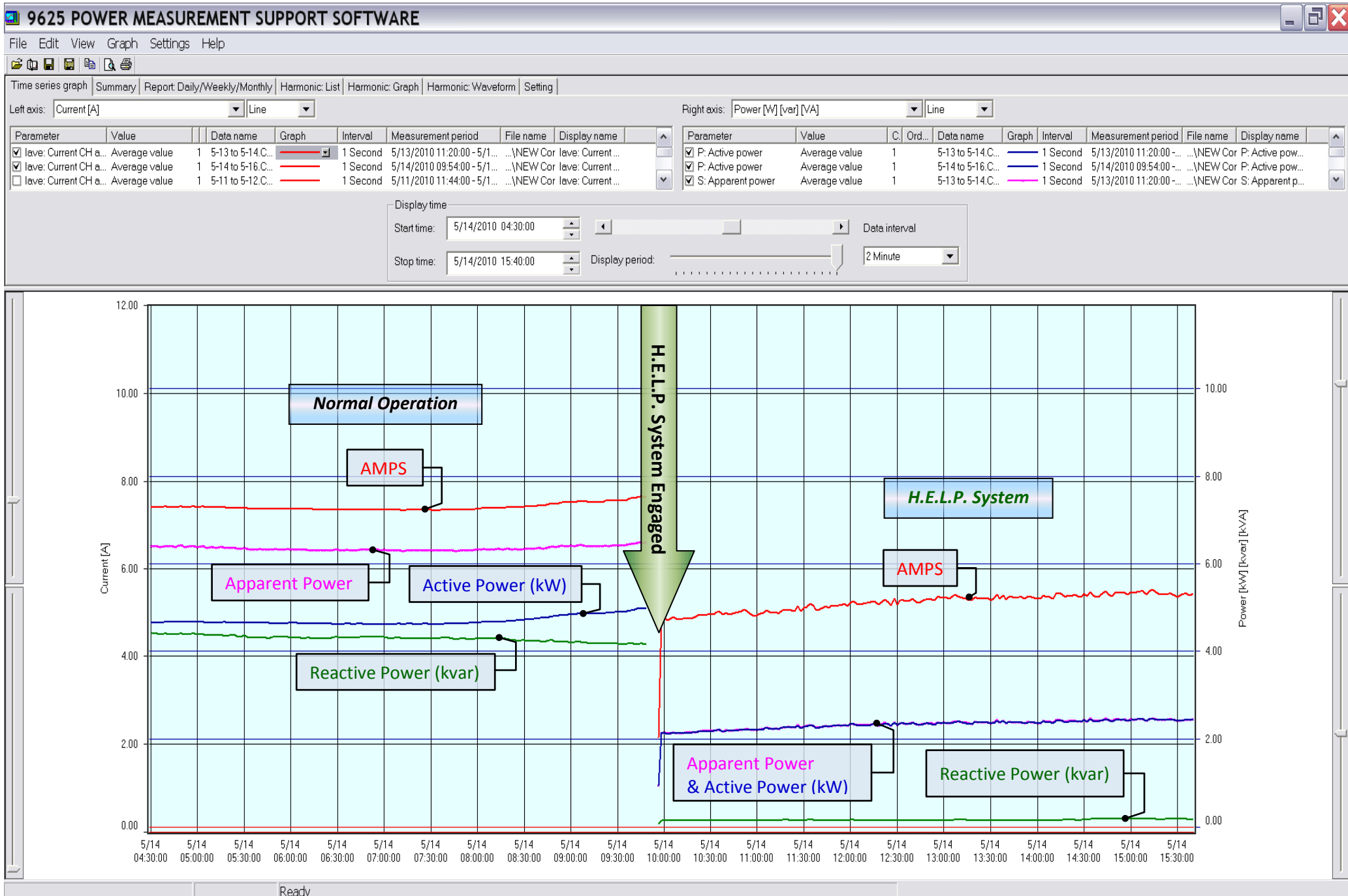


# HVAC Energy Savings Test Comparison by: *The Technology Consortium, Ltd.*



**Figure 1: HVAC Energy Comparison Test Chart**

Parameter	Value	Data name	Graph	Interval	Measurement period	File name	Display name
<input checked="" type="checkbox"/> Iave: Current CH a...	Average value	1 5-13 to 5-14.C...	—	1 Second	5/13/2010 11:20:00 - 5/1...	...\\NEW Cor	Iave: Current...
<input checked="" type="checkbox"/> Iave: Current CH a...	Average value	1 5-14 to 5-16.C...	—	1 Second	5/14/2010 09:54:00 - 5/1...	...\\NEW Cor	Iave: Current...
<input type="checkbox"/> Iave: Current CH a...	Average value	1 5-11 to 5-12.C...	—	1 Second	5/11/2010 11:44:00 - 5/1...	...\\NEW Cor	Iave: Current...

