DCM SHRIRAM SUGAR

COST EFFECTIVE TECHNOLOGY FOR USING SURPLUS CONDENSATE IN POWER PLANT COOLING TOWER WATER

Under the Broader title of ***'Resource Conservation'***

Location :- Ajbapur, U.P. India
Date :- 28th -30th July 2021

Mr. OS Shukla (GM Process)
Mr. Manish Tyagi (AGM Power PP)

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Surplus Condensate in Power Plant Cooling Tower Water

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Cost Effective Technology

We are conserving resources by 400 KLD water saving, Chemicals Saving, Power consumption saving, CO2 emission reduction, etc. Through which we are saving about Rs. 14400 per day saving or approx. Rs. 25.92 lacs per year.This is the cheapest technology for using surplus cane juice condensate as till now CPCB and UPPCB was pressurising all sugar Industry to install RO and UF to use the surplus condensate .Now they have accepted our inhouse technology

01 Water Availability

➢Sugar plants are having excess sugar cane water to the tune of 200 Lt/MT Cane Crush which can be reused /recycled in PP Cooling Towers (CT).

02 Plant Installations

➢MGF, ACF, Magnetic separator, Online conductivity meter, Three way control valve, Chlorine Tonner system, pH value increase of Process Juice from 6.9 to 7.1.

03 Planning & Action

Continue communications on Whatsapp group with all team members related to analysis and actions. We continuously observed power plant CT and Surplus water parameters.

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Process Flow Diagram

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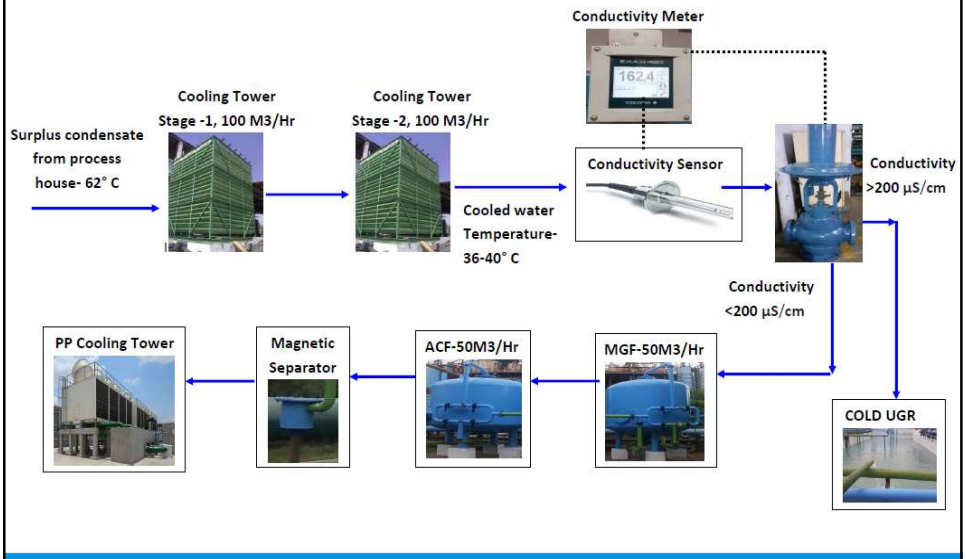

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Project Progress & Roadmap

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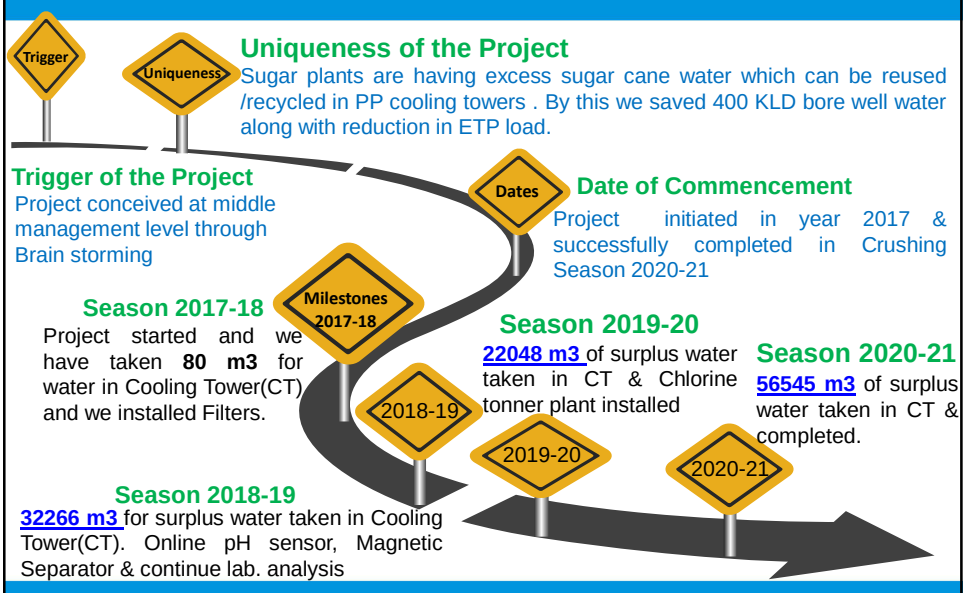

