



Technology with innovation

INTERNATIONAL

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**EDIBLE OIL REFINING  
PROCESS OPTIMIZATION & SUSTAINABILITY**

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**DVC PROCESS TECHNOLOGISTS**

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## ABOUT US



- **DVC Process Technologists** headquartered at Pune is a Technology & Innovation driven company that offers comprehensive processing solution for Edible Oil and Fats, Oleo chemicals & Biodiesel industries.
- Company established with the drive to update the inefficient processing plants on Technological & energy efficiency front
- Own **ISO Certified manufacturing facility.**
- Along with turnkey solution for new greenfield projects, upgraded many inefficient oil refining & related facilities.
- Dedicated competent team for Technical Audits of the current processing & utilities facilities and evaluating for the upgradations. Till date done many domestically as well as internationally with guarantees.

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## DVC's ACHIEVEMENTS INCLUDES



- Over 240+ references including Africa, Europe, USA, Australia & Middle East
- > 52 Green Field Projects
- Introduced Gums (Lecithin) Drying Plants for Rice Bran Oil.
- **Biodiesel plants supplied :-**
  - ✓ **150 TPD Multifeedstock Biodiesel Plant.**
  - ✓ **30 TPD Biodiesel Plant**
  - ✓ **50 TPD & 100TPD Multifeed-stock Biodiesel Plant under execution.**

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- In today's competitive business environment, word 'sustainability' is hammering every manufacturing industry to make operations profitable for the very survival and growth. So, the vegetable oil processing sector is not the exception!
- Basic principles of the vegetable oil processing for edible purpose have not changed much but the techniques do have continuous improvements from time to time in reference to quality requirements of refined product. These improvements are reflected through various process equipment design improvement, resulting in to efficient processes in respect to quality demand and efficiency.



### INTRODUCTION

Edible oil refining is a critical process in the food industry, transforming raw vegetable oils into refined oils suitable for human consumption. This process involves various steps, including degumming, neutralization, bleaching, and deodorization. Refining is essential for crude oils with higher impurities level for ensuring the food safety and quality suitable for human consumptions.

It is also, necessary to select the processing route and system, can have minimal impact on environment.



## **PROCESS OPTIMIZATION:**

1. Energy efficiency techniques
2. Chemical consumptions
3. Water consumption & conservation strategies
4. Process Automation by PLC / DCS system using SCADA

## **SUSTAINABILITY**

1. Sustainable sourcing practices
2. Environmental impact assessment
3. Social responsibility initiatives



## TYPES OF OIL REFINING PROCESSES

### CONVENTIONAL REFINING

For Seed oils like  
Soy, Sun, Corn,  
Canola oils

Wet-deg. Gum condi.  
& Neutralization  
Water wash  
Bleaching  
(Dewaxing for sun &  
corn)  
Deodorization

### PHYSICAL REFINING

For oils like palm,  
palm kernel,  
coconut

Physical Refining  
Gum conditioning &  
Bleaching  
De-acidification  
Deodorization

### MOD. PHYSICAL REFINING

For solvent extracted  
Rice bran, Mustard oil  
Acid / Total / Enzymatic  
degumming  
Water washing /  
Bleaching  
Dewaxing  
Deacidification  
Deodorization

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### **1. ENERGY EFFICIENCY TECHNIQUES**

Energy efficiency is a critical aspect of sustainable edible oil refining. By reducing energy consumption, refineries can lower operational costs, reduce their environmental footprint, and improve overall sustainability. Here are some effective energy efficiency techniques:

#### **A. Heat Recovery -**

**Waste Heat Utilization:** Use of final product heat (deodorized oil) regeneratively in every stage of process systematically resulting in no need to heat oil in intermediate stage in stabilized state of process.

#### **B. Efficient Equipment Design -**

Use high-efficiency motors & pumps, fans, and other equipment to reduce electricity consumption.

