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“Energy Efficiency & Sustainability in Oils & Fats Processing”

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OVERVIEW

- Energy efficiency is priority in present energy crisis rich world, particularly process industry
- Conserving environment is another priority
- Developing energy efficient processes and optimizing uses of environment friendly energy sources like non-conventional, agro-waste & recyclable will help in balancing emissions & environment
- Optimizing utilization of by-products generated in processing (distillates & acid oils) by their further processing adding value to them as well as producing bio-diesel as green fuel.
- Recycling of the wastes

KEY FACTORS INFLUENCING WAY to “NET ZERO”

- Reduce, Re-generate, Recycle

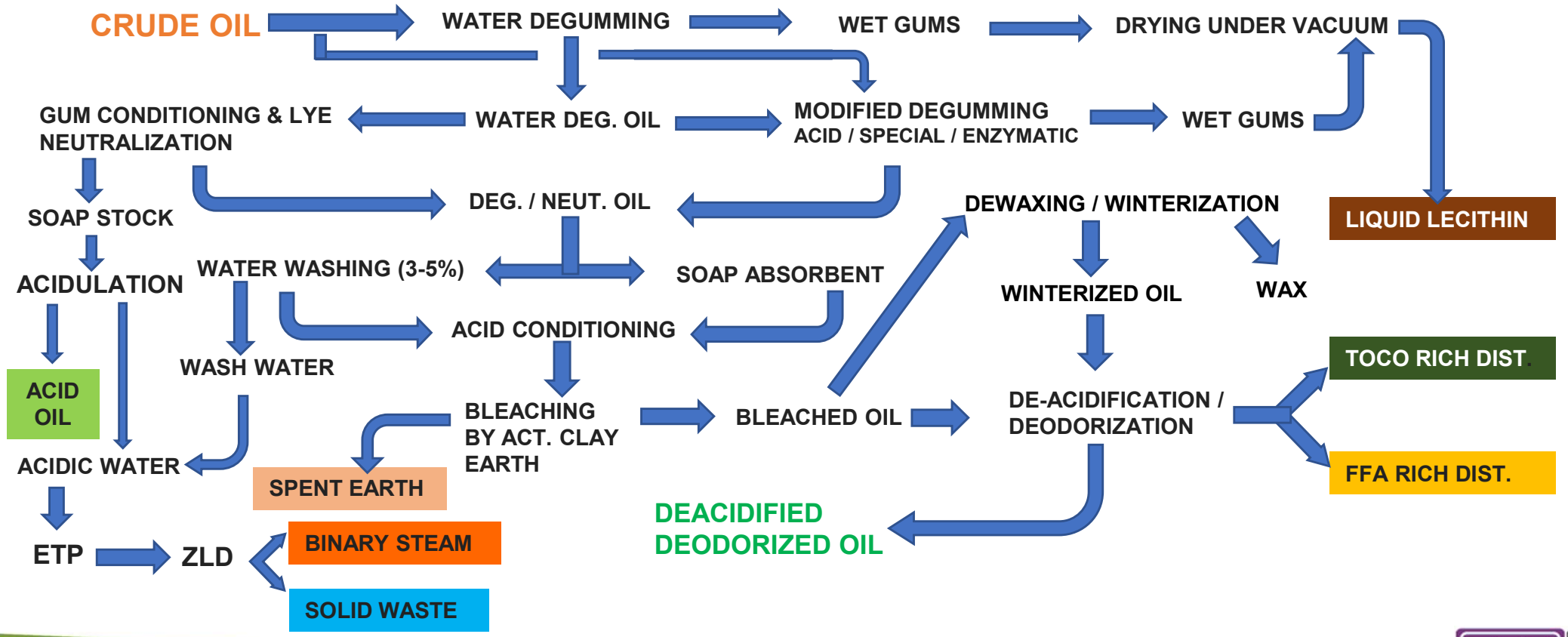
- Need to adopt and develop the energy efficient processes and use environment friendly / green fuels to balance the net effect on environment