Uniqueness of the Project

Sugar plants are having excess sugar cane water which can be reused /recycled in PP cooling towers . By this we saved 400 KLD bore well water along with reduction in ETP load.

Trigger of the Project

Project conceived at middle management level through Brain storming

Date of Commencement

Project initiated in year 2017 & successfully completed in Crushing Season 2020-21

Season 2017-18

Project started and we have taken **80 m3** for water in Cooling Tower(CT) and we installed Filters.

Season 2018-19

32266 m3 for surplus water taken in Cooling Tower(CT). Online pH sensor, Magnetic Separator & continue lab. analysis

Season 2019-20

22048 m3 of surplus water taken in CT & Chlorine tonner plant installed

Season 2020-21

56545 m3 of surplus water taken in CT & completed.

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Challenges Faced and brief on Countering

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Season 2017-18

Major problems faced were Turbidity, COD, pH, Iron, Sugar trace.
To resolve these issues we installed MGF & ACF in 2018, pH Sensor for continue monitoring in 2018, Laboratory monitoring on hourly basis, 2 no. biocides used in CT.

Season 2018-19

We faced turbidity, Iron, COD & FRC issue. To control biological growth Sodium hypochlorite dosing consumption increased by 5 times. Grill magnet installed & MS pipeline replaced to control Iron.

Season 2020-21

This year we stabilize the plant and resolved all issues. Biocide dosing location changed which also reduced cleaning frequency and saving approx. Rs.1.58 lac during Season operation.

Season 2019-20

We faced problem related to Iron content. FRC problem resolved by installing Chlorine tonner plant which also reduced operational cost of biocide and other chemicals .

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Project Tangible benefits

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Energy saving -
400m3 borewell water withdrawal, 400m3 effluent treatment & 2 times alternator cleaning avoided to save power **45.02 MW**

Water Saving -
400 M3/day and Total Qty of Water **56545 M3** for Season 2020-21.

Toxicity Saving -
400 M3 Effluent generation Eliminated. H2SO4 & other Chemicals consumption reduced in power plant.

Carbon Saving –
Reduction in Co2 emission due to pumps operation running hours. Approx. Quantity of **40 Kg/day** saved.

Cost Benefits –
Through this project we are not only saving ground water withdrawal but also about **Rs. 14,400** per day saving or approx. **Rs. 25.92 lacs** per year.

Cycle Time Reduction –
Blow down frequency by reduced 6 times as Surplus condensate water is having Silica 0 ppm and TDS about 50 ppm against the bore well having silica 25ppm and TDS 250 ppm.

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Project Intangible benefits

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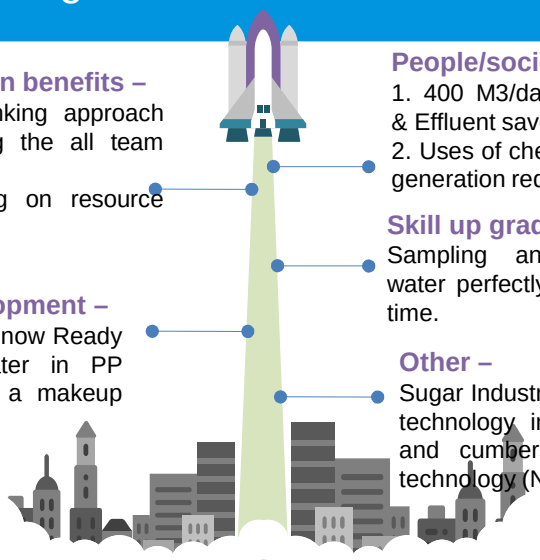
Moral/Motivation benefits –
1. Innovative thinking approach developed among the all team members.
2. Brain storming on resource conservation.

