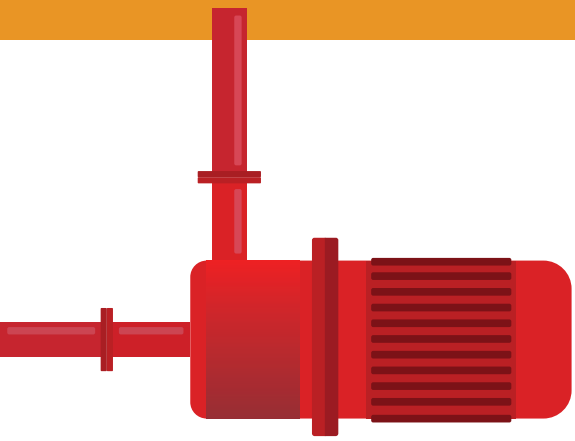
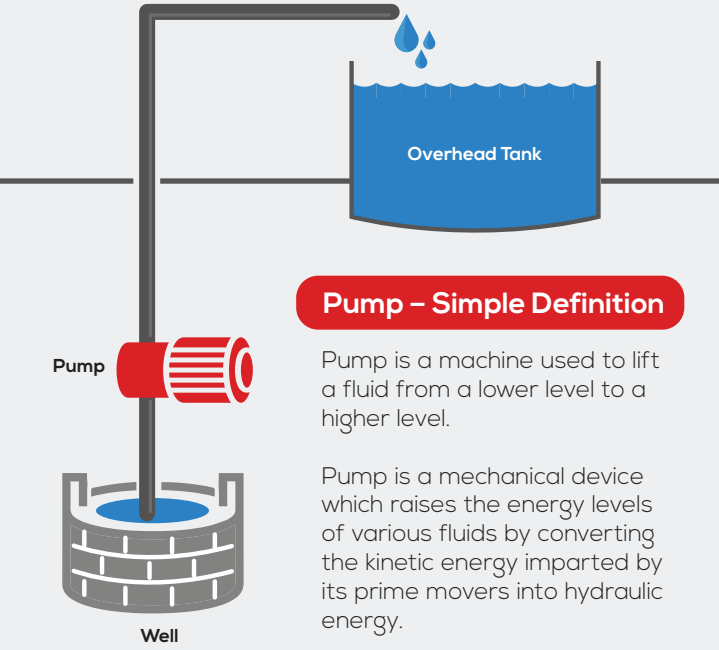
GEF - UNIDO - BEE PROJECT

on

"Promoting EE/RE in selected MSME Clusters in India"

PUMPING SYSTEM





Pump – Simple Definition

Pump is a machine used to lift a fluid from a lower level to a higher level.

Pump is a mechanical device which raises the energy levels of various fluids by converting the kinetic energy imparted by its prime movers into hydraulic energy.

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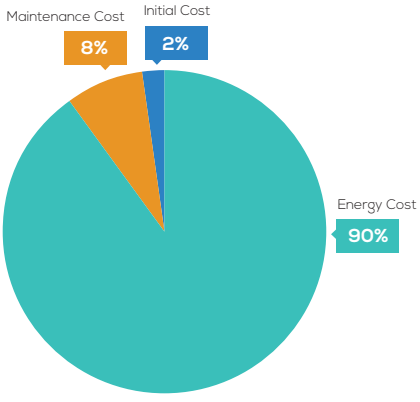
Life Cycle cost for a Pump



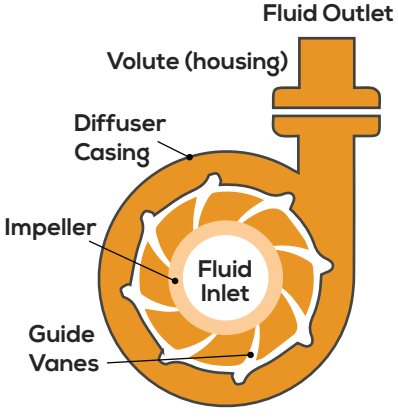
30 kW pump

- Initial cost: Rs 3,00,000/-
- Operating hours: 8000/year
- Power cost: Rs 5/unit
- Lifetime: 15 years
- Maintenance: Rs 30,000/-

Life Cycle Cost: Rs 187,50,000/-

Centrifugal Pumps

Centrifugal Pumps have a rotating element , called impeller, through which as the liquid passes its angular momentum changes , due to which the pressure energy of the liquid is increased.



