Report on Energy Test for Truncator Ltd.

Prepared by Lancaster University

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Introduction.

This report shows the results from a testing several saw horses to assess the effectiveness of each saw horse in terms of energy use and time spent using them with a chainsaw.

Four different saw horses were to be assessed.

1. Truncator 4cup Horse (**Error! Reference source not found.**).
2. Portek Logmaster (Figure 4).
3. Stihl Chainsaw Horse (Figure 2).
4. Roughneck Loggers Mate (Figure 4).

Figure 4

Figure 2

Figure 1

Figure 3

A Stihl electric chainsaw was used and the current drawn during the test was logged using a Fluke A3000FC. This allowed the total power used to saw an equivalent set of logs be measured for each saw horse.

Data Acquisition

A set of logs that were as close to identical as reasonably possible was collected for each sawhorse. The log sets were as follows.

1. Small diameter hazel. Set of six logs, all between 50 and 75mm diameter. Four cuts were used on each set.
2. Medium diameter oak. One log at 75mm, 3 at 100mm and one at 170mm diameter. Four cuts on each set.
3. Medium diameter hazel. Three logs at 50 to 60mm. one at 75mm and one at 170mm diameter.
4. Large diameter Douglas fir at 210mm diameter. Four cuts on each log.
5. Large diameter Douglas fir at 200mm diameter. Two cuts on each.
6. Large diameter Douglas fir at 210mm diameter. Two cuts on each.

One set is shown in Figure 5. As many logs as could fit in the sawhorse were cut together. Set 1 for example, was loaded as a batch into each sawhorse. Not all sets of the larger logs could fit into the devices so these were done in separate batches, this will be explained in more detail in the results section of this report.

Figure 5

The chainsaw was connected to a 230 V power supply and the live feed was monitored by a Fluke A3000 AC current data logger. The sampling interval of the data logger was set to 0.25 seconds and the resulting data was saved as a CSV file. This data was used to produce the chart given later in this report.

Results

The following charts show the power used in the tests. The data sets have been trimmed to remove the time taken to collect the logs and load them into the trailer. This time taken, which is an important aspect of the tests, will be considered separately.

1: Portek Logmaster.

The device was loaded with log batch #1 and the chainsaw installed in the device as per the instructions. The first two cuts were made with the results shown in Figure 6 below. The chainsaw operator halted the test as was deemed to be damaging to the chainsaw and potentially dangerous to the operator and bystanders. As such, no further data was collected for this device.

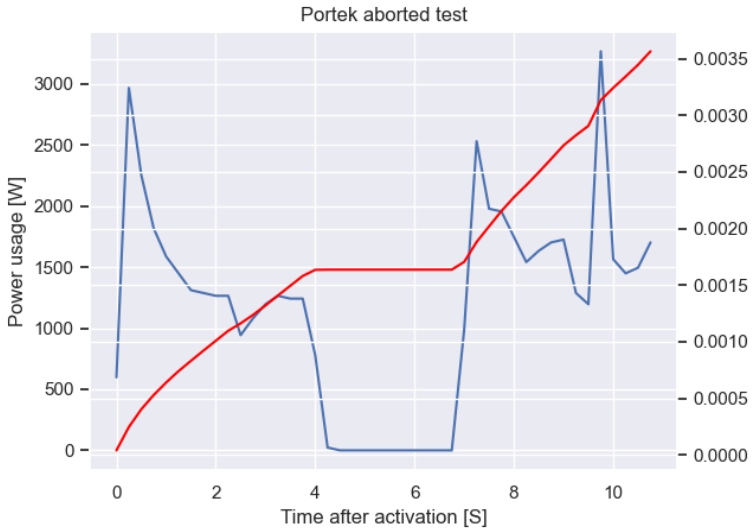

Figure 6

2: Truncator.

Batch #1 was loaded all together. The resulting power curve is as shown below in Figure 7.

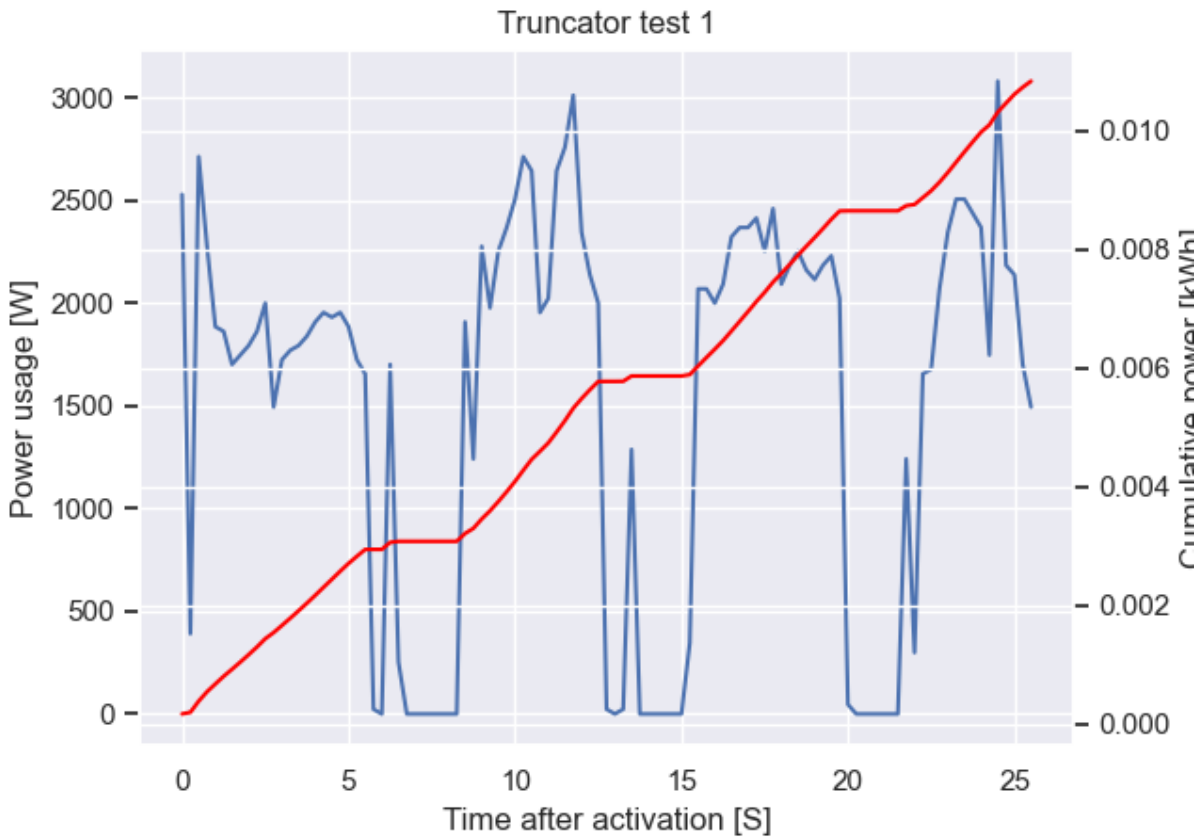

Figure 7

Batch #2 was loaded as the smaller logs all together and the larger log separately. The results are shown in Figure 8 and Figure 9. The data was collected in two separate log files as the log file was interrupted while loading the larger log.

