AFT Fathom™ Instrumental in Chrysler Energy Savings Project: Plant Saves $194,000 Per Year

CASE STUDY

Coolant Filter System

Automotive Industry

Fiat Chrysler Automobiles
Dundee, Michigan, USA
Platinum Pipe Award Winner - Operational Benefits and Sustainability

Chrysler used AFT Fathom to model four large central coolant filter systems in the Dundee Engine plant located in Dundee, Michigan. Coolant is used in the engine machining process to lubricate the metal cutting process and to carry away chips from the machining centers. The large central coolant filter system consists of a large network of piping, pumps and filtration machines and trenches that circulate clean coolant and return coolant and metal chips for separation and filtering (see Figure 2).

The purpose of the project was to reduce energy use by switching from supply header pressure control to pump speed control using remote pressure feedback.

> "[This] was one of the more complex energy optimizations undertaken on process equipment at Chrysler. We saved over $194K/year in energy and were awarded a $200K rebate from the local electric utility. I know for a fact that without AFT Fathom, the project would have never happened."

The existing cooling system was energy intensive. Chrysler wanted to develop a model that matched existing conditions, and then use that model to predict energy savings for different capital expenditure scenarios. Thirty operating scenarios were evaluated over four systems for the project.

The model, based on conservative assumptions, predicted the savings to be approximately 16%, which was enough to secure capital funding and proceed with the project. After implementation and fine tuning the pump staging and speed control, actual savings achieved was 25%. Measurement and validation of the energy savings was done using two methods. The first was by collecting power kW readings at each of the pumps before and after project implementation.

Secondly, Chrysler used filter gallery substation level kW for the plant, normalized for production as a secondary means of measurement and validation. This method showed that Chrysler reduced energy use by about 21% per engine.

The plant also derived operational benefits from this project. Coolant flow feedback was moved out to the process, ensuring that it had precisely the flow required as production volume varies. By slowing down the pumps most of the time, maintenance intervals for tasks like lubrication were extended, saving the cost of grease and labor. Pump service life is also extended since the cycles and forces in the pump are reduced, lowering overall lifecycle costs. These benefits were not quantified in this project but they are real.

Additionally, the waste heat due to excessive pumping was eliminated, saving chiller energy and cooling tower water and chemicals. Saving energy directly reduces greenhouse gas emissions which is an increasing concern in today's world.

Figure 1 – Bryan Whitfield (far right) and the Dundee team set out to optimize four of the plant's large central coolant systems

Fiat Chrysler Automobiles (FCA), the seventh-largest automaker in the world, designs, engineers, manufactures and sells passenger cars, light commercial vehicles, components and production systems worldwide. FCA is an international auto group engaged in industrial activities in the automotive sector through companies located in 40 countries and has commercial relationships with customers in approximately 150 countries.

When asked about the benefits of using AFT Fathom, Bryan Whitfield, senior energy specialist at Chrysler said, "Up to this point, engineers and the original equipment manufacturers could only speculate, never being able to produce a legitimate engineering model of these systems that could withstand any level of engineering review. With AFT Fathom, we could finally complete the modeling required that allowed us to select the best scenario that met our financial requirements. Secondly, it gave us a way of communicating the ideas in a simple way, making the change more acceptable to the process engineers and finance people."

This project also won first place in the energy category, Fiat Chyrsler Automobiles Environment, Health & Safety Leadership Awards 2015 (see Figure 1).