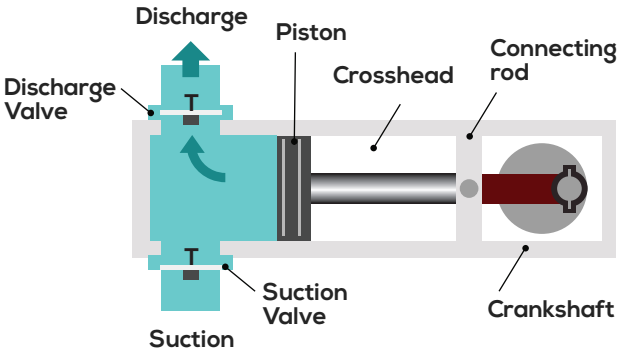
Moderate pressure (upto 6000 m WC)

Moderate capacity (upto 10,000 m3/h)

General applications

Positive Displacement Pumps

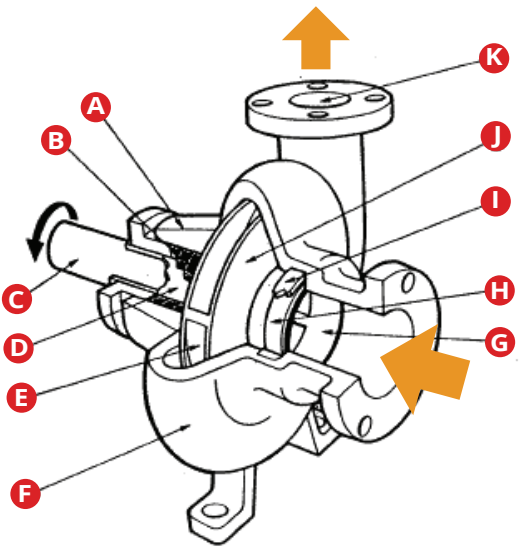
Positive displacement pumps are those in which liquid is sucked and then pushed due to the thrust exerted on it by a moving member, which results in lifting the liquid to the required height.



Reciprocating

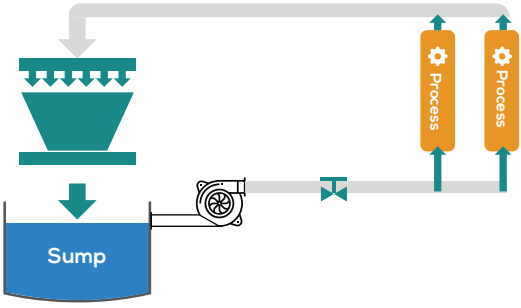
- High pressure - upto 10,000 m WC
- Low capacity - upto 1000 m^3/h
- Lubrication oil pumps

Parts of Pumps

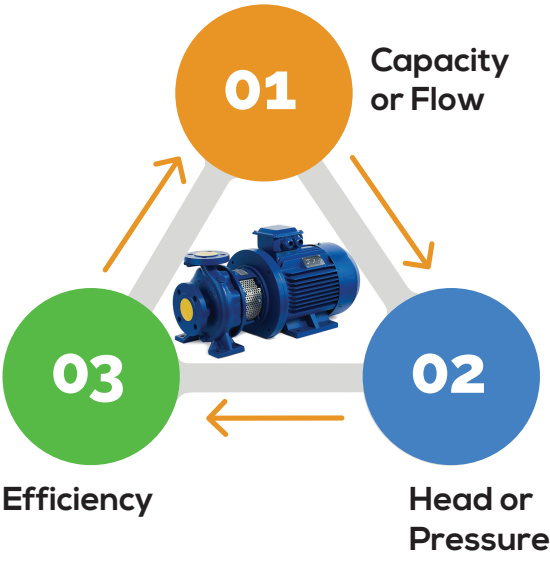


- A Stuffing Box
- B Packing
- C Shaft
- D Shaft Sleeve
- E Vane
- F Casing
- G Eye of Impeller
- H Impeller
- I Casing wear Ring
- J Impeller
- K Discharge Nozzle

