SERVICES AND SOLUTIONS

SUCCESS STORY

High-efficiency Impeller Reduces Energy Usage and Shaft Wear

ISO 13709/API 610 (BB2) Process Pump Upgrade

The Challenge: A major refinery was experiencing high energy costs from one of its severe duty process pumps – the result of changing system requirements. Pump efficiency was far from optimum levels and reliability issues from off-design-point operation were a concern.

The Solution: Flowserve engineers designed a comprehensive hydraulic and mechanical upgrade solution that delivered immediate reliability improvements and an energy cost savings payback in well under one year of operation.

A reduction in required flow rate left a severe duty ISO 13709/API 610 (BB2) refinery pump operating far from its best efficiency point (BEP), resulting in excessive energy consumption. While trimming the existing pump impeller could have delivered the required flow rate, this would have left the pump operating well back from BEP, providing less than optimal efficiency.

Reducing Energy Consumption

Flowserve engineers made the following recommendations to achieve maximum efficiency from the existing pump at the new design point.

- Install a new, high-efficiency impeller that would also offer a steeper performance curve to increase operating stability during system transients
- Increase the number of vanes in the diffuser and alter the rim geometry to reduce pressure pulsations

Eliminating Abnormal Shaft Wear

While assessing possible solutions to reduce energy consumption, Flowserve engineers also performed a rotor-dynamic analysis to explore the cause of another issue – excessive shaft wear. This analysis revealed the pump was running very close to its second critical speed.

To resolve the issue, Flowserve engineers proposed shortening the bearing span, which would push the second critical speed well above the operating speed. To do so, the engineers designed a modification to replace unused cooling jackets with a mounting flange that would accept a different bearing housing design with a shorter bearing span.

FLOWSERVE

FINANCIAL BENEFITS

Original Annual Energy Cost

Power Consumption	220 kW
Annual Running Hours	8760 hr
Energy Consumed	1 927 200 kW•h
Total Energy Cost (0.06/kW•h)	**USD 115 632**

Revised Annual Energy Cost

Power Consumption	150 kW
Annual Running Hours	8760 hr
Energy Consumed	1 314 000 kW•h
Revised Energy Cost (0.06/kW•h)	**USD 78 840**

Pump Upgrade Cost

Design Study	
Parts	
Labor	
Total Upgrade Cost	**USD 26 000**

Two-Year Cost Savings

Original Energy Cost	USD 231 264
Revised Energy Cost	USD 157 680
Upgrade Cost	USD 26 000
Two-Year Energy Cost Savings	**USD 47 584**

Bottom Line Impact

The pre-upgrade assessment clearly indicated significant energy consumption savings would be achieved from the recommended upgrades. This financial analysis did not include operational savings that would also be realized from extended plant uptime as a result of the improved rotor-dynamics. When implemented, the upgrade delivered the results shown.

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