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Energy Management

January 17th 2009

Experience In Motion

Energy Management

- Energy prices have risen significantly across Western Europe
- Emerging legislation has encouraged users to reduce energy consumption
- Users are showing strategic moves to focus on energy consumption

Therefore……..

- Flowserve has established a dedicated Energy Management capability to allow us to take the lead and support our end users.

What will Flowserve offer?

- An holistic approach to energy management
  - To provide our Clients with a range of reasons and benefits for embarking on such a process
  - To provide the technical expertise to develop, support and carry out complete analyses of Clients' pumps and system(s)
  - **Provide Recommendations and Implement Solutions**

How?

- Pump population analysis
- Site testing
- Analysis of systems and data
- Development of upgrade solutions
- Implementation of changes
- Verification of improvements

Where to Start?

- Identifying the potential….
  - Energy usage tariff
  - Pump population
- How are pumps being operated?
  - Performance curves?
  - Interaction with System Curve?
  - % BEP?
  - Absorbed power
  - Utilisation
  - Maintenance history

Pump Population Analysis

- Prioritisation using ranking technique

Asset Review Process

Consumption Profile.					Opportunity Profile.				
Location	Power Kw	Load Factor	# Pumps	**Consumption Factor**	Time since last O/haul (months)	Coating used in last overhaul (Yes = 1 No = 2)	Water Quality (Abstraction = 2, Potable = 1)	Head (m)	**Opportunity Profile**
Lumley Intake 1	550	1	1	550	120	2	2	81	38880
Lumley Intake 2	317	1	1	317	120	2	2	81	38880
Lumley Intake 3	229	1	1	229	120	2	2	81	38880
Lumley Intake 4	110	1	1	110	120	2	2	73	35040
Lumley Outlet 1	300	1	1	300	120	2	1	106	25440
Lumley Outlet 2	265	1	1	265	120	2	1	75	18000
Lumley Outlet 3	250	1	1	250	120	2	1	68	16320
Stella Telem 1	132	1	1	132	120	2	1	28	6720
Whittle Dean Booster	257	1	1	257	60	2	1	18	2160
Stoney Gate Booster 1	185	1	1	185	60	2	1	91.5	10980
Stoney Gate Booster 2	110	1	1	110	60	2	1	91	10920
Walbottle PS	110	0.5	3	165	60	2	1	79.2	9504
Carr Hill PS	55	0.5	3	82.5	60	2	1	46	5520
Whickham PS	37	0.5	3	55.5	60	2	1	81.8	9816