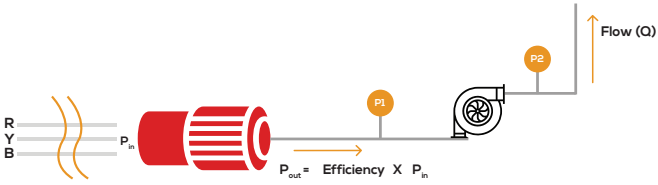
Typical Pumping Layout



Energy Parameters



Efficiency of Pump



$$\text{Pump } \eta\ (\%) = \frac{\text{Flow (lps)} \times (h2-h1)\ (m) \times \text{Sp. Gr.}}{102 \times P_{out}}$$

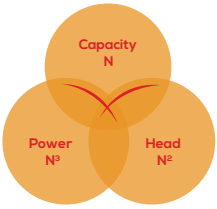
Pumps Formulae

If the RPM is reduced by say 10%, what will happen to the

Capacity reduces by 10%

Head reduces by 19%

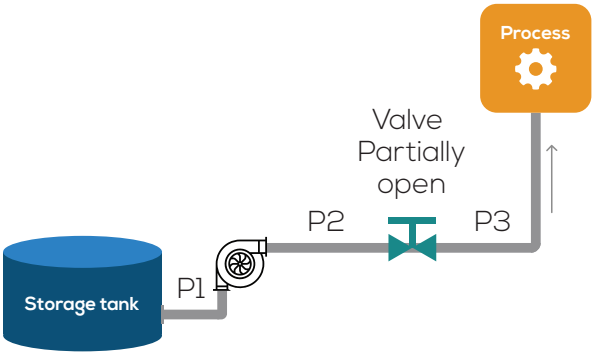
Power reduces by 27%



Reasons for excess power consumption

1. Wrong Selection
2. Over Design
3. Improper Layout
4. Old Improper Pumps
5. Multiple Smaller Size Pumps
6. Poor Operational Practices

Pressure Drop Across Valve



Pr. Drop Across Valve = P2 - P3

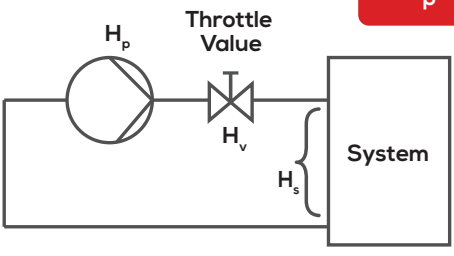
Total Pr. Rise = P2 - P1

Energy Saving Potential = [(P2-P3)/(P2-P1)]