Parameter	Value	C. Ord...	Data name	Graph	Interval	Measurement period	File name	Display name
<input checked="" type="checkbox"/> P: Active power	Average value	1	5-14 to 5-16.C...	—	1 Second	5/14/2010 09:54:00 - ...	...\\NEW Cor	P: Active pow...
<input checked="" type="checkbox"/> S: Apparent power	Average value	1	5-13 to 5-14.C...	—	1 Second	5/13/2010 11:20:00 - ...	...\\NEW Cor	S: Apparent p...
<input checked="" type="checkbox"/> Q: Reactive power	Average value	1	5-13 to 5-14.C...	—	1 Second	5/13/2010 11:20:00 - ...	...\\NEW Cor	Q: Reactive p...

Display time

Start time: 5/14/2010 04:30:00 Data interval

Stop time: 5/14/2010 09:40:00 Display period: 2 Minute

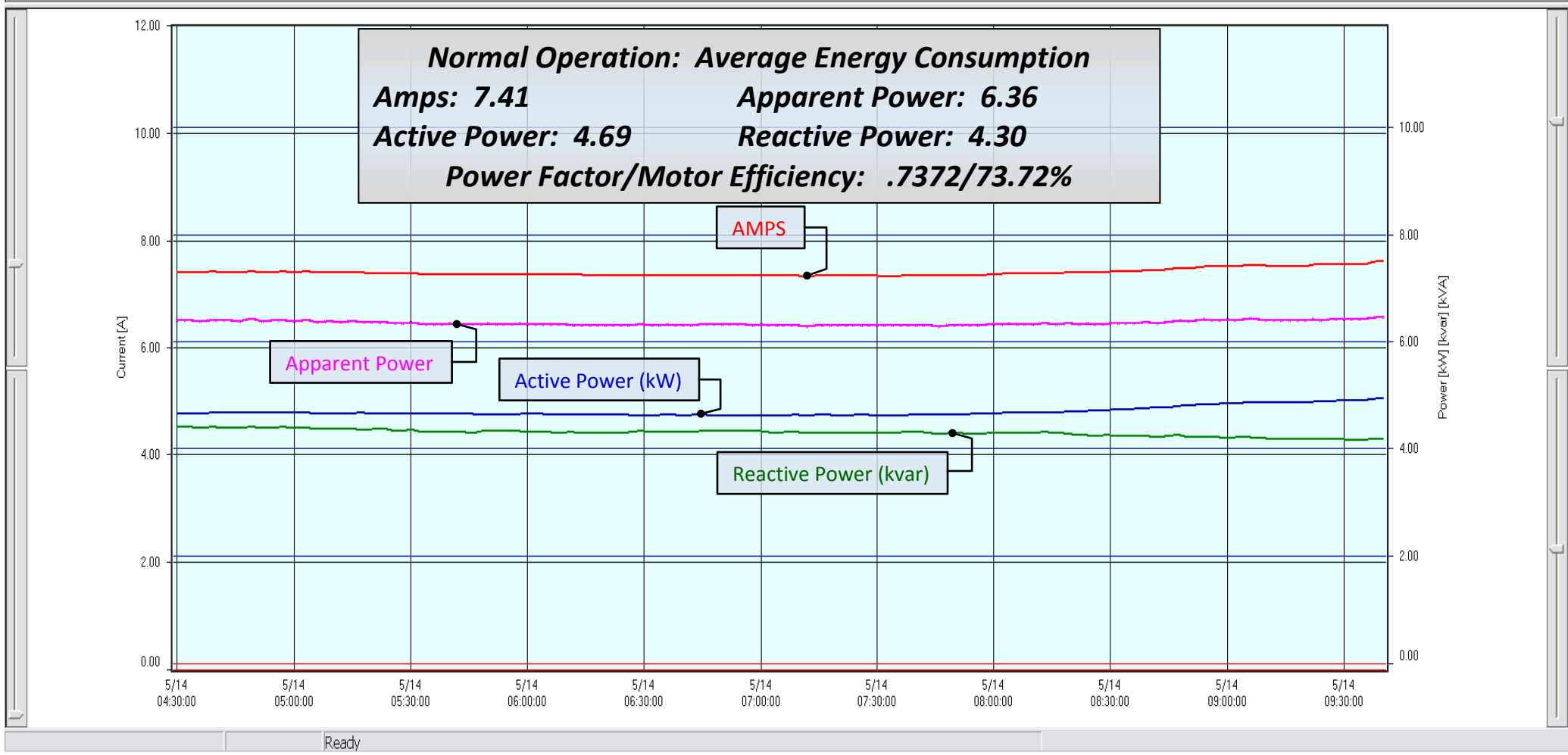


Figure 2: Normal HVAC Operation

Parameter	Value	Circuit	Order	Data name	Interval	Measurement period	File name	Display name	Graph
<input checked="" type="checkbox"/> Uave: Voltage CH average	Average value			5-13 to 5-14.CSV	1 Second	5/13/2010 11:20:00 - 5/14/2010 09:49:36	I:\The Technology Consortiu...NEW Comparison-2.dat	Uave: Voltage CH average Average value , 5-13 to 5-14.CSV[V]	
<input checked="" type="checkbox"/> Iave: Current CH average	Average value	1		5-13 to 5-14.CSV	1 Second	5/13/2010 11:20:00 - 5/14/2010 09:49:36	I:\The Technology Consortiu...NEW Comparison-2.dat	Iave: Current CH average Average value Circuit 1 , 5-13 to 5-14.CSV[A]	
<input checked="" type="checkbox"/> P: Active power	Average value	1		5-13 to 5-14.CSV	1 Second	5/13/2010 11:20:00 - 5/14/2010 09:49:36	I:\The Technology Consortiu...NEW Comparison-2.dat	P: Active power Average value Circuit 1 , 5-13 to 5-14.CSV[kW]	
<input checked="" type="checkbox"/> Q: Reactive power	Average value	1		5-13 to 5-14.CSV	1 Second	5/13/2010 11:20:00 - 5/14/2010 09:49:36	I:\The Technology Consortiu...NEW Comparison-2.dat	Q: Reactive power Average value Circuit 1 , 5-13 to 5-14.CSV[kvar]	

Display time

Start time: 5/14/2010 04:30:00 Data interval: 2 Minute

Stop time: 5/14/2010 09:40:00 Display period: [Timeline]

