Centrifugal Pump Applications

Overview: Siemens is a global powerhouse and one of the world’s largest producers of energy-efficient, resource-saving technologies. The focus for this project is to develop applications using Siemens technology to measure the energy efficiency of centrifugal pumps on crude oil pipelines, and identify other value-add applications for Siemens automation technology in the oil & gas industry.

Objectives:
- Create a means to monitor the efficiency of Siemens Energy’s crude oil pipelines
- Model and define the governing equations with which the secondary team will use to simulate a very simplistic pipeline
- Using data from Team 2, we will have varying displays of the pump efficiency curves
- Use curve fitting equations to create smooth curves for the graph
- Create easy to understand and implement HMI (Human machine interface) display

Approach:
- Defined the input and output variables
- Defined the governing equations to calculate output from input variables
- Developed an algorithm for cubic spline to create smooth pump performance curves
- Incorporated Simatic S-7 program to calculate pump parameters
- Developed a Human Machine Interface (HMI) display
- Plot efficiency, head and shaft power as function of the flow rate for water
- Applied API viscosity correction factors to transform curves from water to crude oil

Control Knobs:
1. Viscosity
2. Density
3. Flow Rate
4. Motor Efficiency
5. Impeller Efficiency

Outcomes:
- Supplied the governing equations to Team 2 to get output values when they were integrated with their program and simulation
- Received the output variables from Team 2 and prepared a connection system so that multiple PLCs can communicate with each other
- HMI display was developed in the Step-7 program to plot the Efficiency vs Flow and Head vs Flow curves, from the output variables

Final Setup of the System