Application of energy efficient process designs



### **C. Process Route – (Chemical / Physical)**

Selecting suitable processing routes to save upon material handling like process pumps

### **2. CHEMICAL CONSUMPTION**

Selecting the appropriate equipment and process route matters with the chemical consumption like, long mix process in neutralization, true retention in bleaching and sparge steam distribution in deodorizer.

### **3. WATER CONSUMPTION & CONSERVATION**

In oil neutralization section water washing stage is skipped by adopting the modified processing route by installing efficient separator machines soap separation saves lot on process water saves from generating effluents. Heat Exchangers: Employ efficient heat exchangers to transfer heat from hot streams to colder ones, minimizing energy losses.

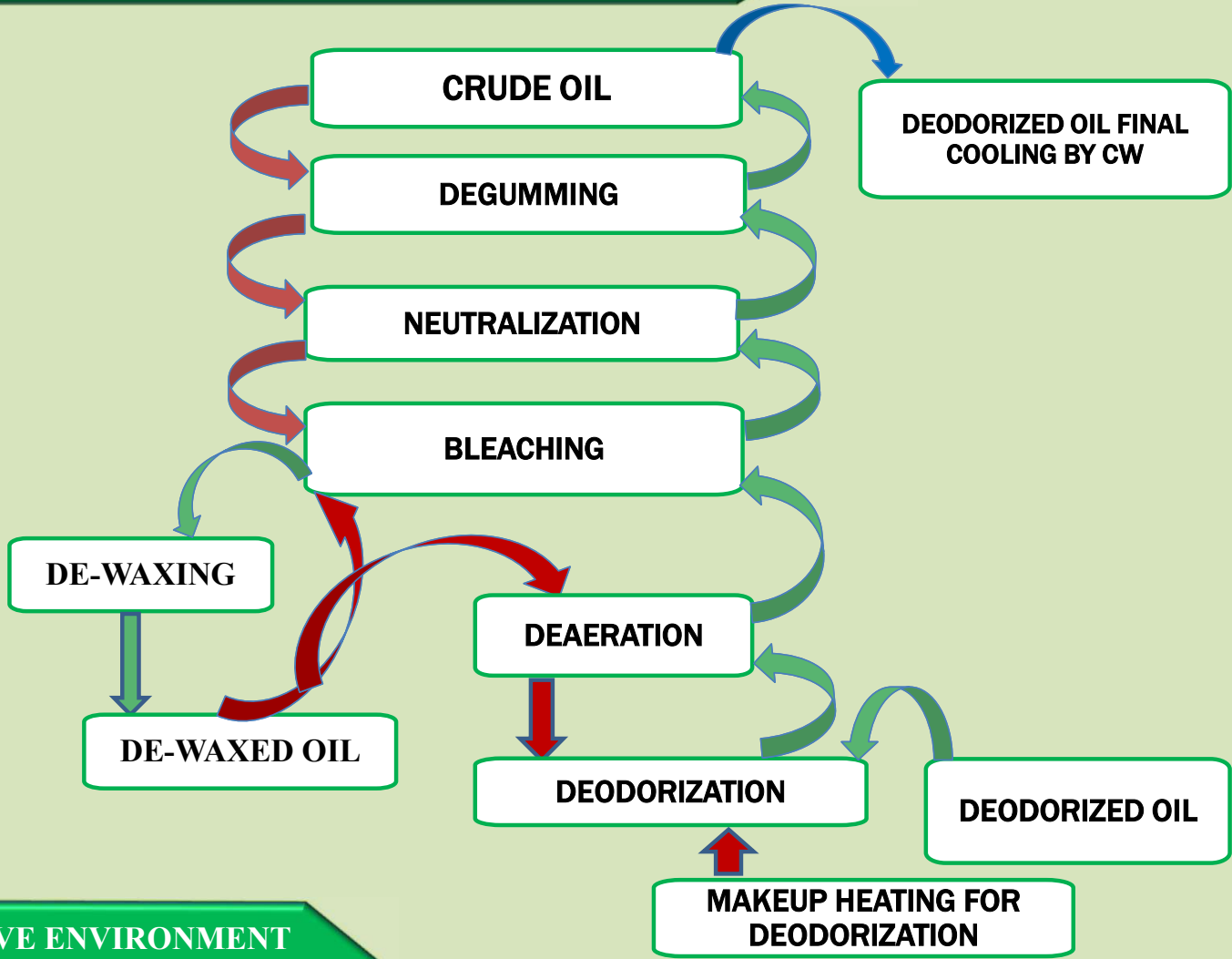


### 4. PROCESS AUTOMATION BY USING PLC / DCS SYSTEM & SCADA

- Use of PLC / DCS system for process control is very necessary in today's competitive environment to keep track of operations as well as to keep close monitoring and control by data logging and its access from remote places by decision makers.
- The use of these systems will patch up the communication gaps, helps to take decisions fast.
- Material movement, storage and handling be monitored and controlled by the system systematically without any flaws for large capacity operations.



**RE-GENERATIVE HEATING / COOLING CYCLE IN STABILIZED STATE**



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## STEAM ENERGY & HIGH TEMP. HEATING MANAGEMENT



1. Selection of steam producing source for its capacity, rating & compatibility for fuel
2. Selection of related accessories like controls, valves etc. which do attract minimum maintenance
