

ENERGY SAVING EFFORTS AND RESULTS IN TNPL



PRESENTED BY
S.GOKULAKANNAN



TNPL UNIT-I, KAGITHAPURAM (PAPER PLANT)

GLOBAL CLIMATE CHANGE IS REAL



ENERGY MANAGEMENT SYSTEM



FUNCTIONALITIES TO CONSIDER FOR ENERGY MANAGEMENT SYSTEM

Connectivity with Devices

01

02

Monitoring and Tracking

Instant Notifications

04

03

Reporting and Analytics



Why EnMS?



BENEFITS OF AN ENERGY MANAGEMENT SYSTEM



SAVE MONEY
Improve energy efficiency and reduce energy consumption



GAIN A COMPETITIVE EDGE
Promote energy management best practice



IMPROVE TRANSPARENCY
Clearly communicate energy management efforts



OPTIMISE ENERGY-CONSUMING ASSETS
Identify problem areas

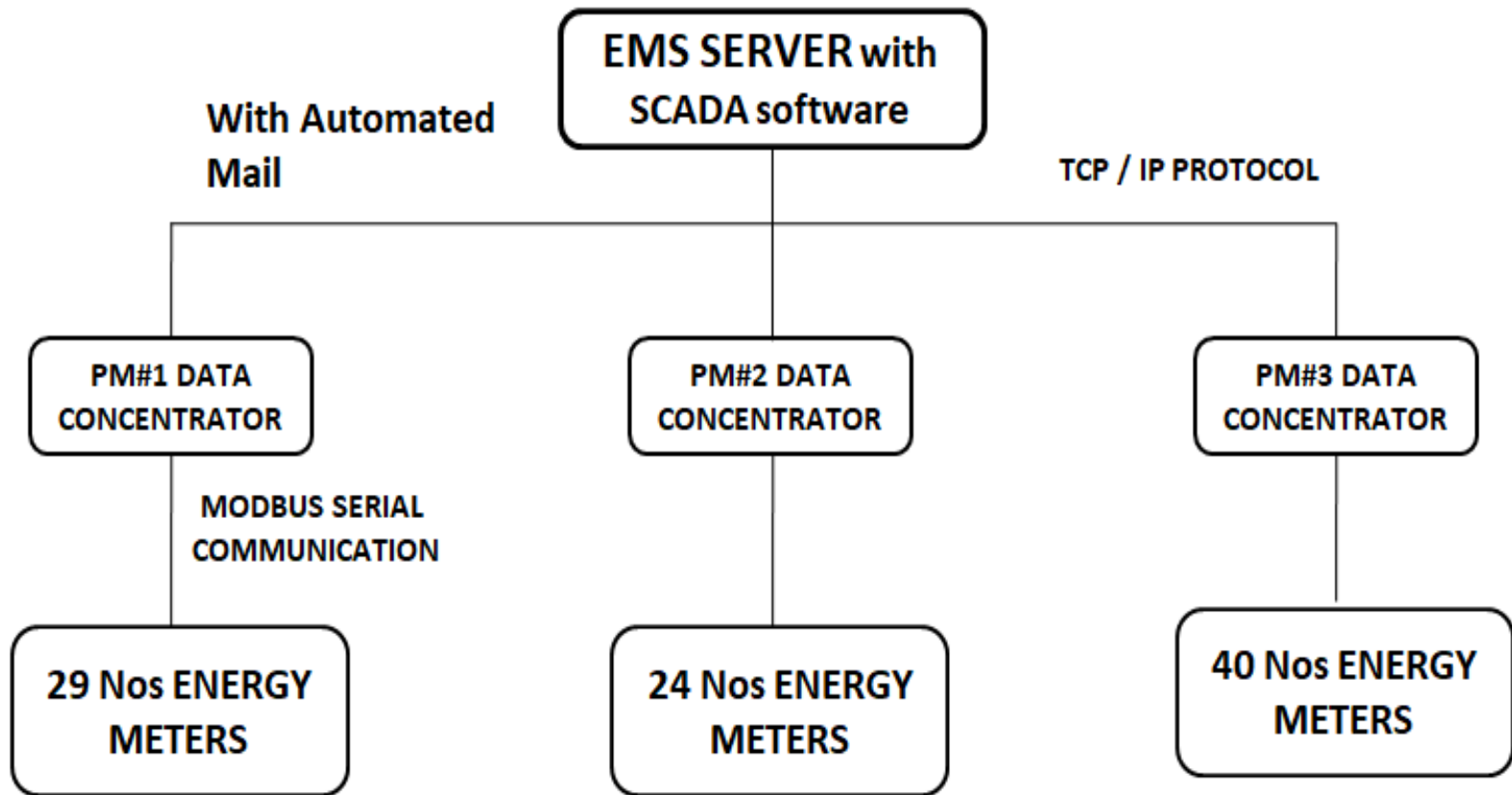


ACHIEVE WORLD-CLASS STANDARDS
Benchmark energy efficiency improvements

ENERGY MONITORING SYSTEM



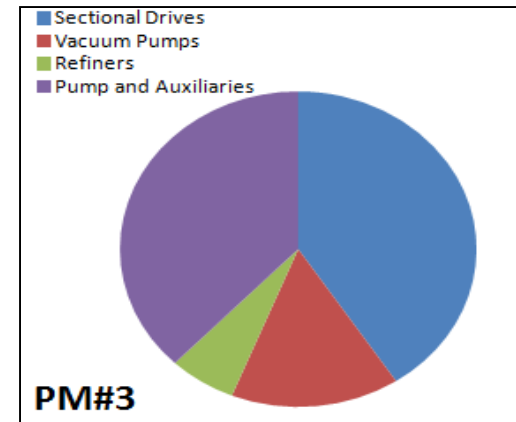
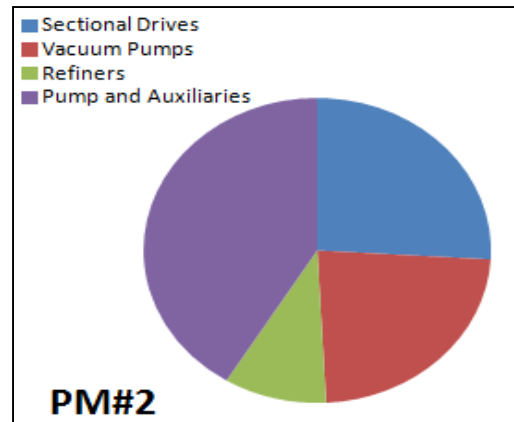
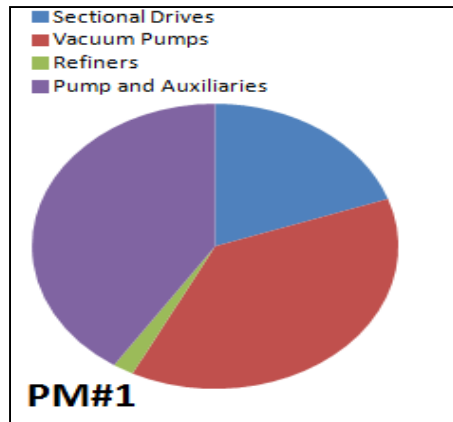
PMC EnMS ARCHITECTURE



