



TAS Online

(Pty.) Ltd.

Pump Monitoring & Consultancy



Improving the Energy Efficiency of Pumping Systems

SA Institute of Agricultural Engineers Conference
29 September 2010

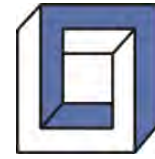
Presenter: Harry Rosen

Managing Director
TAS Online (Pty) Ltd

Who is TAS Online?

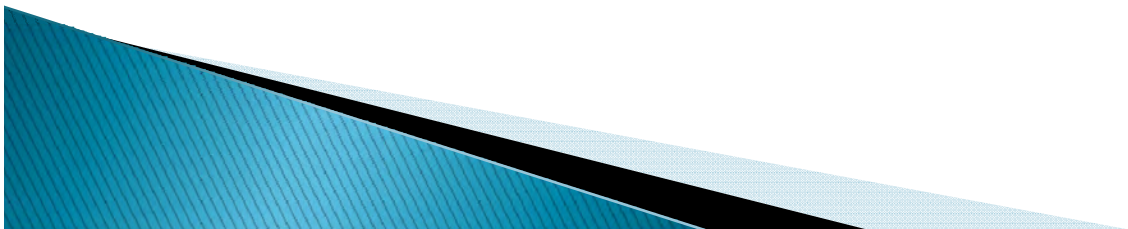
- ▶ Pump selection software in 1990's
- ▶ Introduced remote monitoring of pumps & supporting consultancy in 2004
- ▶ Range of industrial sites including all Gold Fields and Harmony deep level multistage pumps.
- ▶ TAS PumpMonitor audited by Eskom.
- ▶ On site pump system assessments using portable instrumentation.
- ▶ Part of Rare Group
 - Pipelines and valves
 - Chemical
 - Engineering projects





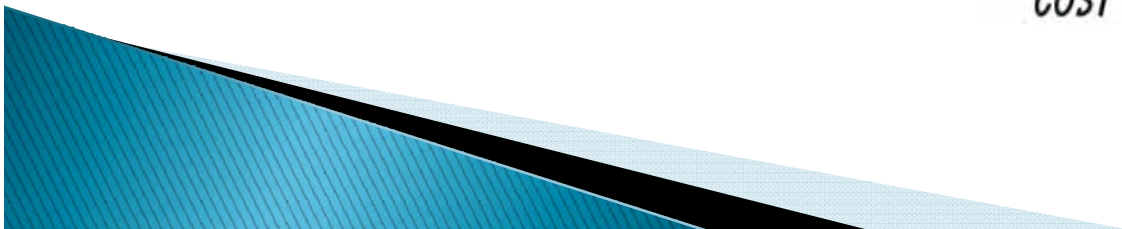
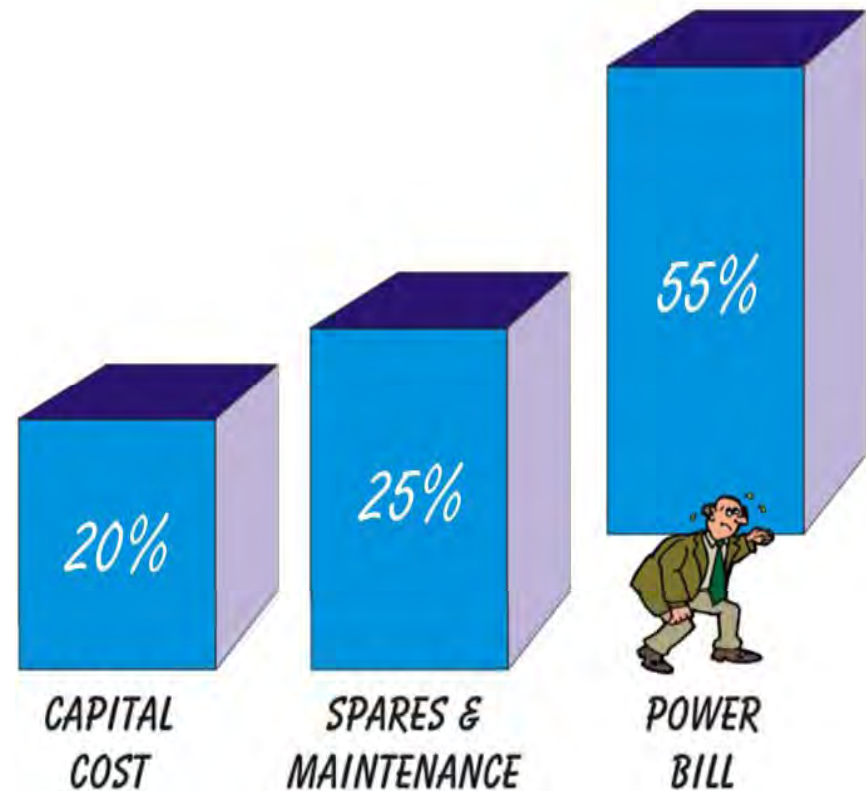
Why concentrate on pumps?