3. From process side – sizing of heat exchangers & their ratings for temp. & Pressures
4. Maximum condensate return from process to boiler out of indirect heating
5. Selection of vacuum system devices of appropriate rating in such way, could able to accommodate the pressure fluctuations and provide steady state
6. Use of thermo-syphon systems for high temp. Heating for low maintenance and recurring cost as well part of food safety

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## EQUIPMENT DESIGN CRITICALITY FOR PROCESS CONTROL



- 1. Mixer designs** - reagent mixing efficiency like hydration water, phosphoric acid & caustic lye is part of particle distribution and same time controlling emulsion factor
- 1. Centrifugal separators** for liquid – liquid separation – their efficiency is prime factor for the process losses & cost. so its design & performance is utmost priority
- 2. Retention vessels** – For effective reagent mixing we need to provide true retention, due their slower reaction kinetics
- 3. Slurry mixers** (liquid – powder) – no escape if under reduced pressure and then followed by true retention for its optimal efficiency
- 4. Re-generative exchangers** for high temp – efficiency and its ease of maintenance is utmost priority directly affects the process cost
- 5. Distribution of sparge steam and selection of vacuum system** are directly related to the skill of the designer OEM, needs to be optimal.

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### **D. Renewable Energy**

**Solar Power:** Install solar panels to generate renewable electricity on-site, reducing reliance on the grid.

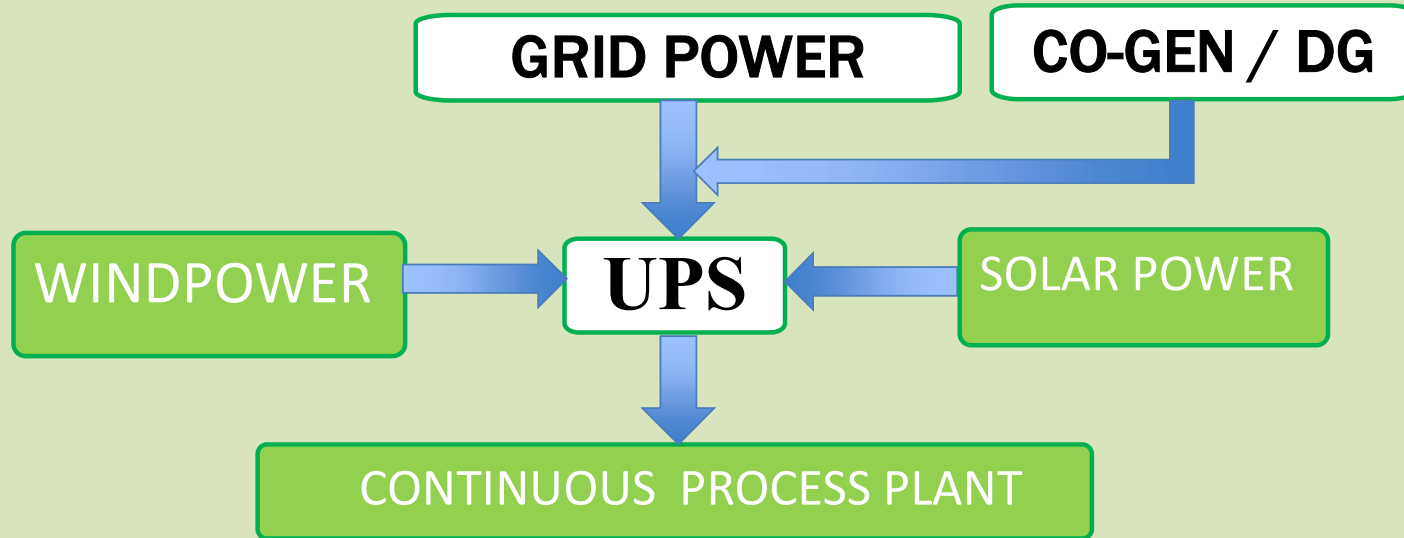
**Biofuel:** Explore the use of biofuels as a renewable energy source for heating or power generation.

