

Life Cycle Costing of Pumps and Systems

Brian Conway
Pump Management Limited



Background

- Water industry has been trying to manage pump energy for >10 years
- Other low product value industries have been considering pump energy for >5 years
- Higher product value industries have just started considering pump energy
- Very high product value industries have started saying they are considering pump energy



- Interest in reducing energy is directly proportional to energy cost
- Interest in reducing energy consumption is directly proportional to unit of product value pumped



Dubious Statistics!

- 20% of World's energy used for pumping
- Energy is the greatest cost of any pump system during a 20 year life
- On average a pump system is 10 to 15% below its best efficiency
- 80% of pumps are at least 10% oversize



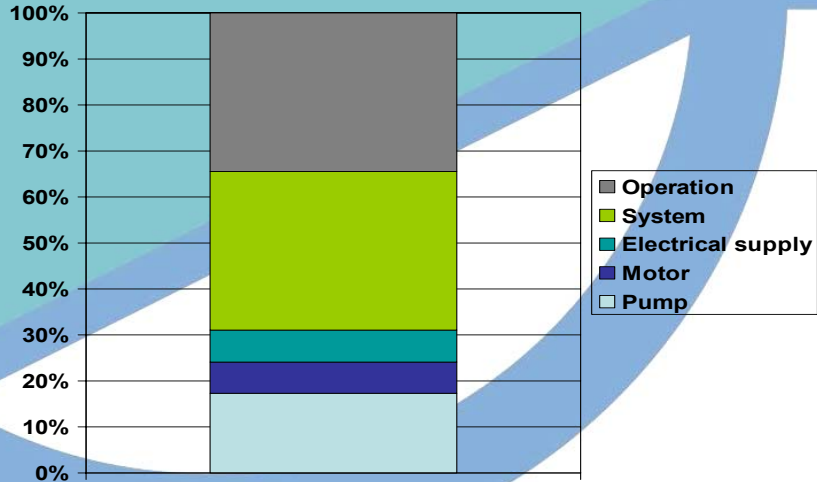
Dubious Statistics – cont.