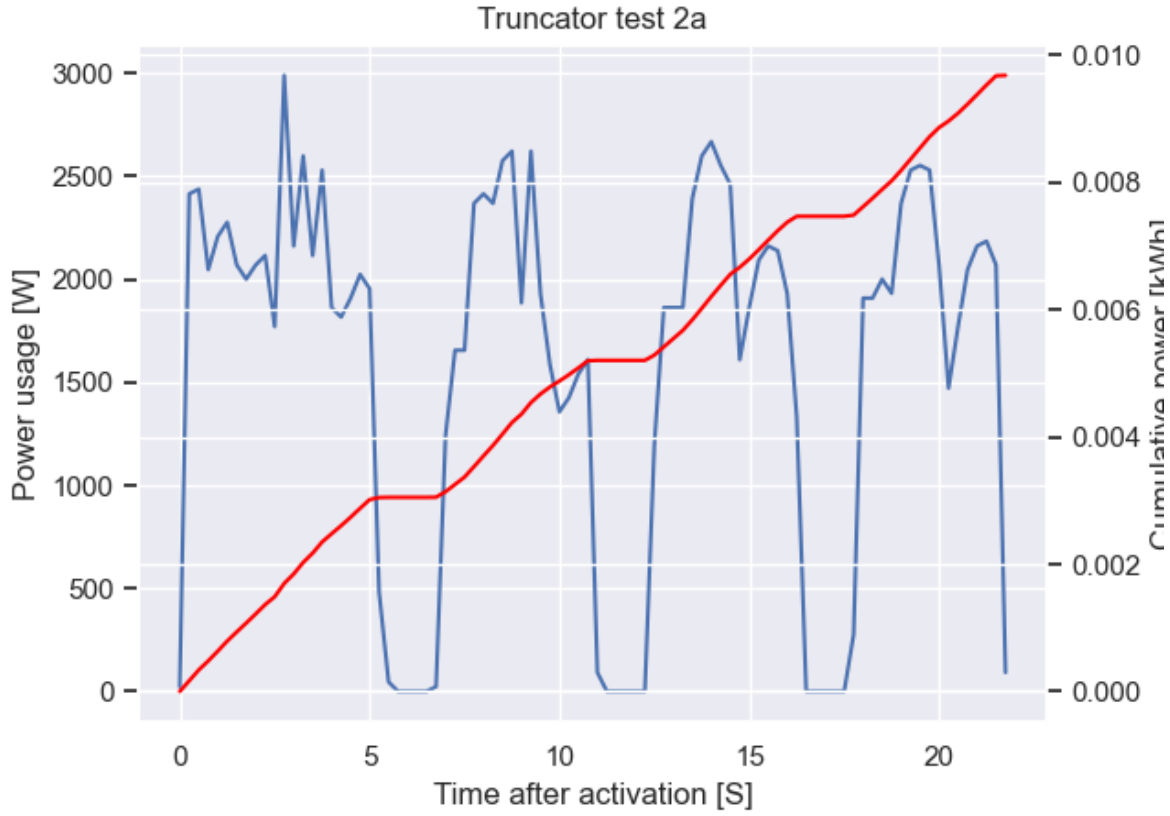

Figure 8

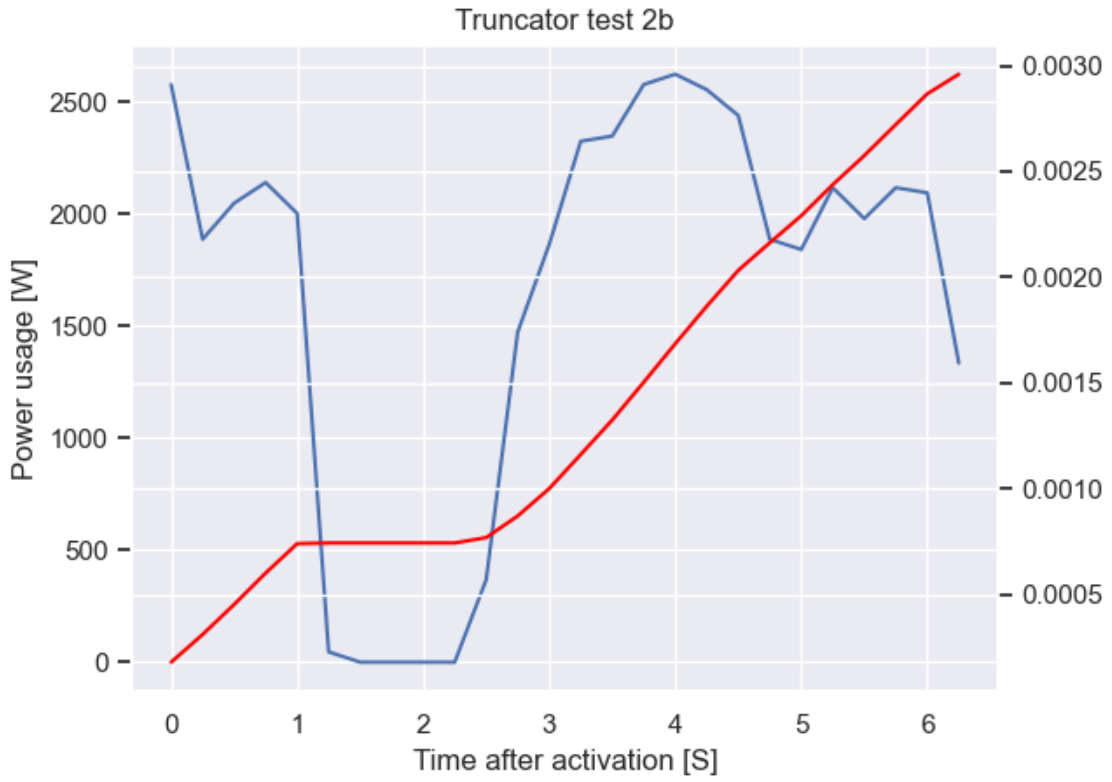

Figure 9

Batch #3 was loaded with the smaller diameter logs as one batch and then the two larger logs were loaded individually. The resulting power curve is shown in Figure 10.