Various Control Techniques in Pumps

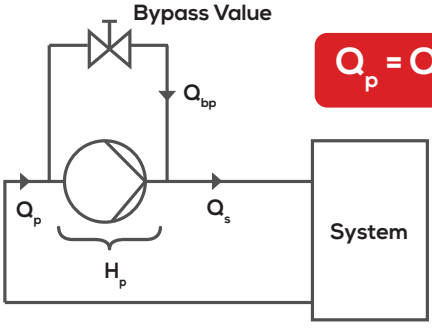
Throttle Control

$$H_p = H_s + H_v$$

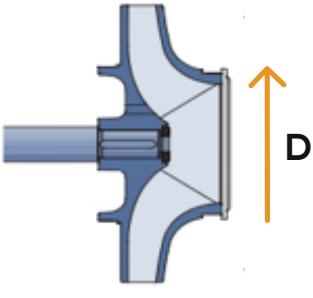


Bypass Control

$$Q_p = Q_s + Q_{bp}$$

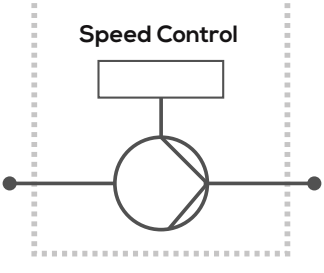


Modifying Impeller Diameter

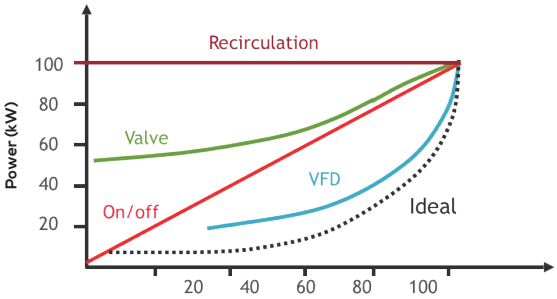


$$Q \sim D$$
$$H \sim D^2$$
$$N \sim D^3$$

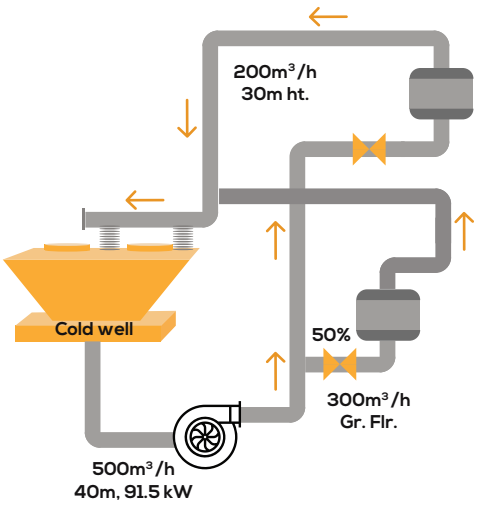
Speed Control

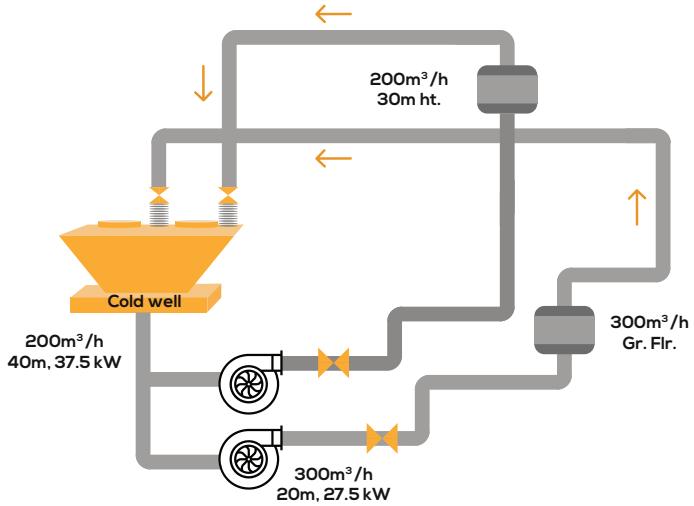


Effect of Various Capacity Controls



Case Study - Segregate high and low head users

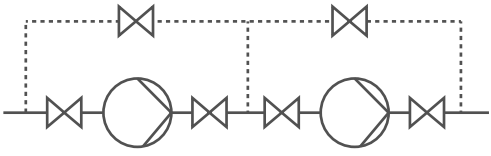


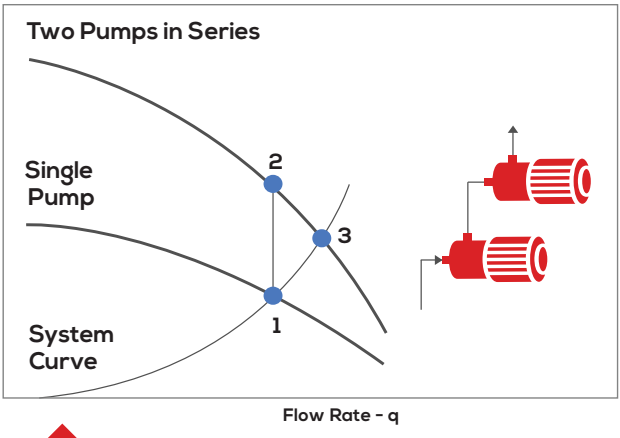


Annual Savings	= Rs. 4.80 Lakhs
Investment	= Rs. 6.00 Lakhs
Payback period	= 15 Months