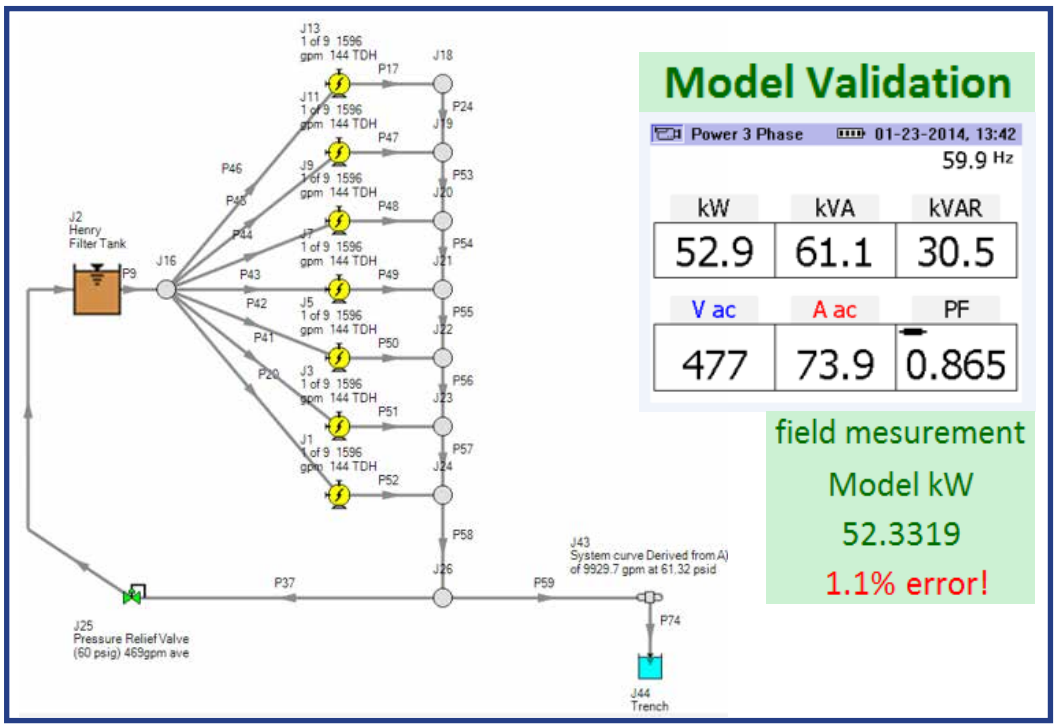

Figure 2 - System simulation: Dundee Engine North Head Line Coolant System; AFT Fathom model; Model validated to 1.1% of field measurements.

Scenario	Description	# of VFDs to be installed	% of time	w'd ave bypass flow (gpm)	No. pmps on	1 pmp flow	From AFT Fathom Modeling Software: speed % full	1 pmp hp	Total flow	Total HP	Pump kWh	Cooling Energy Savings	Total kWh Savings	Annual Pump Energy	Pump & Clg Energy	Percent Savings	Approx Installed cost	BIC	Rebate	BIC after rebate
0	7of9 pmps, 60 hz, 469gpm by-pass	0	100%		7	1486	100%	70.2	10,402	491	3,208,992			$224,629			$0			
A.2	Reduce ave by-pass w/ 7 pmps	9	100%	469	7	1419	98.54%	65.1	9,933	456	2,978,896	35,178	265,274	$208,523	$18,569	8.3%	$117,000	0.16	$18,408	0.2
A.3	Reduce ave by-pass and 5 psid w/ 7 pumps	9	100%	469	7	1356	94.04%	60	9,492	420	2,744,226	71,055	535,822	$192,096	$37,508	16.7%	$117,000	0.32	$37,181	0.5
A.4	Reduce ave by-pass and 5psid w/8 pmps	9	100%	469	8	1187	90.73%	53.5	9,492	428	2,799,054	62,673	472,611	$195,934	$33,083	14.7%	$117,000	0.28	$32,795	0.4
A.5	Reduce ave by-pass and 5psid w/3 pmps	9	100%	469	9	1055	88.21%	46.2	9,492	416	2,719,001	74,912	564,903	$190,330	$39,543	17.6%	$117,000	0.34	$39,199	0.5
A.6	Reduce using UNEvfd, 5 psid w/ 7 pumps	1	100%	469	7	n/a	72.48%	n/a	9,630	456	2,980,203	34,978	263,767	$208,614	$16,464	8.2%	$13,000	1.42	$6,500	2.8
A.7	Reduce using TWO vfd, 5 psid w/ 7 pumps	2	100%	469	7	n/a	83.45%	n/a	9,582	436	2,849,243	55,000	414,750	$199,447	$29,032	12.9%	$26,000	1.12	$13,000	2.2
A.8	Reduce using THREE vfd, 5 psid w/ 7 pumps	3	100%	469	7	n/a	87.88%	n/a	9,945	428	2,798,531	62,753	473,214	$195,897	$33,125	14.7%	$39,000	0.85	$19,500	1.7
A.9	Reduce using FOUR vfd, 5 psid w/ 7 pumps	4	100%	469	7	n/a	90.33%	n/a	9,525	424	2,770,300	67,069	505,761	$193,921	$35,403	15.8%	$52,000	0.68	$26,000	1.4
A.10	Reduce using Five vfd, 5 psid w/ 7 pumps	5	100%	469	7	n/a	92.03%	n/a	9,512	422	2,754,682	69,457	523,767	$192,828	$36,664	16.3%	$65,000	0.56	$32,500	1.1
																	$0			

Figure 3 - Scenario analysis and selection of central coolant filter systems in Dundee Engine Plant