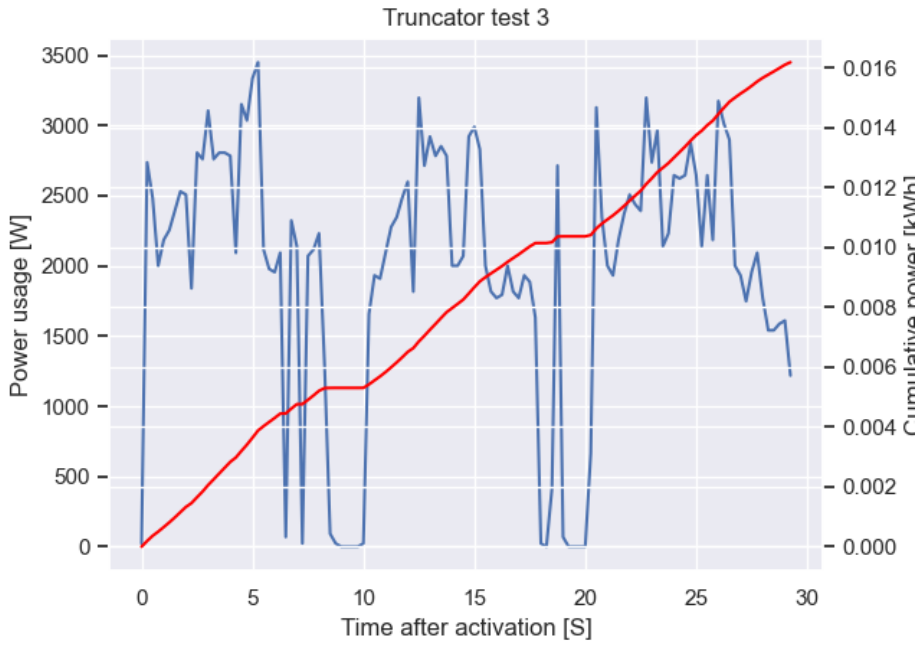

Figure 10

Batch 4 and 5 were loaded individually but recorded in a single log file. This is shown in Figure 11.

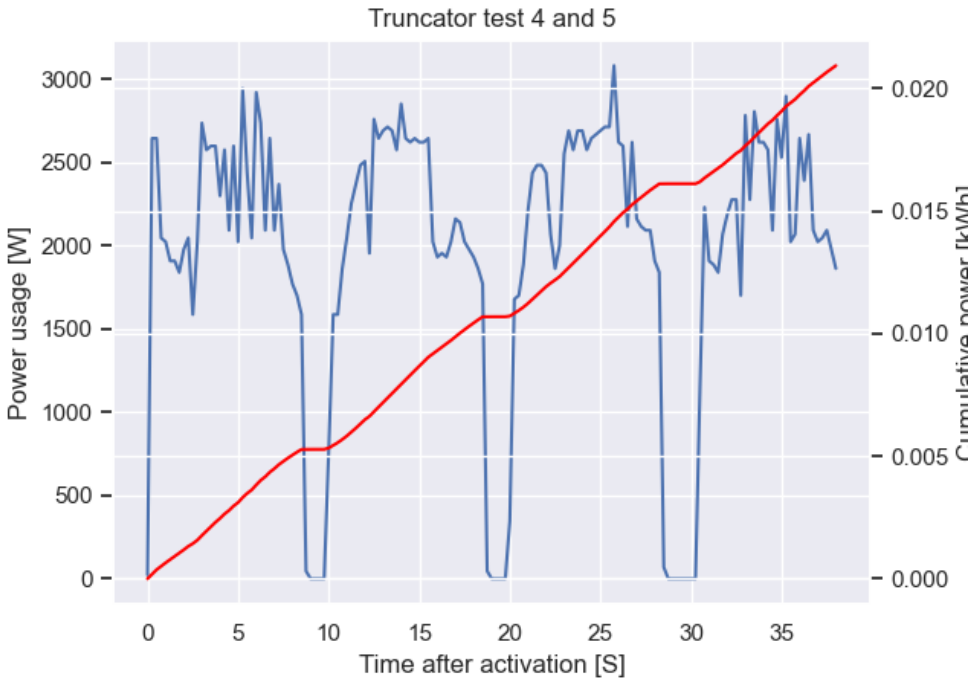

Figure 11

The final Batch of the two shorter large diameter hazel logs were logged in a single file but were too large to fit in together so were cut separately. The results are shown in Figure 12.

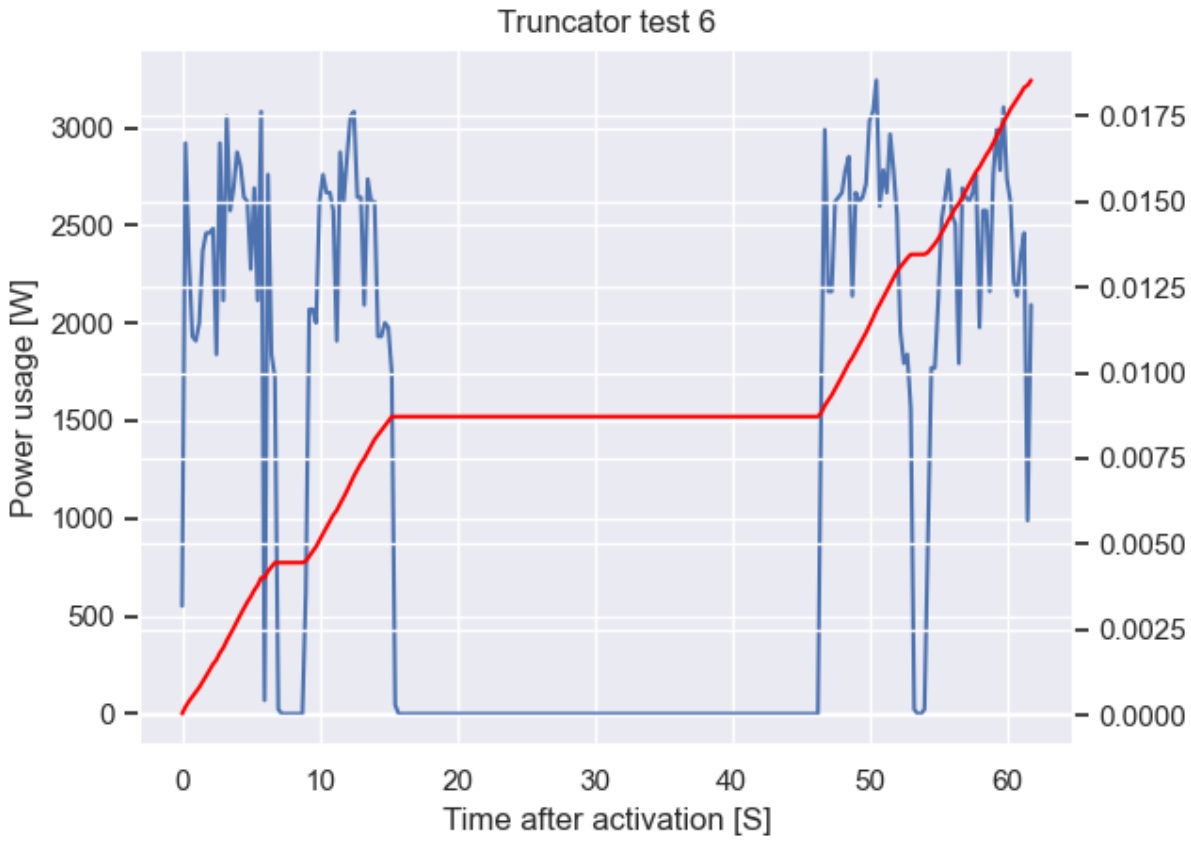

Figure 12

3: Stihl Chainsaw Horse.