Series and Parallel Operation

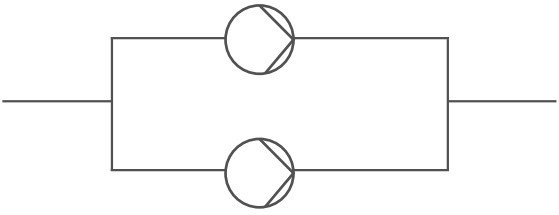
Series Operation

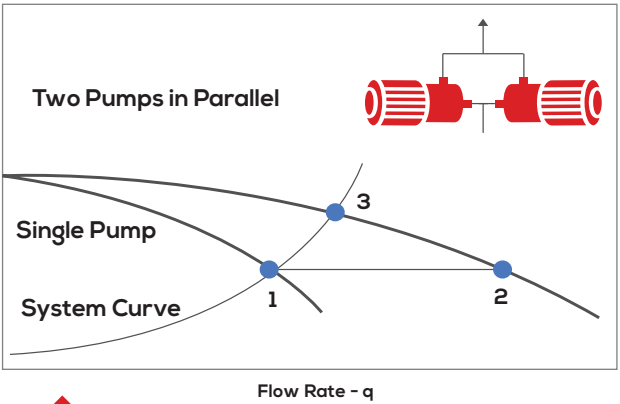




- Head will become double
- Flow will be same

Parallel Operation





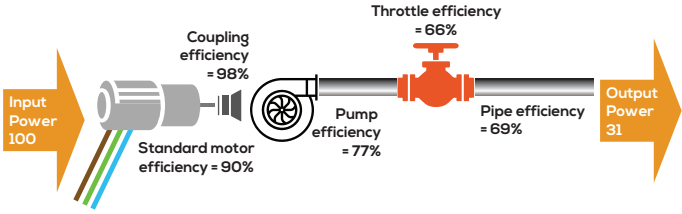
- Flow will become double
- Head will be same

Symptoms indicating opportunities for energy saving

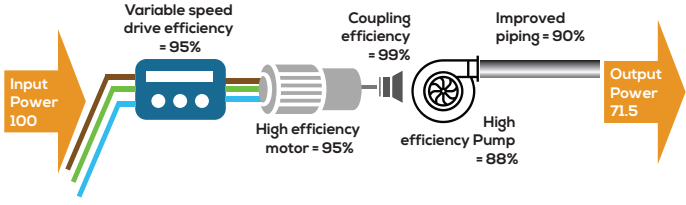
Symptom	Likely Reason	Best Solutions
Throttle valve-controlled systems	Oversized pump	Trim impeller, smaller impeller, variable speed drive, two speed drive, lower rpm
By Pass line (partially or completely) open	Oversized pump	Trim Impeller, smaller impeller, variable speed drive, lower rpm
Multiple parallel pump system with same no of pumps always operating	Pump use not monitored or controlled	Install controls
Constant pump operation in batch environment	Wrong system design	On off controls
High maintenance cost (seals, bearings)	Pump operating away from BEP	Match pump capacity with system requirement

Energy Efficient Pumping System

Conventional Pumping System
(Efficiency ~ 31%)



Efficiency Optimized Pumping System
(Efficiency ~ 72%)



EE Opportunities in Pumping System

- Operate Pumps near best efficiency point and replace old pumps with energy efficient pumps
- Modify pumping system and pump losses to minimize throtteling
- Use variable speed drives to meet vide load variation
- Avoid cooling water recirculation in DG set, compressor, refrigeration system etc.
- Use gravity flow whenever possible
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- Optimize no of stages in multi stage pumps in case of head margin
- For over designed pumps, downsize or replace impeller or replace with correct size pump for efficient operation

Pump Maintenance Check List

Description	Comments	Maintainance Frequency			
		Daily	Weekly	Monthly	Annualy
Pump use/ Sequensing	Turn off/sequence unneccessary pumps	✖			
Overall Visual Inspection	Complete all overall visual inspection to be sure all equipments is working and safety systems are in place	✖			
Check Lubrication	Assure that all bearings are lubricated as per the manufacturer's instruction			✖	
Check Packing	Check packing for the wear and repack as neccessary. Consider replacing packing with mechanical seals			✖	
Motor/pump Alignment	Aligning the pump/ motor couplings allows for efficient torque transfer to the pump			✖	
Check Mountings	Check and secure all the pump mountings			✖	
Check Bearings	Inspect bearings and drive belts for wear. Adjust,repair or replace as neccessary.				✖
Motor Condition	Checking for the condition of the motor through tempreture or vibration analysis assures long life				✖

About Project

Promoting Energy Efficiency & Renewable Energy in Selected MSME Clusters in India

To develop and promote a market environment for introducing energy efficiency and enhanced use of renewable energy technologies in process applications in the selected energy-intensive MSME clusters under GEF UNIDO BEE project.
The main objective of the project is to increase the capacity building of suppliers of EE/RE product and service providers

Desclaimer

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