Date	Time	Uave: Voltage CH average Average value , 5-13 to 5-14.CSV[V]	Iave: Current CH average Average value Circuit 1 , 5-13 to 5-14.CSV[A]	P: Active power Average value Circuit 1 , 5-13 to 5-14.CSV[kW]	Q: Reactive power Average value Circuit 1 , 5-13 to 5-14.CSV[kvar]	PF: Power factor Average value Circuit 1 , 5-13 to 5-14.CSV	S: Apparent power Average value Circuit 1 , 5-13 to 5-14.CSV[kVA]	F: Frequency Average value , 5-13 to 5-14.CSV[Hz]	Voltage unbalance factor Average value , 5-13 to 5-14.CSV[%]	PF_DEM: Demand power factor Circuit 1 , 5-13 to 5-14.CSV	S: Apparent power Average value Circuit 1 , 5-13 to 5-14.CSV[kVA]	U1: Voltage CH1 Average value , 5-13 to 5-14.CSV[V]
Average value in the period		286.14	7.408	4.685	4.292	0.7372	6.355	59.998	0.24	0.7373	6.355	285.76
Maximum value in the period		288.28	7.614	4.940	4.404	0.7643	6.463	60.031	0.32	0.7643	6.463	288.04
Time of maximum value		5/14/2010 04:56:00	5/14/2010 09:40:00	5/14/2010 09:40:00	5/14/2010 04:32:00	5/14/2010 09:40:00	5/14/2010 09:40:00	5/14/2010 06:38:00	5/14/2010 08:12:00	5/14/2010 09:40:00	5/14/2010 09:40:00	5/14/2010 04:56:00
Minimum value in the period		283.13	7.336	4.609	4.159	0.7264	6.298	59.956	0.12	0.7264	6.298	282.60
Time of minimum value		5/14/2010 09:40:00	5/14/2010 07:12:00	5/14/2010 07:02:00	5/14/2010 09:32:00	5/14/2010 04:30:00	5/14/2010 07:12:00	5/14/2010 05:00:00	5/14/2010 05:44:00	5/14/2010 04:30:00	5/14/2010 07:12:00	5/14/2010 09:32:00
5/14/2010	04:30:00	288.14	7.409	4.649	4.399	0.7264	6.401	59.982	0.24	0.7264	6.401	287.82
	04:32:00	288.19	7.424	4.663	4.404	0.7270	6.414	59.972	0.21	0.7270	6.414	287.95
	04:34:00	288.03	7.413	4.654	4.394	0.7271	6.401	59.974	0.20	0.7271	6.401	287.79
	04:36:00	287.87	7.407	4.654	4.382	0.7280	6.393	59.990	0.24	0.7280	6.393	287.56
	04:38:00	288.07	7.421	4.664	4.395	0.7277	6.408	59.985	0.22	0.7277	6.408	287.80
	04:40:00	288.20	7.420	4.659	4.404	0.7267	6.411	59.975	0.22	0.7267	6.411	287.97
	04:42:00	287.95	7.416	4.663	4.386	0.7284	6.402	60.000	0.17	0.7285	6.402	287.78
	04:44:00	287.84	7.416	4.665	4.381	0.7290	6.400	59.998	0.22	0.7290	6.400	287.57
	04:46:00	287.62	7.415	4.663	4.374	0.7293	6.393	59.968	0.26	0.7293	6.393	287.24
	04:48:00	288.14	7.430	4.671	4.401	0.7278	6.418	59.981	0.22	0.7278	6.418	287.91
	04:50:00	288.17	7.434	4.677	4.401	0.7283	6.422	59.994	0.21	0.7283	6.422	287.95
	04:52:00	287.67	7.414	4.664	4.373	0.7295	6.393	59.989	0.25	0.7295	6.393	287.34
	04:54:00	287.88	7.413	4.658	4.385	0.7281	6.398	59.979	0.24	0.7281	6.398	287.64
	04:56:00	288.28	7.421	4.663	4.404	0.7270	6.414	59.999	0.22	0.7270	6.414	288.04
	04:58:00	287.99	7.423	4.667	4.393	0.7282	6.409	59.979	0.26	0.7282	6.409	287.64
	05:00:00	287.76	7.413	4.656	4.383	0.7281	6.395	59.956	0.22	0.7282	6.395	287.50
	05:02:00	287.96	7.421	4.661	4.395	0.7276	6.406	59.959	0.24	0.7276	6.406	287.68
	05:04:00	287.87	7.420	4.666	4.386	0.7286	6.404	59.980	0.20	0.7286	6.404	287.66
	05:06:00	287.35	7.402	4.656	4.357	0.7302	6.376	59.977	0.18	0.7302	6.376	287.17
	05:08:00	287.46	7.403	4.656	4.361	0.7298	6.380	59.984	0.24	0.7298	6.380	287.13

Figure 3: Support Data for Normal Operation Energy Consumption

File Edit View Graph Settings Help

Time series graph Summary Report: Daily/Weekly/Monthly Harmonic: List Harmonic: Graph Harmonic: Waveform Setting

Left axis: Current [A] Line Right axis: Power [W] [var] [VA] Line

Parameter	Value	Data name	Graph	Interval	Measurement period	File name	Display name
<input checked="" type="checkbox"/> Iave: Current CH a...	Average value	1 5-13 to 5-14.C...	—	1 Second	5/13/2010 11:20:00 - 5/1...	...\NEW Cor	Iave: Current...
<input checked="" type="checkbox"/> Iave: Current CH a...	Average value	1 5-14 to 5-16.C...	—	1 Second	5/14/2010 09:54:00 - 5/1...	...\NEW Cor	Iave: Current...
<input type="checkbox"/> Iave: Current CH a...	Average value	1 5-11 to 5-12.C...	—	1 Second	5/11/2010 11:44:00 - 5/1...	...\NEW Cor	Iave: Current...

