower battery charging rate based on the relative current supplies and so changing your coil configuration depends on what your goals are.

If you were then to go on and add a further fourth coil in series, while the AT value will remain at a similar level, the further reduction of current will incur scenario 3 in Figure 4 and the response will start to drop off. As with most of these parameter, some testing will allow you to find the optimum arrangement but this straightforward analysis will give you a head start in confirming what might work best with your setup.

Bear in mind also that an increase in the peak HV output will be capped by the ‘avalanche’ rating of the device. The suggestion here is that the peak HV is not the only quantity that determines the response from the coil and battery and which results in effective battery charging or additional energy input. High kV pulses do not automatically translate to effective battery charging, as was shown in earlier work. High kVs tend to produce a lot of surface charge that does not transfer deep into the electrolyte bulk to result in substantive battery charging, but produces a charge on the electrode surface that rapidly ‘evaporates’ when a load is applied. While a scope will only portray the voltage, there are other qualities of the flyback pulses that determine the effect on the local environment that are realised in the battery. *The scope trace is only showing a two dimensional interpretation of a ‘multi-dimensional’ event*.

Using a similar approach, an attempt was made to reconfigure the multi 4 winding coil used with the rotor, with an additional 2 winding and trigger coil that was linked in series. Here the trigger coils were linked as one longer coil and two of the 4 windings in the main coil were supplemented with two windings from the other litzed coil. However, despite the fact that the rotor was able to operate the trigger for the transistor, even with the increased coil resistance and inductance for two of the windings, the current was instead raised and brought the CoP down from around 2 to 1.1. It appears that the current is a finely tuned balance, with some mode of feedback from the battery, and is lowest when there is a 'form of 'resonance' occurring in the interchanges between the single litzed coil. Adding another on the basis of the logic for the solid state system, detracts from this balance and results in a higher supply current.

Nevertheless, if a coil is designed from the outset to have a higher value of AT, with more turns of the same wire gauge (e.g. 23AWG) or a slightly larger gauge, then this is likely to perform better, as is the case when a larger number of independent windings and channels is used. In this V5/V5A system there are just 4 channels for the four litzed coil windings and the extra independently run one. Those using the typical 'SG' seven windings should expect to see good results if all the parameters are optimised but again, current limiting measures will help ensure you can reach an OU state.

Fine Tuning

As is well known, the rotor is started, either manually or with a power drill, using a lower base resistance than when the rotor has built up some speed, necessitating that the adjustment pot be used to trim the resistance.

However, in order to minimise the total average supply current over a test run the fine tuning needs to be done at several stages during the charging session. As the rotor increases speed so too does the supply current due to the increasing number of pulses being delivered to the battery and their hysteresis and I^2R losses within the coils.

The ideal situation is to have the base resistance set up so that the rotor speed is not increasing, which would gradually increase the supply current, and also not falling which would happen if the timing was past its optimum value (thinking optimum Top Dead Centre (TDC) timing advance in the ignition timing in older car systems).

With my system, after turning the 1k pot screw back about 5 half turns, the drill arbour quickly brings the rotor up to around 700rpm. Watching either the current meter, or a dedicated RPM/PRF meter, will allow one to make small adjustments to the pot to prevent the rotor speed creeping up.

In Figure 7, the supply current is 304mA and the pot adjustment screw has been set after the rotor has stabilised at around 850rpm. Further clockwise turns on the pot will start to cause the rotor to slow down and this is reflected by a gradual drop in the supply current. The 'sweet spot' is where rpm stays at this level and does not start to drop. If the rpm has, for whatever reason, started to rise then a quick touch of the rotor with a finger tip will slow it down to the desired level and then the pot can be adjusted again to maintain it at the desired rpm. It is worth checking the status of the rpm, current and pot adjustment at several points throughout the test run if you are undertaking a CoP test where the input current is critical. Like balancing a pencil in its point, once a drift has started it tends to pick up momentum.