ENERGY CONSUMPTION REPORTS



| ENERGY CONSUMPTION REPORTS- DASHBOARD | | | | | |
|---------------------------------------|-------------|----------------------|------------|----------------------|-------------|
| PM#1 | MW | PM#2 | MW | PM#3 | MW |
| Sectional Drives | 1.37 | Sectional Drives | 2.24 | Sectional Drives | 3.47 |
| Vacuum Pumps | 2.65 | Vacuum Pumps | 2.01 | Vacuum Pumps | 1.31 |
| Refiners | 0.13 | Refiners | 0.83 | Refiners | 0.52 |
| Pump and Auxiliaries | 2.85 | Pump and Auxiliaries | 3.56 | Pump and Auxiliaries | 3.22 |
| Total | 6.94 | Total | 8.8 | Total | 9.27 |

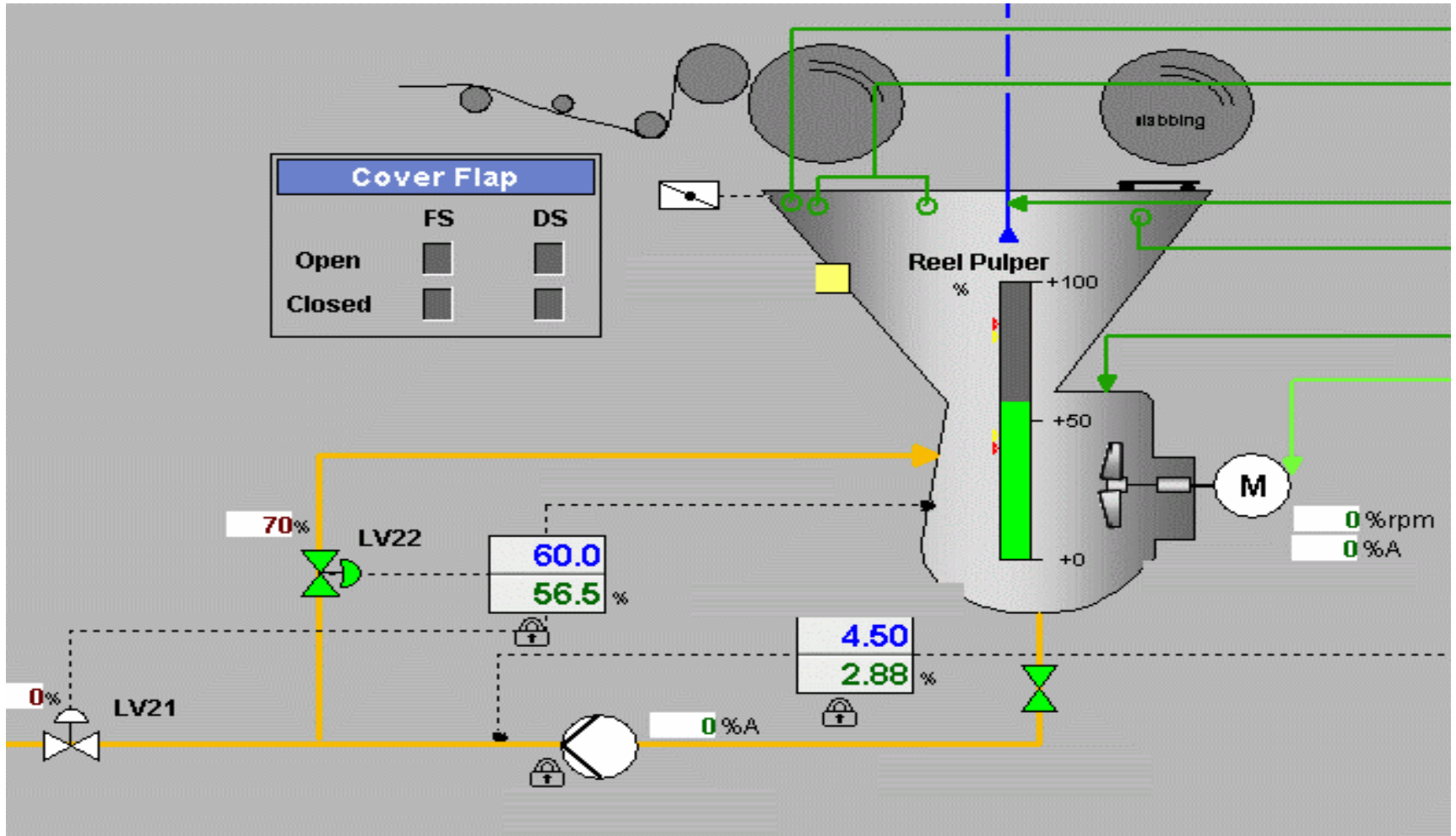


CASE STUDY 1



**ENERGY SAVING BY MODIFYING THE LOGIC
IN PULPER OPERATIONS IN PAPER MACHINE**

PULPER OPERATION



PULPER OPERATION



6 Nos. of Pulper are installed at respective stages to slush the wet & dry broke during normal operation of Paper Machine#3.

Each pulper is equipped with agitator to slush the broke as quickly as possible and discharge it through pump for further process

As per existing logic once manual mode is selected during loose broke feeding, pulper agitator will run for 600 seconds continuously.

LOGIC MODIFICATION



AGITATION TIME

- Agitation time reduced from 600 seconds to 400 seconds by modifying the logic in operation sequence

AVERAGE RUNNING TIME

- Average running time of pulper agitator got reduced from 12hrs/day to 9hrs/day

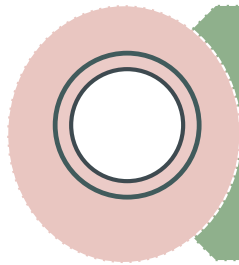
ENERGY COST BENEFITS



TABLE 2. PULPER AGITATOR OPERATION OPTIMIZATION IN PM#3

| Description | UOM | Reel Pulper | PDS Pulper |
|---|-------------|-------------|------------|
| | | Parameters | Parameters |
| Pulper agitator motor capacity | KW | 315 | 315 |
| Agitator full load current | Amp | 318 | 318 |
| Agitator normal running current | Amp | 250 | 250 |
| Agitator Running Power | KW | 240 | 240 |
| Pulper agitator running time as per existing logic | Sec | 600 | 600 |
| Modified Pulper agitator running time | Sec | 400 | 400 |
| Time saved as per new logic | Sec | 200 | 200 |
| Average running time of Pulper agitator | Hrs/day | 12 | 7 |
| Average running time after logic change of Pulper agitator | Hrs/day | 9 | 4 |
| Total Time saved due to logic change | Hrs/day | 3 | 3 |
| Total Power saved due to logic change | Unit/day | 720 | 720 |
| Power Cost | Rs/Unit | 6.0 | 6.0 |
| Total Cost saving by modifying the logic of pulper agitator operation | Rs/day | 4320 | 4320 |
| Saving per Annum (Assuming 330 days operation) | Lakhs/Annum | 14.25 | 14.25 |
| TOTAL SAVINGS (REEL & PDS PULPER), SAY | | 28.5 | |

RESULTS



With the efforts to save power, we incurred cost savings of around 28.5 lakhs per annum, without investing additional cost.

