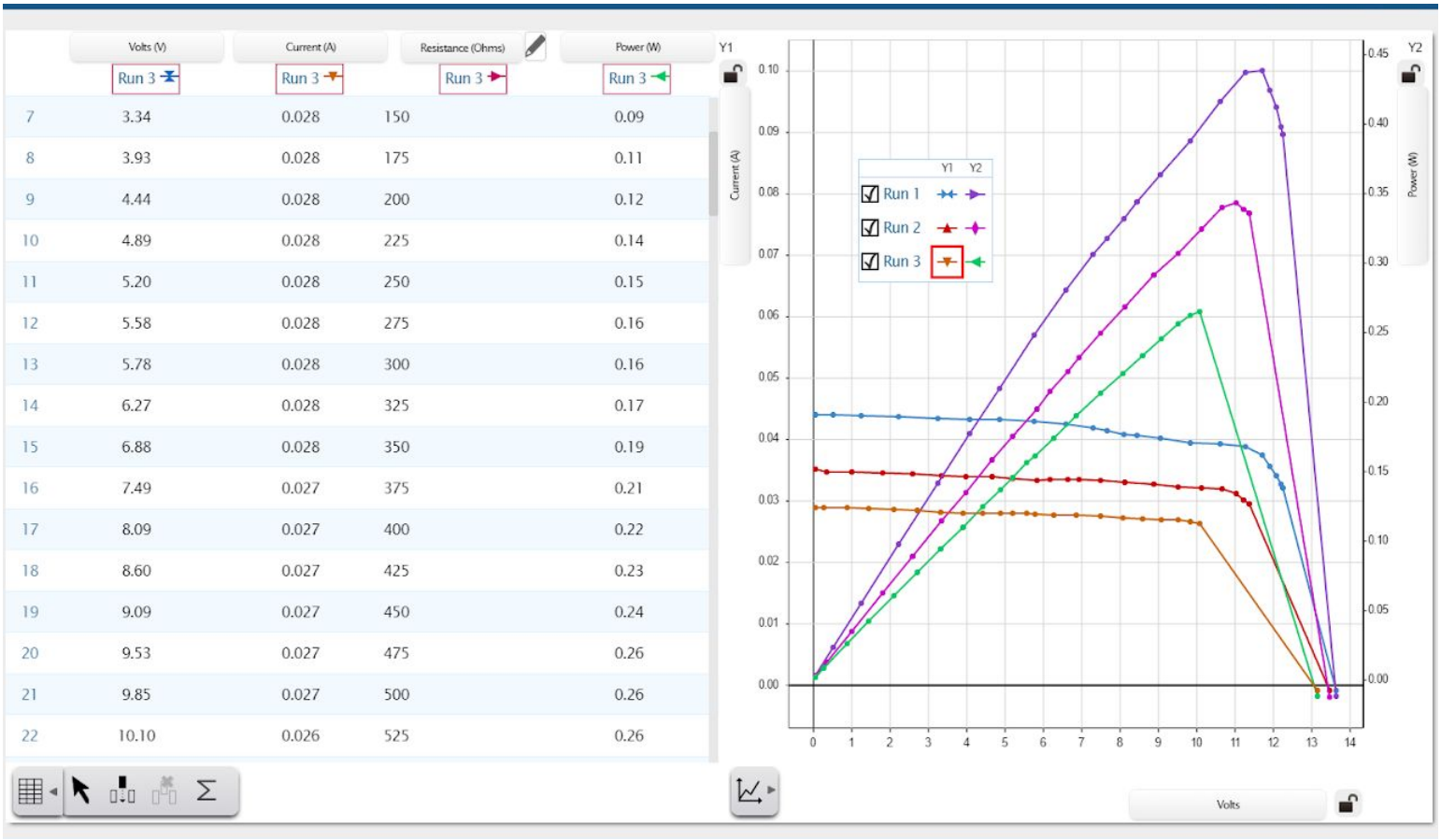
PhotoVoltaic Lab Report

In our labs we have been looking at and identifying the properties of photovoltaic panels, and how they interact in varying situations.

In our first lab we looked at the current/voltage (power) curve of the cells. This was done by placing the cell in series with a variable resistor. By varying the resistance within the circuit we are able to find the point where maximum power is output by the panel. This process was then repeated 3 times at three varying heights, allowing us to observe the difference of power output of a panel as distance increases.