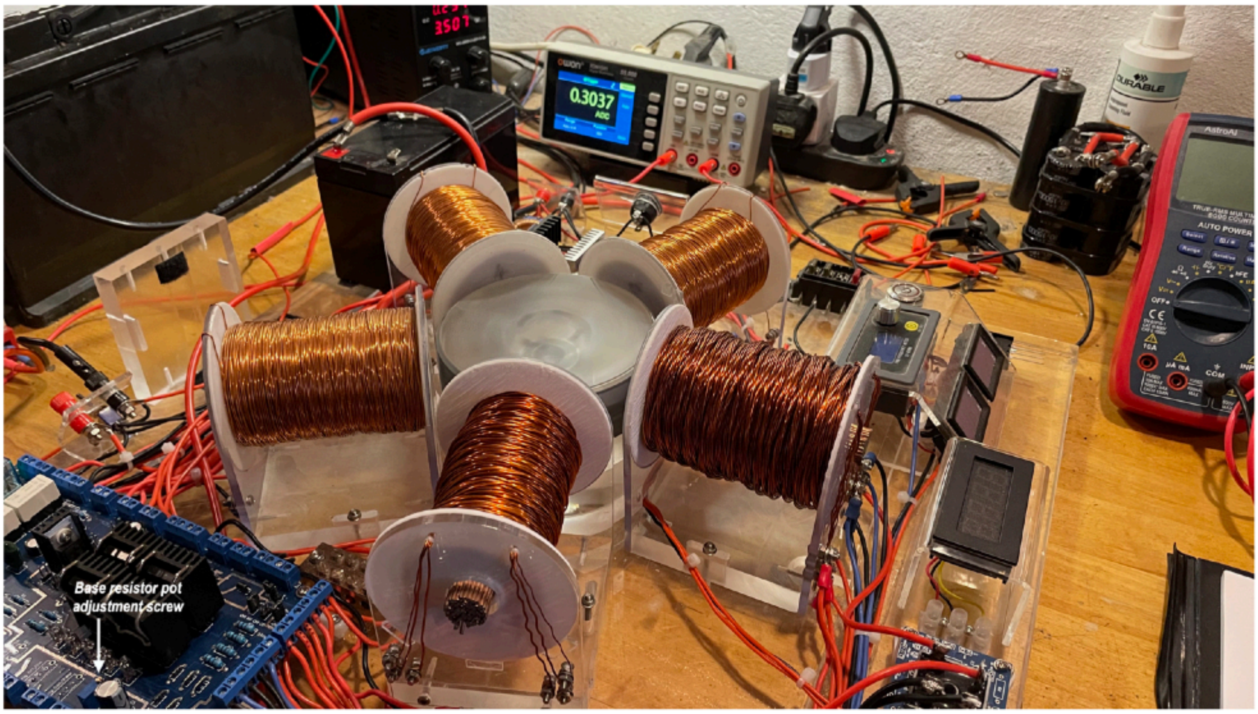


Figure 7: Fine tuning the base resistor for minimum current

For example, it was noted that about half way through a test run, at about 30mins in of a 60min run, the rpm starts to rise spontaneously slowly driving up the supply current. Another small adjustment was required to increase the resistance a little so as to stop this spontaneous rise.

A high rpm will not result in better performance since the battery has a preferred PRF for assimilating the effects of the pulses. Aiming for the highest rpm will only draw more current with little benefit while at the same time reducing the CoP. It is best therefore the set the rotor speed, using finger drag, for a PRF of around 50Hz in my case and then maintain it with the pot adjustment.