Batch 1 was loaded into the saw horse in 2 separate loads as they would not fit in as a single batch. The test was recorded in a single log file. Results shown in Figure 13 .

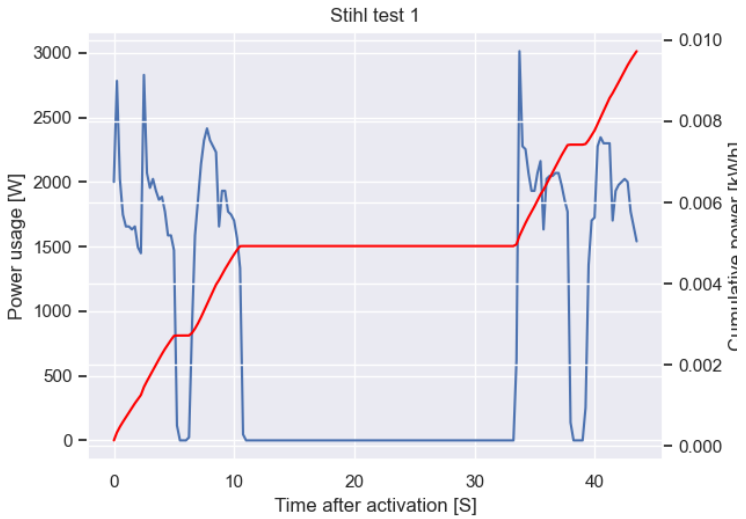

Figure 13

Batch 2 was loaded in 3 separate loads. The results are shown in Figure 14

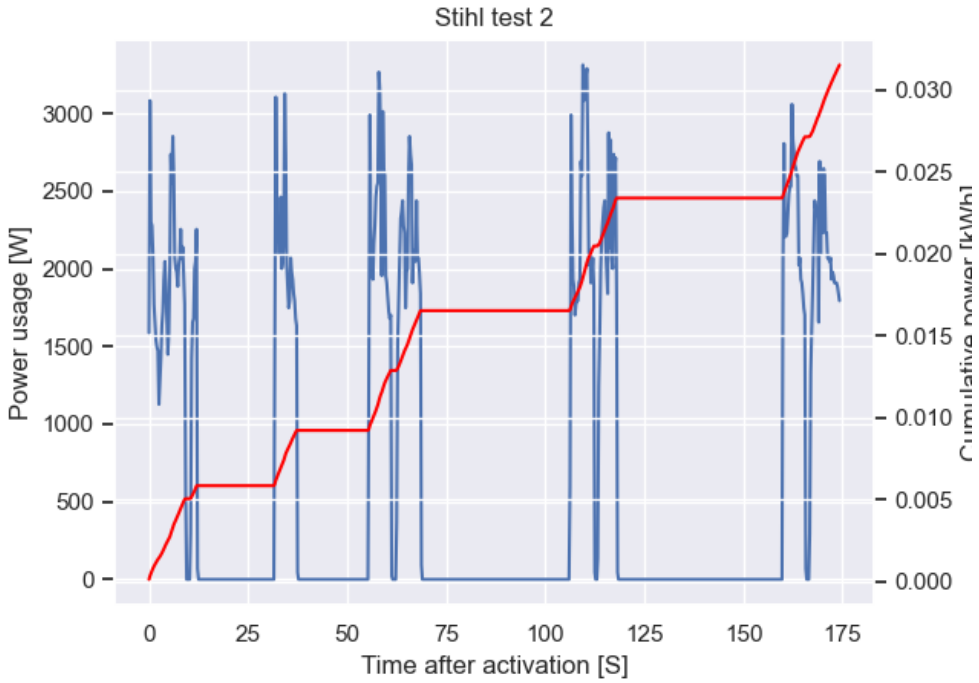

Figure 14

Batch 3 was loaded in separate sets and recorded in 2 separate log files shown in Figure 15 and Figure 16.