CASE STUDY 2



**REDUCE POWER CONSUMPTION BY STOPPING
6.0 BAR & WARM WATER MAKEUP PUMP**



BRIEF DESCRIPTION

Two Vital roles of the 6 Bar pump in Paper machine 3

- 1. Retention Chemical Preparation System
- 2. Stock and Wet end Area Cleaning System

- *The 6 bar Pump operated continuously with VFD having 55KW motor capacity.*

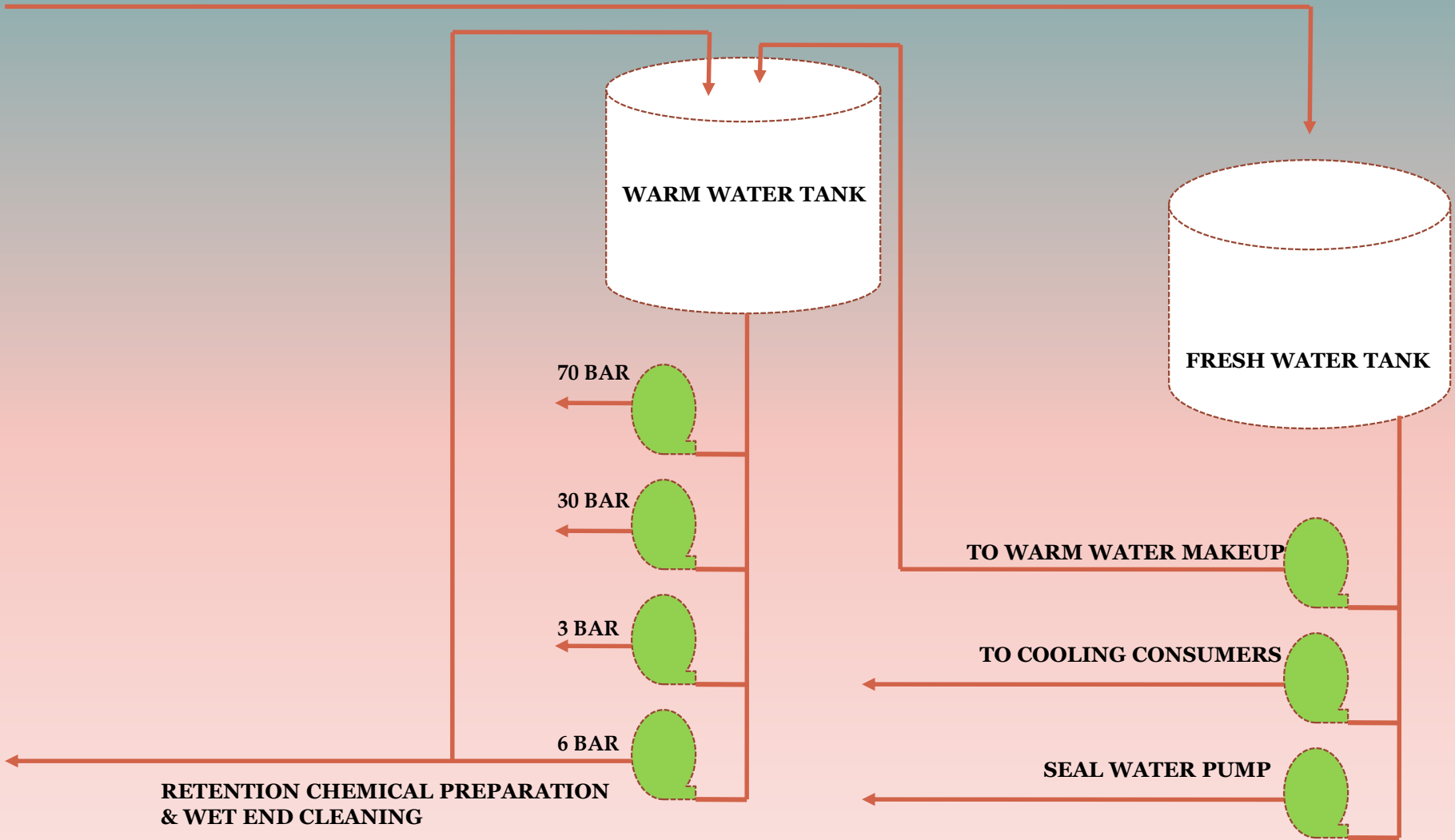
SCOPE

- In-order to reduce power consumption, it is suggested that 6.0 bar pump shall be replaced with same pressure line to fulfill the current fresh water requirement without affecting the existing operation of paper machine.