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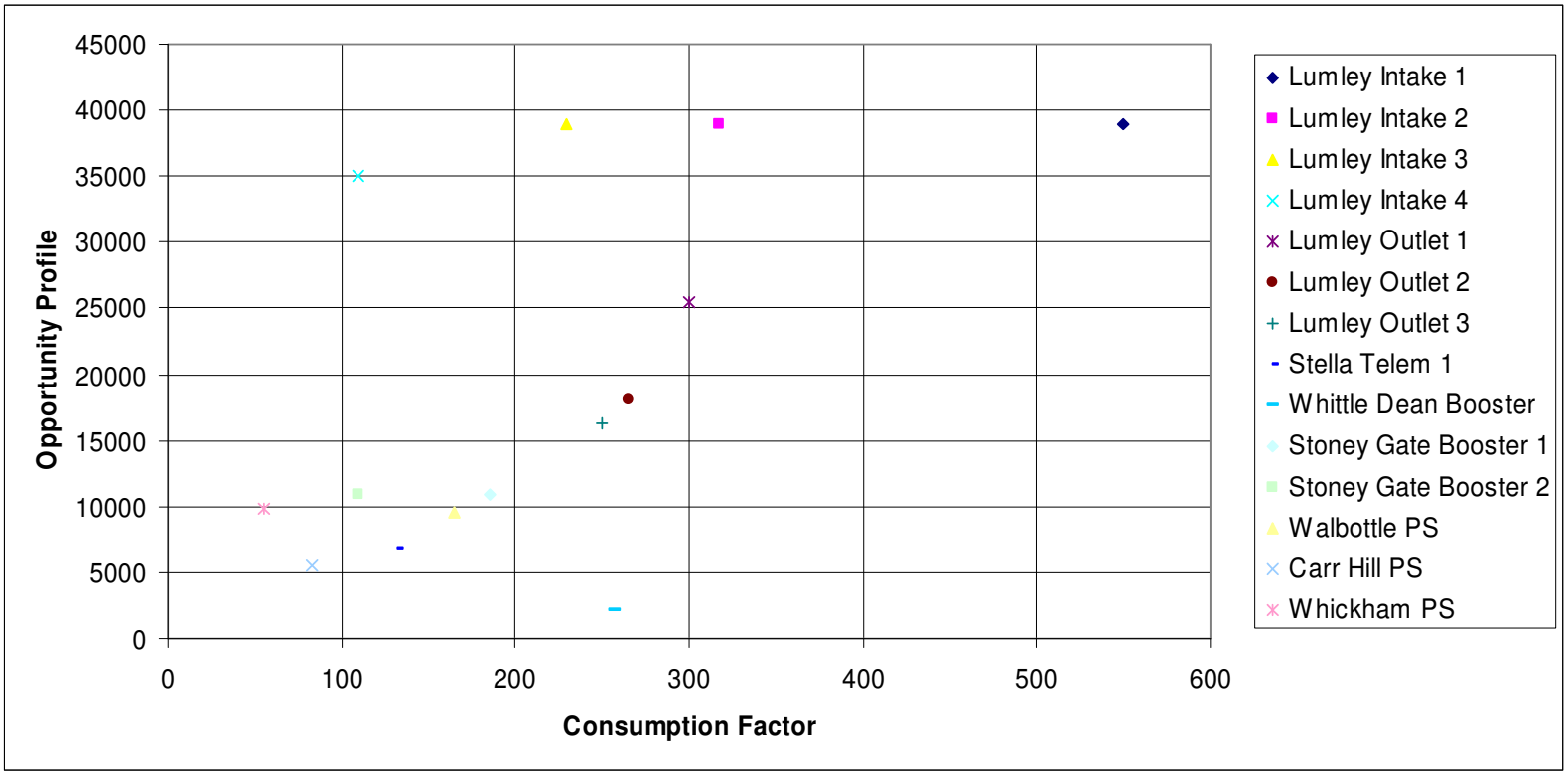
Asset Review Process



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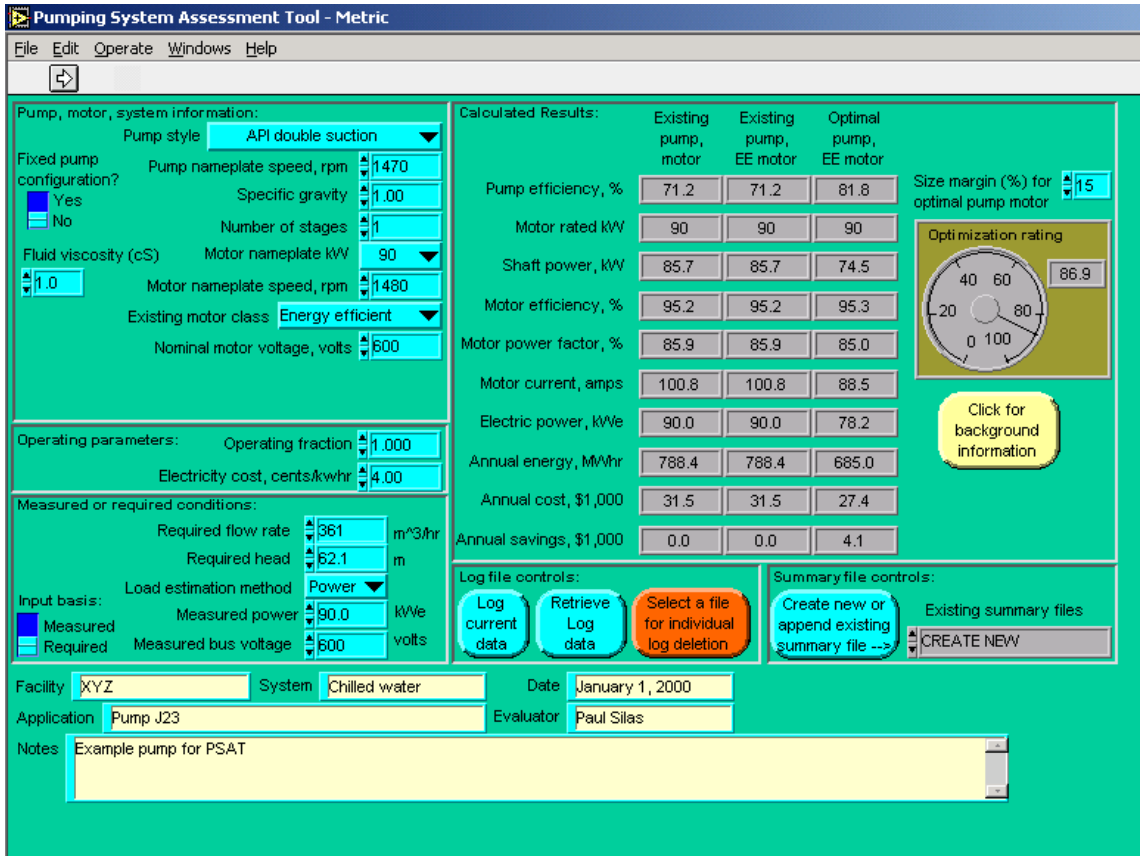
Asset Review Process