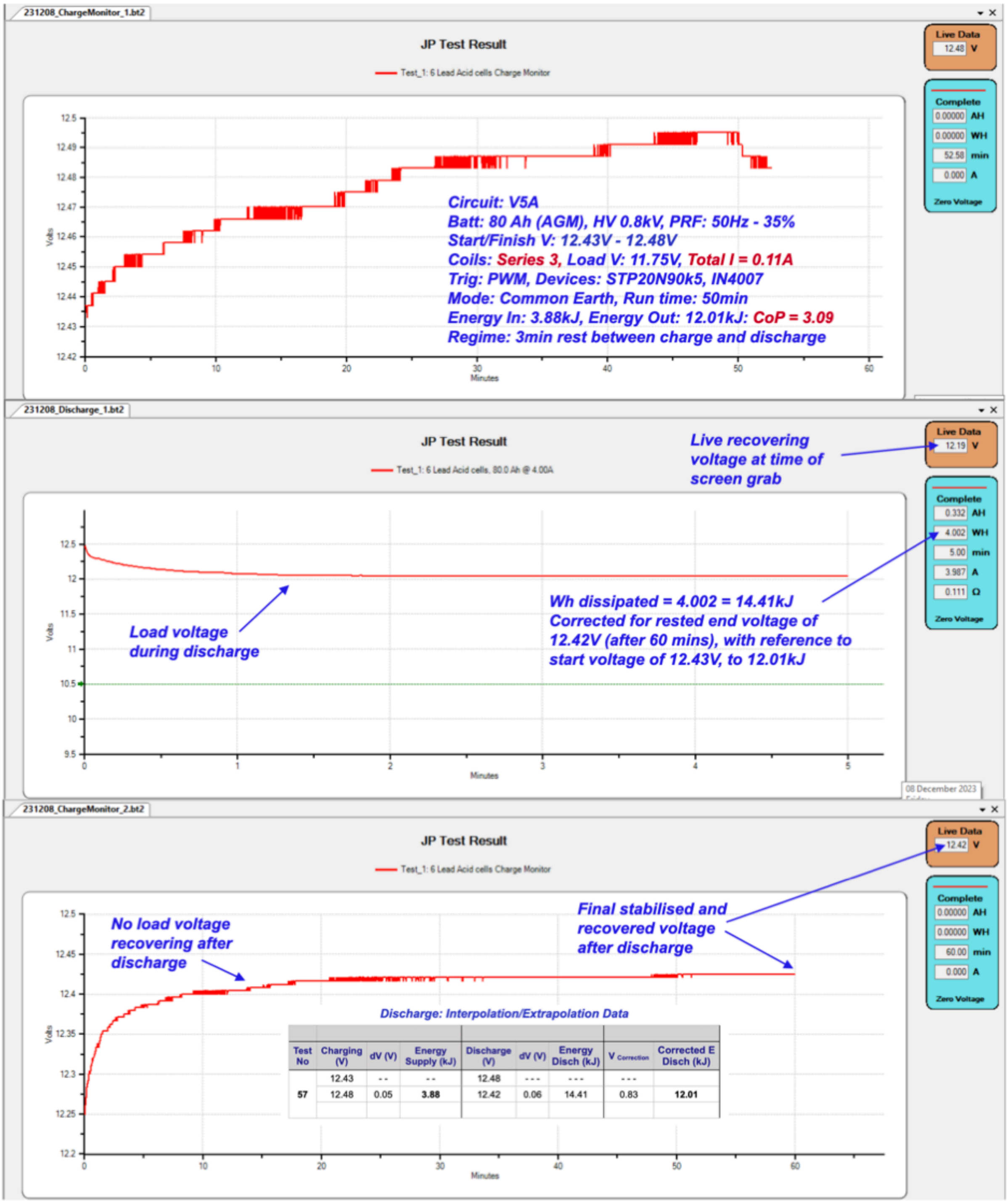
In cases where one is using a solid state setup, the supply current is far more stable, partly due to the absence of the rotor which has multiple interactions and feedback with the battery and system, but also since the PRF and duty cycle are set and fixed throughout the test run e.g. 50Hz, 37%.

OU Results:

The following set of graphs present the data for two OU measurements but with different configurations and parameters as explained above; three single strand coils in series with the solid state option and a 4 multi-winding litzed coil using the rotor and trigger coil.

Figure 8 shows the various data using the system in solid-state mode, with its PWM unit and MOSFET in a single channel, using 3 single strand coils in series to increase the coil resistance, and charging an 80Ah AGM battery. The specifics are shown on the top charge monitor graph and the discharge data on the lower one. The third graph below that shows the voltage recovery after the discharge stage and therefore the final stabilised voltage then used to apply a correction to the discharge energy if required.

The various stages for the CoP measurement are as follows and a detailed analysis of the calculation follows this.