Attitude/ Development –
Power plant team now Ready to take this water in PP cooling tower as a makeup water.



People/society benefit –
1. 400 M3/day drinking water & Effluent saved.
2. Uses of chemicals & Sludge generation reduced.

Skill up gradation –
Sampling and Analysis of water perfectly within specific time.

Other –
Sugar Industry may adopt this technology instead of costly and cumbersome RO –UF technology (National gain)

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Replication potential of project within Sector

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This project having great opportunity in all sugar industries, this having an innovative approach based on AI module where conductivity has been matched with other required parameters of Cooling Tower. Other sugar industries representative have visited the project. Since it is a cheapest surplus water using technology instead of costly RO –UF installation .Parallel propagation of the same will be done in our other sugar plants

Milestone 2017-18
Project started after discussion with Team members and installation and commissioning of plant.

Milestone 2018-19
To reduce the iron content, we installed the Magnetic separator 12500 Gauss.

Milestone 2019-20
We used the manganese dioxide (MnO2) in ACF to reduce the dissolve iron content.

Milestone 2020-21
1-We replaced the Old MS pipe line to reduce the iron content .
2-MGF-ACF Media in 2020.
3-We maintain the Clear juice pH in the range of 7.1 instead of 6.9 to maintain the surplus condensate pH.

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Achieving National bench Mark/ Standards

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Achieving National bench Mark/ Standards					
Environment Parameter:Energy/ water/Carbon/Toxicity and Emission					
SN	**Water Parameters**	**UOM**	**Before**	**Current status**	**Standards Norms**
1	pH	unit	4.5-6	6.5-7.5	7.2-7.8
2	TDS	ppm	130-240	70-160	<500
3	Conductivity	µS/cm	200-360	100-240	<750
4	Total Hardness as Ca CO3	ppm	4-10	0	0
5	Ca Hardness as Ca CO3			0	0
6	Silica	mg/l	0.2-0.3	0	<25
7	Iron	mg/l	4-10	0.4-0.8	<1.0
8	P. Alkalinity	ppm			<50
9	M Alkalinity	ppm			
10	Sugar Trace		Available	Nil	Nil
11	PO4	ppm		<3	<3
12	Chloride	ppm		<25	<25
13	FRC	ppm	2	0.5-1.0	0.5-1.0
14	COD	mg/l	400	100-200	<250
15	BOD	mg/l	60	20-30	<30
16	Turbidity	NTU	3-5	3-4	<5
17	COC (based on Silica)			6	6
Compression on Men/ material/ methods/ Technology/ Measurement					
SN	**Water Parameters**	**UOM**	**Before**	**Current status**	**Standards Norms**
1	Manpower			No change	
2	Material		NO CPU	CPU commissioned	

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Priority Plan for Next 2 yrs

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Season 2021-22 :

1. Consistent operation to get desired results with out any additional resources.
2. This year we have also planned to work on **Galvanic Principle Technology** for utilization of 400 KLD ETP treated effluent directly in Cooling tower so that again we can save ground water withdrawal & disposal issue.
3-Parallel technology propagation to our other plants will be done

Season 2022-23 :

We plan to installed **ZLD plant** at ETP treated effluent. RO treated water will be given to our Distillery Unit. Cooling Tower water requirement and RO reject water of TDS 12000 ppm approx. will be used in Sugar Plant Cooling Tower. By using this we will maximize the water saving approx. 2000 m3/day of Sugar plant as well as Distillery Plant.