- ▶ Pumps consume 15% of the World's electricity. Pump affected systems add another 15%
- ▶ Pumps typically run 15 – 40% away from best efficiency so considerable scope for improvement
- ▶ Much wastage is avoidable but pumps are neglected because:
 - They're robust - if they're delivering flow it's OK.
 - Not the focus of the process
 - No time / expertise for regular pump tests.
 - Energy was cheap.
 - Instrumentation is seldom installed so wastage is not easily visible



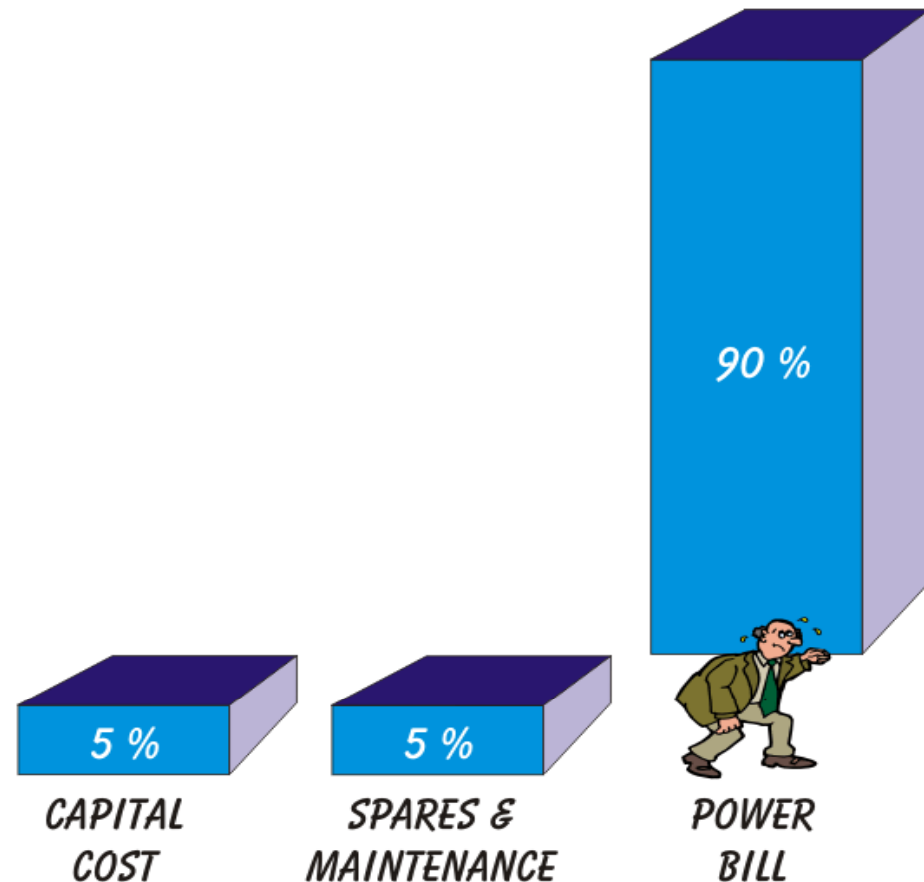
Historical Situation

Abundant cheap power and high capital/maintenance costs



Current Situation

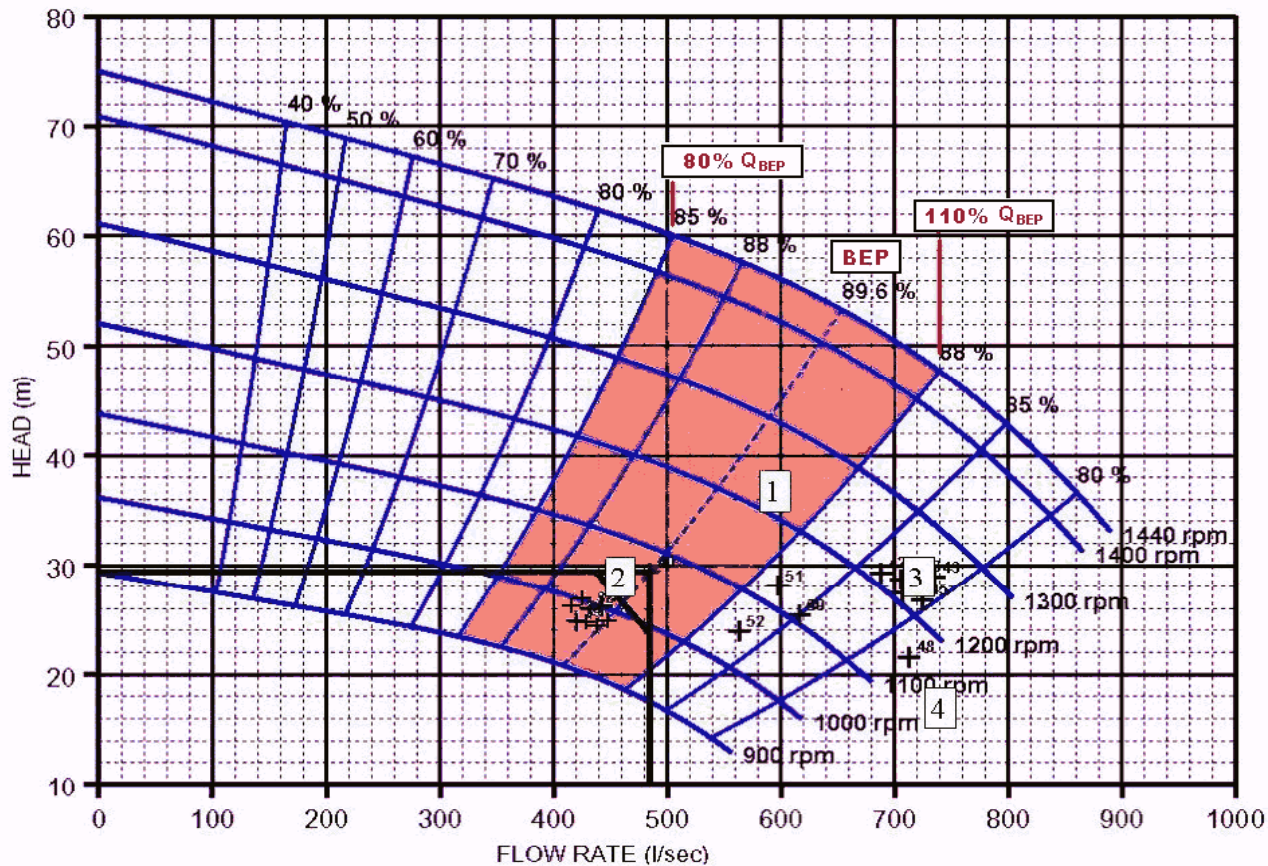
Power costs account for 90% of the Life Cycle Costs of a typical water pump