### **E. Energy Management Systems**

**Monitoring and Control:** Implement energy management systems to monitor energy consumption, identify areas for improvement, and optimize energy usage.



# ELECTRICAL ENERGY MANAGEMENT



- 1. **Need to have continuous power supply for process plants:** UPS systems helps to avoid power break downs. Every breakdown of 5 minutes wastes minimum 25 to 30 minutes for resuming process. Also, un-noticed power breakdowns can results in to mechanical breakdowns.
- 2. Incorporation of solar power / wind power in synchronous to the grid supply system reduces the electrical power cost & thus effects the processing cost.

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### 1. **Water Conservation:**

**Closed-Loop Systems:** Develop closed-loop water systems to reduce water consumption and minimize wastewater discharge.

**Efficient Water Usage:** Implement measures to reduce water usage during washing and cleaning steps.

**Wastewater Treatment:** Treat wastewater before discharge to minimize environmental impact. ZLD is good option for the same.

### 2. **Waste Reduction:**

**By-product Utilization:** Explore opportunities to utilize byproducts from the refining process as valuable resources.

**Waste Minimization:** Implement practices to reduce waste generation throughout the refining process.



## ZERO LIQUID DISCHARGE - ZLD



Customized Zero Liquid Discharge solutions for waste water

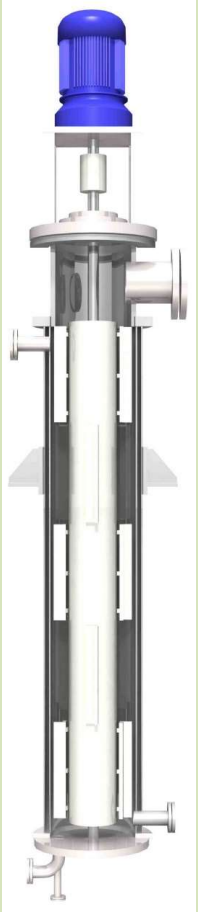
### **THE SALIENT FEATURES OF OUR ZLD SYSTEMS**

- Easy disposal of final dried solid waste
- Least consumption of heat energy by recovery & utilization of heat energy from binary steam / hot water
- It can be designed to operate on heat energy from existing process plant
- Fully automated operation, PLC-SCADA based
- Continuous plant with 24x7 operation
- User friendly and easy to clean (CIP) system

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## GUMS DRYING (LECITHIN / LYSO-LECITHIN) PLANT



**GUMS DRYING (LECITHIN / LYSO-LECITHIN) PLANT :**  
For Rice bran, Soybean, Mustard / Corn / Rapeseed wet gums

**USING FALLING FILM SCR®-  
SCRAPPED SURFACE HEAT EXCHANGER**

- Short residence time thus retaining quality of the product
- High heat transfer coefficient
- Ensures no charring thus light color of the product without burnt odor
- Suitable for highly viscous fluids, up to 20000 cp
- Used in production of edible / pharma