Parameter	Value	C. Ord...	Data name	Graph	Interval	Measurement period	File name	Display name
<input checked="" type="checkbox"/> P: Active power	Average value	1	5-13 to 5-14.C...	—	1 Second	5/13/2010 11:20:00 - ...	...\NEW Cor	P: Active pow...
<input checked="" type="checkbox"/> P: Active power	Average value	1	5-14 to 5-16.C...	—	1 Second	5/14/2010 09:54:00 - ...	...\NEW Cor	P: Active pow...
<input checked="" type="checkbox"/> S: Apparent power	Average value	1	5-13 to 5-14.C...	—	1 Second	5/13/2010 11:20:00 - ...	...\NEW Cor	S: Apparent p...

Display time  
 Start time: 5/14/2010 10:00:00 Data interval  
 Stop time: 5/14/2010 15:10:00 Display period: 2 Minute

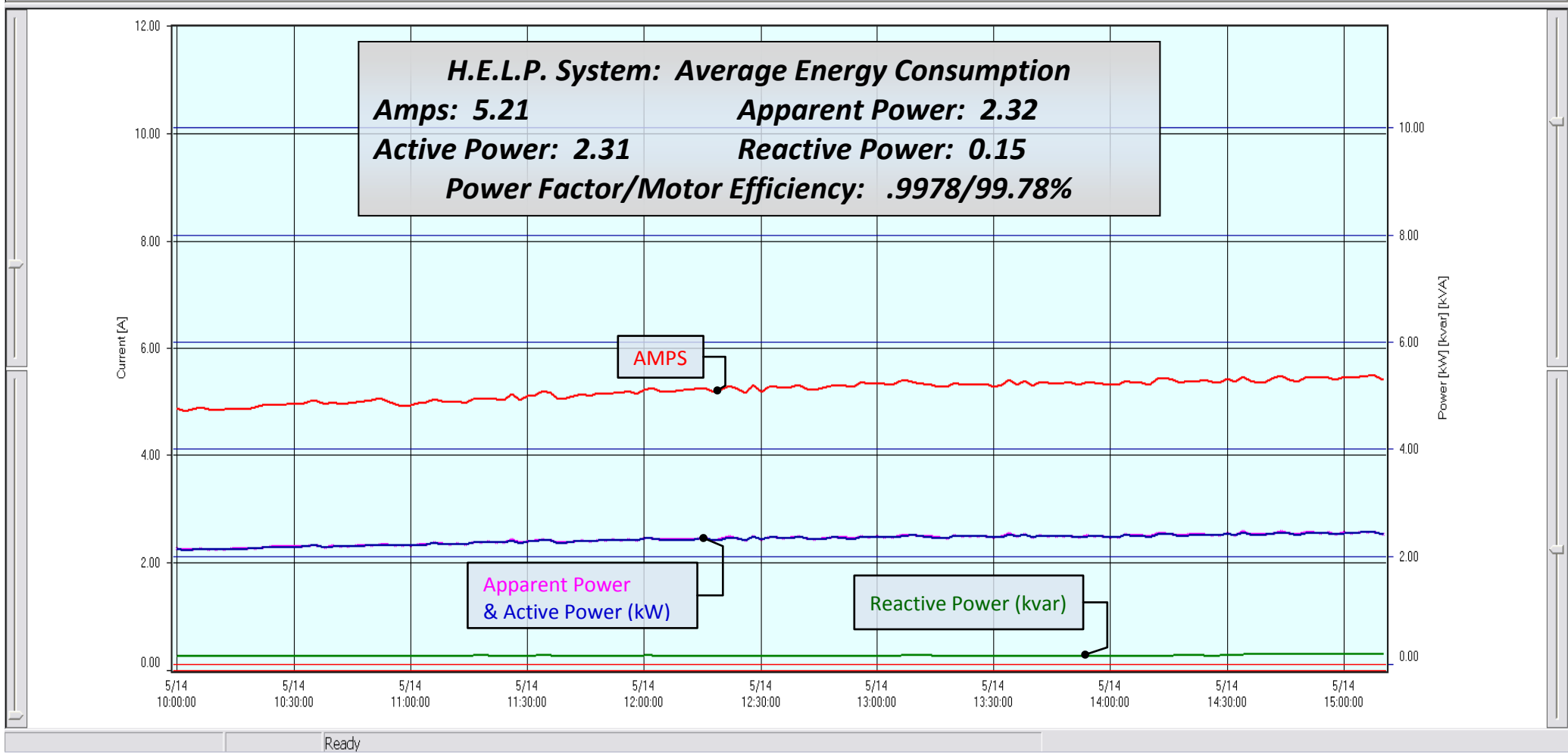


Figure 4: H.E.L.P. System Engaged

Parameter	Value	Circuit	Order	Data name	Interval	Measurement period	File name	Display name	Graph
<input checked="" type="checkbox"/> Uave: Voltage CH average	Average value			5-14 to 5-16.CSV	1 Second	5/14/2010 09:54:00 - 5/16/2010 21:28:26	I:\The Technology Consortiu... \NEW Comparison-2.dat	Uave: Voltage CH average Average value , 5-14 to 5-16.CSV[V]	
<input checked="" type="checkbox"/> Iave: Current CH average	Average value	1		5-14 to 5-16.CSV	1 Second	5/14/2010 09:54:00 - 5/16/2010 21:28:26	I:\The Technology Consortiu... \NEW Comparison-2.dat	Iave: Current CH average Average value Circuit 1 , 5-14 to 5-16.CSV[A]	
<input checked="" type="checkbox"/> P: Active power	Average value	1		5-14 to 5-16.CSV	1 Second	5/14/2010 09:54:00 - 5/16/2010 21:28:26	I:\The Technology Consortiu... \NEW Comparison-2.dat	P: Active power Average value Circuit 1 , 5-14 to 5-16.CSV[kW]	
<input checked="" type="checkbox"/> Q: Reactive power	Average value	1		5-14 to 5-16.CSV	1 Second	5/14/2010 09:54:00 - 5/16/2010 21:28:26	I:\The Technology Consortiu... \NEW Comparison-2.dat	Q: Reactive power Average value Circuit 1 , 5-14 to 5-16.CSV[kvar]	