Pump Best Efficiency Point

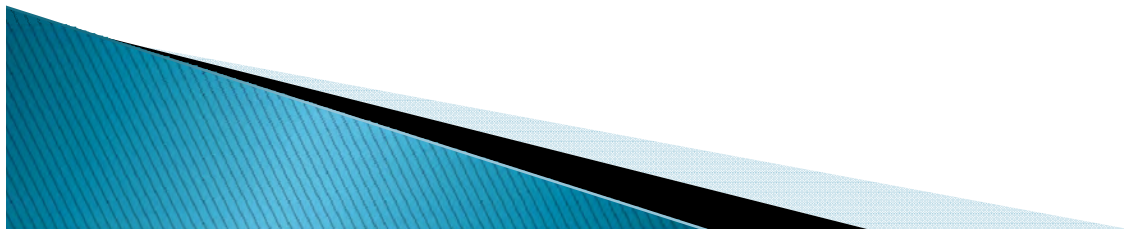
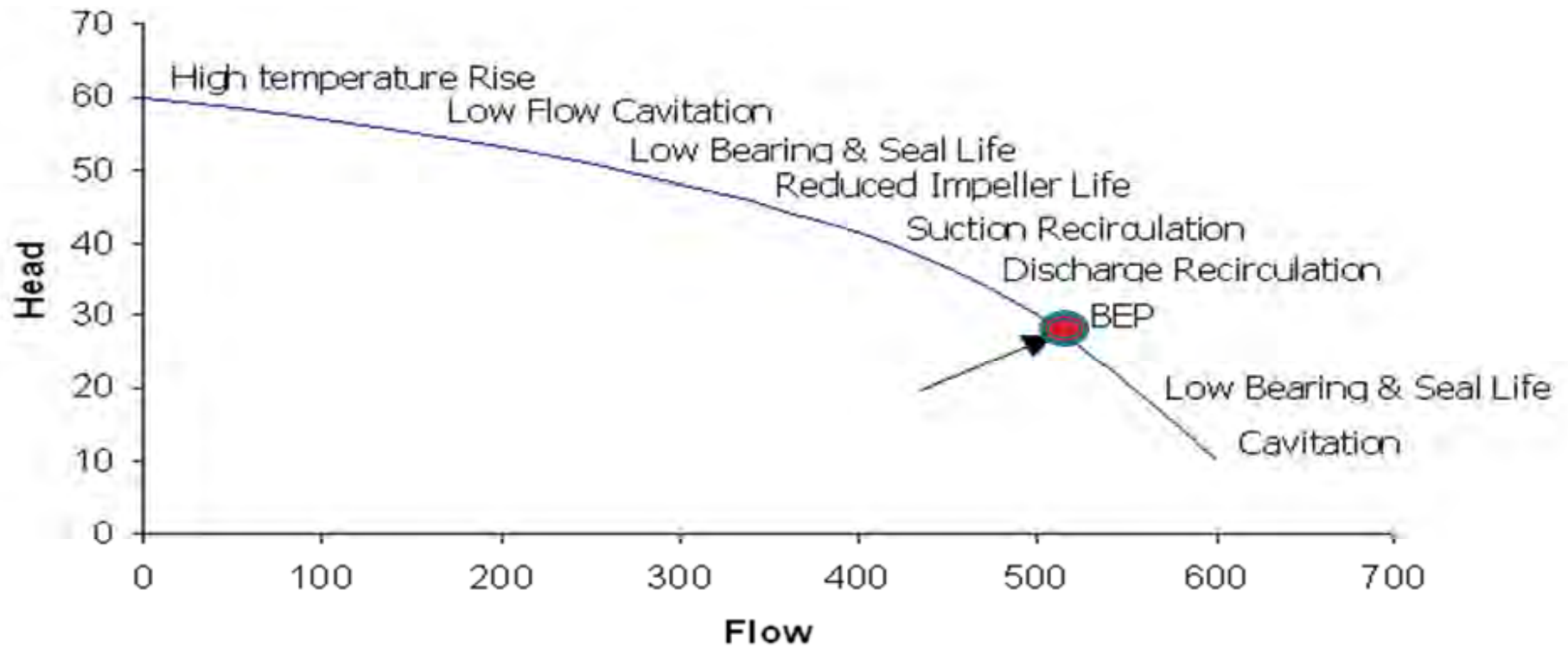