7,258,064,516kWh

Estimated annual pump energy used to supply and treat water in UK



Efficiency Savings in Pump Systems – Water Supply



Advanced Technology - Pipeline

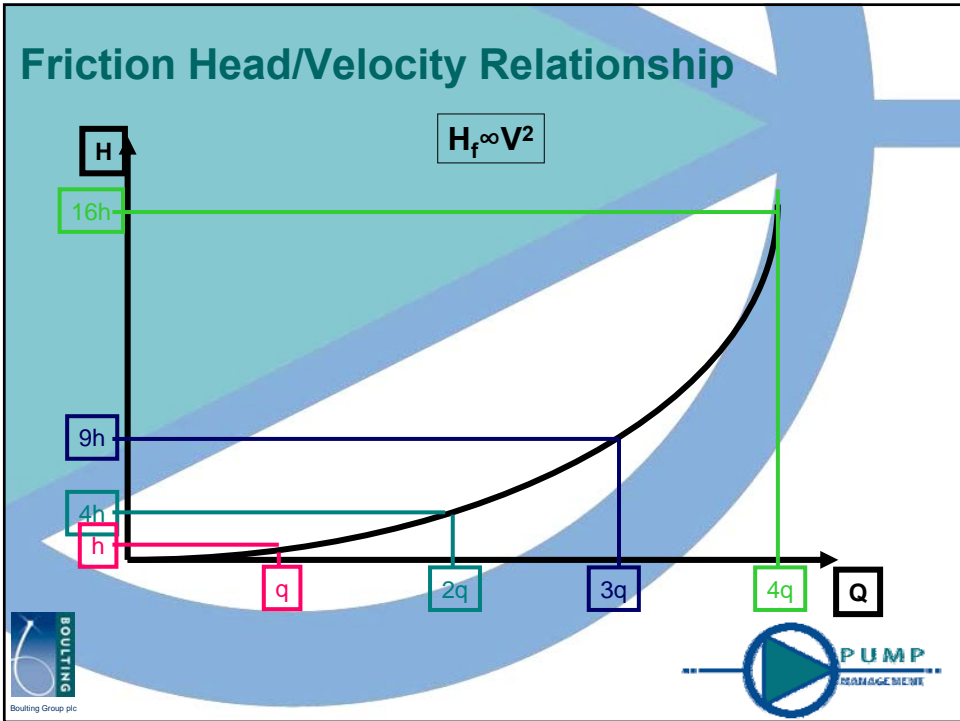
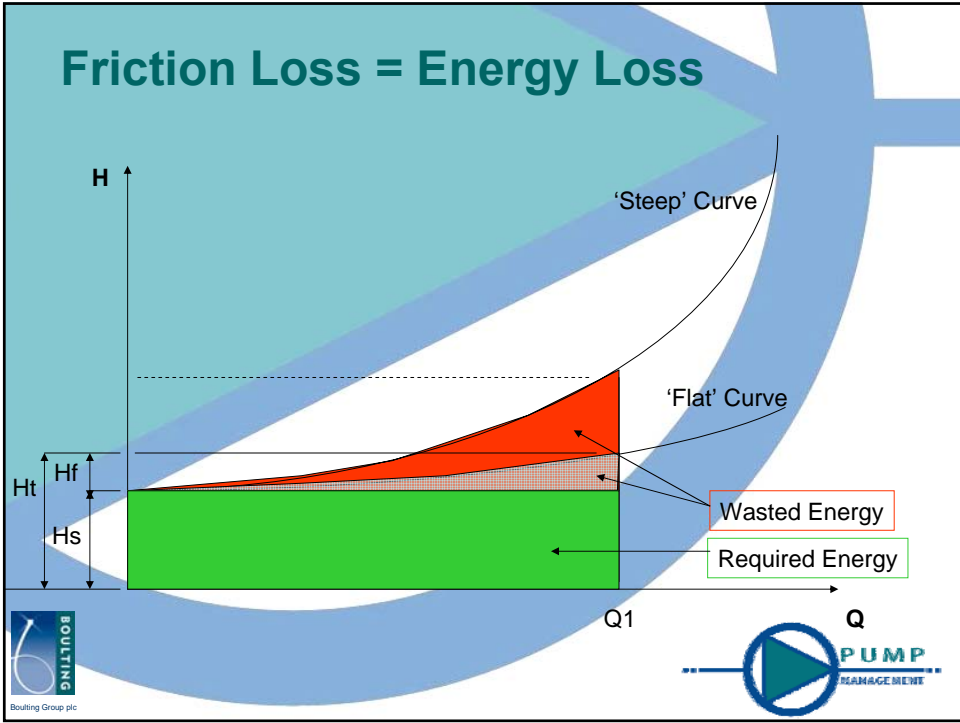
50mm. 37.9m friction. 35,406kWh annual energy. £2,195 energy bill

75mm. 4.83m friction. 4,512kWh annual energy. £280 energy bill.
87% ENERGY REDUCTION

100mm. 1.15m friction. 1,074kWh annual energy. £67 energy bill
97% ENERGY REDUCTION

1000m pipeline. 30m³/hr. 8000 hrs per year. 70% efficient pump/motor. £0.062/kWh





Conclusions

- Interest in reducing energy is directly proportional to energy cost
- Interest in reducing energy consumption is directly proportional to unit of product value pumped



**IF WE CANNOT MEASURE
WE CANNOT MANAGE**



Pump System Energy Audits

- Installed Power
- Power absorbed x Hrs run per year
- Energy consumption
- Prioritise in kWh/yr