	Volts (V) Run 3	Current (A) Run 3	Resistance (Ohms) Run 3	Power (W) Run 3
7	3.34	0.028	150	0.09
8	3.93	0.028	175	0.11
9	4.44	0.028	200	0.12
10	4.89	0.028	225	0.14
11	5.20	0.028	250	0.15
12	5.58	0.028	275	0.16
13	5.78	0.028	300	0.16
14	6.27	0.028	325	0.17
15	6.88	0.028	350	0.19
16	7.49	0.027	375	0.21
17	8.09	0.027	400	0.22
18	8.60	0.027	425	0.23
19	9.09	0.027	450	0.24
20	9.53	0.027	475	0.26
21	9.85	0.027	500	0.26
22	10.10	0.026	525	0.26



What we can observe from these curves is that as you increase the resistance within the circuit, the current remains almost static, up to a point. When that point is reached the current decreases rapidly, approaching the point where the resistance is near infinite and the current is zero.

Next we looked at the relationship between the angle of incidence of light to the panel, and the power output of the panel. The panel was set up in series with a resistance of 275 Ohms, this remained static so that the only variable within the test was the angle of the light source to the panel. The light source was then placed 30 cm away from the panel, and beginning at an angle of incidence of 0º, measurements were taken every 10º till 90º.

	Volts (V) Run 1	Current (A) Run 1	Angle (Degrees) Run 1	Power (W) Run 1
1	0.94	0.003	0.00	0.00
2	1.61	0.007	10.00	0.01
3	2.41	0.011	20.00	0.03
4	2.61	0.012	30.00	0.03
5	2.83	0.013	40.00	0.04
6	3.26	0.015	50.00	0.05
7	3.91	0.019	60.00	0.07
8	3.97	0.019	70.00	0.08
9	4.20	0.020	80.00	0.08
10	5.26	0.026	90.00	0.13
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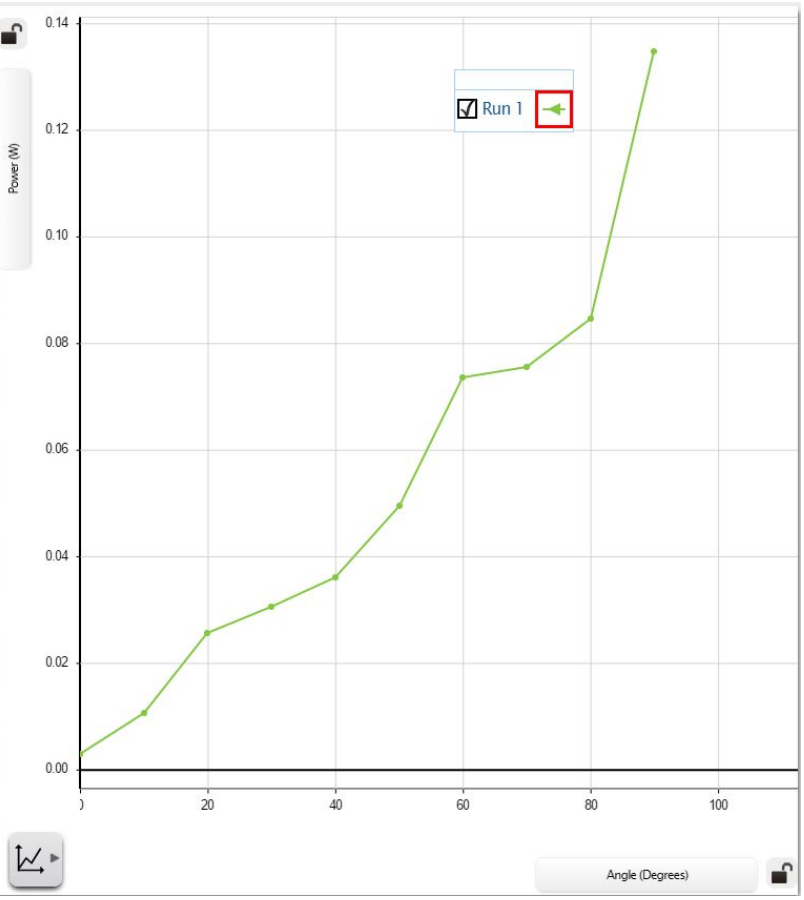
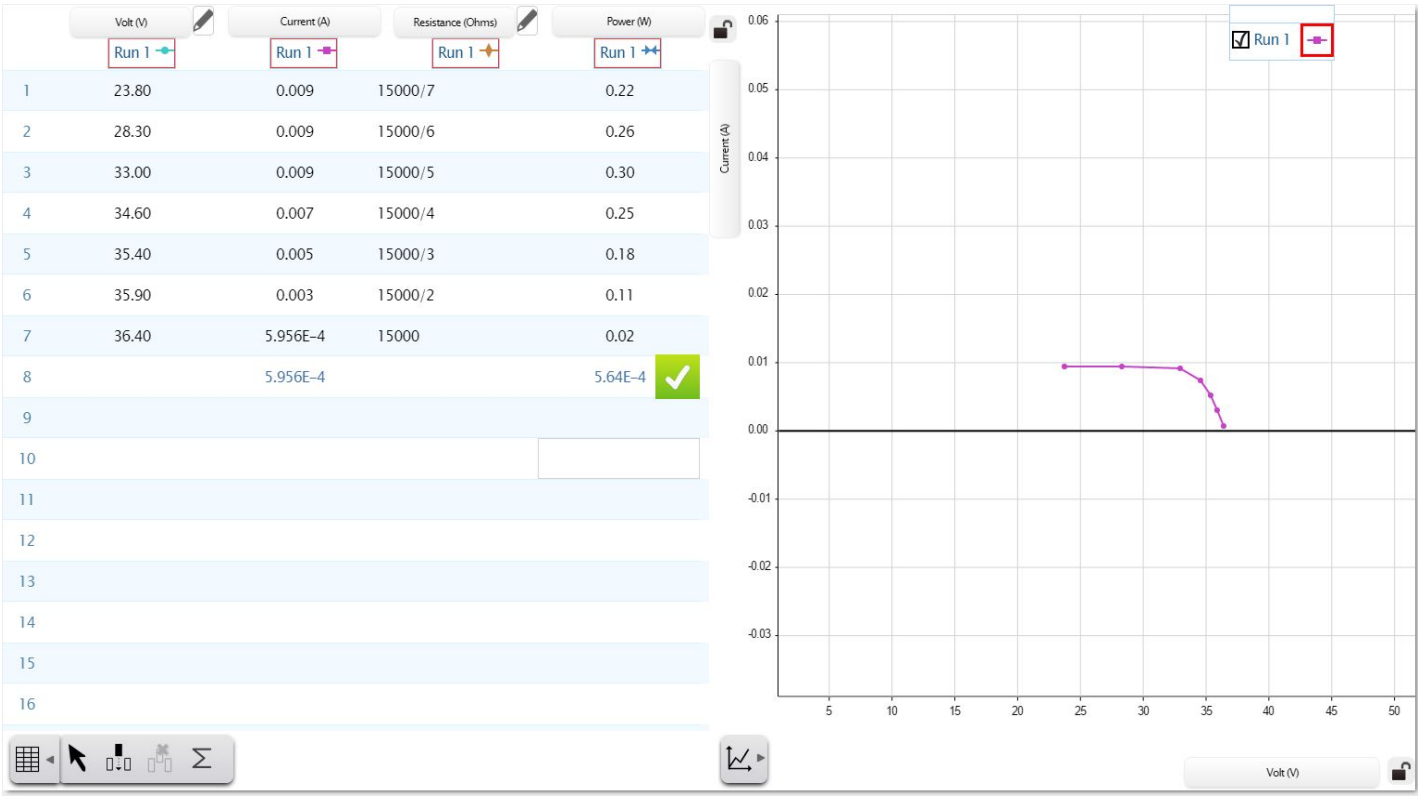