Display time

Start time: 5/14/2010 10:00:00 Data interval

Stop time: 5/14/2010 15:10:00 Display period: 2 Minute

Date	Time	Uave: Voltage CH average Average value , 5-14 to 5-16.CSV[V]	Iave: Current CH average Average value Circuit 1 , 5-14 to 5-16.CSV[A]	P: Active power Average value Circuit 1 , 5-14 to 5-16.CSV[kW]	Q: Reactive power Average value Circuit 1 , 5-14 to 5-16.CSV[kvar]	PF: Power factor Average value Circuit 1 , 5-14 to 5-16.CSV	S: Apparent power Average value Circuit 1 , 5-14 to 5-16.CSV[kVA]	F: Frequency Average value , 5-14 to 5-16.CSV[Hz]	Voltage unbalance factor Average value , 5-14 to 5-16.CSV[%]	PF_DEM: Demand power factor Circuit 1 , 5-14 to 5-16.CSV	S: Apparent power Average value Circuit 1 , 5-14 to 5-16.CSV[kVA]	U1: Voltage CH1 Average value , 5-14 to 5-16.CSV[V]
Average value in the period		284.19	5.207	2.317	0.154	0.9978	2.322	60.001	0.22	0.9978	2.322	283.73
Maximum value in the period		286.89	5.482	2.456	0.187	0.9981	2.463	60.031	0.28	0.9981	2.463	286.45
Time of maximum value		5/14/2010 10:56:00	5/14/2010 15:08:00	5/14/2010 14:34:00	5/14/2010 14:34:00	5/14/2010 13:50:00	5/14/2010 14:34:00	5/14/2010 14:06:00	5/14/2010 12:54:00	5/14/2010 13:50:00	5/14/2010 14:34:00	5/14/2010 10:56:00
Minimum value in the period		282.77	4.812	2.121	0.139	0.9971	2.126	59.965	0.18	0.9971	2.126	282.24
Time of minimum value		5/14/2010 13:56:00	5/14/2010 10:02:00	5/14/2010 10:02:00	5/14/2010 10:44:00	5/14/2010 14:36:00	5/14/2010 10:02:00	5/14/2010 11:02:00	5/14/2010 10:02:00	5/14/2010 14:36:00	5/14/2010 10:02:00	5/14/2010 13:56:00
5/14/2010	10:00:00	284.67	4.872	2.143	0.145	0.9977	2.148	59.993	0.19	0.9977	2.148	284.32
	10:02:00	285.03	4.812	2.121	0.146	0.9976	2.126	60.001	0.18	0.9976	2.126	284.71
	10:04:00	284.63	4.859	2.134	0.144	0.9977	2.139	59.992	0.19	0.9977	2.139	284.26
	10:06:00	284.31	4.893	2.147	0.142	0.9978	2.151	59.993	0.20	0.9978	2.151	283.93
	10:08:00	284.37	4.848	2.129	0.142	0.9978	2.133	60.000	0.22	0.9978	2.133	284.00
	10:10:00	284.36	4.839	2.132	0.141	0.9978	2.137	60.013	0.21	0.9978	2.137	284.05
	10:12:00	283.99	4.859	2.135	0.139	0.9979	2.139	59.998	0.21	0.9979	2.139	283.65
	10:14:00	283.92	4.862	2.136	0.139	0.9979	2.141	60.004	0.19	0.9979	2.141	283.58