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## DUALSCRUB™: ELEVATE YOUR DEODORIZATION PROCESS



**Innovative Two-Stage Scrubbing Technology:** Unique design that enhances separation of valuable components.

**Optimal Operating Conditions:** Functions at low pressure (1.5 mmHg abs) superior efficiency.

**Hot Scrubber (D804A):** Condenses at High Temp, capturing valuable non-glyceride compounds (tocopherols, sterols, tocotrienols). **10 – 12%**

**Cold Scrubber (D804B):** Condenses at Low Temp., focusing on Free Fatty Acids (FFA) for targeted recovery **80 – 85%**

**Enhanced Value:** Optimum separation, adding premium value to both product streams.

**No Extra Cost:** There is no extra cost for the processing.

**Versatile Installation:** Can be integrated into existing deodorization systems effortlessly. Existing deodorization system can be modified with DUALSCRUB™ and will optimize byproducts' value!

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## DEWAXING / WINTERIZATION: CRYSTALLIZATION:

### **Crystallization Process:**

After bleaching, wax is crystallized in specially designed crystallizers. These crystallizers use concentric cooling coils to gently agitate and homogenize the wax mass while circulating chilled water or brine for controlled cooling. This process facilitates the formation of crystals of the desired size.

**Retention Time:** Is necessary for effective Dewaxing & varies depending on the type of wax:

- **Sun and Corn Oil Waxes:** 6-8 hours
- **Rice Bran Oil Wax:** 16-24 hours

### **Crystallizer - Multipurpose Type Winterization / Fractionation**

- Cylindrical flat bottom comprising of concentric dual zone cooling coils
- Agitator drive motor provided with VFD for speed regulation
- Agitator assembly mounted with 'H' type blades which provides agitation in between of the two concentric coils assembly
- Cooling cycle programmed and controlled by PLC
- Multipurpose design compatible for de-waxing, winterization & fractionation



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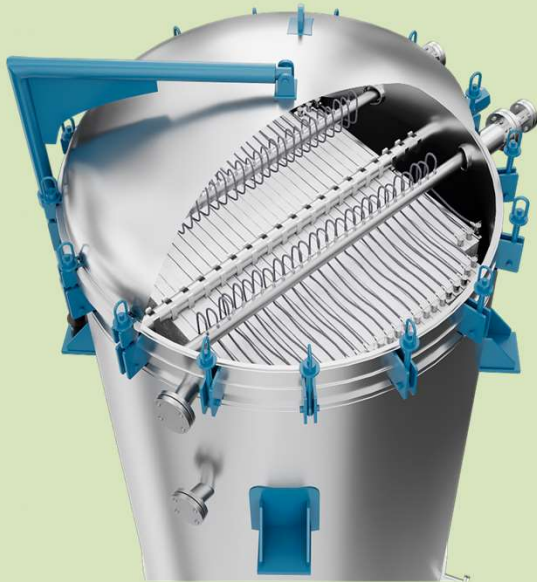
## DEWAXING / WINTERIZATION: FILTRATION BY LPVLF

### Filtration by LPVLF:

- Conveying of crystalized wax-oil mixture to filter LPVLF by appropriate head screw pump to avoid damage to wax crystals and their churning helps in improving filtration efficiency.
- LPVLF is inline filter operates in the range of 0 – 1 barg pressure at inlet while filtered oil outlet is under the vacuum of 500 – 600 mmHg, this unique feature in filtration of waxes in de-waxing gives better de-waxing level and efficient filtration.