Test No	Charging (V)	dV (V)	Energy Supply (kJ)	Discharge (V)	dV (V)	Energy Disch (kJ)	$V_{Correction}$	Corrected E Disch (kJ)
	12.43	- -	- -	12.48	- - -	- - -	- - -	
57	12.48	0.05	**3.88**	12.42	0.06	14.41	0.83	**12.01**

Figure 8: CoP from modification to coil arrangement in solid-state system

- Pulse charging from a suitable start voltage with CBA monitoring for 50 mins
- A three minute rest and assimilation period and recording the voltage for the start of the discharge
- A controlled discharge using the CBA at a nominal 4A (C20 rate) for 5 mins (time depends on anticipated gains)
- Final battery voltage measured with CBA after 60 mins rest and stabilisation

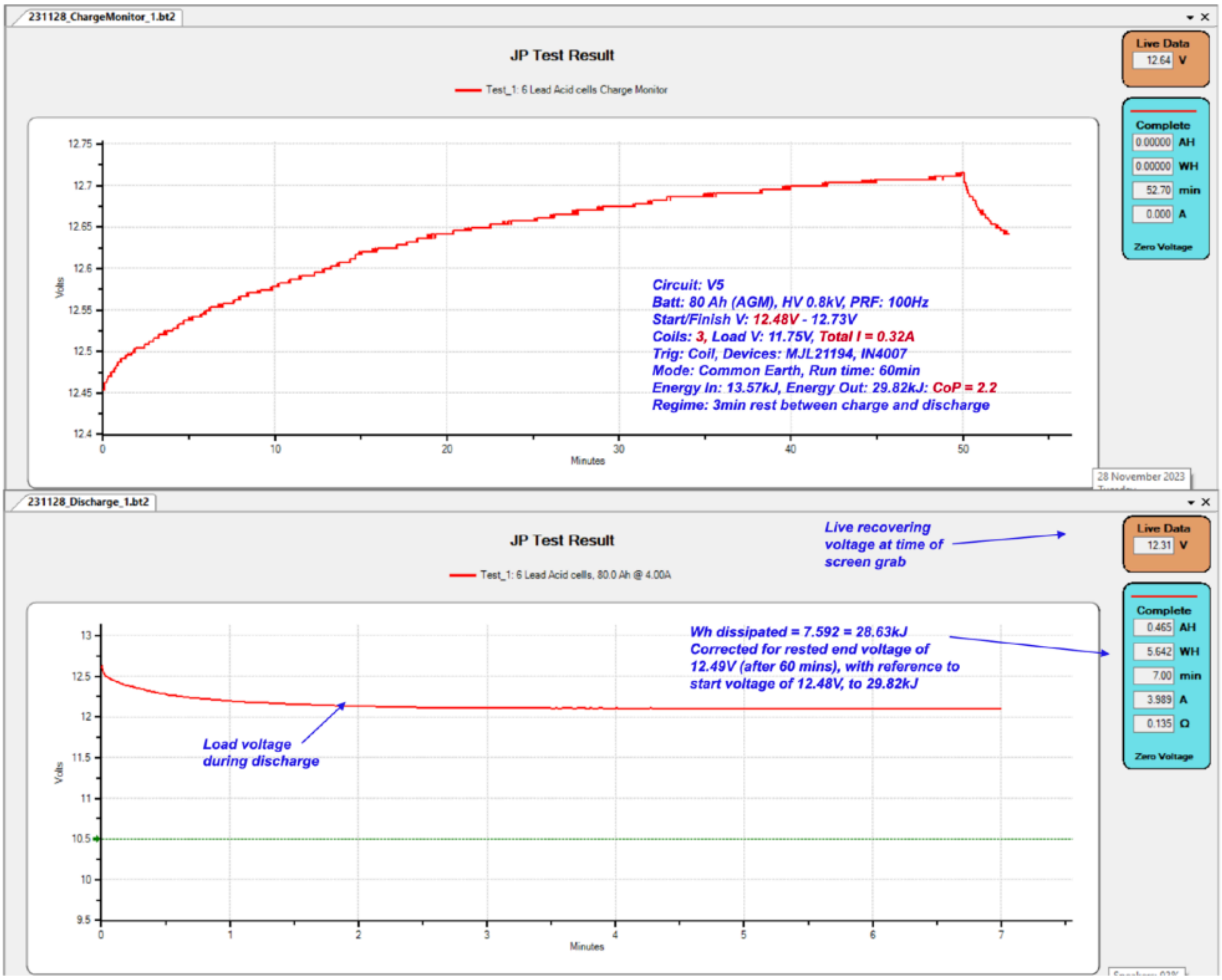


Figure 9: CoP from rotor based system

◉ Correction of the discharge energy value by extrapolation/interpolation according to the final voltage compared to starting voltage (as shown in lower graph insert).

