ECM (Electronically Commutated Motor) Circulation Pump Pilot Project

M&V Analysis

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Original System

The original system consists of GSHPs with two 3/4 HP condenser water pumps that circulate water to the Heat Pumps throughout the building. One pump runs during low load months with both running during high load months.

New ECM PUMP System

Replace one of the condenser water pumps with a new variable flow ECM pump and keep one of the original condenser pumps for emergency backup.

Measurement and Verification Strategy:

The M&V plan will follow BPA's "End Use Metering Protocol" and will consist of installing energy loggers on the new pumps. The data will be compared to the outside ambient temperature and a kWh vs. OSA relationship will be established. This relationship will be used to extrapolate annual energy usage for a typical year.

Project Notes:

Original Motor and Pump	New Motor and Pump
Enerson 3 PH Motor Taco Pump 1614C3E2, 6.35" Impeller	Grundfos Magna 3, 40-180 F 216

Post Monitoring period: 7/17/2015 to 8/19/2015 at fifteen minute intervals. Minimal difference in average kW draw over each interval, constant reading of .461 kW.

Pre Pump Tests	GPM	kW	kW/GPM
Pump A & B Running	26.7	1.265	0.0474
Pump A Only	25.4	0.721	0.0284
Pump B Only	25.7	0.714	0.0278
Grundfos Pump	GPM	kW	kW/GPM
Pump A Only	22	0.461	0.0210

Pre & Post Energy Calculations:

Savings are based on system upgrades over the original equipment and control strategy.

WSHP Main Pump Savings Calcs	Comparison of Original System Operation			
From Original Proposal				
	days	# Pumps	kW	kWh
January	31.0	2.0	1.264	940.6
February	28.0	2.0	1.264	849.5
March	31.0	2.0	1.264	940.6
April	30.0	2.0	1.264	910.2
May	31.0	1.0	0.712	530.0
June	30.0	1.0	0.712	512.9
July	31.0	2.0	1.264	940.6
August	31.0	2.0	1.264	940.6
September	30.0	1.0	0.712	512.9
October	31.0	1.0	0.712	530.0
November	30.0	2.0	1.264	910.2
December	31.0	2.0	1.264	940.6
Total kWh for Original Pumps				9,458.7
Post Data				
	days	# Pumps	kW	kWh
January	31.0	1.0	0.461	343.2
February	28.0	1.0	0.461	310.0
March	31.0	1.0	0.461	343.2
April	30.0	1.0	0.461	332.2
May	31.0	1.0	0.461	343.2
June	30.0	1.0	0.461	332.2
July	31.0	1.0	0.461	343.2
August	31.0	1.0	0.461	343.2
September	30.0	1.0	0.461	332.2
October	31.0	1.0	0.461	343.2
November	30.0	1.0	0.461	332.2
December	31.0	1.0	0.461	343.2
Total kWh for Original Pumps				4,041.3
Total Measure Savings				5,417.40
				57%

Savings are based on a ONE-FOR-ONE replacement of pumps.

WSHP Main Pump Savings Calcs	Comparison of ONE-FOR-ONE Replacement			
From Original Proposal				
	days	# Pumps	kW	kWh
January	31.0	1.0	0.712	530.0
February	28.0	1.0	0.712	478.7
March	31.0	1.0	0.712	530.0
April	30.0	1.0	0.712	512.9
May	31.0	1.0	0.712	530.0
June	30.0	1.0	0.712	512.9
July	31.0	1.0	0.712	530.0
August	31.0	1.0	0.712	530.0
September	30.0	1.0	0.712	512.9
October	31.0	1.0	0.712	530.0
November	30.0	1.0	0.712	512.9
December	31.0	1.0	0.712	530.0
Total kWh for Original Pumps				6,240.8
Post Data				
	days	# Pumps	kW	kWh
January	31.0	1.0	0.461	343.2
February	28.0	1.0	0.461	310.0
March	31.0	1.0	0.461	343.2
April	30.0	1.0	0.461	332.2
May	31.0	1.0	0.461	343.2
June	30.0	1.0	0.461	332.2
July	31.0	1.0	0.461	343.2
August	31.0	1.0	0.461	343.2
September	30.0	1.0	0.461	332.2
October	31.0	1.0	0.461	343.2
November	30.0	1.0	0.461	332.2
December	31.0	1.0	0.461	343.2
Total kWh for Original Pumps				4,041.3
Total Measure Savings				2,199.42
				35%

Comparison of power usage per gallon delivered (kW/GPM)

Pre Pump Tests	**gpm**	**kW**	**kW/GPM**
Pump A & B Running	26.7	1.265	0.0474
Pump A Only	25.4	0.721	0.0284
Pump B Only	25.7	0.714	0.0278
Grundfos Pump	**gpm**	**kW**	**kW/GPM**
Magna3 Only	22	0.461	0.0210
Original Pumps			**Efficiency Gain**
Pump A & B Running			55.77%
Pump A Only			26.18%
Pump B Only			24.58%