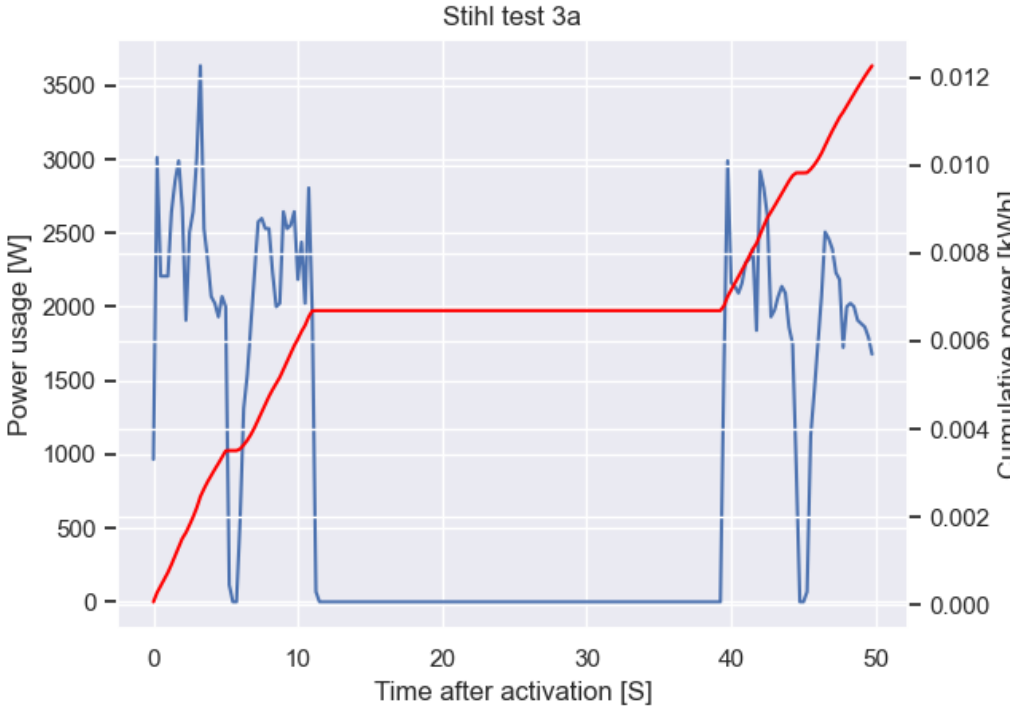

Figure 15

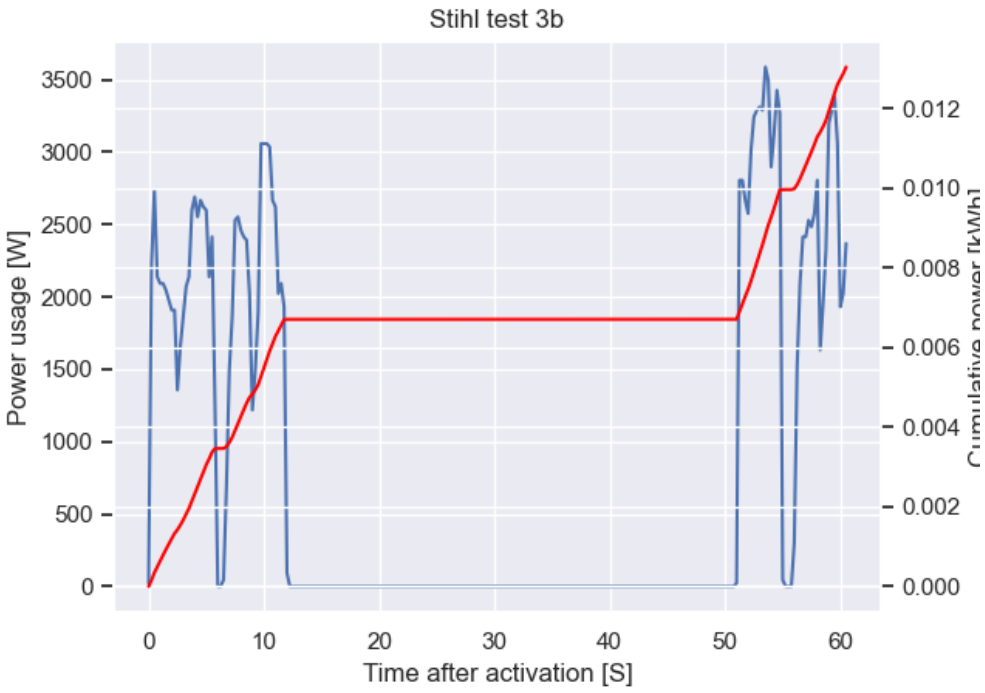

Figure 16

Batch 4 results are shown in Figure 17. The log had to be repositioned which is the reason for the zero current section shown.

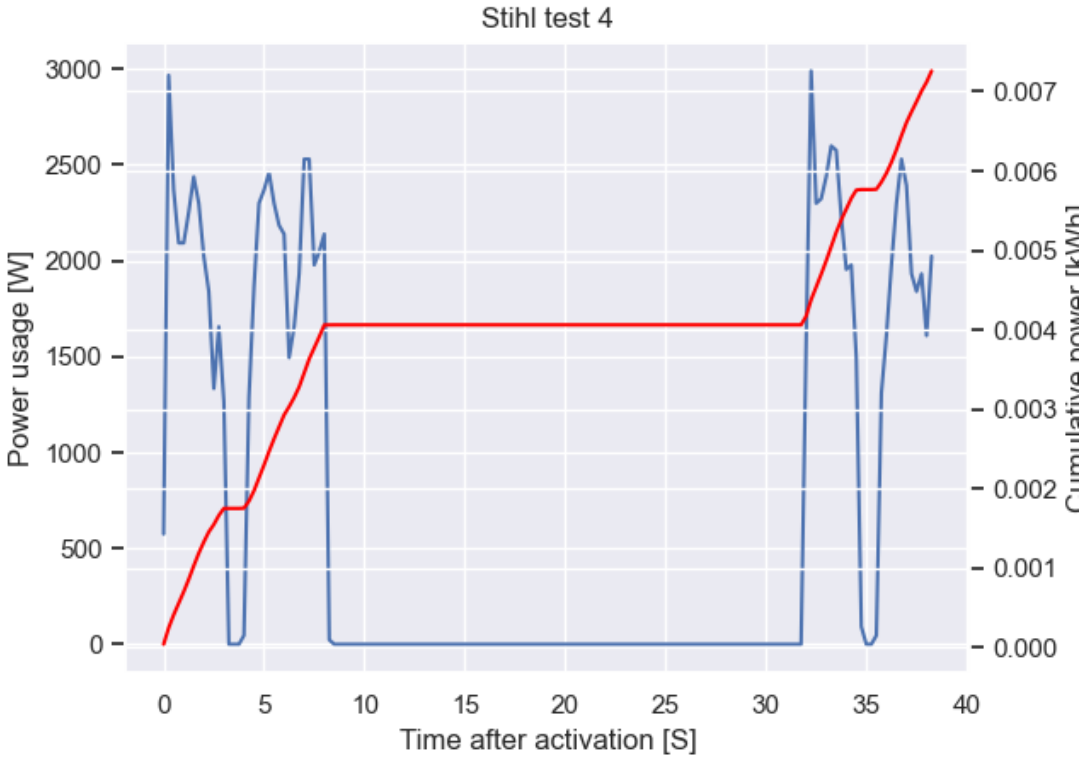

Figure 17

Batch 5 also had to be repositioned as with batch 4. The results shown in Figure 18

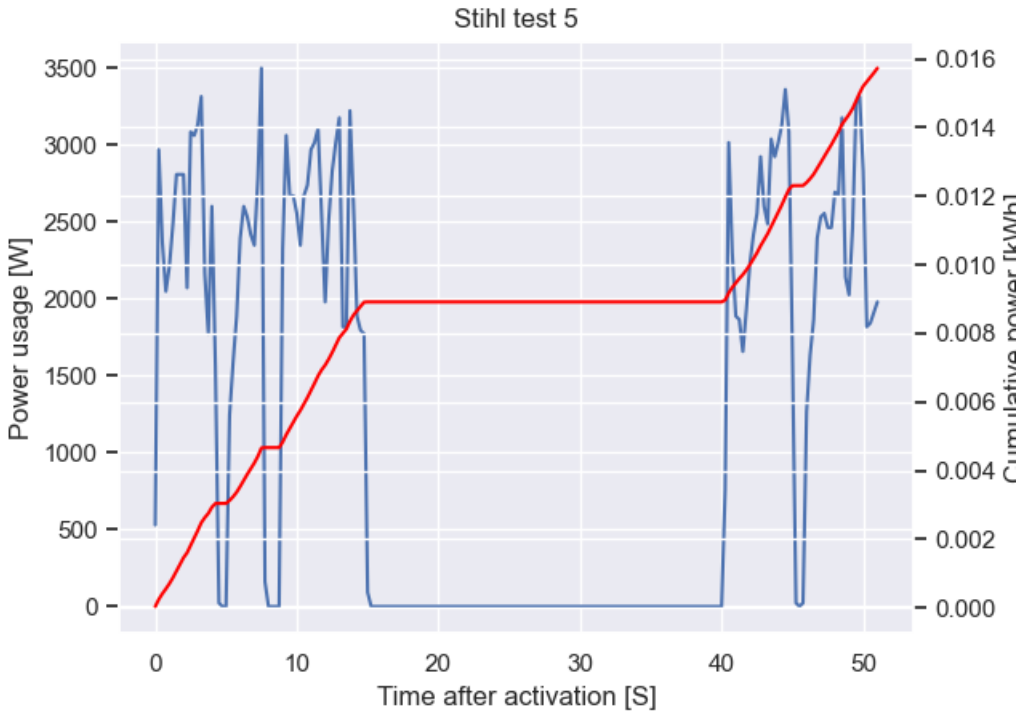

Figure 18

Finally, batch 6 was the same as batches 4 and 5. The results are shown in Figure 19