The graph in Figure 9 shows the same process for the rotors based setup with the same battery.

It is important to restate that a CoP value does not mean that the total output energy will be the input energy times the CoP. In other words, the output energy *is not a variable multiple* of the input energy, although it is tempting to think it should or might be.

If you raise the input energy you will still get a similar 'energy influx' to before but because of the raised input energy the CoP will drop, even though the charging rate increases. For a specific coil configuration and circuit parameters, the energy influx is relatively consistent (see section below), up to the point shown as scenario 3 in Figure 4. Any additional input energy is largely wasted and not translated to an increase in the energy influx. Similarly, dropping the input energy too low will affect the energy influx through a drop in the MMF/LMD component.

CoP Calculations:

The calculation of the result shown in Figure 8 is broken down into there stages; the supply input energy, the discharge output energy and the discharge energy correction.

Input:

The input energy is a straightforward calculation based on the average supply voltage, average current and time where:

$E = V_{(av)}. I_{(av)}. t /1000$ (kJ)

The slight pulsing of an analog meter gives an average reading within 5% of the digital recording meter so the latter is used and provided an average of 0.11A. In practice this value is the average of 50 readings taken automatically at 1 minute intervals and exploited as an XLS spreadsheet.

The total current measured, 0.11A in this example is used in the following manner. The circuit current of 0.03A with the circuit on, but with the coils off, is subtracted from the 0.11A to give the current demand of the coils alone (0.08A). This is multiplied by the coil load voltage (11.75V) to give 0.94W.

The quiescent circuit current (coils not running) is multiplied by the supply voltage to give the power expended by the control circuit itself (11.98V x 0.03A = 0.36W). These two values are added together to give the total power expended by the system (1.3W) and then multiplied by the run time in seconds (3,000s - 50m) and divided by 1,000 to give the input energy in kJ.

This is: 1.3 x 3000/1000 = **3.9kJ**

Output:

After a 3 minute rest, to allow the battery to assimilate all the energy inputs, the controlled discharge is started for an appropriate time and a C20 current. For an 80Ah AGM battery, this is typically 7mins@4A but will depend on the degree of pulse charging and the battery's typical response. The C20 discharge rate of 4A is consistent for each test even if it does not reflect a potential load.

During the discharge the battery voltage will drop under load and remain stable until the end of the discharge time (see middle graph in Figure 8). Once the discharge is manually stopped after 5 mins, the discharged energy is recorded in Wh (1Wh = 3.6kJ). A value of Ah (charge) is also available and the Internal resistance can be checked after stabilisation using the specific IR test.

The live voltage will immediately start to recover towards a stable value and is plotted using another charge monitor session with the CBA. After 60min the final voltage is the 'end' value. This is then compared with the stabilised voltage at the start of pulse charging to accurately determine the output energy by applying a correction factor as shown in the inset box on the bottom graph.

Going through the numbers, in this example, 4.002Wh (see Fig 8 middle graph readings) were discharged which equates to **14.41kJ**.

Correction factor:

Since the resulting stabilised end voltage after discharge is a little below the voltage at the start of pulse charging, 12.42V compared to 12.43V, the output energy needs to be linearly interpolated to a value that would have been measured if the discharge had taken the battery back down to the start voltage and not a bit beyond. In this case the correction factor will lower the final discharge energy value.

The linear correction factor is determined from the voltage differential from discharge as a proportion of the start to peak voltage (12.48 - 12.43) / (12.48 - 12.42) = **0.83**. The discharge energy is multiplied by this correction factor to give the output energy that would have been released if the battery had been returned to its original starting value.

In this case is it: 14.41 x 0.83 = **12.01kJ**

The CoP is then calculated from total output energy/ input energy:

12.01kJ / 3.88kJ = **3.09** ± uncertainty (not calculated in this example)

When required the uncertainty can be calculated and which takes into account all the errors in the meter readings and how they are assembled into the final result. It is estimated that the uncertainty here would be around ± **0.3** meaning that the actual CoP is somewhere in the range **2.79 - 3.39**.