- PSAT



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Availability of Data

- Original OEM data
  - H-Q curves
- Assessing current performance
  - Pump wear
  - Revised process conditions

……site testing

Site Testing thermodynamic

- Performance Test (H,Q,η,P)
  - Thermometric
  - Conventional methods
- System Analysis
  - Data gathering/measurement
- Noise
- Vibration

What is Thermometric Testing?

$$\mathbf{P}\ (\text{power}) = \frac{\mathbf{H}\ (\text{head}) \times \mathbf{Q}\ (\text{flow}) \times \text{sg}}{\text{Constant} \times \boldsymbol{\eta}\ (\text{efficiency})}$$

- Typical “conventional” performance testing measures “H”,”Q” & “P” from which efficiency can be calculated.
- Measuring “Q” on site can be difficult.
  - Client PI system
  - Ultrasonic techniques
- Thermometric testing techniques measure “P”, “H” & “η”, from which “Q” can be derived

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Measuring Efficiency

- In a pump described as 80% efficient, the energy associated with the 20% “lost” efficiency goes into heating the pumped fluid.
- Accurately measuring the change in temperature across the pump enables the efficiency to be calculated.

Hardware

- Transducers
  - Pressure and Temperature
    - Suction and Discharge
- Power measurement
  - LV & HV capability

Hardware

- Robertson
- Primarily designed for cold, clean water applications and Safe Areas
  - -1 to 5 bar - suction
  - 0 to 20 bar - discharge
  - 0 to 40^{0}C
- Also.....
  - 40 bar suction
  - 300 bar discharge
  - 200^{0}C