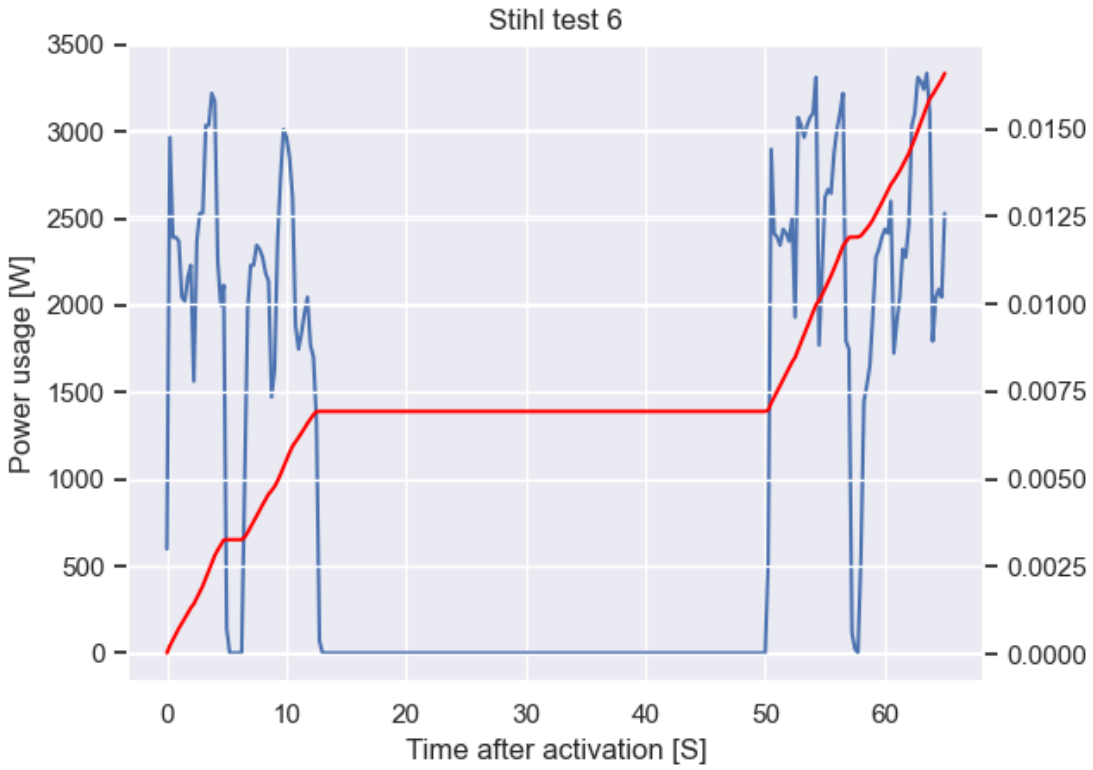

Figure 19

4: Roughneck Loggers Mate.
Batch 1 was done with all the logs in the device. It was a little difficult to get them all to lock into position and they had to be readjusted after each cut. The log file can be seen in Figure 20.

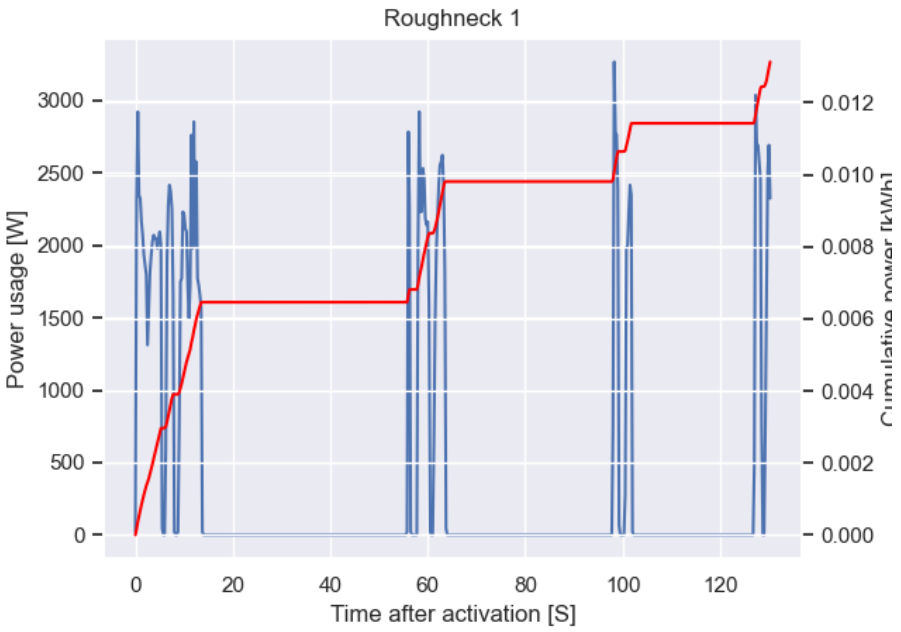

Figure 20

Batch 2 was done with the small diameter logs together and the larger ones separately. As with batch 1, the logs had to be repositioned after each cut. The resulting data is shown in Figure 21.

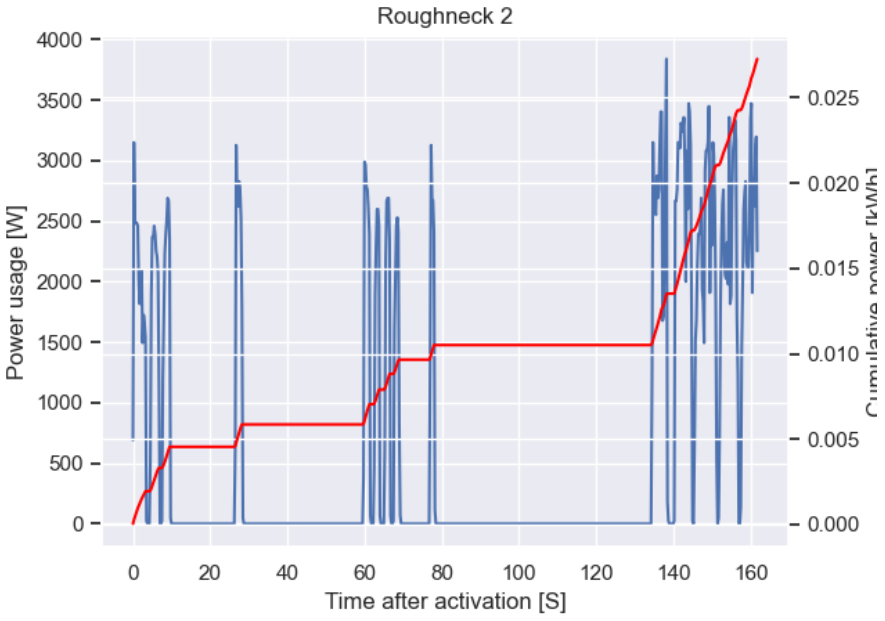

Figure 21

Batch 3 was cut in a similar manner to the first 2. However. The larger logs remained in position to allow more cut without repositioning them. Data is shown in Figure 22.