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Major Learning

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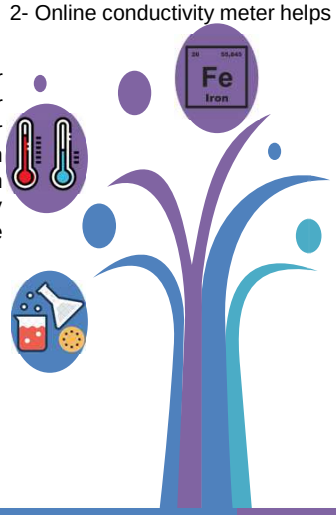
Higher iron content:
1-Magnetic separator installed in outlet of ACF
2- Online conductivity meter helps us to divert the water in UGR.

Higher Temperature issue:
we made proper platform with ladder for cleaning of cooling tower Nozzles and made drain arrangement in Each Nozzle header, Every day cleaning of Nozzle be came possible.



Sample Analysis:
Sampling and analysis of Inlet and outlet water continue 2 Hourly basis.

Lower pH Issue:
We should maintain the Juice ph 7.1 instead of 6.9 regularly to avoid any fluctuation of surplus condensate water pH.

Communications:
For effective communication & actions, we have made a Whatsapp group with all concern Team members. This also helped in continuous monitoring of the system.

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Environmental Performance Evaluation (EPE)

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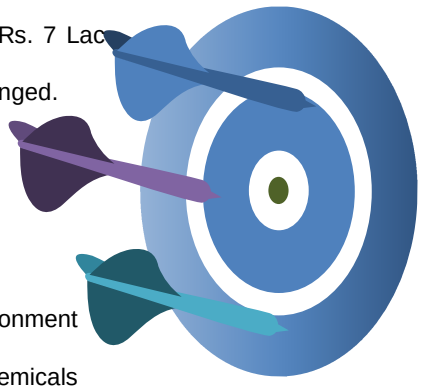
Management performance indicator(MPI) –
- 2017-18: We have taken a Capex. of Rs. 15 Lac for installation of filters.
- 2019-20: We have taken a Capex. of Rs. 7 Lac for installation of Chlorine Toner Plant.
- 2020-21: Filters media of Rs. 2 Lac changed.



Operational Performance Indicator:
- 400 KLD bore well water saving.
- 400 KLD effluent treatment saving.
- Chemicals cost reduces.
- 40Kg/day CO_2 emission reduced.

Environmental Condition Indicator:
- Over all impact of the project on Environment is +ive.
- Large quantity of Water Saving, Chemicals Saving, Effluent generation saving, Sludge generation saving, Plant Operational Cost Saving, Carbon emission saving,

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THANKS!

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Surplus Condensate Filtration Unit- Ajbapur

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Auto Control System Specification

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Auto control system: Conductivity sensor and three Way Control Valve

➢**Conductivity Sensor Specification:**

Quantity : 01 Set
Model : Exaxt 450,
Make :Yokogawa.

➢**Three way auto control Valve Specification:**

Quantity : 01 No
Make : I&S
Model : IS-GLV-150.
Size : 150 mm.

Our System Working Theory:

➢ Auto control System working on the Basis of conductivity.
➢ Set Point of Conductivity: 200 (µS/cm) micro Siemens per centimetre.
➢ If Conductivity < 200 : Control valve open towards MGF-ACF and Surplus water is consumed in PP cooling tower.
➢ If Conductivity >200 than control Valve diverts the Water towards Cold UGR where process water is used **(i.e. Surplus water not fulfill the norms for make up for Power plant cooling tower)**

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Conductivity and its Set Point cut off for usages

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➢**Conductivity** meaning:
The ability or power to conduct or transmit heat, electricity, or sound.
➢**Conductance per unit of area or volume, measured in siemens per meter OR** (µS/cm) micro Siemens per centimetre
➢ During Season 2018-19 do analysis Condensate water regularly.
➢ On the Basis of Analysis it is observed at 200 Conductivity water is satisfactory for Power plant usages