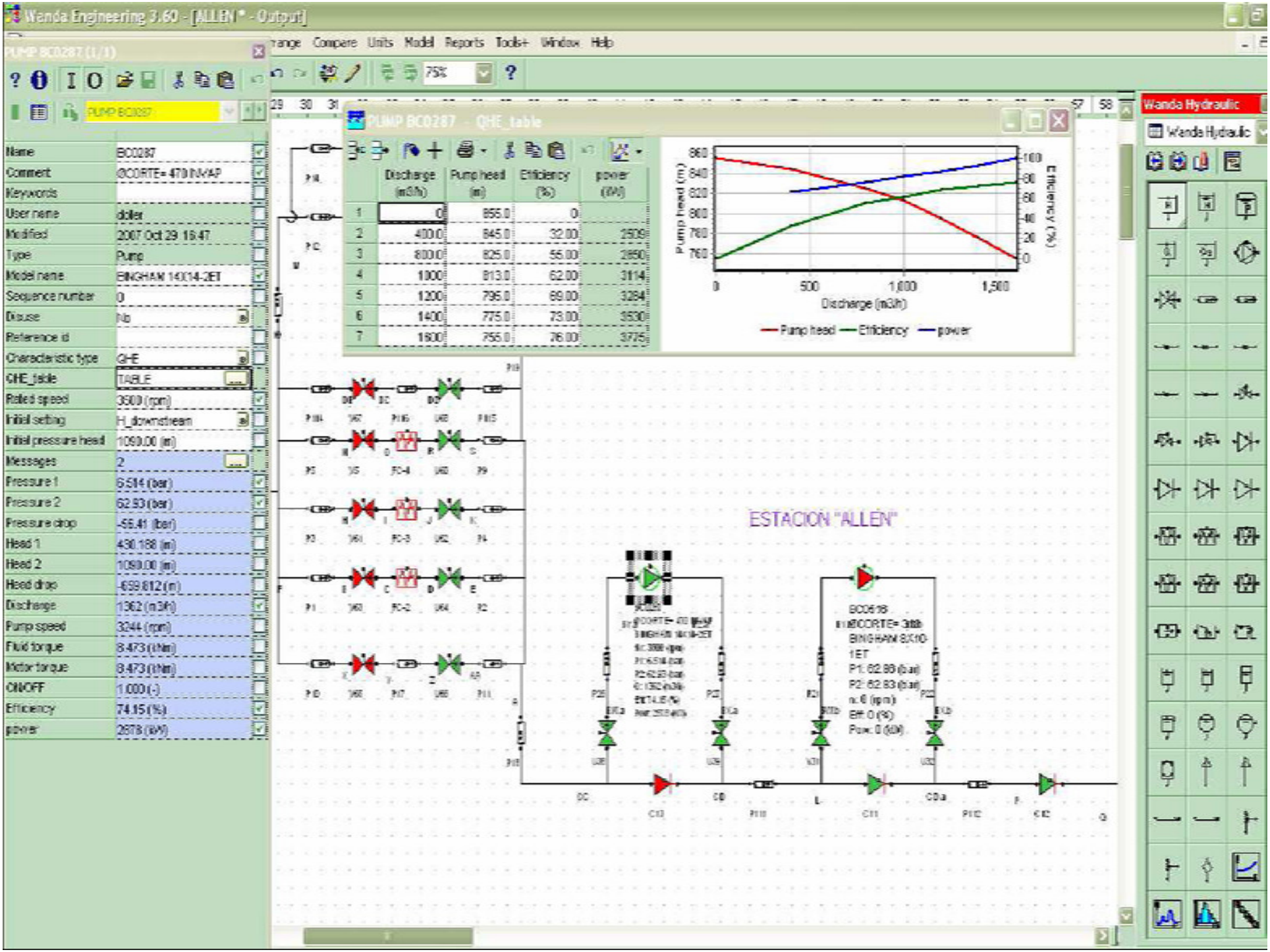
  …Thus opening up opportunities for boiler feed applications

Typical Applications/Processes

- Cooling Water Circuits Water industry
- Fire Mains
- Boiler Feed
  - MBFP's
  - Start/Standby BFP's
  - Feed Water Booster Pumps
  - Condensate Extraction Pumps

Software

- Thermometric Test Data
  - Robertson software
- System Analysis
  - Wanda3
    - Calculates system characteristics
    - The module “Pump Energy” calculates the most efficient use of pumps in a pumping station based on a delivery pattern and the system characteristic.
    - Instantly the energy use of a specific pump schedule is made visible.
  - Gatecycle
    - Heat load analysis


Wanda Engineering 3.60 - [ALLEN * - Output]
PUMP BC0287 (1/1)
Compare
Units
Model
Reports
Tools+
Window
Help
PUMP BC0287 - QHE_table
Discharge (m3/h)
Pump head (m)
Efficiency (%)
power (BA)
Pump head (m)
Efficiency (%)
Discharge (m3/h)
Pump head
Efficiency
power
ESTACION "ALLEN"
Wanda Hydraulic
Name
Comment
Keywords
User name
Modified
Type
Model name
Sequence number
Disuse
Reference id
Characteristic type
QHE_table
Rated speed
Initial setting
Initial pressure head
Messages
Pressure 1
Pressure 2
Pressure drop
Head 1
Head 2
Head drop
Discharge
Pump speed
Fluid torque
Motor torque
ON/OFF
Efficiency
power

