



UPGRADATION OF EXISTING EDIBLE OIL REFINERIES



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DVC PROCESS TECHNOLOGIST

COMPANY AT A GLANCE

- DVC Process Technologists is one of the leading manufacturer and service provider in the field of Edible Oils and Fats
- Founded in 2001, Now our existence is geographically all over the globe.
- Technical expertise and Customer Satisfaction is the basis of our success.



PROJECT SUPPLIER FOR OILS & FATS FOR EXTRACTION

- Edible Oil Processing (Degumming, Neutralization, Bleaching, Deodorization, De-waxing, Fractionation, Hydrogenation, Inter-esterification)
- By-products processing – Gums drying (Lecithin) and Acid Oil
- Bio-diesel plants from multiple feed stocks
- Effluent treatment(ETP) and Zero Liquid Discharge plant (ZLD)
- Fully automated or manual plant



TECHNICAL AUDIT OF INSTALLED EDIBLE OIL REFINERIES & UPDATING IT TO RECENT TECHNOLOGY AND ENERGY EFFICIENT PROCESSES

Why Technical Audit is Necessary for Up-gradation?

- Apart from scheduled maintenance, processing facilities are allowed to run unless it develops any hassles in routine production capacity and products quality due to any technical snags!
- Problems faced in processing can be uniform & routine in nature, intermittent and may not be fixable, then need to analyse systematically.
- Apart from processing capacity and products quality there are other aspects related to processing cost in terms of consumptions like chemicals & utilities!
- The varying trend of production cost / products quality over the time for the identical input material quality as well as other operational snags need to be evaluated systematically by way of **“TECHNICAL AUDIT OF THE FACILITY”**

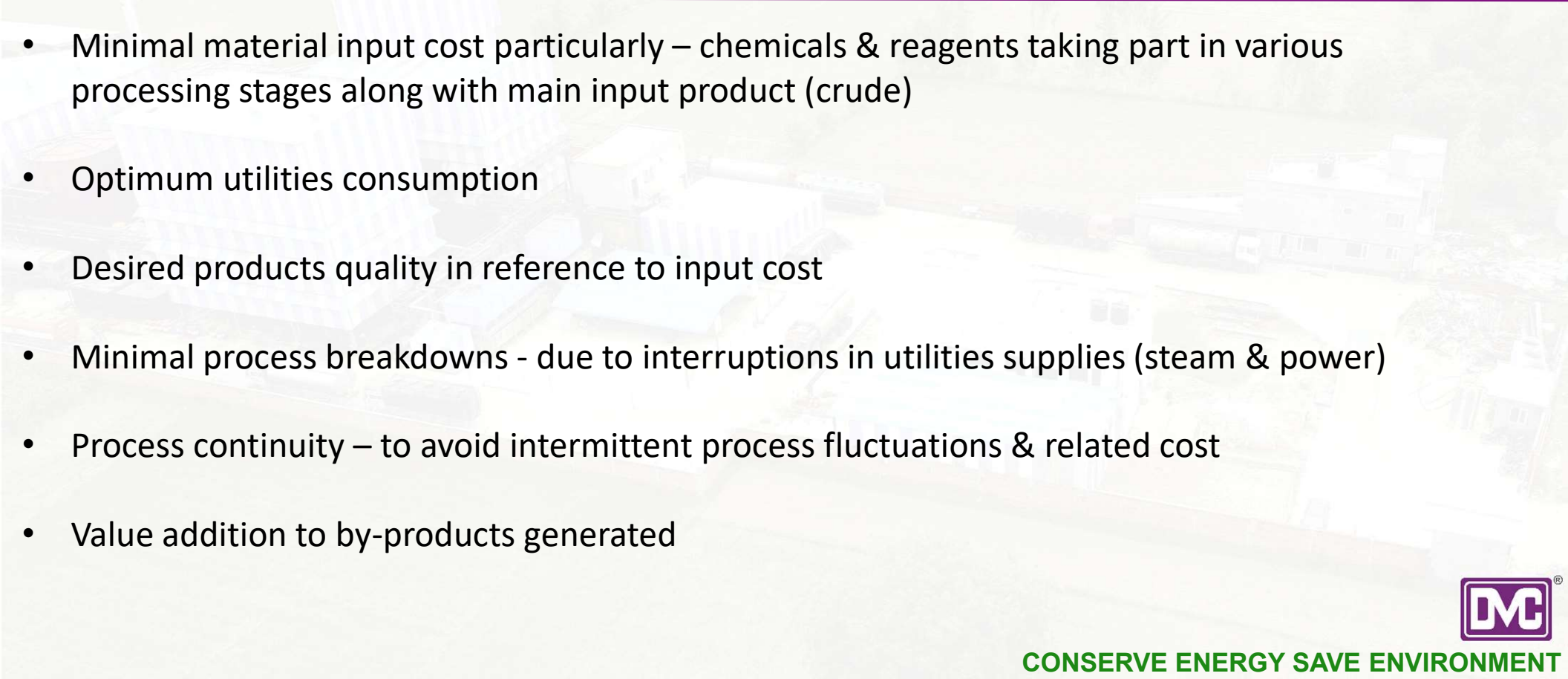


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OPERATIONAL PRIORITIES OF EXISTING PROCESS PLANT IN GENERAL

- Minimal material input cost particularly – chemicals & reagents taking part in various processing stages along with main input product (crude)
 - Optimum utilities consumption
 - Desired products quality in reference to input cost
 - Minimal process breakdowns - due to interruptions in utilities supplies (steam & power)
 - Process continuity – to avoid intermittent process fluctuations & related cost
 - Value addition to by-products generated
- 



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TECHNICAL AUDIT OF THE PROCESSING FACILITY

To get consistency in process performance need to maintain plant asset health by timely scheduled maintenance along side periodic **“Technical audit of the processing facility”**.