We observe that as the angle of incidence of the light source to the panel increases there is an increase in the total power output of the panel. Our results are inconclusive as to the shape of this curve however, and more accurate and more often readings would need to be taken in order to define the relationship between the angle and the power.

We then took two panels and placed them in series in order to observe how the total power output would be affected.



	Volt (V) Run 1	Current (A) Run 1	Resistance (Ohms) Run 1	Power (W) Run 1
1	23.80	0.009	15000/7	0.22
2	28.30	0.009	15000/6	0.26
3	33.00	0.009	15000/5	0.30
4	34.60	0.007	15000/4	0.25
5	35.40	0.005	15000/3	0.18
6	35.90	0.003	15000/2	0.11
7	36.40	5.956E-4	15000	0.02
8		5.956E-4		5.64E-4
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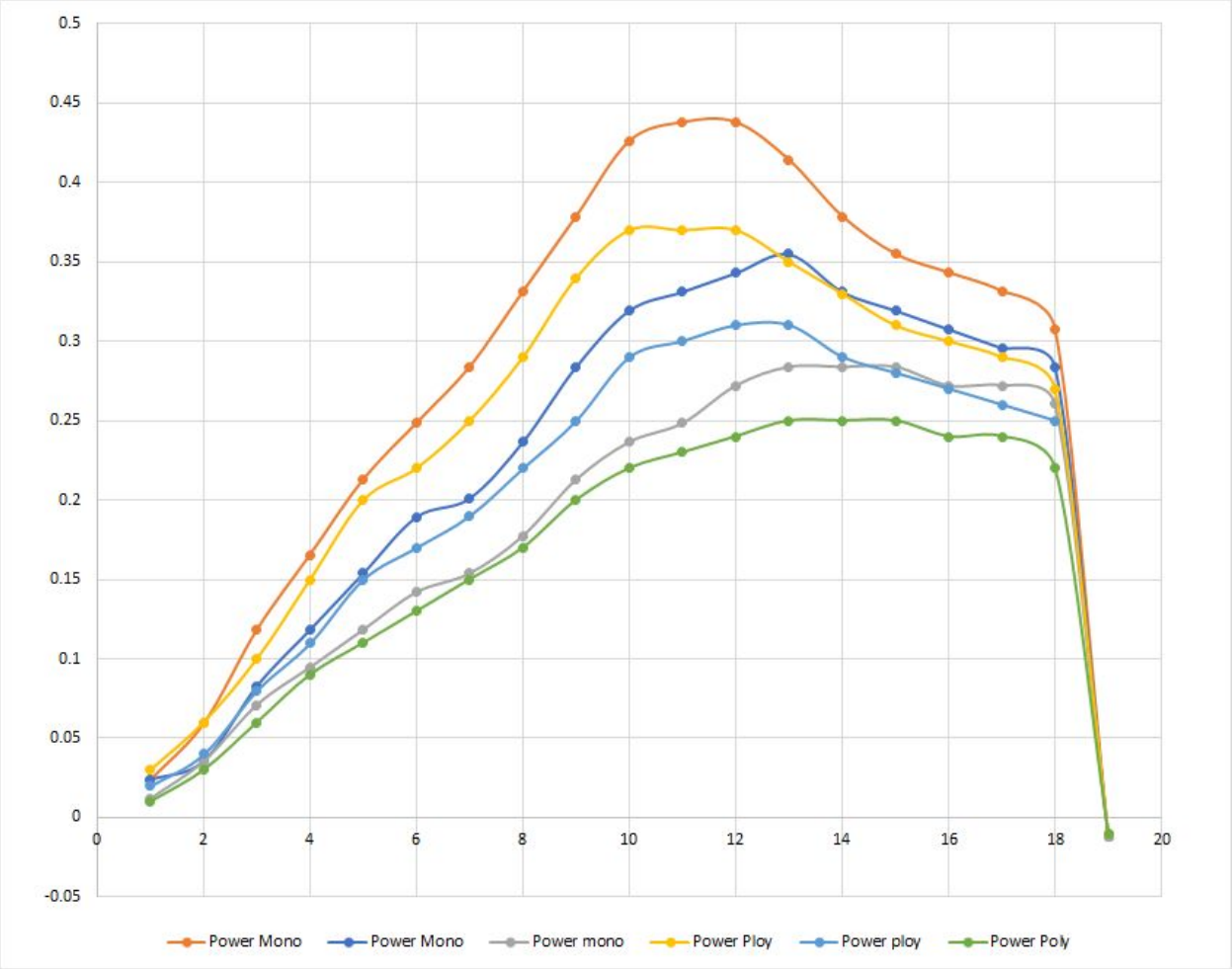
We observed that in series, the panels experience the the same current vs voltage curve as a single panel, but the total output of the panel is now much greater, and the voltage is greater. We can see that the total resistance within the circuit required to incur a voltage drop is now much greater than the two panels combined. This would infer that this resistance is not additive when placing panels in series, and rather seems to multiplicative.

In lab three we compared the characteristics of Mono and Polycrystalline panels, and evaluated their uses in different situations. We did the same current/voltage measurements that we performed in lab one it get three power curves for each panel, each one at a different distance.



In order to get consistent results, the power values of the monocrystalline panels was multiplied by 1.183. This is because the areas of the two panels we were testing was not the same, so in order to compensate for this we have calculates the difference in area and multiplied by it.

From this graph we can see that consistently, the monocrystalline panels are more efficient than the poly. This matches what we would expect from the panels as the mono panels are made from a more refined silicone and are more expensive.

Financial Analysis of Mono vs Poly panels

monocrystalline solar panel		
wattage	price	price per watt
250	460	1.84
300	430	1.433333333
300	380	1.266666667
350	365	1.042857143
300	350	1.166666667
290	350	1.206896552
Total average watt/$	1.32607	

Poly crystalline solar panel		
wattage	price	price per watt
270	280	1.037037037
260	380	1.461538462
200	405	2.025
315	350	1.111111111
265	265	1
200	300	1.5
Total average watt/$	1.355781	

- we are installing 3kWs worth of PV on a rooftop and calculate the price of each technology

  Price for monocrystalline = 3000/1.326= $2262

  Price for Polycrystalline = 3000/1.355= $2214

From this we can see that yes, poly panels are more cost effective, supplying a higher total average watt/$. However they do have the cons of not being able to supply the same power output for area as the mono panels.

Because of this, I would recommend that Polycrystalline panels be used in any situation where price rather than efficiency and total area is the controlling factor in purchase, perhaps a small home system to help support a family's power usage.

However, if it is important to be able to most efficiently make use of all of the available space, monocrystalline panels are by far the superior option.