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- 1 Pump Best Efficiency Point (BEP)
- 2 Ideal pump duty
- 3 Pump operating to the right of BEP
- 4 Pump cavitating (very far right of BEP)

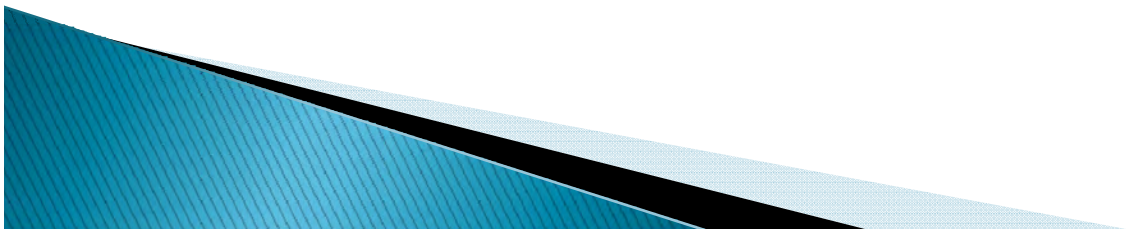
Pumps operate over a wide range but...



Efficient pump systems

- ▶ Operating your pumps more efficiently will deliver:
 - **Reduced power consumption**
 - Reduced maintenance cost
 - Increased system reliability
 - Eliminate over pumping
 - water waste
 - fertiliser waste
 - pollution
 - Reduced capital investment

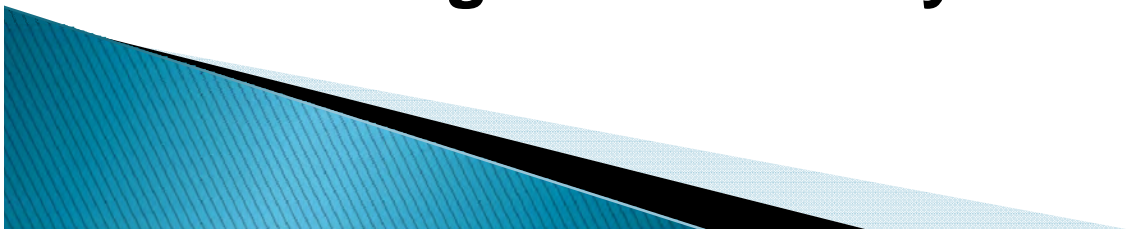
- ▶ **Greater profitability**





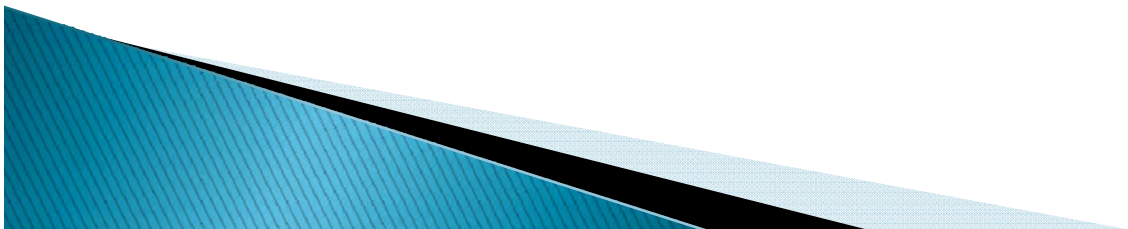
Why are pump systems frequently inefficient?