TYPES OF AUDIT

- MECHANICAL
- ELECTRICAL
- INSTRUMENTATION & PROCESS CONTROL
- UTILITIES
- PROCESS AUTOMATION – PLC / DCS & SCADA
- QUALITY CONTROL
- PROCESS & EQUIPMENT DESIGN



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MECHANICAL

Physical status of the facility and mechanical health

- Overall heat insulation (cold / hot)
- Mechanical alignment of all rotating & moving part like pumps, agitators, blowers, conveyers etc.
- Power transmission devices – gear boxes, v-belt else



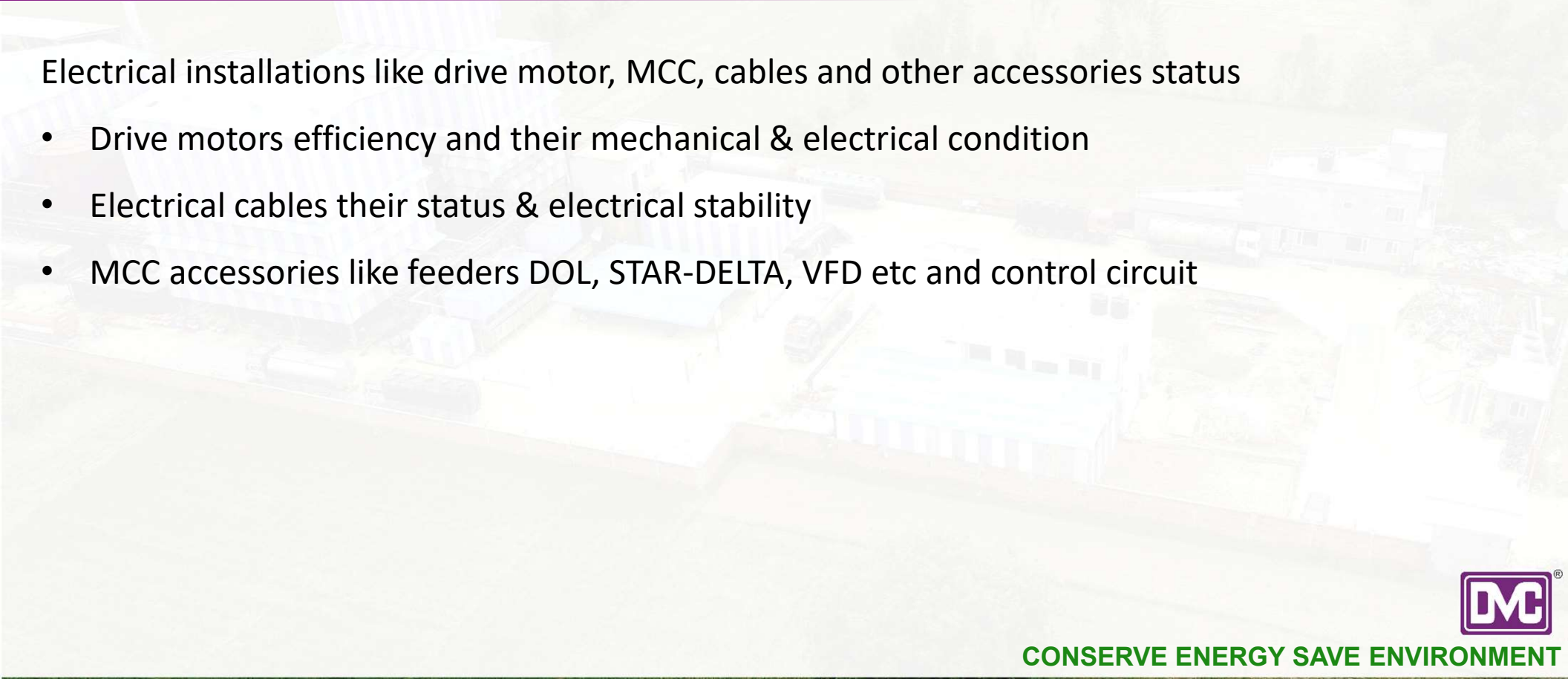
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ELECTRICAL

Electrical installations like drive motor, MCC, cables and other accessories status

- Drive motors efficiency and their mechanical & electrical condition
 - Electrical cables their status & electrical stability
 - MCC accessories like feeders DOL, STAR-DELTA, VFD etc and control circuit
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INSTRUMENTATION & PROCESS CONTROL

In reference to the type of process like batch / semi continuous / continuous ensuring instrumentation is in place and controlling the process appropriately

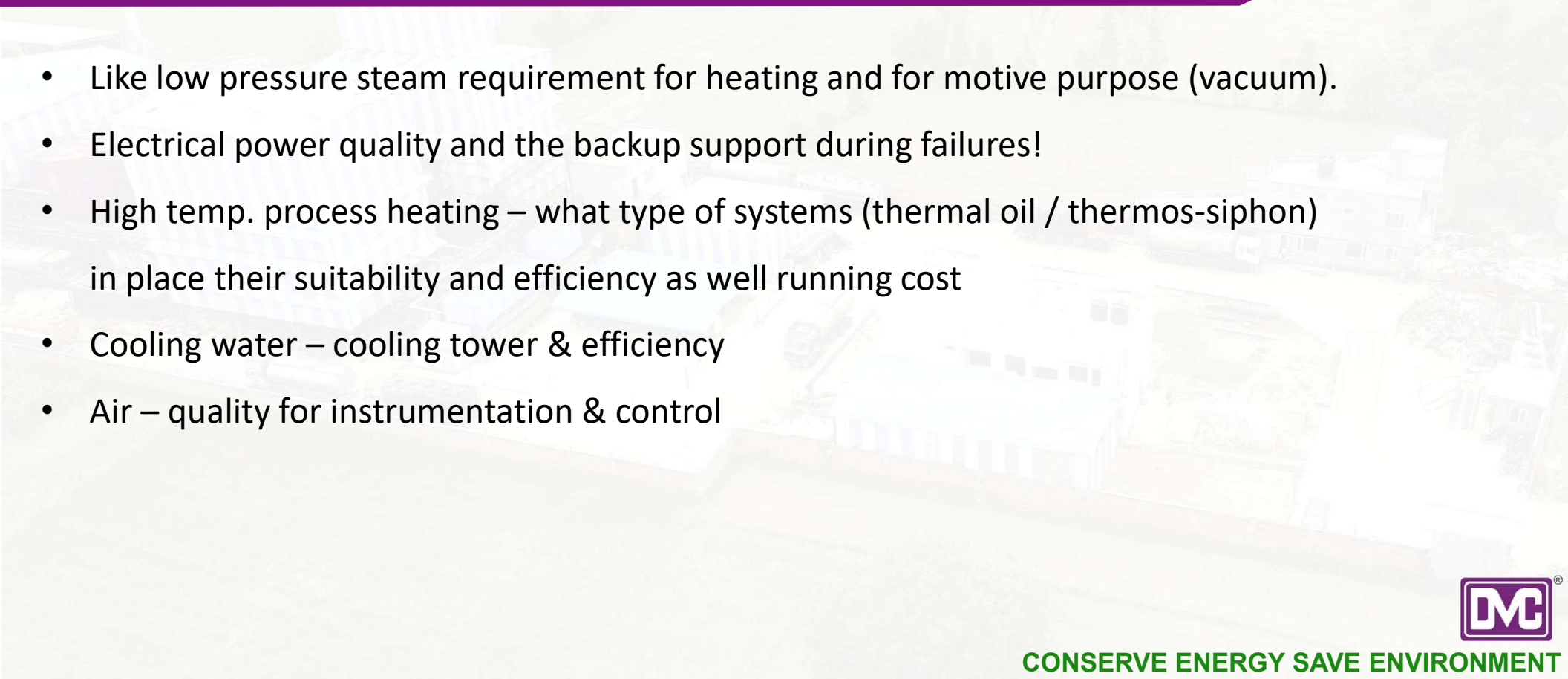
- Instrumentation for parameters like temp, pressure, volumetric, level and mass measurement and control as defined in the system at various stages in the process (PID / PLC / DCS)
- Evaluating and redefining the process control points in reference to revised requirement