FRESH WATER LOOP SCHEMATIC

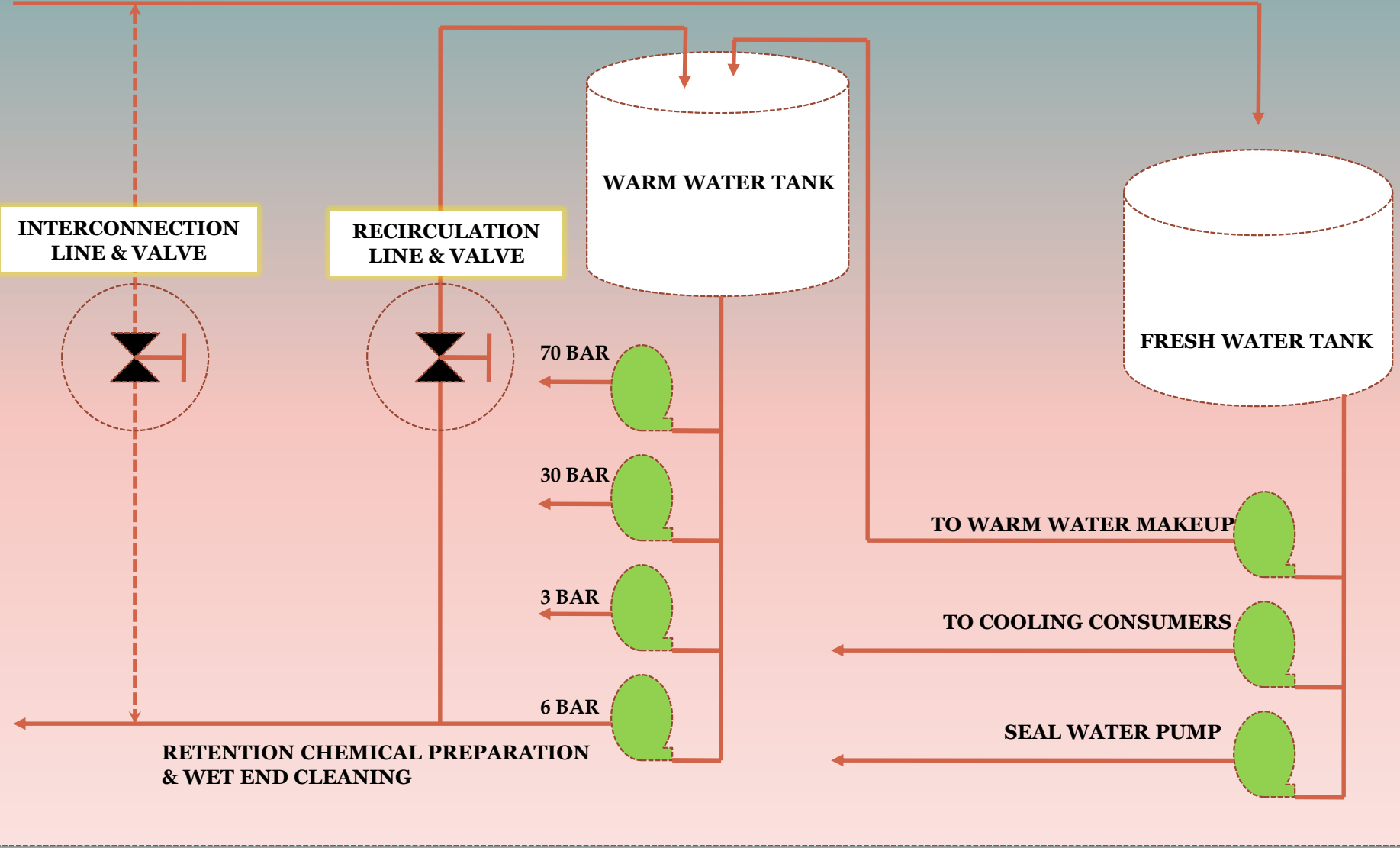
FRESH WATER FROM WTP





FRESH WATER LOOP SCHEMATIC

FRESH WATER FROM WTP

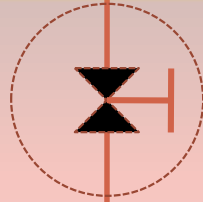
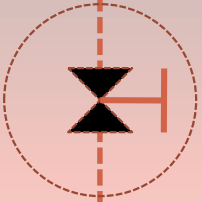