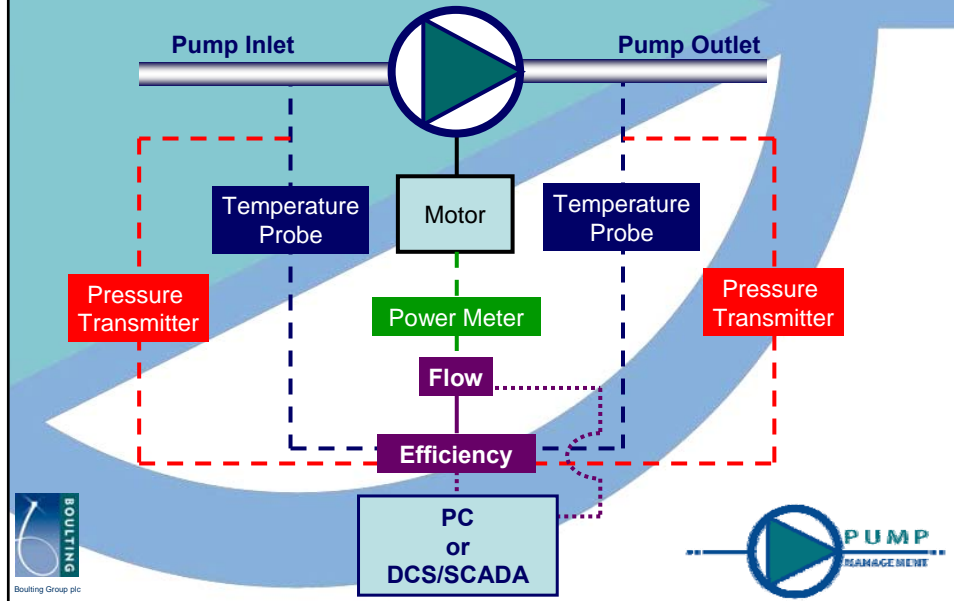


Pump System Assessment

- Pump Optimisation
 - Pump Review
 - System review
 - Operational review
 - Recommendations
 - Costs (installation and operation)
 - R o I Evaluation
 - Supply and installation



Pump Testing - Thermodynamic



Data Collection - Thermodynamic

Pump Management – Pump Monitor [X]

Log Record
 Continuous
 View E Terms

Waiting for Next Measurement
 Due 13/01/2003 15:25:31
 Now 13/01/2003 15:24:23

Data Input

Quit

Sample	Average	Max	Min	StDev
T1 025.023 C	025.0206	025.0228	025.0182	0.00125
T2 025.123 C	025.1213	025.1231	025.1188	0.00120
dT 0.10035 C	0.100701	0.101135	0.100297	0.00018
P1 002.000 bar	001.9998	002.0001	001.9996	0.00011
P2 011.998 bar	011.9985	011.9991	011.9979	0.00028
dP 009.998 bar	009.9987	009.9993	009.9982	0.00031
H 0103.37 m	0103.379	0103.385	0103.374	0.00325
n 0.74834	0.747539	0.748470	0.746542	0.00042
q 0177.64 l/s	0177.443	0177.663	0177.208	000.101
pw 0300.00 kW	0300.000	0300.000	0300.000	000.000

Pump Efficiency or Pump System Efficiency?

Is it Important?



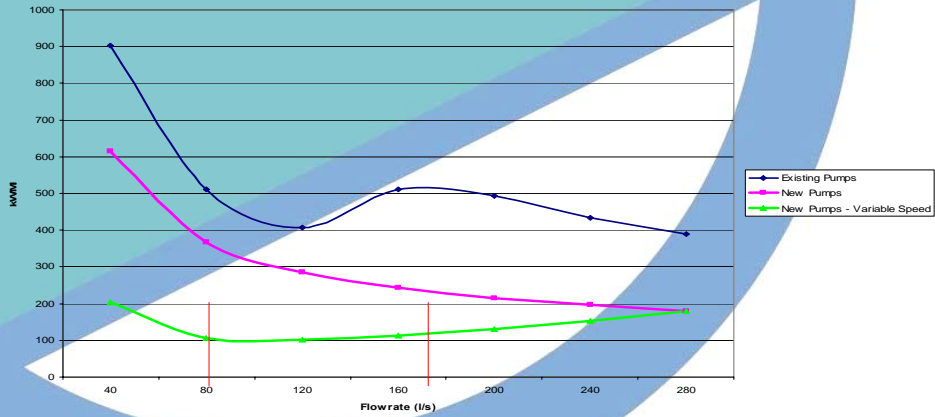
Original Data

- Installed Power = 500kW
- Pump Efficiency = 70%
- Annual Energy Consumption = 1,800,000 kWh