Season 2018-2019 Analysis for conductivity set Points

Date	**15.12.2018**	**Date**	**16.12.2018**	**Date**	**17.12.2018**	units
BOD	55	BOD	45	BOD	42	ppm
COD	300	COD	255	COD	265	ppm
pH	5.86	pH	5.8	pH	5.9	ppm
conductivity	270	conductivity	261	conductivity	255	**µS/cm**
iron	2.5	iron	2.1	iron	2	ppm
Date	**18.12.2018**	**Date**	**19.12.20218**	**Date**	**20.12.2018**	units
BOD	40	BOD	35	BOD	29	ppm
COD	260	COD	235	COD	230	ppm
pH	6.92	pH	6.89	pH	7	ppm
conductivity	249	conductivity	255	conductivity	200	**µS/cm**
iron	1.8	iron	1.3	iron	1.2	ppm
Date	**21.12.2018**	**Date**	**22.12.2018**	**Date**	**23.12.2021**	units
BOD	30	BOD	28	BOD	**27**	ppm
COD	230	COD	232	COD	**225**	ppm
pH	6.98	pH	7.02	pH	**6.89**	ppm
conductivity	200	conductivity	180	conductivity	**178**	**µS/cm**
iron	1	iron	0.6	iron	**0.4**	ppm

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Working Methodology on WhatsApp group

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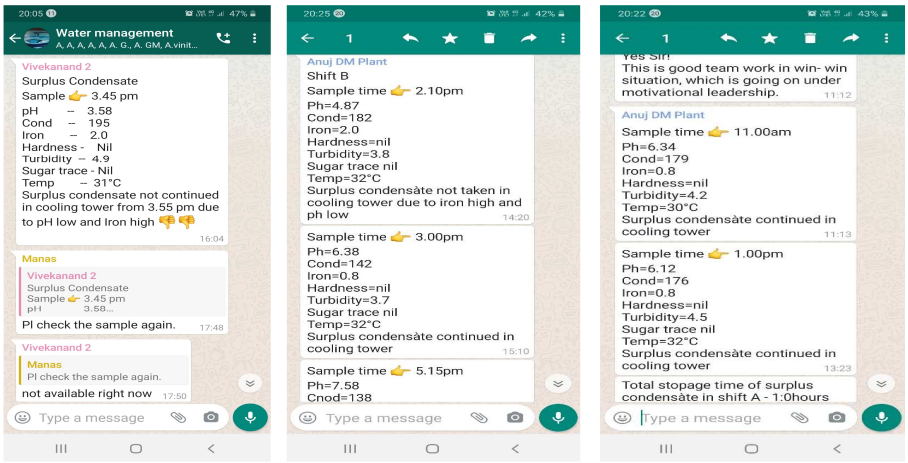
➢Two hourly sample analysis, monitoring and and Control the Parameters by Power Plant and Process Team working.



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Chlorine Tonner System

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•Earlier, for Microbiological Treatment in the Power Plant Cooling Tower, Sodium Hypo Chlorite was used as an oxidizing biocide agent for algae and fungi growth .

•But this was not sufficient to kill the algae etc growth in water .

•We installed Chlorine toner in the year 2019-20 which is now taking care of all the algae and fungi formation.

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Carbon Emission saving by Pumps Operation

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Carbon Emission saving by Pumps Operation				
Sr. No.	**Pumps Location**	**Water Quantity in KL/day**	**CO2 generation factor**	**Kg./day of CO2 emission saved**
1	Borewell Pump	400	0.02	8
2	ETP Equalization	400	0.02	8
3	IC Buffer	400	0.02	8
4	Filter Feed	400	0.02	8
5	Treated water tank	400	0.02	8
			Total =	**40**

Reference: Ain Shams Engineering Journal (2016) 7, 939–951 - Assessing greenhouse gasses emitted from on-farm irrigation pumps: Case studies from Egypt.

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Cost Savings Surplus Condensate Water

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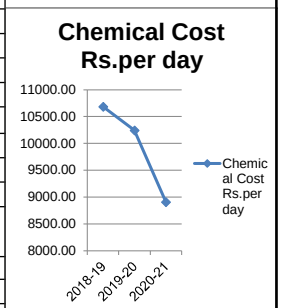
	CPU Installment (Season 2017-18) cost in Rs.	15,00,000.00	
	Chlorine tonner Plant cost in Rs.	7,00,000.00	
	Total Capital Cost in Rs. =	**22,00,000.00**	
Cost Calculation for water Saving			
Ground water Cost Calculation			
Sr	**Particulars**	**Values**	**UOM**
	Ground water withdrawal cost		
1	Ground water abstraction cost (as per CGWA)	3	Rs./KL
2	Pumping cost for water withdrawal	0.87	Rs./KL
	Total GW withdrawal Cost	**3.87**	**Rs./KL**
Cost for Water Saving- Achievements - due to condensate polishing unit			
1	Plant is Installed for Use of Process surplus condensate in Power plant cooling Tower	400	M3/Day
2	Water Saving @180 Season Days	72,000	M3
3	Water saving in term of Money @3.87	2,78,640.00	Rs
4	ETP treatment cost is Rs. 25/KL, So ETP saving	18,00,000.00	Rs
	Total Saving	20,78,640.00	Rs./ Annum
1	Saving in CT Chemicals =	1,777.26	Rs./Day
	Total saving in a Season of 200 days =	3,55,452	Rs./ Annum
3	Total Saving by eliminating Alternator cleaning =	158070	Rs./ Annum
	Total Operational Cost saving =	14400.90	per day
	Total Operational Cost saving =	25,92,162	per Year



