

Data Analysis Sample

In this data analysis sample, I use excel to determine the efficiency of both the electrolyzer and fuel cell within a hydrogen energy system. This lab demonstrated some of the shortcomings of hydrogen energy technology mainly its inefficiencies. Unfortunately, the fuel cell failed within its second run leaving my lab partners and I unable to gather data on a third run. From the data we gathered from running the apparatus, I found that the entire energy system was only effectively using 1.14% of electrical energy input. This technology has a long way to go but it is still intriguing to explore it in action.

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Input Parameters	
Temperature (C)	296.35
Pressure (atm)	1
Gas Constant R	0.0821
Energy of H ₂ (kJ/mol)	273

Final Efficiencies (%)	
Run 1	12.84
Run 2	11.61
Run 3	12.02
Average	12.16

Run 1 Data			
Time (S)	H ₂ volume (mL)	Voltage V	Current (A)
0	0		
30	1	12.00	0.54
60	2	12.00	0.56
90	9	11.99	0.57
120	10	11.99	0.6
150	12	11.98	0.61
180	15	11.98	0.62
210	19	11.98	0.63
240	21	11.97	0.65
270	23	11.97	0.66
300	25	11.97	0.67

Run 1 Calculations
Power (W)
6.48
6.72
6.83
7.19
7.31
7.43
7.55
7.78
7.90
8.02

Run 2 Data			
Time (S)	H ₂ volume (mL)	Voltage V	Current (A)
0	0		
30	29	11.97	0.66
60	32	11.96	0.67
90	33	11.96	0.68
120	37	11.96	0.69
150	39	11.95	0.70
180	41	11.95	0.71
210	44	11.95	0.72
240	46	11.95	0.73
270	49	11.95	0.74
300	51	11.95	0.75

Run 1 Calculations
Power (W)
7.90
8.01
8.13
8.25
8.37
8.48
8.60
8.72
8.84
8.96

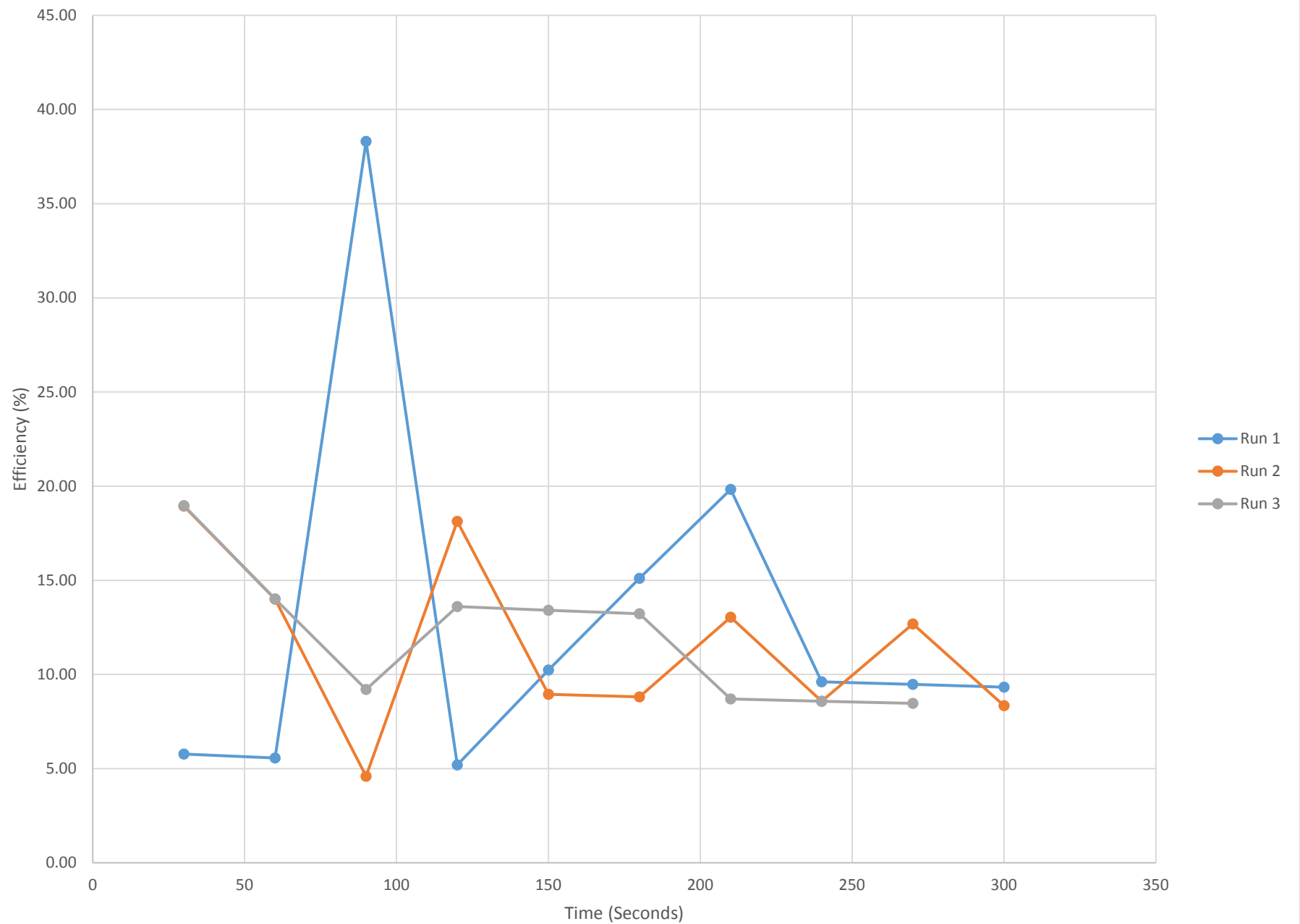
Run 2 Data			
Time (S)	H ₂ volume (ml)	Voltage V	Current (A)
0	0		
30	55	11.95	0.66
60	58	11.95	0.67
90	60	11.95	0.68
120	63	11.95	0.69
150	66	11.95	0.70
180	69	11.95	0.71
210	71	11.94	0.72
240	73	11.94	0.73
270	75	11.94	0.74