	10:16:00	284.04	4.856	2.140	0.141	0.9978	2.145	59.981	0.20	0.9978	2.145	283.73
	10:18:00	284.22	4.860	2.141	0.141	0.9978	2.146	59.979	0.21	0.9978	2.146	283.91
	10:20:00	284.09	4.901	2.152	0.141	0.9979	2.156	59.985	0.22	0.9979	2.156	283.71
	10:22:00	284.07	4.930	2.164	0.142	0.9978	2.168	60.006	0.23	0.9978	2.168	283.66
	10:24:00	284.35	4.950	2.184	0.143	0.9979	2.189	60.000	0.21	0.9979	2.189	283.97
	10:26:00	284.23	4.935	2.175	0.143	0.9978	2.180	59.990	0.21	0.9978	2.180	283.84
	10:28:00	283.94	4.956	2.182	0.142	0.9979	2.187	59.990	0.21	0.9979	2.187	283.55
	10:30:00	283.81	4.947	2.178	0.143	0.9979	2.182	59.984	0.21	0.9979	2.182	283.44
	10:32:00	283.88	4.955	2.183	0.144	0.9978	2.188	59.992	0.20	0.9978	2.188	283.51
	10:34:00	283.63	5.013	2.209	0.145	0.9979	2.214	59.987	0.20	0.9979	2.214	283.24
	10:36:00	283.38	5.015	2.205	0.142	0.9979	2.209	60.003	0.22	0.9979	2.209	282.97
	10:38:00	283.55	4.944	2.172	0.139	0.9979	2.177	60.012	0.22	0.9980	2.177	283.16

Figure 5: Support Data for H.E.L.P. System Energy Consumption

Left axis: Current [A] Line Right axis: Power [W] [var] [VA] Line

Parameter	Value	Data name	Graph	Interval	Measurement period	File name	Display name
<input checked="" type="checkbox"/> Iave: Current CH a...	Average value	1 5-13 to 5-14.C...	[Red Line]	1 Second	5/13/2010 11:20:00 - 5/1...	... \NEW Cor	Iave: Current ...
<input checked="" type="checkbox"/> Iave: Current CH a...	Average value	1 5-14 to 5-16.C...	[Red Line]	1 Second	5/14/2010 09:54:00 - 5/1...	... \NEW Cor	Iave: Current ...
<input type="checkbox"/> Iave: Current CH a...	Average value	1 5-11 to 5-12.C...	[Red Line]	1 Second	5/11/2010 11:44:00 - 5/1...	... \NEW Cor	Iave: Current ...

Parameter	Value	C. Ord...	Data name	Graph	Interval	Measurement period	File name	Display name
<input checked="" type="checkbox"/> P: Active power	Average value	1	5-13 to 5-14.C...	[Blue Line]	1 Second	5/13/2010 11:20:00 - ...	... \NEW Cor	P: Active pow...
<input checked="" type="checkbox"/> P: Active power	Average value	1	5-14 to 5-16.C...	[Blue Line]	1 Second	5/14/2010 09:54:00 - ...	... \NEW Cor	P: Active pow...
<input checked="" type="checkbox"/> S: Apparent power	Average value	1	5-13 to 5-14.C...	[Magenta Line]	1 Second	5/13/2010 11:20:00 - ...	... \NEW Cor	S: Apparent p...