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SURPLUS CONDENSATE CONSUMED IN COOLING TOWERS in 2018-19

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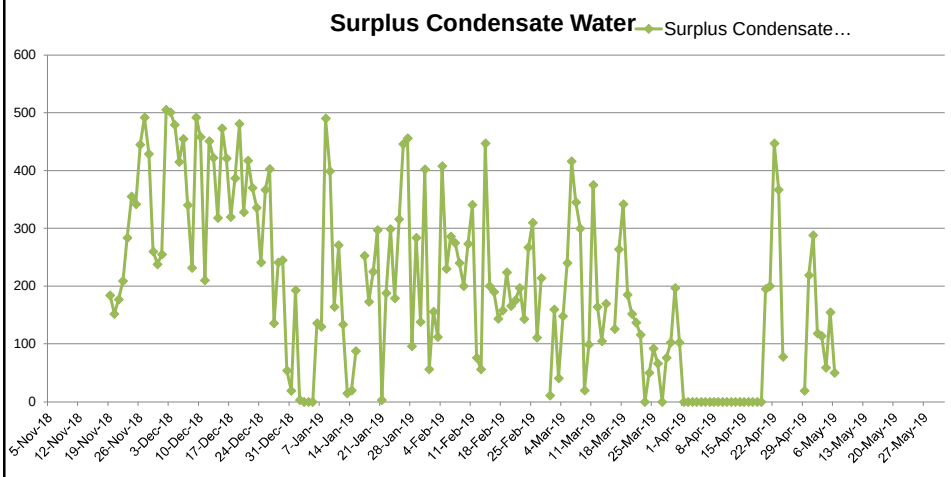

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SURPLUS CONDENSATE CONSUMED IN COOLING TOWERS in 2019-20

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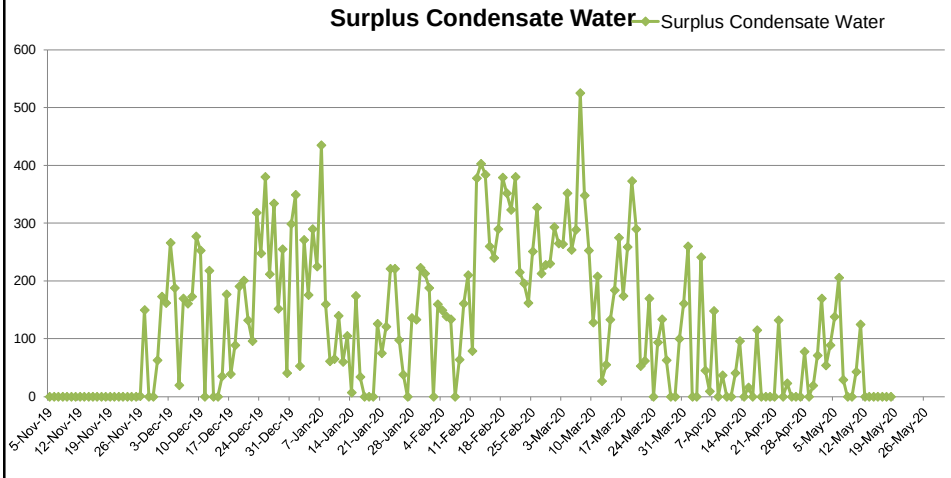

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SURPLUS CONDENSATE CONSUMED IN COOLING TOWERS in 2020-21