INTERCONNECTION
LINE & VALVE

RECIRCULATION
LINE & VALVE

WARM WATER TANK

FRESH WATER TANK



70 BAR

30 BAR

3 BAR

6 BAR

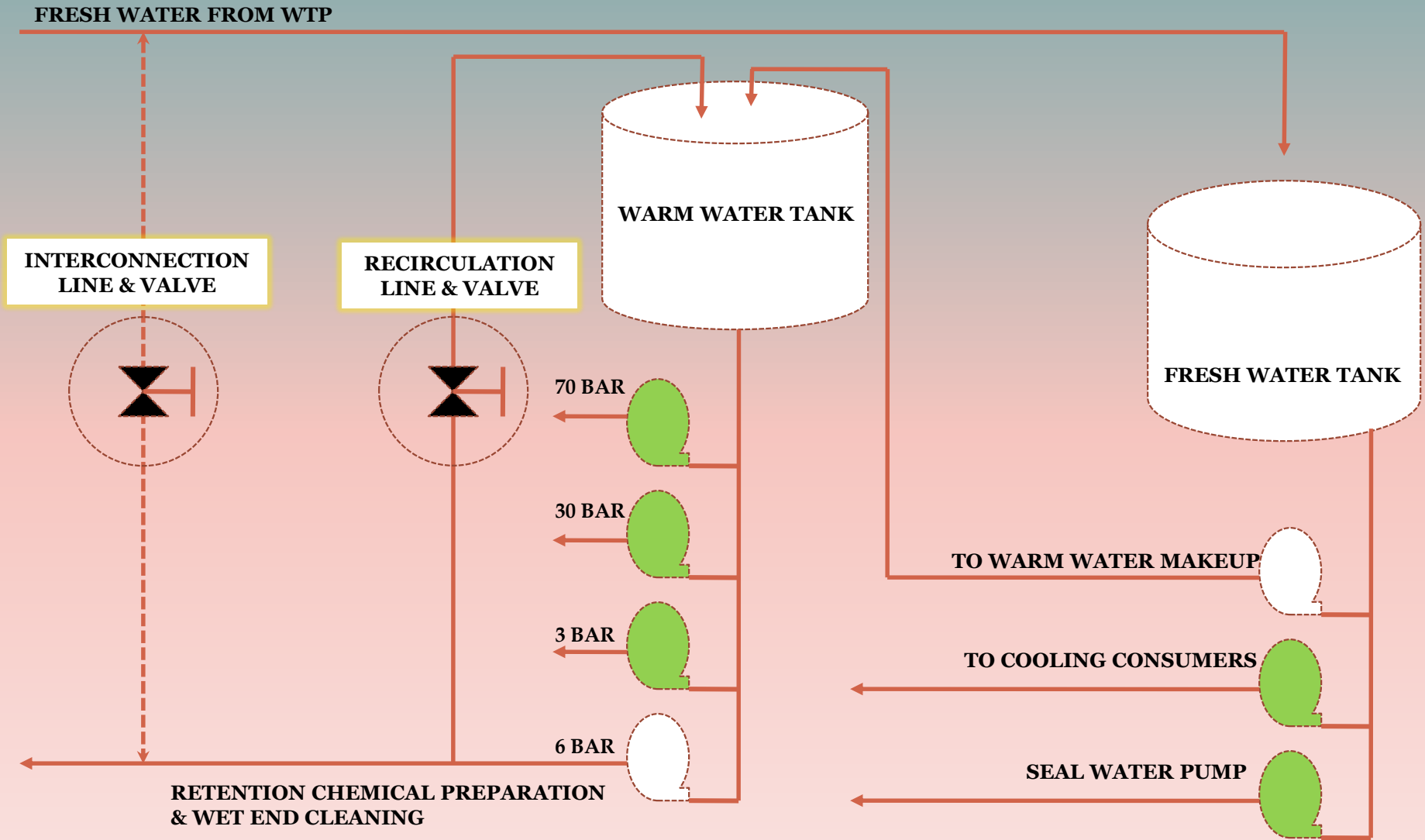
TO WARM WATER MAKEUP

TO COOLING CONSUMERS

SEAL WATER PUMP

RETENTION CHEMICAL PREPARATION
& WET END CLEANING

FRESH WATER LOOP SCHEMATIC



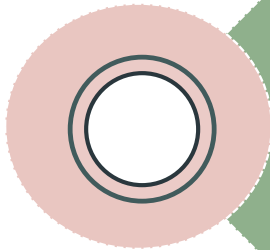
ENERGY COST BENEFITS



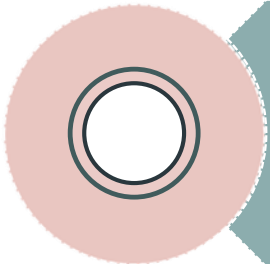
POWER SAVING CALCULATION

| DESCRIPTION | UOM | 6.0 bar pump | WW makeup pump |
|---|-----------------|--------------|----------------|
| | | PARAMETER | PARAMETER |
| Motor KW | KW | 55 | 30 |
| Motor Full load current | Amps | 96 | 52 |
| Running Current | Amps | 25 | 15 |
| Running Power | Unit | 25 | 15 |
| Net savings per day | Unit/day | 600 | 360 |
| Cost of Power | Rs/unit | 6.0 | 6.0 |
| Total Savings | Rs/day | 3600 | 2160 |
| Saving per Annum (Assuming 330 days operation) | Lakhs/Annu m | 11.88 | 7.13 |
| TOTAL SAVINGS | | 19.01 | |

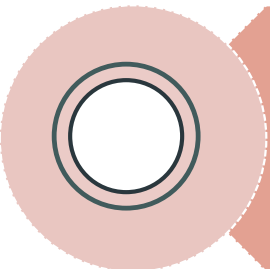
RESULTS



6 Bar Pump of 55KW power stopped permanently, which reduced 25 Amps running load



Warm water makeup pump stopped after optimizing the 6 bar recirculation to make up the desired level



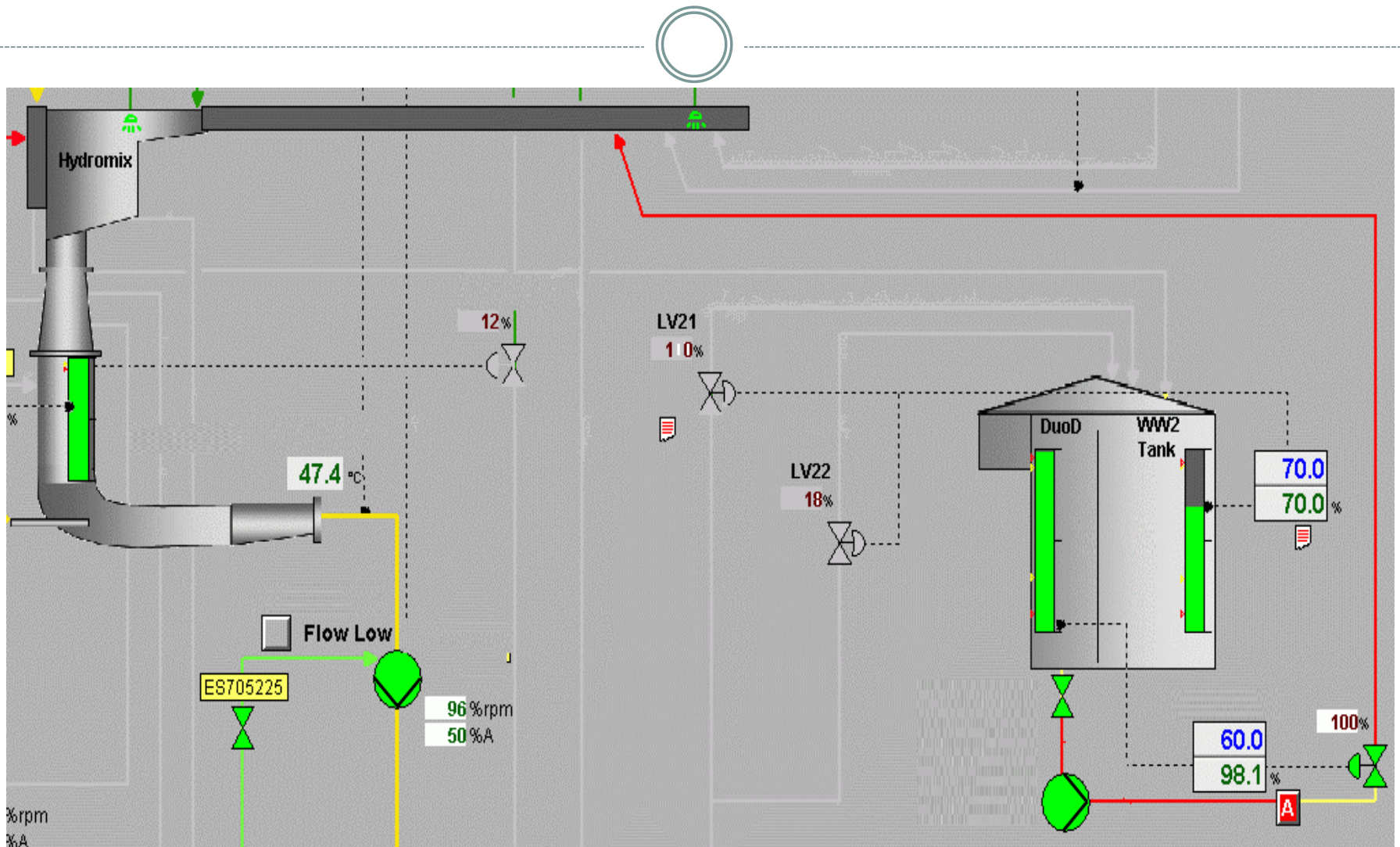
Procurement of spares and maintenance cost reduced for these pumps.

CASE STUDY 3



**REDUCE POWER CONSUMPTION BY PROVIDING
VFD IN HYDROMIX MAKEUP PUMP**

HYDROMIX & WW2 CIRCUIT





BRIEF DESCRIPTION

SCOPE

Process

- The function of Hydromix makeup pump (P) is to pump excess white water from DuoD tank to Hydromix and to maintain the Hydromix level as per the process requirement.
- *The existing pump motor capacity is 75KW and being operated with Direct on Line control (DOL).*

- Power consumption can be optimized/reduced by providing Variable frequency drive (VFD control) for the pump operation instead of DOL.