Although little work has been undertaken yet on the effect of battery temperature on the CoP value, it is highly likely to play a role since temperature affects ion mobility and the rate of the reversible electrochemical reactions. How these known process may interact with the as yet unknown ones involved in an 'energy influx' is unclear. When temperature effects are examined at the start of 2024, it is expected that there will be a measurable positive coefficient of CoP with temperature.

Consistent energy influx:

One of the most interesting findings arising from recent tests is that, for a particular coil and battery setup, the additional 'energy influx' appears remarkable consistent. This backs up the idea presented earlier that it is the input current and energy that mainly determines the CoP and that one cannot just ramp up the input and expect the output to increase by a factor of the CoP value. If it were so then it would be straightforward to develop a useful off-grid system of whatever power level you wanted.

Instead the 'energy influx' is a function of the particular makeup of your coils and the battery's receptivity (interaction cross-section) to the available energy from the 'environment' by whatever pathways yet to be repeatably identified. With a maximum possible energy influx determined by your inherent design features, it can nevertheless be lowered through the use of non-optimal parameters (as for example in scenario 3 in Figure 4).

To demonstrate this consistent energy influx for a specific configuration, an assessment has been of the data so far collected to work out the 'energy influx' that is occurring. Some sample data is shown in Table 2 and has been derived based on the following principles.

Main Coils	Trig	Rec Coils	Trig	PRF/ %	Coil Voltage (V)	Total Current (A)	Run time (s)	$E_{(Supply)}$ kJ	Start V	CoP	E to CoP=1 (kJ)	CoP-1	Extra E (kJ)	Total Extra E (kJ)	Power (W)	Comments
4	Coil	---	---	---	11.75	0.430	3600	18.21	12.31	1.32	13.66	0.32	5.90	19.56	5.43	*80Ah, M4*
4	Coil	---	---	---	11.50	0.380	3000	13.16	12.40	1.47	9.87	0.47	6.21	16.08	5.36	*80Ah, M4, shorter time*
4	Coil	---	---	---	11.28	0.380	3600	15.51	12.39	1.49	11.63	0.49	7.58	19.21	5.34	*80Ah, M4, shorter time, core gap 4.5mm*
4	Coil	---	---	---	11.50	0.300	3000	10.41	12.45	1.85	7.81	0.85	8.88	16.69	5.56	*80Ah, M4*
---	---	3S	PWM	50/35	11.75	0.110	6000	7.83	12.38	2.59	5.87	1.59	12.46	18.33	3.06	*80Ah, R3S, 35% duty, 100 mins charging*
---	---	3S	PWM	50/35	11.75	0.110	3000	3.88	12.43	3.09	2.91	2.09	8.13	11.04	3.68	*80Ah, R3S, 50Hz/35% duty*
---	---	3S	PWM	50/35	11.75	0.110	3000	3.89	12.516	2.92	2.92	1.92	7.47	10.39	3.46	*80Ah, R3S, 50Hz/35% duty, RN-12 recharged*
---	---	3S	PWM	50/37	11.76	0.122	3000	4.32	12.360	2.96	3.24	1.96	8.44	11.68	3.89	*80Ah, R3S, 50Hz/37% duty*

Table 2: Energy influx calculations

The conventional efficiency of the device, that converts the input energy to flyback spikes, is very low and here will be estimated as 25%. This means that just to get the overall system to a CoP of 1, the additional energy influx needs to offset and compensate for the poor internal efficiency of the system. This component will therefore be required to be 75% of the input energy to make up the overall performance to a CoP = 1.

Next we have the additional energy showing as a CoP above 1. For example, with a CoP value of 2.4, that is 1.4 above a CoP of 1 and therefore requires an additional energy of 1.4 times the input energy. So we can then add together the energy influx offsetting the device's inefficiency with that showing as 'over unity'. This gives us a total value for the 'energy influx' and a means to demonstrate what is happening with this aspect of the system.

In Table 2, the variations in energy influx are within the expected uncertainties but generally they are loosely consistent for a particular coil arrangement (all with the 80Ah AGM battery) despite the various CoP values changing as a result of changes in input energy using the 'current limiting' measures. So even when the calculated CoP differs for various parameter adjustments within a specific setup, the total energy influx is reasonably consistent. This supports the earlier presented theory regarding the available energy from a system and how the CoP can be altered by limiting the current, and therefore the input energy, while maintaining the MMF/LMD component at a consistent level. Again it is evident that at the moment the best total energy is with the rotor system and a litzed coil for reasons yet to be fully explored.