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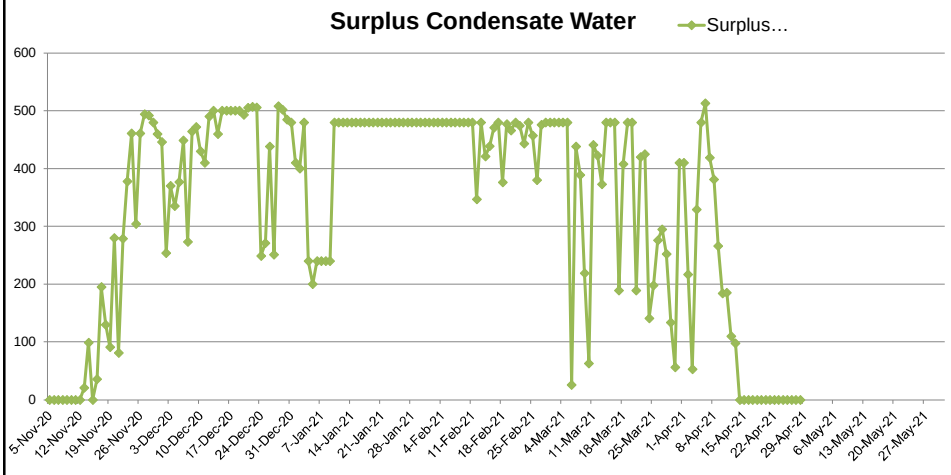

Average Flow is 400 KLD.

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Water management Team and Workers Participation

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Water Management Team		
SN	Officers Name	Department
1	Mr. OS Shukla	Process
2	Mr. Anil khare	Process
3	Mr. Lokman Gangwar	Process
4	Mr.Vivek Mishra	Process
5	Mr.Dhananjai Kumar Rai	Process
6	Mr.Ankur Agarwal	Process
7	Mr. Anuj Kumar	Process
8	Mr.Vineet Mishra	Process
9	Mr.Anuj Verma	Process
10	Mr. Manas Shukla	Process
11	Mr.Harish	Process
12	Mr. Chandrakant Sharma	Environment
13	Mr. MA shamy	Power Plant
14	Mr.Manish Tyagi	Power Plant
15	Mr. Anurag charan Panday	Power Plant
16	Mr. Sonu Dwevedi	Power Plant
17	Mr. Arpan singh	Power Plant
18	Mr. Gyanesh Tyagi	BH-Engg
19	Mr. Dharmendra Yadav	BH-Engg
20	Mr. Nitin Rajpoot	BH-Engg
21	Mr. Prasant Yadav	BH-Engg

Workers Participation in This projects		
SN	Employee Name	Department
1	Mr.Vivekanand Sharma	Power plant
2	Mr. Pawan Panday	Power plant
3	Mr. jitendra kumar	Power plant
4	Mr.Anuj singh	Power plant
5	Mr. Omprakash	Power plant
6	Mr. Vinay Kumar	ETP
7	Mr. Parvesh kanaujia	ETP
8	Mr. Sunil Singh	ETP Lab
9	Mr. Lal Babu	Process
10	Mr. Ram singh	Process
11	Mr. Dinesh kumar	Process
12	Mr. Vipul kumar	Process
13	Mr. Sanjeev kumar	Process

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Power & Cleaning cost Saving

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2 times Alternator cleaning of 27 MW Turbine avoided due to COC increase-

So, Power saving = 2 x 25.58 x 0.88 x 1000
= 45020.8 KW

Considering Electricity rates = Rs. 3.4 /KW

So, Cost Saving = 45020.8 x 3.4 = Rs. 1,53,070

Normal blow down water quantity to ETP = 100 KL

So Cost saving at ETP = Rs. 25 x 2 x 100 = Rs. 5000

Total Saving = Rs. 153070 + 5000 = Rs. 158070

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GALVANIC PRINCIPLE & PROCESS