- ▶ Incorrect pump selection
 - Safety factors added at design stage
 - Incorrect projections / assumptions
 - The pump was available
- ▶ Dynamic system conditions
 - Changes to river & dam levels
 - Changes to suction pipe, filters, strainers
 - Pump & system wear – pipes, valves, nozzles etc.
 - Flow control
 - New system components
- ▶ Motor not matched to system requirement
- ▶ **Wastage is not easily visible**



Assessment procedure

- ▶ Pump user supplies:
 - List of pump models & motor sizes
 - Approximate annual electricity spend on pumping
 - Brief description of pumping system
- ▶ Minimum installed base of 100kW / R100 000p.a.
- ▶ Fixed price quotation
- ▶ Undertake assessment
- ▶ Produce report
- ▶ User actions cost-justified recommendations
- ▶ Follow-up assessment



System Assessment

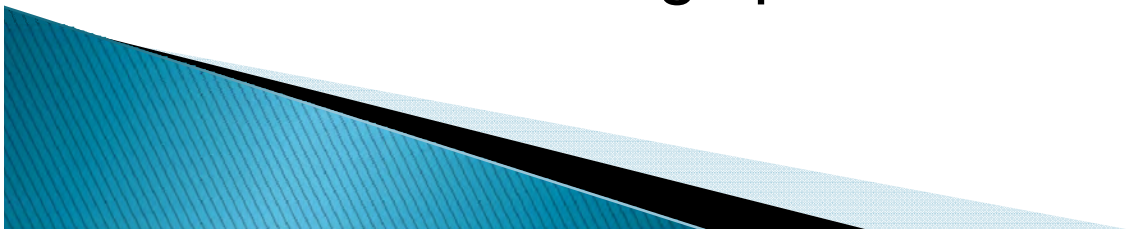


- ▶ Pump performance tests using portable instrumentation
 - Suction & discharge pressure (if gauges / tappings available)
 - Flow
 - Amps drawn per pump
- ▶ Check accuracy of any installed instrumentation
- ▶ Obtain manufacturers performance curve for each pump
- ▶ Visual inspection of pump & system
 - Valves
 - Pipework system & design
 - Motor
 - Seals
 - Strainer / filter





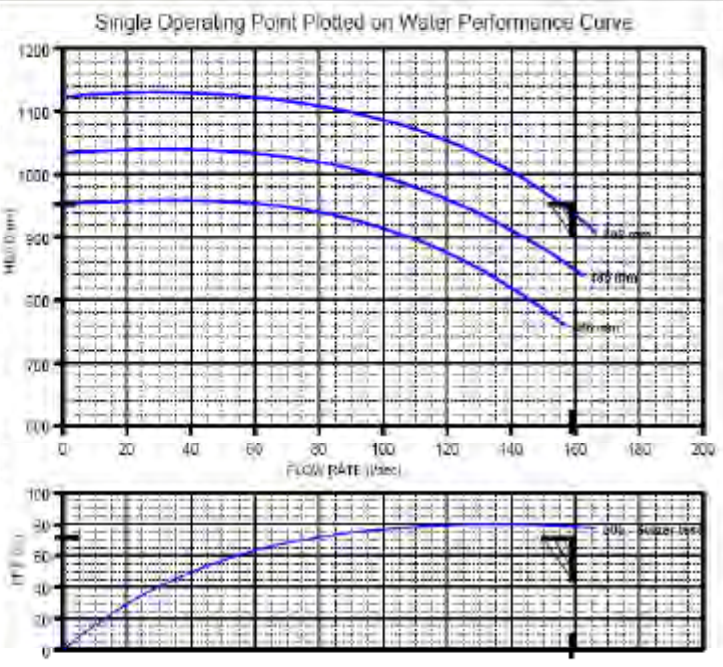
Assessment Report

- ▶ Pump test report
 - Pump efficiency
 - Analysis of reasons for wastage
 - Cost per MI pumped – **sets baseline for:**
 - **PCP / tax rebates / DSM projects**
 - **Carbon credits**
- ▶ Current physical status of system components
- ▶ Review of system design
- ▶ Recommend ways to reduce power consumption
- ▶ Estimate savings per recommendation