### Advantages

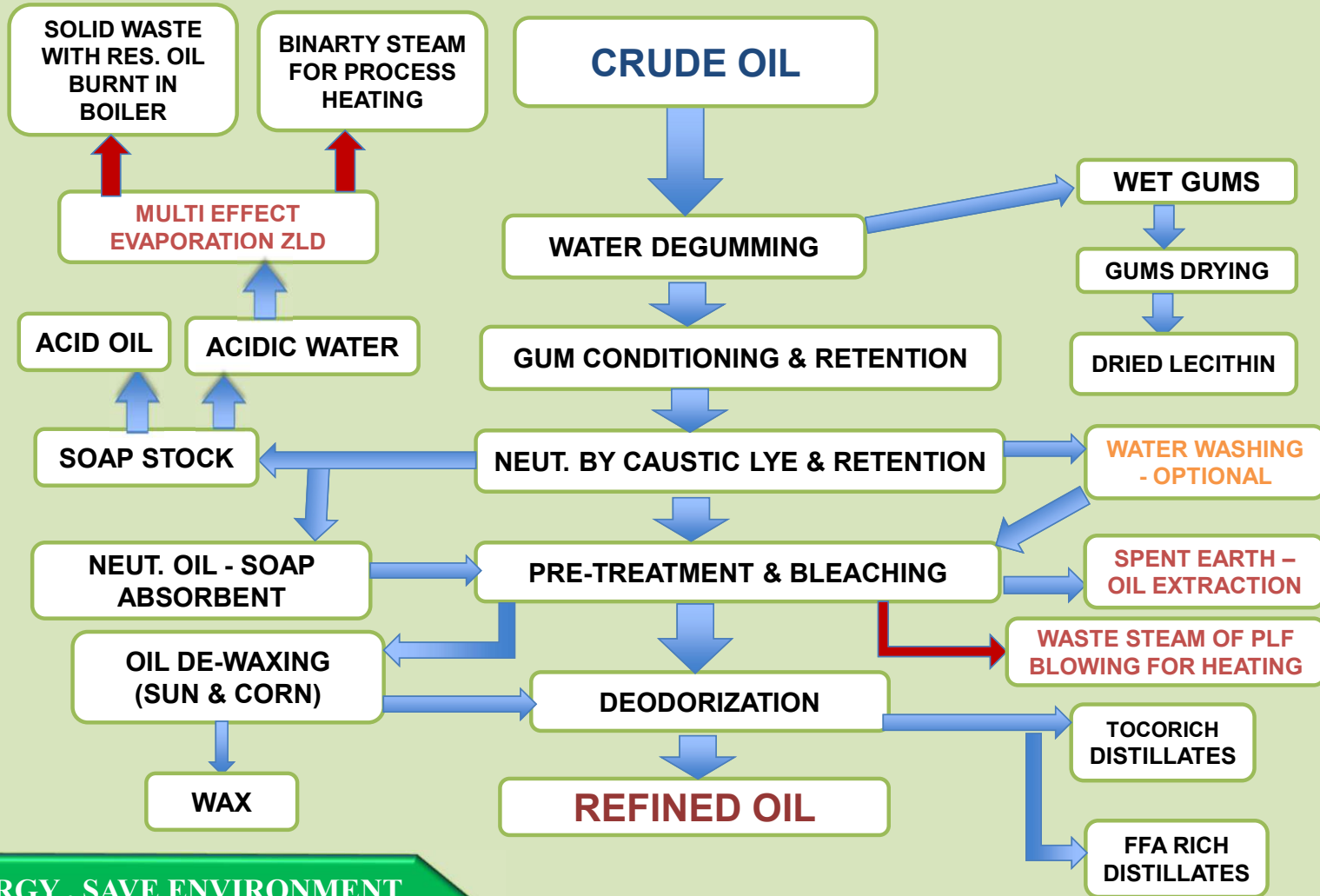
- No filter aid is used for filtration, so the wax recovered is free of filtering aid and provides more value!
- As this filter leaves are inside vessel, so the operations are hermetically sealed which helps in maintaining quality of oil and housekeeping!
- Simple in design, easy to handle and operate
- Lower maintenance cost
- Can be used in multiple parallel lines for higher capacities.
- Sizes available from 100 – 300 sq. Mt.
- Easy to integrate with automated operations