Run 1 Calculations	
Power (W)	
	7.89
	8.01
	8.13
	8.25
	8.37
	8.48
	8.60
	8.72
	8.84

Electrical Energy in (J)	Mols H ₂	Chemical Energy Out (KJ)	Efficiency (%)
	#VALUE!		
194.40	0.041	0.0112	5.77
201.60	0.041	0.0112	5.57
205.03	0.288	0.0785	38.31
215.82	0.041	0.0112	5.20
219.23	0.082	0.0224	10.24
222.83	0.123	0.0337	15.11
226.42	0.164	0.0449	19.82
233.42	0.082	0.0224	9.61
237.01	0.082	0.0224	9.47
240.60	0.082	0.0224	9.33

Electrical Energy in (j)	Mols H ₂	Chemical Energy Out (Kj)	Efficiency (%)
	#VALUE!		
237.01	0.164	0.0449	18.94
240.40	0.123	0.0337	14.00
243.98	0.041	0.0112	4.60
247.57	0.164	0.0449	18.13
250.95	0.082	0.0224	8.94
254.54	0.082	0.0224	8.82
258.12	0.123	0.0337	13.04
261.71	0.082	0.0224	8.57
265.29	0.123	0.0337	12.69
268.88	0.082	0.0224	8.35

Electrical Energy in (j)	Mols H ₂	Chemical Energy Out (Kj)	Efficiency (%)
	#VALUE!		
236.61	0.1644038	0.0449	18.97
240.20	0.1233029	0.0337	14.01
243.78	0.0822019	0.0224	9.21
247.37	0.1233029	0.0337	13.61
250.95	0.1233029	0.0337	13.41
254.54	0.1233029	0.0337	13.22
257.90	0.0822019	0.0224	8.70
261.49	0.0822019	0.0224	8.58
265.07	0.0822019	0.0224	8.47



Input Parameters	
Temperature (C)	296.35
Pressure (atm)	1
Gas Constant R	0.0821
Energy of H ₂ (kJ/mol)	273

Final Efficiencies (%)	
Run 1	26.60
Run 2	27.50
Average	27.05

Run 1 Data			
Time (S)	H ₂ volume (mL)	Voltage V	Current (A)
0			
30	70	0.546	0.22
60	68	0.538	0.23
90	67	0.522	0.22
120	66	0.528	0.22
150	65.5	0.526	0.22
180	65	0.502	0.21
210	64	0.517	0.15
240	63	0.514	0.08
270	58	0.524	0.24
300	57	0.522	0.23
330	56	0.517	0.23
360	55	0.514	0.23
390	54	0.505	0.23
410	52.5	0.252	0.21
440	52	0.252	0.12
470	46	0.545	0.2

Run 1 Calculations	
Power (W)	
	0.12
	0.12
	0.11
	0.12
	0.12
	0.11
	0.08
	0.04
	0.13
	0.12
	0.12
	0.12
	0.12
	0.05
	0.03
	0.11

Run 2 Data			
Time (S)	H ₂ volume (mL)	Voltage V	Current (A)
0			
30	41	0.532	0.2
60	40.5	0.529	0.2
90	40	0.519	0.2
120	38.5	0.511	0.2
150	38	0.508	0.2
180	36	0.490	0.19
210	34	0.345	0.13
240	33	0.468	0.2
270	32	0.450	0.19
300	31	0.436	0.18
330	30.5	0.412	0.18
360	30	0.386	0.16

Run 1 Calculations	
Power (W)	
	0.11
	0.11
	0.10
	0.10
	0.10
	0.09
	0.04
	0.09
	0.09
	0.08
	0.07
	0.06

390	29	0.345	0.15
410	28	0.433	0.19

0.05
0.08

Chemical Energy In (KJ)	Mols H ₂	Electrical Energy Out (J)	Efficiency (%)
0.022	0.082	3.6036	16.06
0.011	0.041	3.7122	33.08
0.011	0.041	3.4452	30.70
0.006	0.021	3.4848	62.11
0.006	0.021	3.4716	61.88
0.011	0.041	3.1626	28.19
0.011	0.041	2.3265	20.73
0.056	0.206	1.2336	2.20
0.011	0.041	3.7728	33.62
0.011	0.041	3.6018	32.10
0.011	0.041	3.5673	31.79
0.011	0.041	3.5466	31.61
0.017	0.062	3.4845	20.70
0.006	0.021	1.0584	18.87
0.067	0.247	0.9072	1.35
0.516	1.891	3.2700	0.63

Chemical Energy In (KJ)	Mols H ₂	Electrical Energy Out (J)	Efficiency (%)
0.006	0.021	3.1920	56.90
0.006	0.021	3.1740	56.57
0.017	0.062	3.1140	18.50
0.006	0.021	3.0660	54.65
0.022	0.082	3.0480	13.58
0.022	0.082	2.7930	12.45
0.011	0.041	1.3455	11.99
0.011	0.041	2.8080	25.03
0.011	0.041	2.5650	22.86
0.006	0.021	2.3544	41.97
0.006	0.021	2.2248	39.66
0.011	0.041	1.8528	16.51

0.011	0.041	1.5525	13.84
0.314	1.151	1.6454	0.52