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UTILITIES

- Like low pressure steam requirement for heating and for motive purpose (vacuum).
 - Electrical power quality and the backup support during failures!
 - High temp. process heating – what type of systems (thermal oil / thermos-siphon) in place their suitability and efficiency as well running cost
 - Cooling water – cooling tower & efficiency
 - Air – quality for instrumentation & control
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PROCESS & EQUIPMENT DESIGN

Usually, available facility is designed for particular input oil quality and due to prevailing conditions need to process different crude oil quality. Then need to evaluate the flexibility in the process design and suitability of the process equipment!

- Evaluation of present veg oil refining facility to process different types and quality of oils right from crude soy to crude rice bran oil (high FFA)
- Adoptability of different process routes – chemical & physical with option of different degumming processes incorporated with different reagent dosing and mixing devices and respective required retention time.
 - DEGUMMING, NEUTRALIZATION & WATER WASHING
 - PRE-TREATMENT BLEACHING
 - DE-ACIDIFICATION DEODORIZATION
 - DRY FRACTIONATION / WINTERIZATION
 - LECITHIN DRYING PLANT
 - ACID OIL PLANT



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SCOPE FOR IMPROVEMENT

- Customised solutions for vacuum system by evaluating steam and electricity availability @ cost. Eg Chilled water vacuum system.
- Utilization of back pressure steam available from captive power plant (Co-generation) for processes heating and Vacuum systems.
- Tocopherol content enhancement in deo-distillates by incorporating duel scrub system as part of value addition.
- Low trans fatty acid in refined oils as part of quality enhancement by modifying the existing deodorization system.
- Incorporating mass measuring devices for product, by-products generated and utilities consumptions to keep control on processing cost.

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SCOPE FOR IMPROVEMENT

- Effective communication timely with system provider getting timely supports and improvements time to time..
- Gums drying plant for value addition. New technology is introduced Falling fill to scrap heat exchanger to produce low colour dry Lecithin.
- Zero Liquid Discharge Plant: Customise solution to eliminate environmental threat by facilitating Neutral oil washing stage skipping by soap adsorption system and soap splitting plant effluent water will processing through ZLD.

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DEGUMMING, NEUTRALIZATION & WATER WASHING

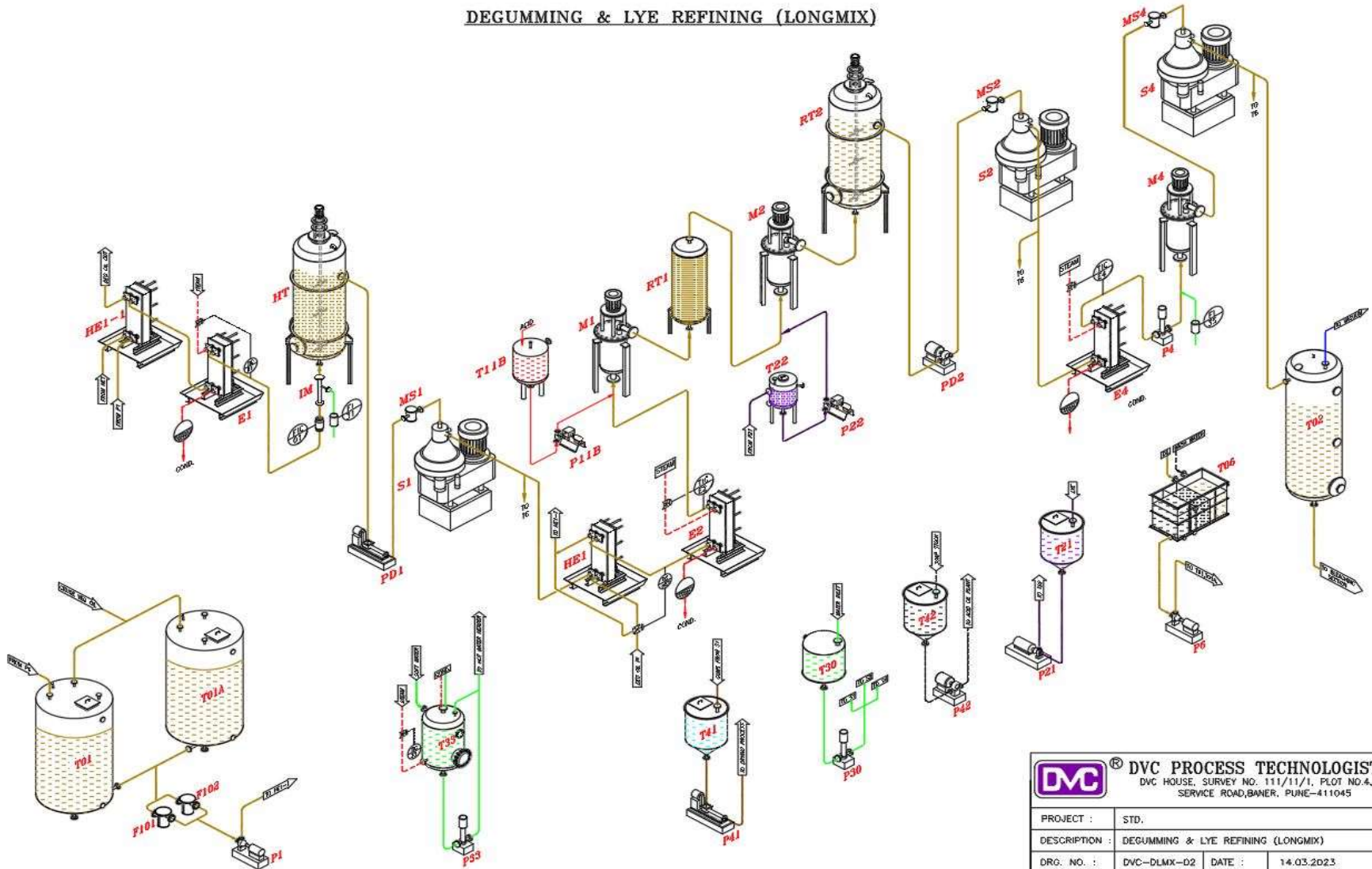
- Mixing of reagents in degumming and neutralization section and their true retention time for efficient dispersion across main stream product.
- Also keeping control over emulsion effect.
- To effect zero liquid discharge concept, avoid the water washing or minimise the washing water (2 – 3%) and use soap absorbent / neutralizing reagent