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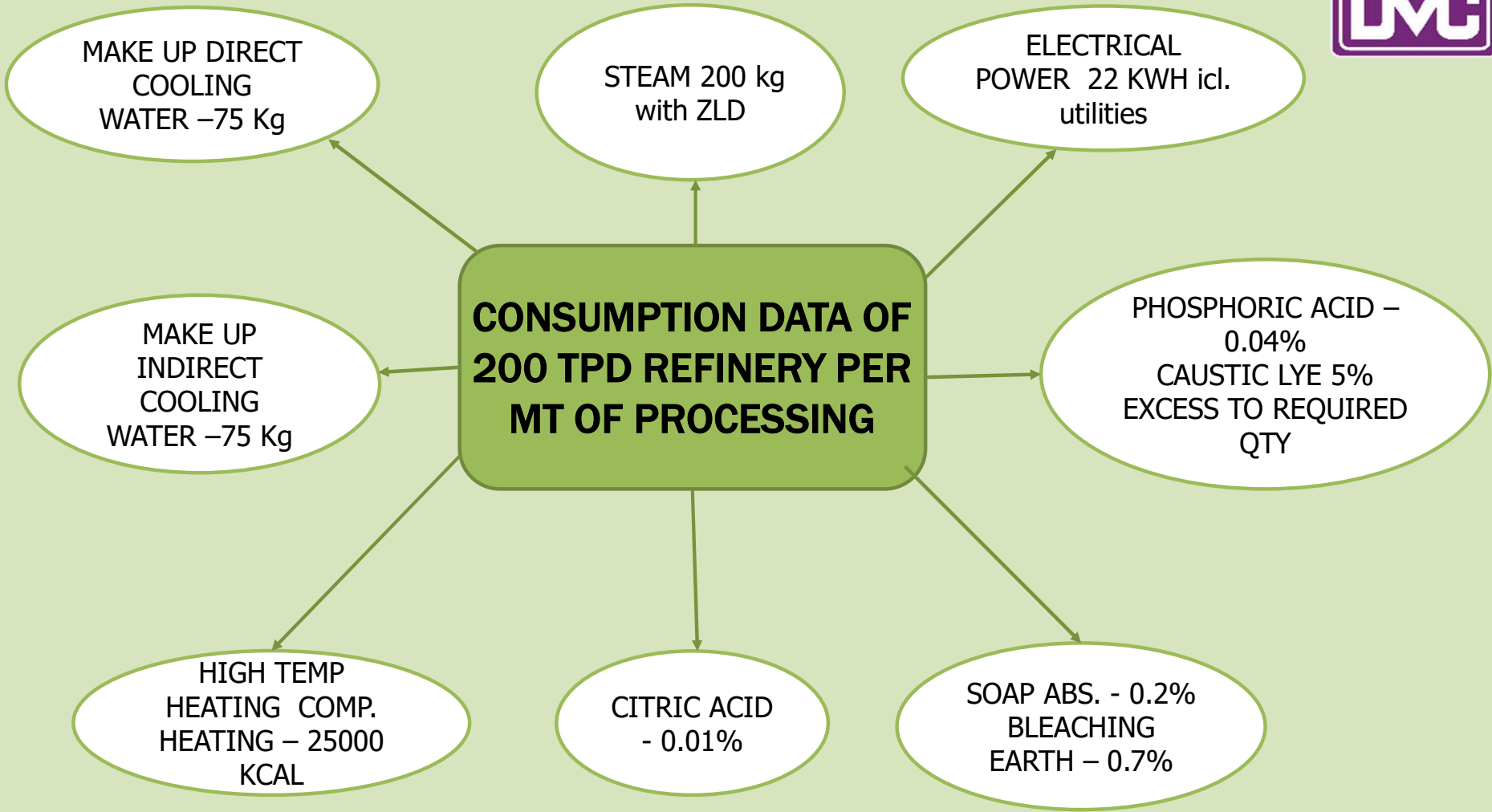


# OIL REFINING CYCLE - SUSTAINABLE



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# Thank You!

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