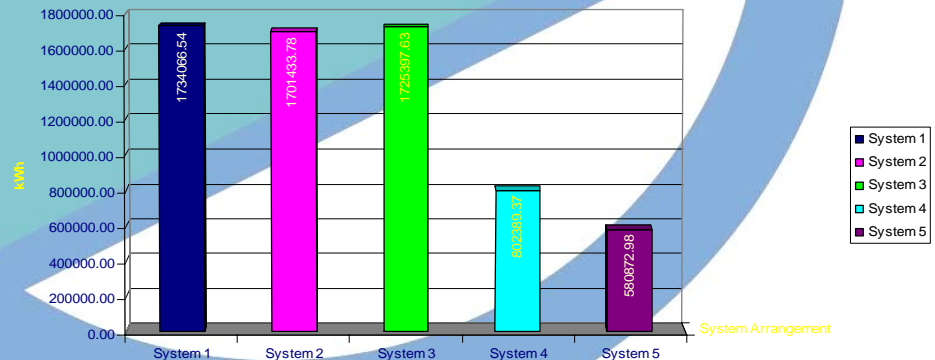


Specific Consumption (kWh/MI)

kWh/MI for Different Pump System Options

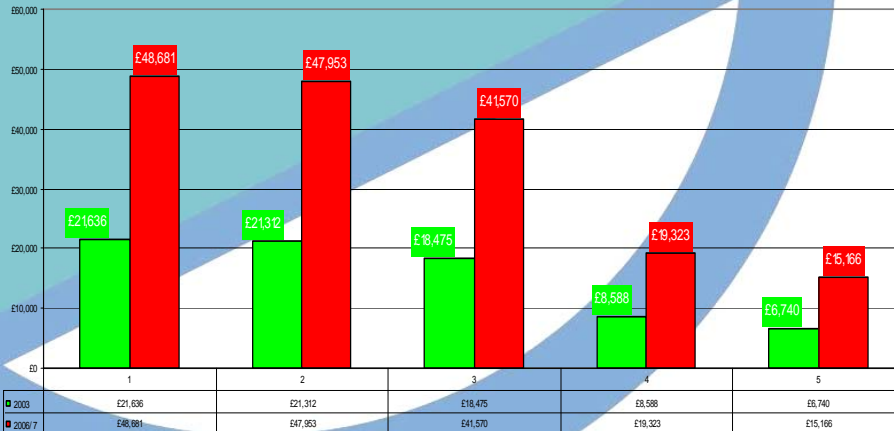


Annual Power Consumption Comparison



Annual Power Cost Comparison

Annual Total Energy Cost Comparison



New Data

- **Installed Power = 250kW (was 500kW)**
- **Pump Efficiency = 80%**
- **Annual Energy Consumption = 580,000 kWh (was 1,780,000kWh)**
- **% Energy Reduction = 67%**
- **% Cost Reduction = 69%**



Benefits

- Sustainable Reduced Energy Consumption
- Reduced CO₂ emissions
- Minimise energy cost
- Increased reliability
- Restraint of power generation expansion
- Environmental improvements



Performance to Date

- Average pump efficiency improvements +11%
- Pump reliability improvements +17%
- Pump system improvements +21%
- Energy reduction to date 82m kWh



Energy Saving Technologies?

- Confidence in analysis
- Common sense approach to efficient design
- Best available technology



Energy Cost?

or

Energy Consumption?