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DEGUMMING & LYE REFINING (LONGMIX)



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DVC HOUSE, SURVEY NO. 111/111/1, PLOT NO.4, SERVICE ROAD, BANER, PUNE-411045	
PROJECT :	STD.
DESCRIPTION :	DEGUMMING & LYE REFINING (LONGMIX)
DRG. NO. :	DVC-DLMX-02
DATE :	14.03.2023
SHEET :	A3
FILENAME :	2023-Flowchart



PRE-TREATMENT BLEACHING

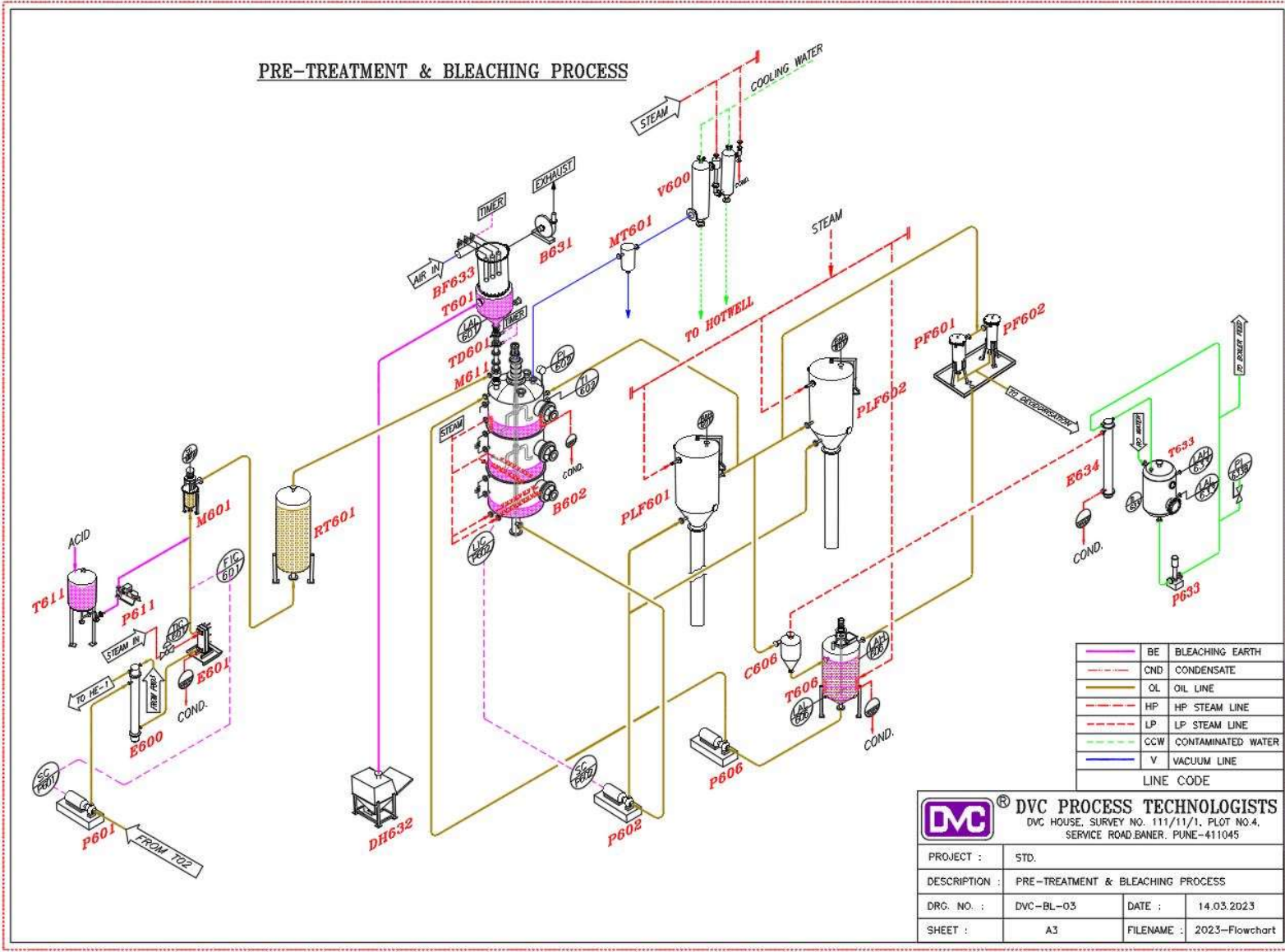
- To take care of residual phosphatides and pigments, pre-treatment by food grade acids like citric / phosphoric acid with necessary retention
- Inline slurry mixing followed by appropriate retention with variable time facility
- Wet bleaching effect by use of sparge steam
- Utilization of waste steam released during filter steaming (re-generative heating)
- Storage of bleached filtered oil under high vacuum (hermetic sealing) prior feed to deodorizer



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PRE-TREATMENT & BLEACHING PROCESS



BE	BLEACHING EARTH
CND	CONDENSATE
OL	OIL LINE
HP	HP STEAM LINE
LP	LP STEAM LINE
CCW	CONTAMINATED WATER
V	VACUUM LINE
LINE CODE	

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 SERVICE ROAD, BANER, PUNE-411045

PROJECT :	STD.		
DESCRIPTION :	PRE-TREATMENT & BLEACHING PROCESS		
DRG. NO. :	DVC-BL-03	DATE :	14.03.2023
SHEET :	A3	FILENAME :	2023-Flowchart

DE-ACIDIFICATION DEODORIZATION

- Deodorization system in general – multipurpose like de-acidification deodorization with or without low trans facility or just deodorizer
- Scrubbing system – single or dual to enrich high & low boiling constituents adding value to both
- Usage of high temp. thermos-siphon in place of thermal oil heater
- Motive steam pressure for vacuum system design (easily available and maintained from boiler) so as cooling water temp considering adverse conditions
- Load data for vacuum system in reference to the system design at chosen suction pressure of 1.2 – 1.5 mmHg abs (0.5 – 0.7% sparge steam load in respect to oil flow)
- Usage of mass transfer enhancers for stripping and scrubbing zones
- User friendly designs of high temp heat exchange devices (vacuum exchangers) for ease of maintenance as well for modifications during capacity enhancement