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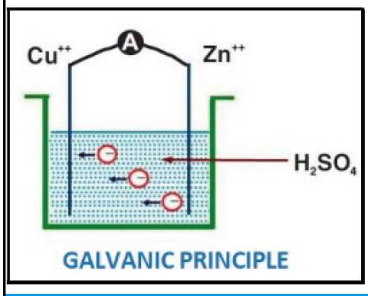
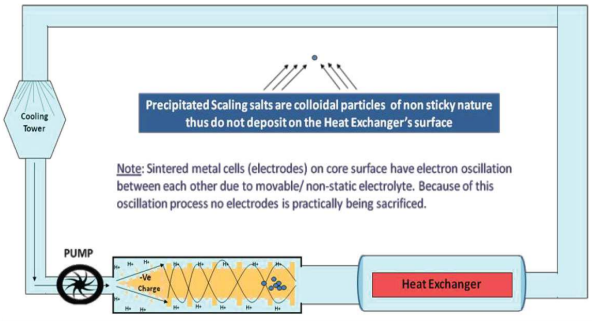
- **GALVANIC PRINCIPLE:** "Galvanic principle says that when you immerse two electrodes of different electro-negativity in an electrolyte, electrons will start flowing from electrode of higher electro-negativity to the electrode of lower electro-negativity through the electrolyte."
- Galvanic Principle locally/ temporarily increase pH value of water flowing through it and precipitates out hardness causing salts into fine particles of colloidal nature before water reaches to high temperature zone.





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Future Plan - Zero Liquid Discharge

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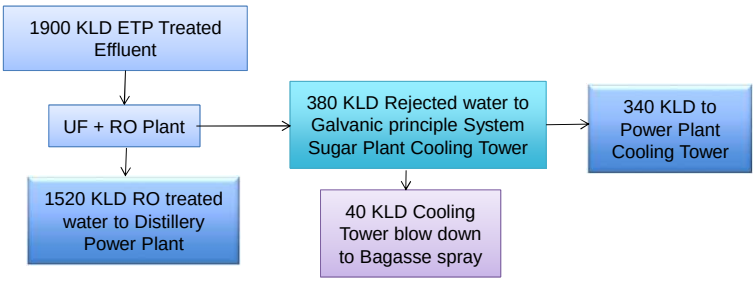
We have contacted successful trial on Pilot UF+RO plant and we are proposing future water management as under:



Remark:-

1- After this RO treatment of ETP treated water can stop the bore well extraction for Distillery power plant and RO Plant reject water will be used for Sugar Unit Power Plant Cooling Tower through Galvanic principle technology.

2- Galvanic principle system blow down will be utilized in ash, Bagasse and Cane yard wetting.

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Cost Savings Surplus Condensate Water

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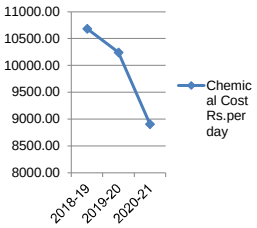
Chemical Cost Rs.per day



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SURPLUS CONDENSATE CONSUMED IN COOLING TOWERS in 2020-21

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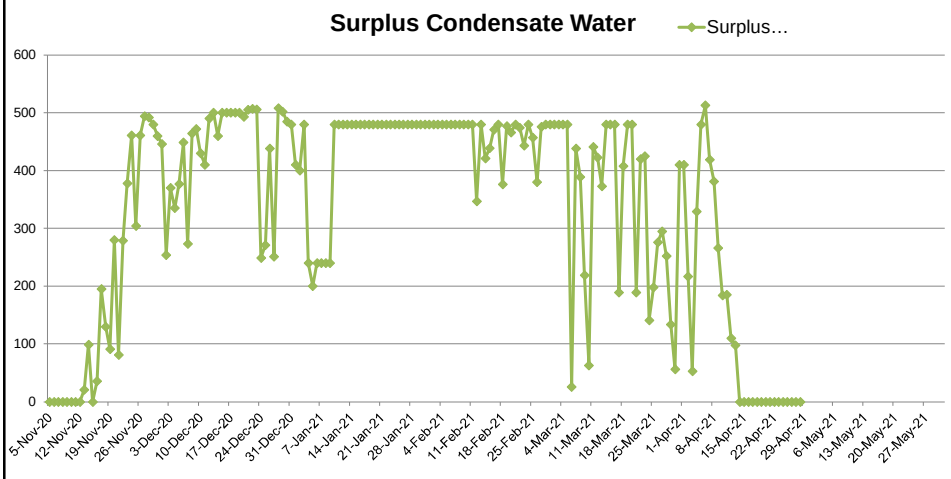

Average Flow is 400 KLD.

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