ENERGY COST BENEFITS



TABLE 4. COST SAVING CALCULATION

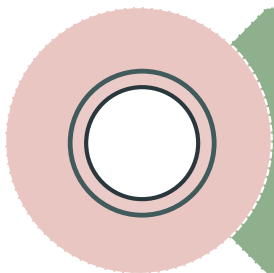
| PARTICULARS | OUM | DOL control | VFD Control |
|--------------------------------|--------------------|--------------------|--------------------|
| Motor KW | KW | 75 | 75 |
| Motor Full load current | Amps | 130 | - |
| Running Current | Amps | 76 | 21 |
| Running Power | KW | 43.7 | 13.5 |
| Power Saving per day | Unit/day | 1048.8 | 324 |
| Net savings | Unit/day | 724.8 | |
| Cost of Power | Rs/unit | 6.0 | |
| Total Savings | Rs/day | 4348.8 | |
| Savings per Annum | Lakhs/Annum | 14.35 | |

PAYBACK CALCULATION

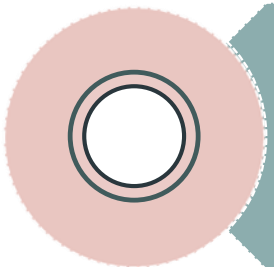


| TABLE 5. PAYBACK CALCULATION | | |
|--|-----------------|--------------|
| PARTICULARS | UOM | COST |
| Cost of YASKAWA DRIVE 75 KW | lakhs | 2.5 |
| Cable 3CX150sqmm & Other expenses | lakhs | 1.0 |
| Total Investment | lakhs | 3.5 |
| Savings due to VFD | Rs/month | 90425 |
| Pay back | Months | 4 |

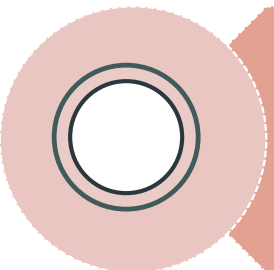
RESULTS



During DOL operation of the makeup pump (P), the 75KW motor was running at 100% speed with the control valve operating at 30-40%.



After changing the control to VFD, the motor speed got reduced to 60% with control valve operating at 85% opening.



The drive change from DOL to VFD control resulted in the power consumption reduction from 76Amps to 21Amps without affecting the process.

CASE STUDY 4



**REDUCE POWER AND WATER CONSUMPTION
BY REPLACING MACHINE BACK WATER FROM
FRESH WATER FOR NATIVE STARCH FILTER
FLUSHING AT PM#3 SIZE PRESS.**



BRIEF DESCRIPTION

SCOPE

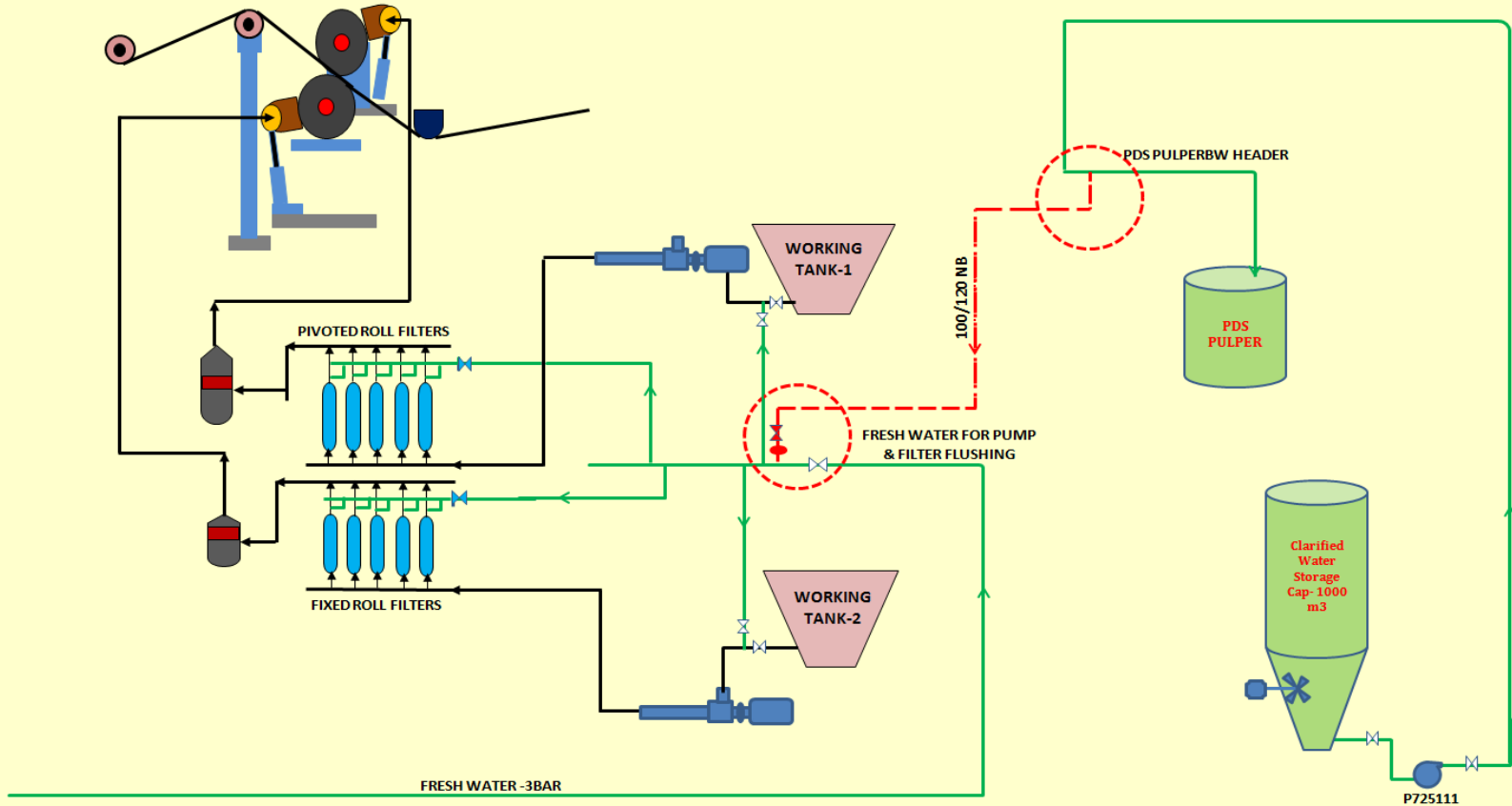
Process

- The size press filter auto flushing is provided for top & Bottom applicator filter station to maintain the minimum desired differential pressure.
 - The 3.0 Bar Pump is designed to supply fresh water to size press filter station and wet end roll lubrication and its line delivery pressure is maintained at 400 Kpa.
-
- Minimum flushing interval time is maintained 40-60minutes.
 - The fresh water consumption for starch filter flushing is 60-70 m³/day
 - During the size press filter flushing the 3.0 bar line pressure is fluctuating from 250Kpa to 500Kpa against the pressure set point of 400Kpa, which leads to more power consumption during normal operation.
 - The Pressure set point shall be reduced after correcting the pressure fluctuation.