Display time  
 Start time: 5/14/2010 04:30:00 Data interval  
 Stop time: 5/14/2010 15:40:00 Display period: 2 Minute

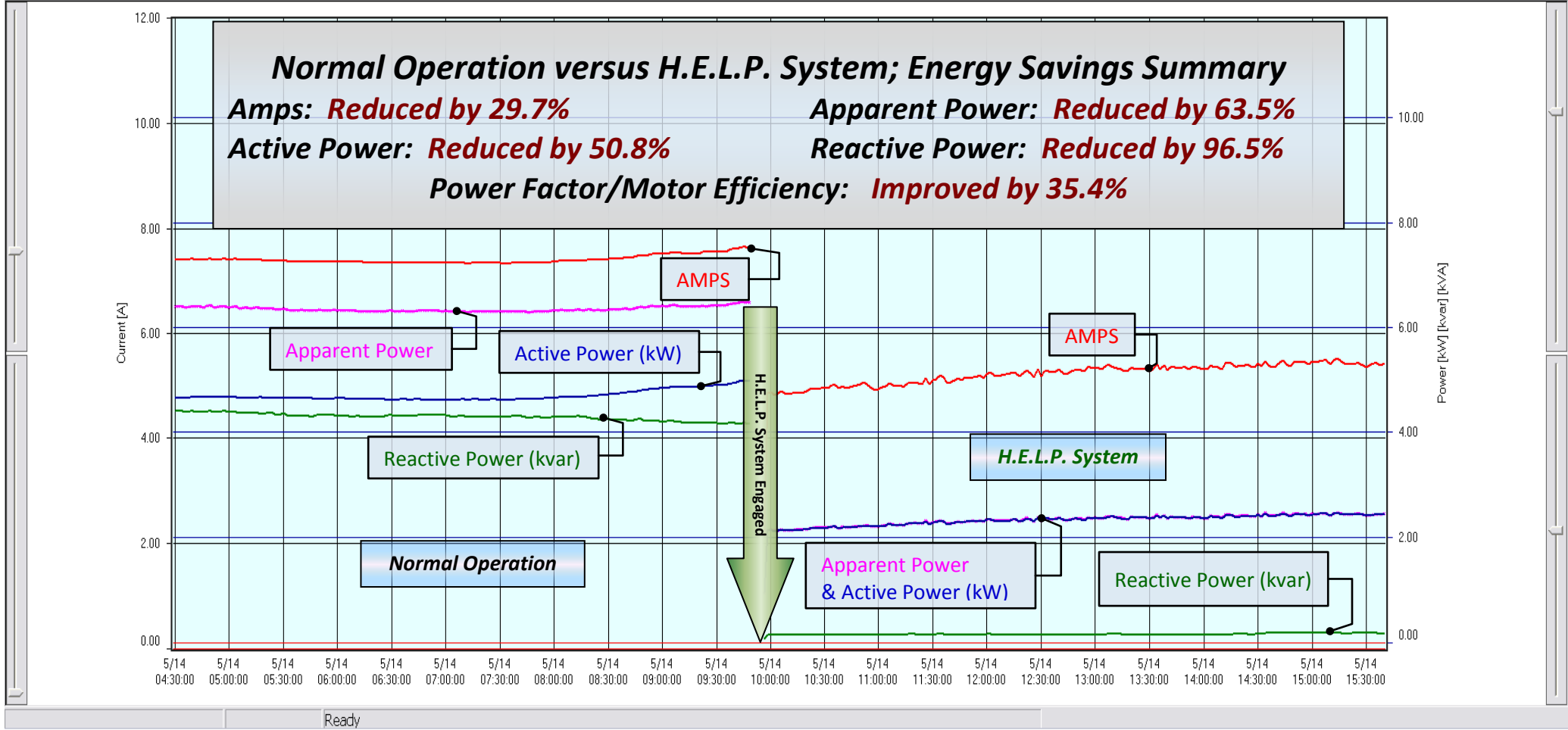


Figure 6: Normal Operation versus H.E.L.P. System; Summary of Energy Savings