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TWO STAGE SCRUBBING

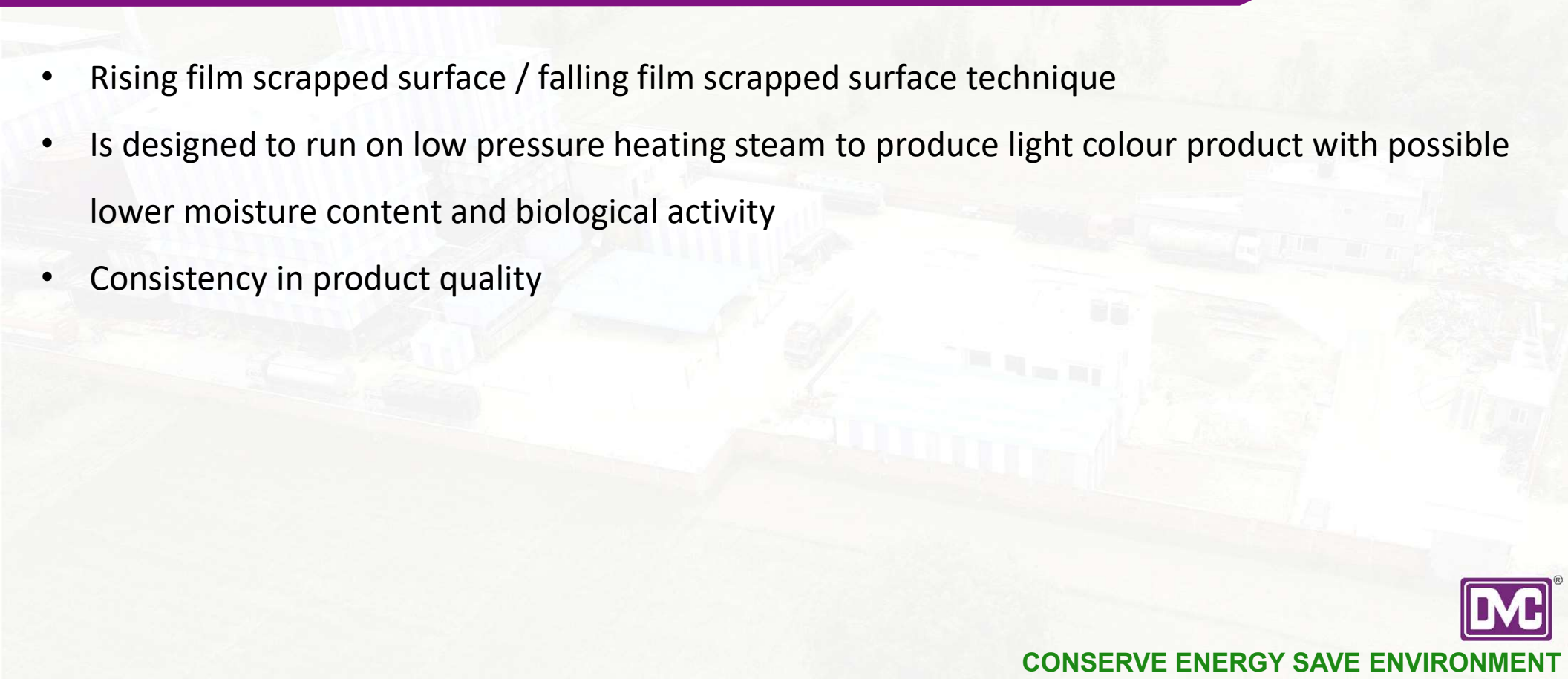
- Maximum separation between FFA and tocopherols streams.
- No extra processing cost
- Higher tocopherol yield in alkali refined soybean, sunflower and rapeseed oil.
- In physical refined oils (crude Rice Bran Oil, crude Palm Oil)
- Adds premium value to both the products yielded from the two stages of scrubbing.
- **DUALSCRUB™** can be installed in existing systems too.



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LECITHIN DRYING PLANT

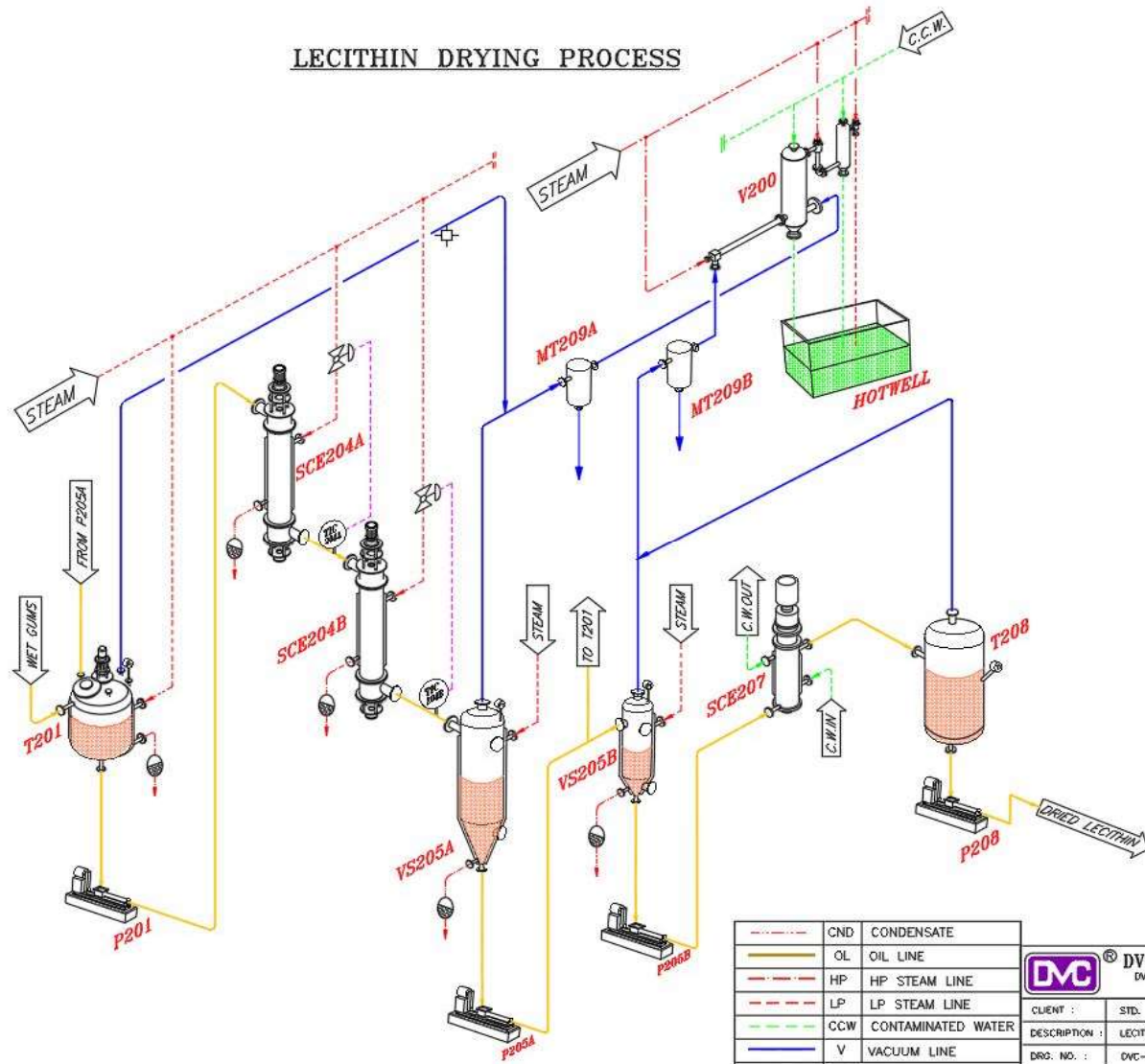
- Rising film scrapped surface / falling film scrapped surface technique
 - Is designed to run on low pressure heating steam to produce light colour product with possible lower moisture content and biological activity
 - Consistency in product quality
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LECITHIN DRYING PROCESS