LINE MODIFICATION SCHEMATIC



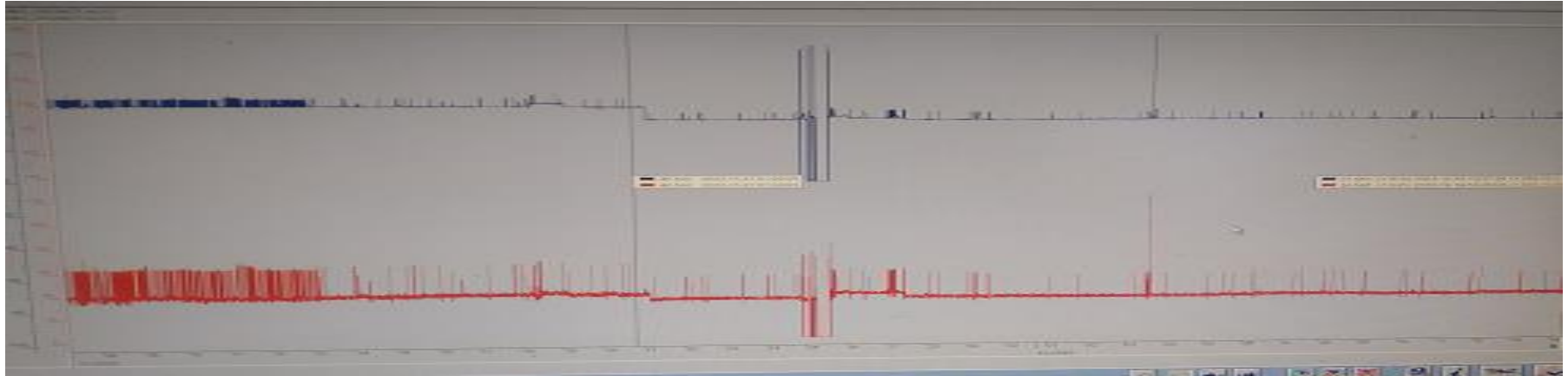
PAPER MACHINME#3 - SIZER FILTER FLUSHING LINE MODIFICATION SCHEMATIC DIAGRAM



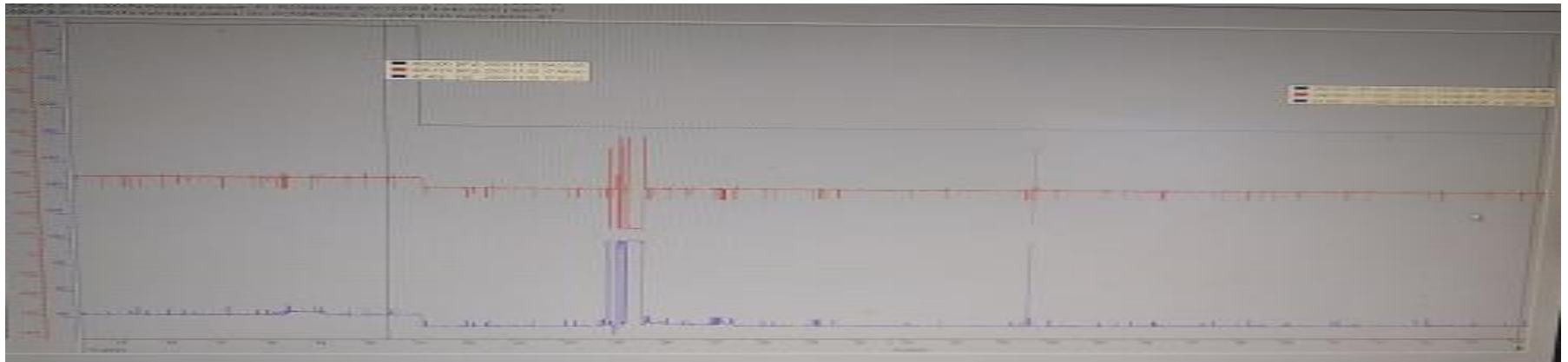
PRESSURE VARIATION VS POWER FLUCTUATION



BEFORE MODIFICATION



AFTER MODIFICATION



COST BENEFITS FROM POWER CONSERVED



TABLE.7 COST SAVINGS BY REDUCING 3 BAR LINE PRESSURE SET POINT

| PARTICULARS | UOM | PARAMETERS |
|--------------------------------------|--------------------|-------------|
| Existing current before modification | Amps | 40 |
| Running Current after modification | Amps | 34 |
| Running Power | KW | 6 |
| Power Saving per day | Unit/day | 144 |
| Cost of Power | Rs/unit | 6 |
| Total Savings | Rs/day | 864 |
| Savings per Annum,(A) | Lakhs/annum | 2.85 |

TABLE.8 COST SAVINGS BY REDUCING 3 BAR LINE PRESSURE FLUCTUATION

| PARTICULARS | UOM | PARAMETERS |
|---|--------------------|-------------|
| Current fluctuation per days | No/day | 50 |
| Duration of fluctuation | sec | 30 |
| Total time taken | Min/day | 25 |
| Minimum current | Amp | 40 |
| Maximum current | Amp | 62 |
| Average current during fluctuation | Amp | 12 |
| Total Power consumed due to fluctuation | Unit/day | 288 |
| Power cost | Rs | 6 |
| Total Savings | Rs/day | 1728 |
| Savings per Annum, (B) | Lakhs/annum | 5.70 |
| TOTAL SAVINGS (A+B), SAY | Lakhs/annum | 8.55 |

COST BENEFITS FROM WATER CONSERVED



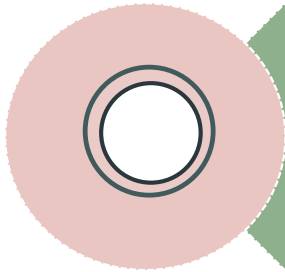
TABLE.6 COST SAVINGS DUE TO FRESH WATER CONSERVATION

| PARTICULARS | UOM | PARAMETERS |
|------------------------------|--------------------|-------------------|
| Fresh water conserved | M3/day | 70 |
| Cost of Process water | Rs/M3 | 10 |
| Total savings, say | Rs/day | 700 |
| Annual saving | Lakhs/Annum | 2.31 |

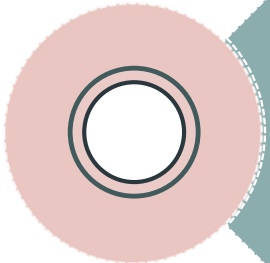
PAY BACK CALCULATION

| PARTICULARS | UOM | COST |
|---|--------------|-------------|
| Pipe line and valve installation | lakhs | 0.25 |
| Pay back | Days | 10 |

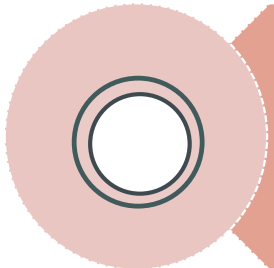
RESULTS



Fresh water conserved 70 cubic meters per day.