Manual reissue:

Given the recent findings regarding the CoP values using the solid-state setup with the V5A PCB when used as a V4 PCB, next year I will revise the 'Assembly & Guidance' manual, based around the V4 board. This will be of value for those wishing to show evidence of OU results and also those who may wish to replicate the findings of the first research study starting next February (see 'Research Preparations' below). Meanwhile the manual and earlier work (but not the V4 PCB Gerber file) are still available on the storage sites, and also on the Open Science Framework site via the link given towards the end of this report.

Website:

My website at kerrowenergetics.org.uk continues to hold material of interest to the topic of IPC and pre-print articles and material. It also hosts relevant historical and present day patents and papers on previous work and will do so for those arising from the first and subsequent research studies.

Figure 10: Website at kerrowenergetics.org.uk

An article I have recently completed entitled: *Inductive Pulse Charging: What, How and Why?,* which sets the historical and technical background for this topic, has been submitted to the peer-reviewed *Journal of Scientific Exploration*. I hope to hear back early in the new year if they will be publishing it and once I know that I can provide a link. If they choose not to then there are other journals that I will submit to.

Research Preparations:

With the preparations nearly complete for the research study, it is expected to start in February 2024 and with full registration with the Open Science Framework during January. The registration process aids transparency and minimises 'hindsight' bias as well as allowing the public to view key data as it is gathered.

The link to the research study with the OSF is here: https://osf.io/ZTFUB/ and one to a developmental blog, charting some aspects of the preparations for the study, is here: https://osf.io/ztfub/wiki/home/.

The approach of the OSF to research is covered in this video at: https://www.youtube.com/watch?v=9YuNGB3vNOw

By way off a summary for the various findings in recent months a bulleted list is presented highlighting the key points.

Key Findings:

1. For a given coil and battery arrangement, the 'energy influx' is reasonably consistent within certain input energy limits, such that changes to the input current are the main cause of the changes to the derived CoP.

2. Energy influx and battery charging are not synonymous. Good battery charging rates will tend to be accompanied by lower CoPs for a given setup, since the increased supply current used for higher charging rates will bring down the CoP for a relatively consistent energy influx.

3. An improvement in CoP will result in a lower charging rate due to the lower supply current and given that, for a specific set of device parameters, the energy influx is reasonably constant.

4. Fine tuning of the base resistance circuit at various points during a test run is required to maintain the minimum supply. Supply current increases with rotor rpm and so can be used as a guide to find the 'sweet spot'. For optimum CoP regular adjustment is needed throughout a test run.

5. The response of the battery is highly dependent on its internal resistance and 'interaction cross-section' for the additional 'energy influx'. That is affected mainly by the materials used, the internal design and the charge capacity.

6. An AGM battery has a lower internal resistance than a flooded battery due to its thicker plates designed to cope with 'Stop-Start' vehicle use.

7. Calculating the ratio of the total coil inductance L (in mH) to the AT value will give a useful ranking order and indication of whether the CoP performance will be improved with a different coil configuration.

8. Although not tested thoroughly yet, CoP is expected to have a positive temperature coefficient in that a higher battery temperature will result in a higher CoP due to the recognised effect of temperature on the reversible electrochemical reactions.

9. Interlacing high intensity 'Cap Dump' pulses with HV pulses does not improve the CoP due mainly to the significant increase in supply current required. While HI/CD pulses may offer some advantages in specific settings, there was no observed clear benefit in terms of CoP.

10. The 'Assembly & Guidance Manual ' released in early 2023 and based around the V4 PCB using a MOSFET and a PWM module, will be re-released in 2024 since by using a reconfiguration of just three of the single strand coils, it can demonstrate a CoP>2 even though the battery charging rate is low.

11. Scope traces only show a two dimensional presentation (normally voltage) of a 'multi-dimensional' event.

12. Good battery charging and CoP measurements are aiming at very different goals, albeit technically related. To switch between the two may require significant adjustments to your setup.

Julian Perry
30th December, 2023