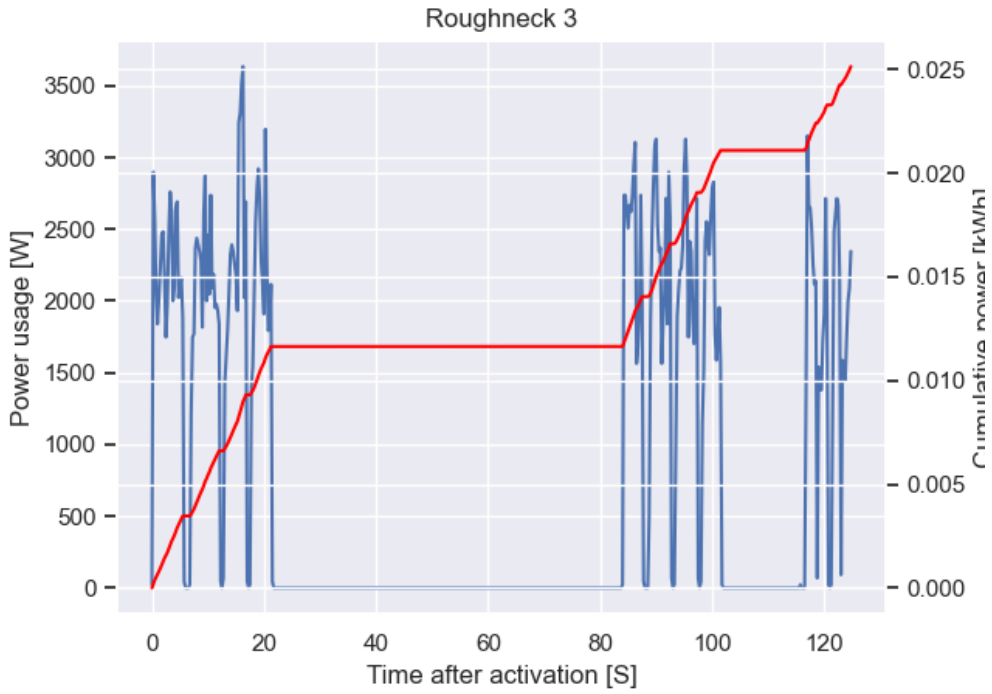

Figure 22

Batch 4 was possible to cut without repositioning the log as the greater weight of the large log held it in place. The resulting data is shown in Figure 23.

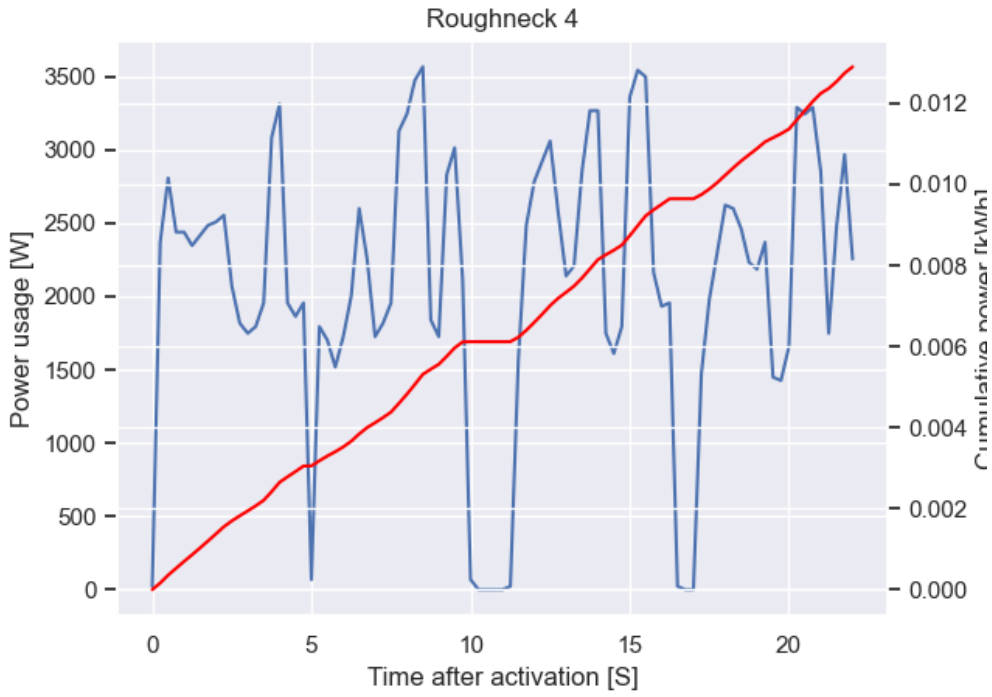

Figure 23

Batch 5 and 6 were conducted in a very similar way. Because the logs were shorter than batch 4, they didn't hold themselves in position as well as the longer, heavier logs and had to be repositioned after the first cut. The resulting data is shown in Figure 24 and Figure 25 respectively.