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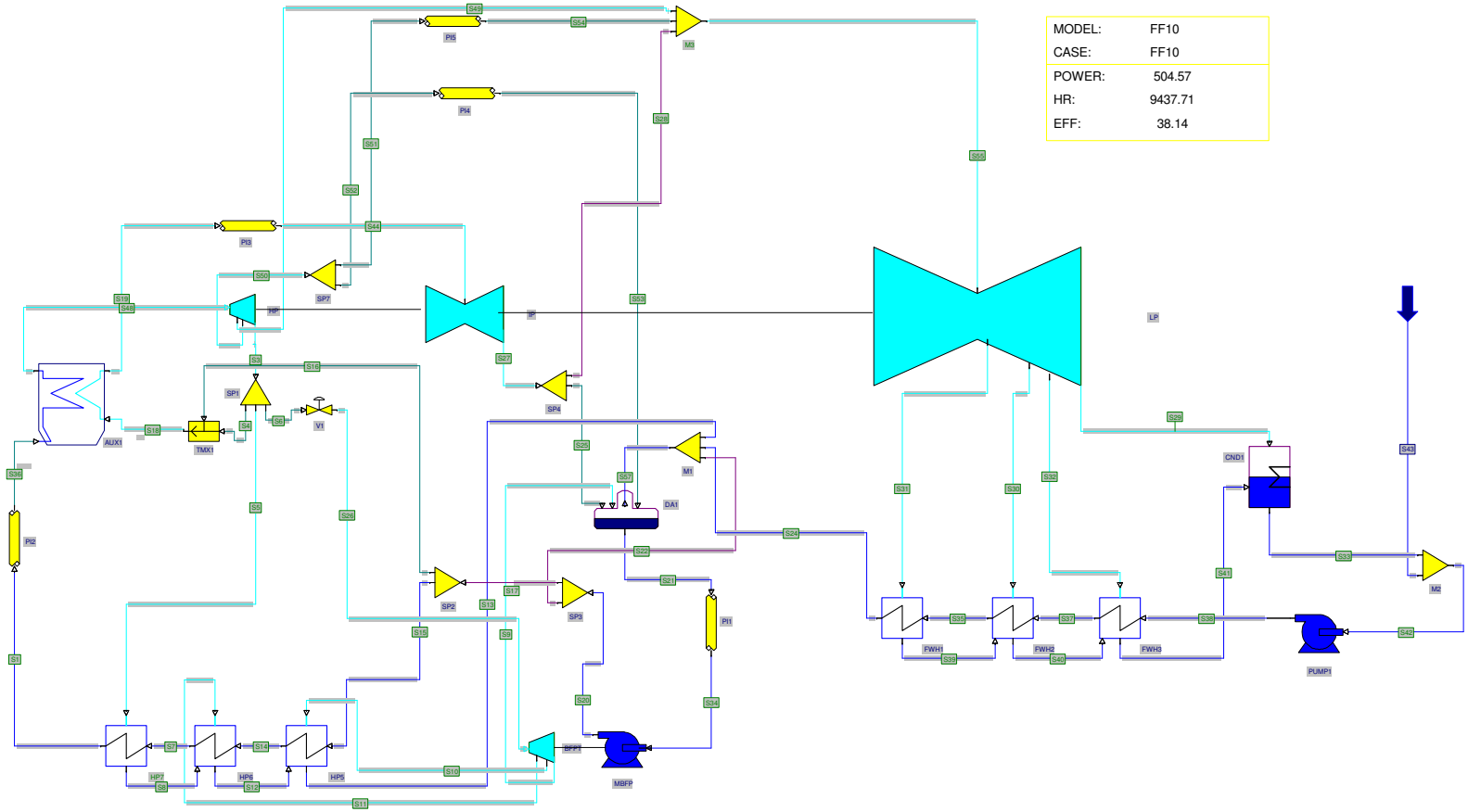

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Recommendations

- Hydraulic Re-rates
  - Casing modifications
  - New impeller(s)
  - New pumps
- Mechanical Upgrades
  - Bearings
  - Cooling
- New Pump(s)
- Speed control commercial models
- Operational changes

Implementation

- Flowserve's opportunity to provide value added solutions

Verification

- Site testing
- Self financing remedial works
- Pay as u save