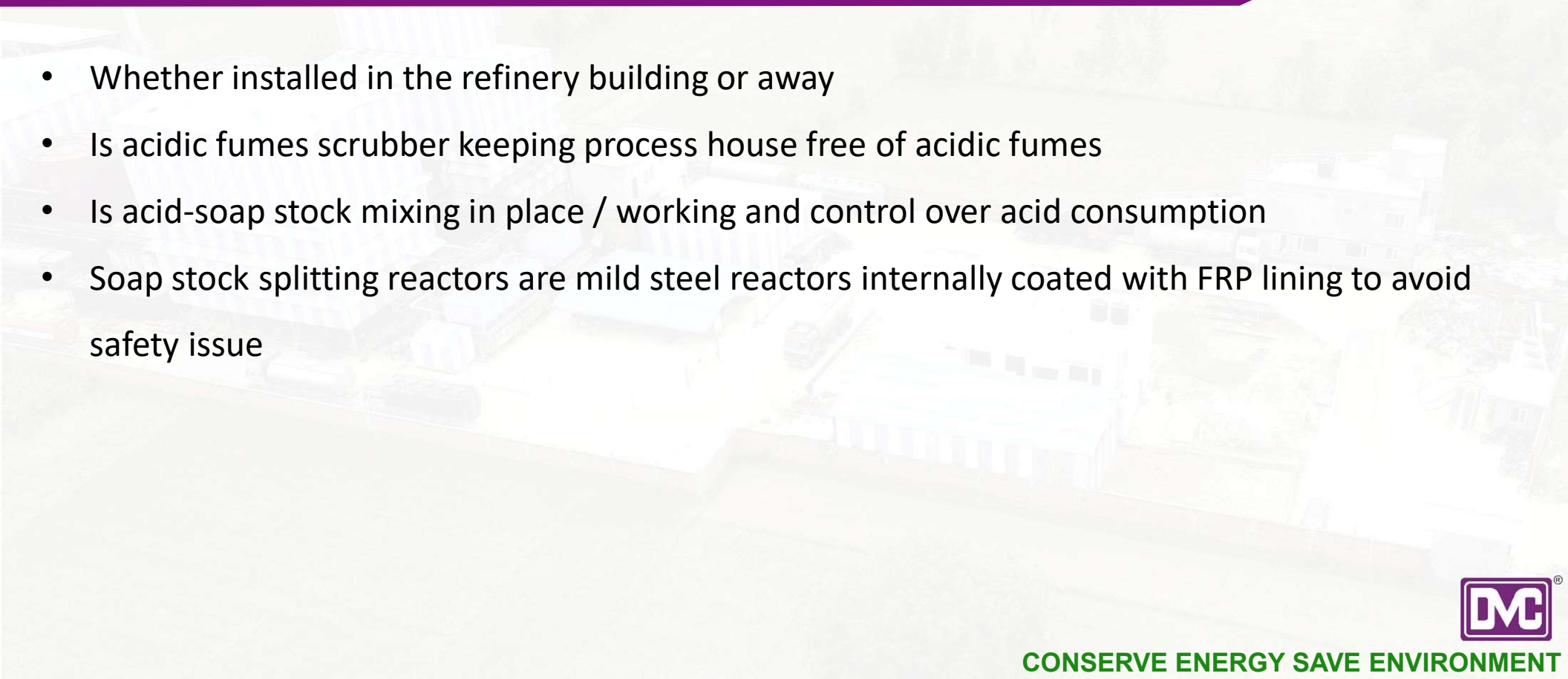


---	CND	CONDENSATE
---	OL	OIL LINE
---	HP	HP STEAM LINE
---	LP	LP STEAM LINE
---	CCW	CONTAMINATED WATER
---	V	VACUUM LINE
---	LINE	CODE

DVC PROCESS TECHNOLOGISTS DVC HOUSE, SURVEY NO. 111/11/1, PLOT NO.4, SERVICE ROAD, BANER, PUNE-411045			
CLIENT :	STD.		
DESCRIPTION :	LECITHIN DRYING PROCESS		
DRG. NO. :	DVC-LD-02	DATE :	14.03.2023
SHEET :	A3	FILENAME :	2023 - FLOWCHART