Pump test report



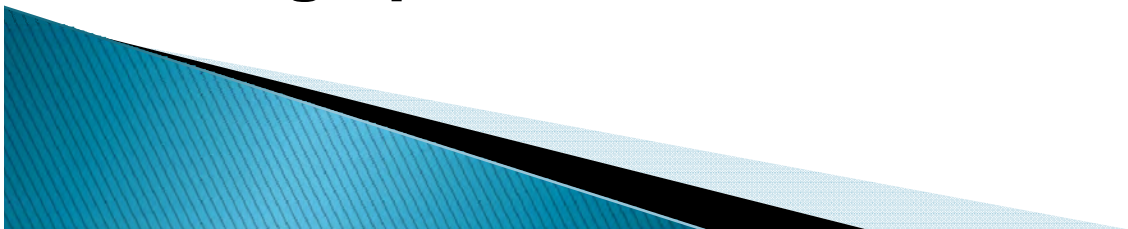
 TAS Online <small>(Pty) Ltd.</small> Pump Monitoring & Consultancy		PUMP TEST REPORT		P.O. BOX 411203 CRAIGHALL 2024 SOUTH AFRICA TEL +27 11 325 0881 FAX +27 11 325 0488																												
CLIENT: MINE & SHAFT: LEVEL & POSITION:		 TAS Online Tel: +2711 325 0881 sales@tasonline.co.za Fax: +2711 325 0488		DATE: 14-1-2009 11:43																												
Test Details Test date: 07 September 2009 Supplier: Sulzer OEM: Sulzer Pump model: HPH 50/20w Stages: 11+1 Impeller diameter: 505 Pre refurbishment efficiency: N/A Refurbishment cost: N/A Serial Number: 650582 Motor Rating [kW][Amps]: 1850 kW / 192 A Motor efficiency (from motor plate): 96%				Ref No: Pump Model: Client: Location: Dist: Dlamini Tag No:																												
<table border="1"> <thead> <tr> <th>Measured Parameters</th> <th>Instrument</th> <th>Local</th> </tr> </thead> <tbody> <tr> <td>Suction pressure [kPa]:</td> <td>54</td> <td>N/A</td> </tr> <tr> <td>Delivery pressure [kPa]:</td> <td>9,436</td> <td>9,800</td> </tr> <tr> <td>Balance flow [l/s]:</td> <td>4,0</td> <td>4,2</td> </tr> <tr> <td>Amps:</td> <td>N/A</td> <td>237</td> </tr> <tr> <td>Motor Power [kW]:</td> <td>2,180</td> <td>2,284</td> </tr> <tr> <td>Pump speed [rpm]:</td> <td></td> <td></td> </tr> <tr> <td>Column flow [l/s]:</td> <td>158</td> <td>157</td> </tr> <tr> <td>Motor efficiency:</td> <td></td> <td>96%</td> </tr> </tbody> </table>		Measured Parameters	Instrument	Local	Suction pressure [kPa]:	54	N/A	Delivery pressure [kPa]:	9,436	9,800	Balance flow [l/s]:	4,0	4,2	Amps:	N/A	237	Motor Power [kW]:	2,180	2,284	Pump speed [rpm]:			Column flow [l/s]:	158	157	Motor efficiency:		96%	<p style="text-align: center;">Single Operating Point Plotted on Water Performance Curve</p> 			
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Calculated Values System head: 956 Pump set efficiency: 71%		Result: Successful test.																														