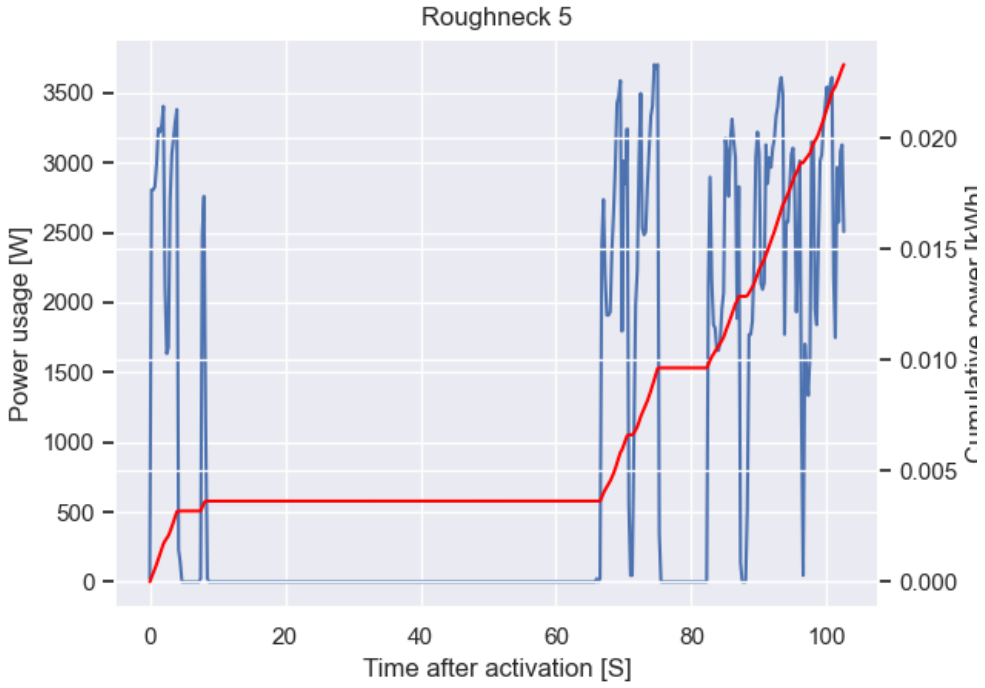

Figure 24

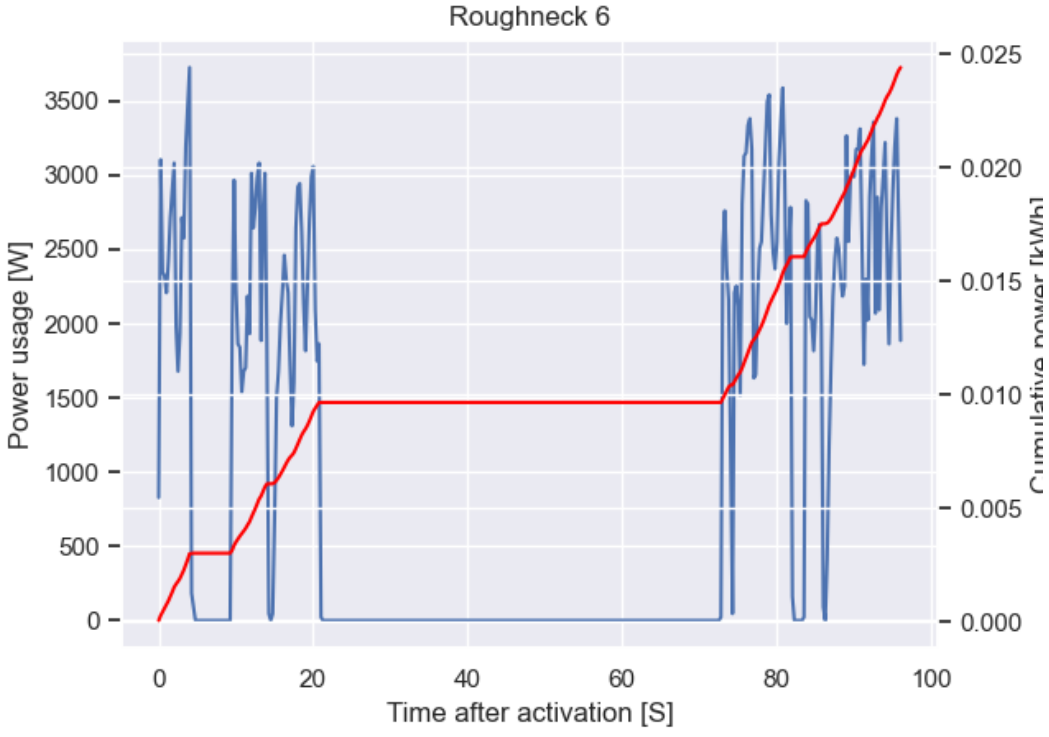

Figure 25

Result Summary of Power Used

The data logger recorded the current drawn over the sampling interval. This was used to calculate the power used in Watts and also total energy used in kWh (kilo watt hours).

The equation used for this was to multiply the power used (simply the current drawn x voltage) by a conversion factor.

T V/3600

Where T is the sampling interval (0.25 sec)

V is the supply voltage (230V)

3600 is the conversion from seconds to hours

This worked out as 1.5972×10^{-5} or 0.000015972

The results can be presented in 2 ways. The first is a batch to batch comparison as shown in Table 1. The values shown are the energy used in kWh. The highlighted values are the lowest value fort each batch.

Device	Batch Number					
	1	2	3	4	5	6
Truncator	0.010696	0.012499	0.016132	0.0104	0.0104	0.01846
Stihl	0.009604	0.03141	0.012172	0.025124	0.015642	0.016474
Roughneck	0.013049	0.027162	0.025053	0.012819	0.024303	0.024303

Table 1

The second way to present the results are in the total energy used for all the batches of logs. This is shown in Table 2.

Device	Total Energy Used (kWh)
Truncator	0.078658
Stihl	0.105423
Roughneck	0.12563

Table 2

As can be seen in Table 1, some batches were more effective using the Stihl horse. However, when the Truncator was more efficient it was to a greater extend and the total energy used for all the logs was considerably less for the Truncator, using approximately 75% of the energy used for the Stihl and 63% of the energy used with the Roughneck.

Time Analysis.

A major cost to any business, and logging is no exception, is labour. Whilst it has been shown that energy usage of the chainsaw is reduced by holding the logs in the Truncator, the log files also show the dwell time during the operation. This includes repositioning the logs while cutting and collecting the logs from the floor after cutting. In the tests done, the cost of the chainsaw during these dwells was zero but should the chainsaw have been petrol powered as most commercial chainsaws are, then this dwell would have used fuel, oil and wear and tear on the clutch.

As such, any time reduction in the none cutting time has a compound effect on cost reduction. The actual costs will obviously vary on many factors that will vary between businesses, but an analysis of this dwell time will give a relative comparison of all the different devices.

The log files were analysed and the time where the chainsaw was not drawing current was summed up. The dwell after the last cut was the time taken to clean the last of the logs on the floor and putting them into the trailer. The times are shown in the following tables.

Truncator

Test	Total Time (s)	Cutting Time	Dwell Time	Clean Up Time
1	55	22.25	32.75	28
2	65	26.25	38.75	19
3	64	20.5	34.5	8
4	36	18.25	17.75	11
5	36	18.25	17.75	11
6	93	32.25	60.75	18
Total	349	137.75	211.25	95

Roughneck

Test	Total Time (s)	Cutting Time	Dwell Time	Clean Up Time
1	157	31	126	21
2	234	53	181	14
3	168	50.5	117.5	9
4	52	22.75	29.25	25
5	136	39.25	96.75	25
6	118	42	76	13
Total	865	238.5	626.5	107

Stihl

Test	Total Time (s)	Cutting Time	Dwell Time	Clean Up Time
1	38	10	28	27
2	84	21	63	27
3	96	23	73	32
4	76	15.25	60.75	7
5	80	27.25	52.75	9
6	94	29	65	5
Total	468	126	342	107

As can be seen in the values above, the Roughneck loggers mate was the most time consuming to use in terms of both cutting time and also dwell time. The cutting time for the Stihl and the Truncator sawhorses was very similar, only 12 seconds difference with the Stihl being the quicker to cut. However, the dwell time that was spent loading, moving and collecting the logs during and after cutting was considerably longer with the Stihl sawhorse. The dwell time for the whole test was 61% for the Truncator compared to the Stihl sawhorse and 34% of the dwell time for the Roughneck.

The overall time for the test on the Truncator was 75% of the test time for the Stihl with all of the time saving being in the log handling side of the operation. The total time take for the Truncator was 40% of the time taken with the Roughneck device.

Conclusion

The energy used by the chainsaw during the test was similar for the Stihl and the Truncator but the Truncator was more energy efficient using approximately 75% of the energy used in the Stihl test.

The largest saving it would appear is the increase in efficiency in handling and manipulating the logs. The Trucator only took 75% of the time taken for the Stihl and the downtime was 61% for the Truncator over the Stihl.

The Roughneck was the most time consuming and energy hungry of the three sawhorses tested.