ACID OIL PLANT

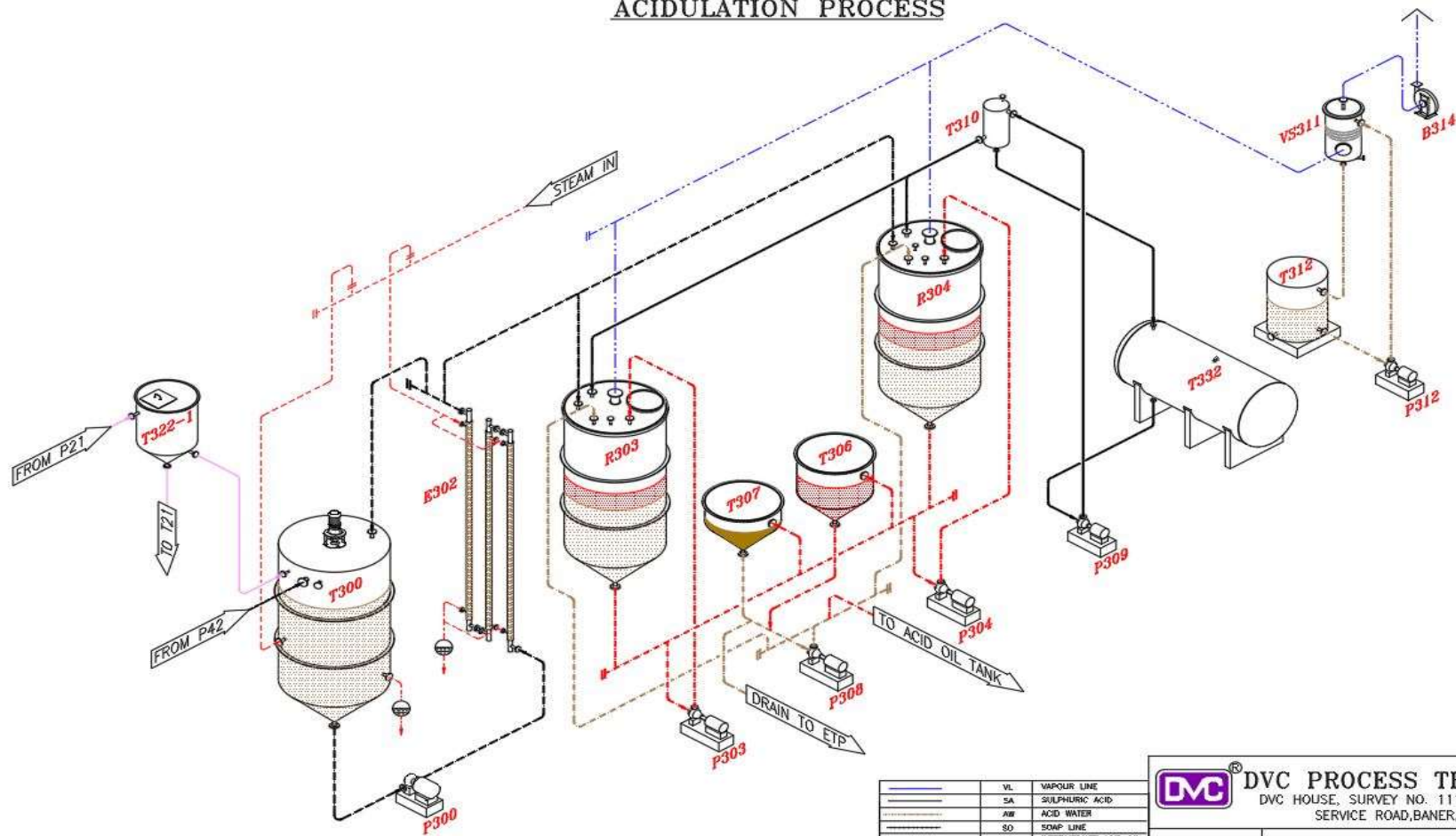
- Whether installed in the refinery building or away
 - Is acidic fumes scrubber keeping process house free of acidic fumes
 - Is acid-soap stock mixing in place / working and control over acid consumption
 - Soap stock splitting reactors are mild steel reactors internally coated with FRP lining to avoid safety issue
- 



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ACIDULATION PROCESS



—	VL	VAPOUR LINE
—	SA	SULPHURIC ACID
—	AW	ACID WATER
—	SO	SOAP LINE
—	AO	INTERMEDIATE ACID OIL
—	CW	CLEAN WATER
—	AW	AIR LINE
—	CL	CAUSTIC LYE
—	CND	CONDENSATE
—	SL	LP. STEAM LINE
—	HW	HOT WATER LINE
—	OL	ACID OIL LINE
LINE CODE		

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PROJECT :	STD.		
DESCRIPTION :	ACIDULATION PROCESS		
DRG. NO. :	DVC-AOP-01	DATE :	11.03.2023
SHEET :	A3	FILENAME :	2023-FLOWCHART

TO VALIDATE EFF

FACTORS INFLUENCING THE PROCESSING COST

- Quality of the input crude oil
(case studies of crude Soy / RBO / CPO)
- Quality & specs of the reagents and chemicals used in process
(phosphoric acid, caustic lye, citric acid, absorbent, activated clay powder etc)
- Process route / design
(Selection of appropriate process route in reference to input crude type & quality)
- Equipment design
e.g., Efficiency of the reagent mixers directly effecting their consumption, retention time in processing stages like hydration, acid conditioning, alkali conditioning / neutralization and silica absorption, bleaching clay mixing and retention



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RE-DEFINING THE PROCESS & EQUIPMENT DESIGN IN EXISTING PROCESS PLANT

- Evaluating the scope for re-defining regeneration of heat energy in various processing stages
- Exploring the scope for optimizing pressure drop parameter in process & utilities fluids by studying the various passes in fluids flow as well as redefining the fluid handling devices like pumps in reference to application
- Understanding the chemical kinetics in the current process and finding the scope for its improvement in respect to energy and process inputs like chemicals / reagents usage.
- Synchronization of process parameters as per process needs. E.g. vacuum & sparge steam requirement in deodorization section for getting desired quality with efficiency
- Scope for redesigning of the process & process equipment to get better quality of the product with optimal energy efficiency.



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CASE STUDY – RUYAT OILS LTD, Lagos Nigeria

BEFORE:

- CPO refinery original supply 50 TPD
- Feed FFA 5-7% , output FFA 0.1%
- Capacity achieved around 45- 50 TPD

After Modification :

Refined CPO FFA < 0.05%

Capacity 200 TPD

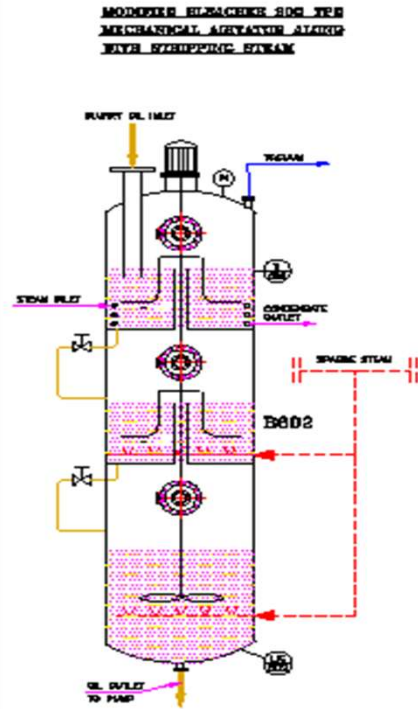
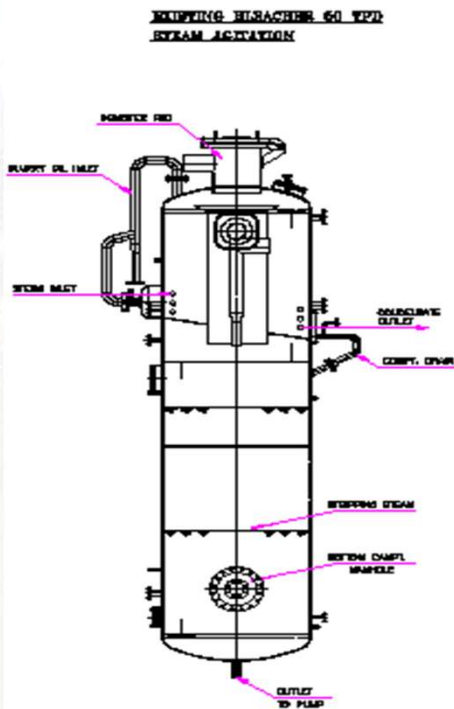
Vacuum system steam consumption per MT reduced by 50%