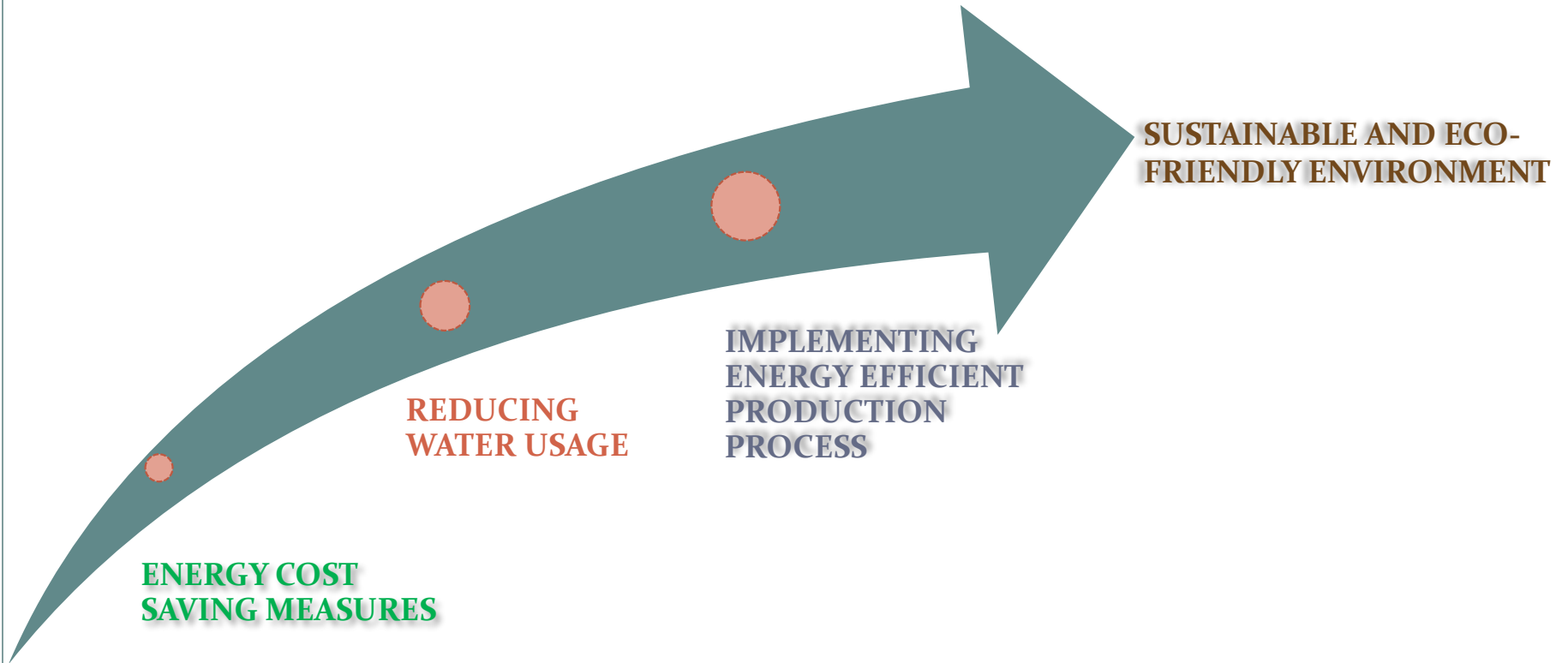


3 bar line pressure fluctuation eliminated and thereby power saved by 144 units per day.



Power consumption reduced by reducing the delivery line pressure set point.

CONCLUSION

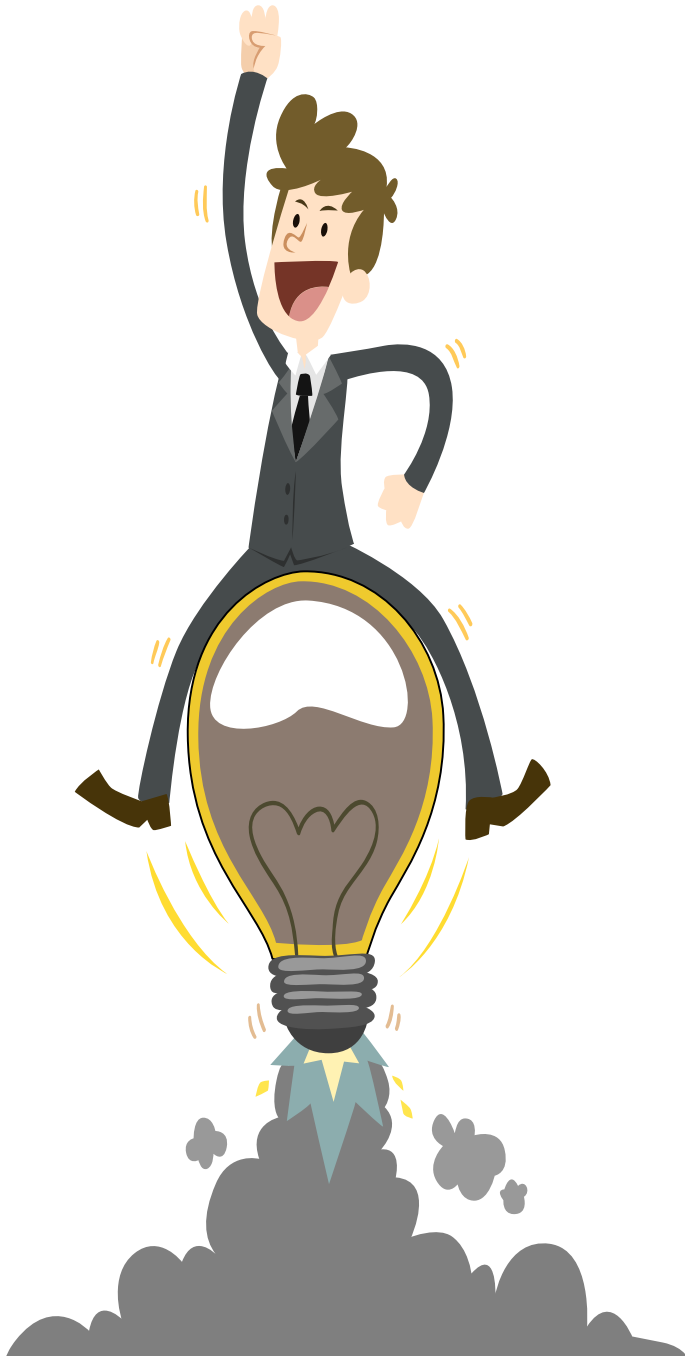


**ENERGY COST
SAVING MEASURES**

**REDUCING
WATER USAGE**

**IMPLEMENTING
ENERGY EFFICIENT
PRODUCTION
PROCESS**

**SUSTAINABLE AND ECO-
FRIENDLY ENVIRONMENT**



THANK YOU !!!!