Short term, low cost remedies



- ▶ Run most efficient pumps whenever possible
- ▶ Improve parallel operation
 - Optimised scheduling
 - Matching pump duties
 - Refurbishing pumps – wear has greater effect in parallel pumping
- ▶ Modify or replace the impeller
- ▶ Change pump speed by replacing pulleys
- ▶ Reshuffle pumps to ensure unit matches requirement
- ▶ Clear blocked system components

Savings potential 10% - 15%



Longer term remedies



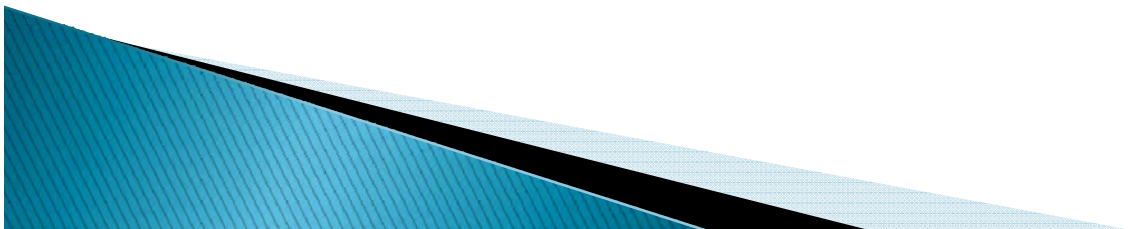
- ▶ Replace or refurbish pump
- ▶ Coat pump internals
- ▶ Overhaul system – pipes, valves, nozzles, filters, screens etc.
- ▶ Install VSD
 - Meet variable demand
 - Soft start reduces pressure on pipes, valves etc.
 - Save water (overpumping) &/or power (throttling)
 - Not cost-justifiable with low utilisation systems
- ▶ Improved maintenance planning
- ▶ Modify system design

Total savings potential 10% - 40%



Follow up

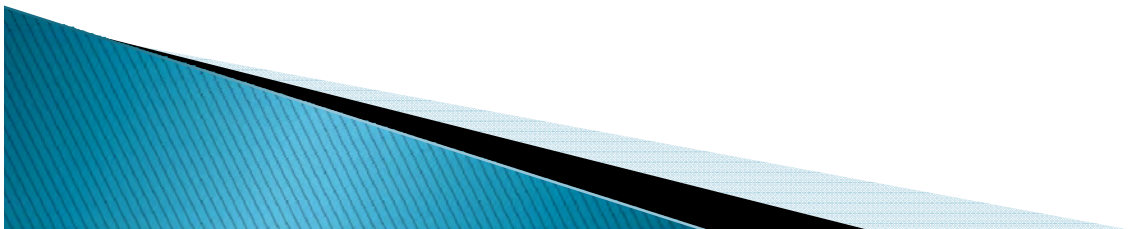
- ▶ After initial changes have been completed
- ▶ Pumps tested under improved conditions
- ▶ Evaluate success of remedial measures
- ▶ Annualise savings
- ▶ Additional recommendations if justified
- ▶ Repeat process at set intervals (annually?) or
- ▶ Attend one-day training course



Financial Justification



- ▶ Minimum system (100kW installed / R100 000p.a.)
 - Assessment R10 000 – R15 000 + expenses
 - Follow-up R5 000 + expenses
 - Electricity cost savings R10 000 - R40 000 p.a.
- ▶ For larger systems the savings potential per R spent on the Assessment is likely to be greater
- ▶ Additional savings:
 - Maintenance / reliability
 - Water
 - Fertiliser
 - Pollution



Is a Pumping System Assessment cost-justified?



- ▶ Initial cost should be recovered within 1 – 2 years
- ▶ Thereafter only cost is for a periodic re-assessment
- ▶ Initial savings can be re-invested on further improvements
- ▶ Payback period will progressively shorten due to:
 - Electricity tariff rises
 - Punitive tariffs
 - Power shortages
 - Tax incentives
 - Savings must be verified (kW.hrs/MI pumped)