Electrical power consumption per MT reduced by 50%



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CASE STUDY – RUYAT OILS LTD, Lagos Nigeria



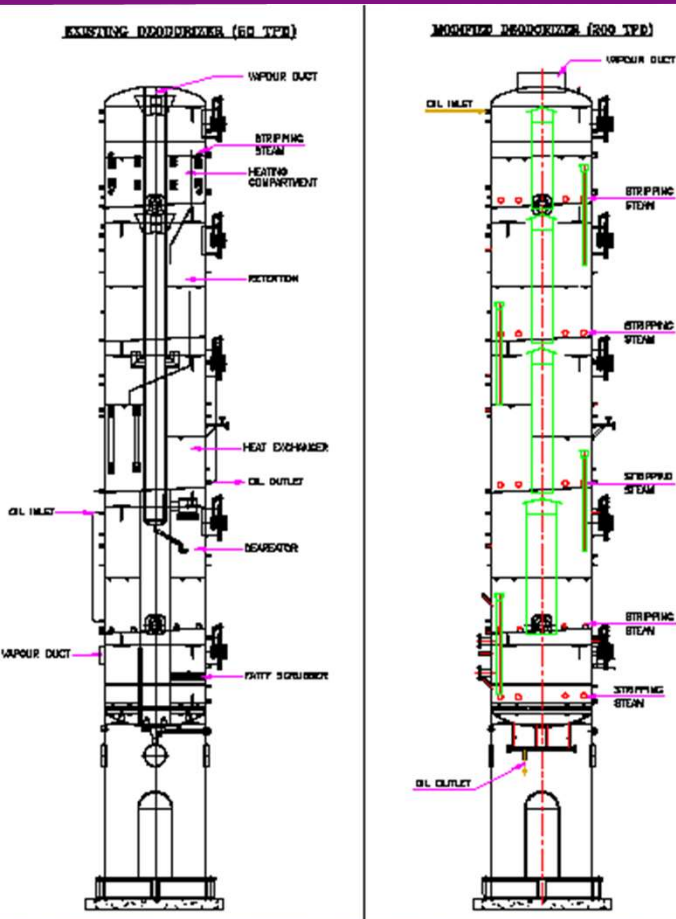
Before modification OF Bleacher issues faced:

- Original Bleacher design is on steam agitation and usage of high bulk density bleaching clays, earth gets deposit on heating coil of top compartment and cant do any inspection/maintenance inside because no provision of manhole.
- Demister pad gets chocked and resulted on poor vacuum level in bleacher.
- Compartment drain line gets chocked and difficult for de-choking.
- Improper bleaching effect because stripping steam holes get chocked.
- Bottom dish of vessel gets erosion and corrosion.



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CASE STUDY – RUYAT OILS LTD, Lagos Nigeria



Before deodorizer modification issues are:

- Booster gets chocked by accumulation of Fatty Acids because installation of Booster is vertical in position. Fatty vapors get blocked which resulting on poor vacuum level and downtime.
- Very difficult to carry internal maintenance of deodorizer because obstruction of Heat exchange coils and center duct.
- Difficult to carry maintenance of stripping steam pump and stripping steam coil.
- Unsafe to enter in center duct for internal maintenance if bottom vent gets blocked.



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CASE STUDY – FORTUNE COTTON & AGRO INDUSTRIES, HUBLI, KARNATAKA

BEFORE:

- CPO refinery original supply 100 TPD
- Feed FFA 5-7% , output FFA 0.3 -0.4%
- Capacity achieved around 80- 90 TPD
- Motive steam consumption for Deodorizer vacuum system 900 Kg/Hr

After Modification :

Refined CPO FFA < 0.08%

Capacity 225 TPD

Vacuum system steam consumption per MT reduced by 50%

Electrical power consumption per MT reduced by 50%



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SUMMING UP

1. To know process plant asset health, need to have necessary instrumentation in place
2. Need to keep track of utilities consumption pattern and correlating with the designed values
3. Periodic check of motive steam consumption for vacuum system where ever installed, which may likely to go up after 3-years due to erosion of the steam jet nozzles! This necessitates to replace or redefine if any change in the requirement!
4. Need to cross check process & utilities pumps performance, if required fine tune
5. Waste steam heat recovery by way of regeneration
6. Use of instrumentation and automation for precise process control and improvisation



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SOME OF OUR UPGRADATION PROJECTS

SL. NO.	LIST OF ONGOING PROJECTS	NAME OF CLIENT
1	Capacity enhancement of Degummed Soy Oil Refinery From 100 TPD to 200 TPD For CPO Input FFA 12-15% & Output FFA is 0.05-0.06%	M/s RUYAT OIL LIMITED , Lagos Nigeria
2	Up-gradation of Bleaching and Deodorization to 225 TPD for Sunflower Soybean and Palm Oil.	M/s FORTUNE COTTON AGRO INDUSTRIES , Karnataka
3	Up-gradation of Palm Complex from 60 TPD to 100 TPD	M/s OLAM PALM GABON , Africa
4	Up-gradation of Palm Complex to 250 TPD	M/s NILE AGRO INDUSTRIES , Jinja, Uganda
5	Up-gradation of Palm Complex from 100 TPD to 150 TPD	M/s OLAM PALM , Libreville, Africa



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SOME OF OUR UPGRADATION PROJECTS

SL. NO.	LIST OF ONGOING PROJECTS	NAME OF CLIENT
6	Capacity enhancement of Degummed Soy and Sunflower Oil Refinery From 100 TPD to 200 TPD	M/s SUNOLA OIL REFINERY, Johannesburg South Africa
7	Up-gradation of Refinery which delivering 30 TPD to 100 TPD	Former M/s Ruchi Soya, Mangalore Now M/s Patanjali Group
8	Soya processing plant modified to process Rice bran oil	Betul Oils Ltd, Satna, MP
9	Capacity Enhancement 300 TO 600 TPD	M/s BUDGE BUDGE REFINERY ,India



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THANK YOU!



DVC PROCESS TECHNOLOGISTS
Technology with Innovation

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