- Optimized utilization of by-products generated, by their further processing like dried lecithin, toco rich distillates as value added products while acid oil & FFA rich distillates converting to bio-fuels and using as fuel for generating required energy for process

HOW FATS & OIL PROCESSING INDUSTRY CAN CONTRIBUTE TO NET ZERO

- Identifying & Blocking wastages – steam as well as electrical power
- Adopting energy efficient process and equipment designs
- Installing appropriate heat recovery systems (re-generation) to narrow the gap between required & available
- Optimum use of Instrumentation and automation to monitor energy consumption at every processing stage
- Integrating with renewable energy resources like solar, wind, hydrogen, biofuels to cover their energy needs
- Doing plantations and reducing their own carbon footprints

CRUDE (Soy) OIL & BYPRODUCTS PROCESSING CHART



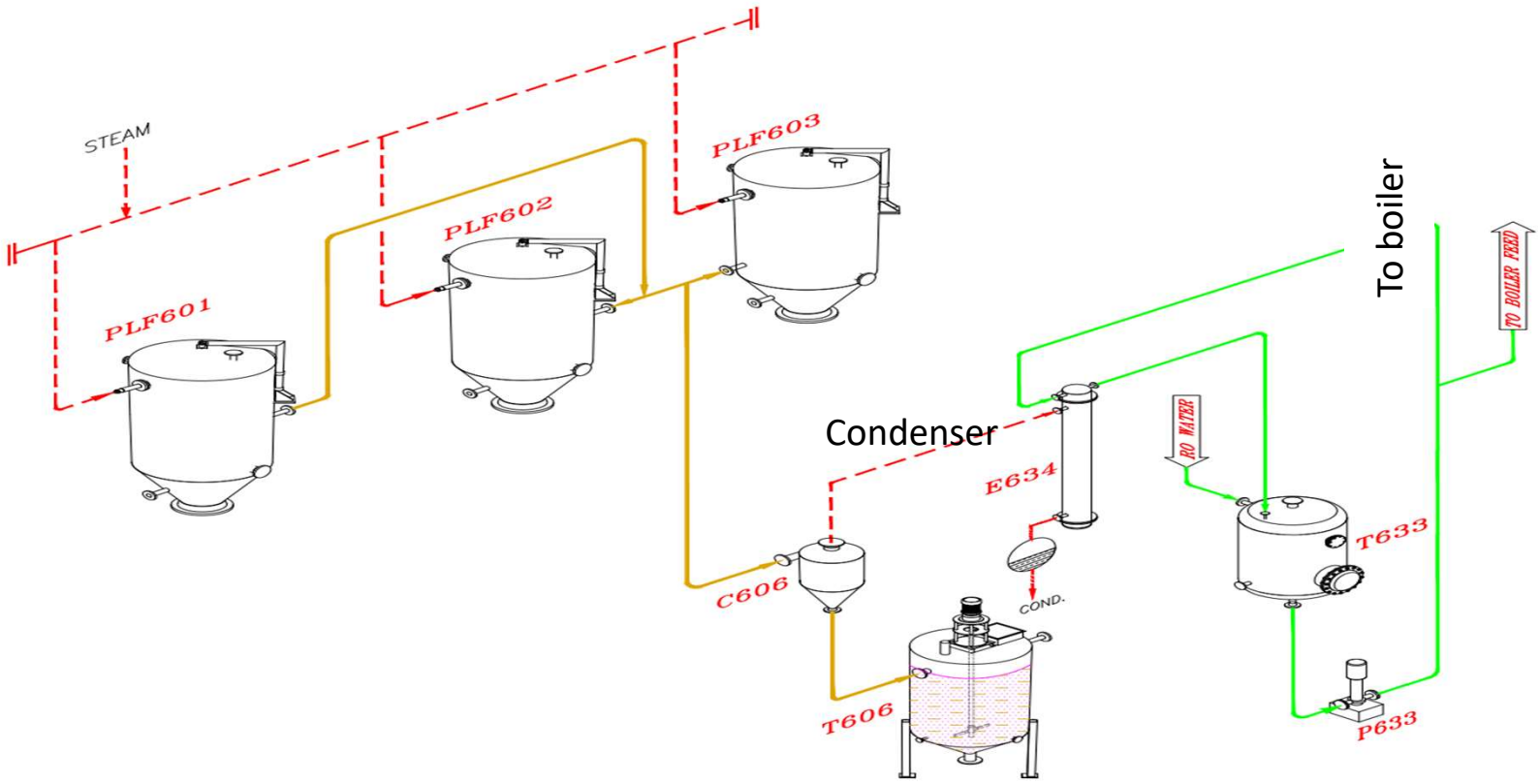
CONSERVE ENERGY SAVE ENVIRONMENT

UTILITY CONSUMPTION OF 500 TPD SOYA OIL REFINERY

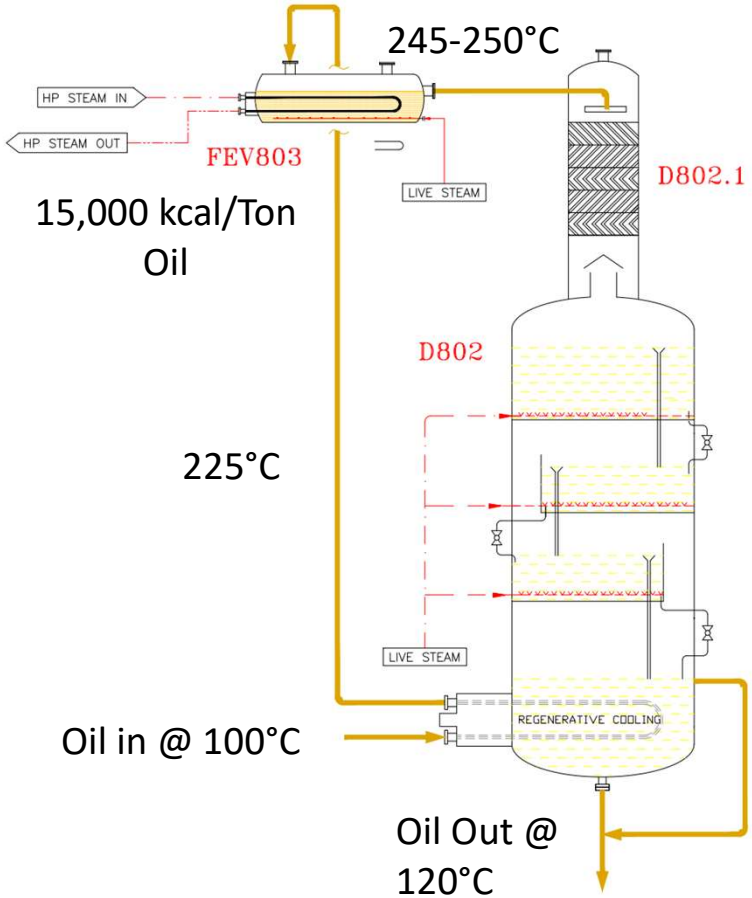
Sr. No.	Parameter	Unit	Deg. Lye ref. & water-washing	Pre-treatment & Bleaching	Deodorization	Lecithin Plant	Acid Oil Plant	Power Cons. for CT & water Cir.	Total Cons. / MT Crude Oil incl. of byproduct
	A: UTILITIES								
1	Feed Oil temp.	°C	30	80	100	60	60	-	-
2	Steam at 3 barg								
	for heating– start up	Kg	80	20	0	38	23	-	-
	steady state	kg	40	0	0	-	-	-	-
	Live steam	kg	-	10	8	-	-	-	-
	Steam for filter blowing	kg	-	10	-	-	-	-	-
	Steam for vacuum at **2.75 barg and temp. of water 9 °C**	kg	0	4	40	7	-	-	-
	Total steam Consumption in steady state	**kg/T oil pro.**	**20**	**24**	**48**	**45**	**23**	-	**160**
3	Installed power (indicative inside process house)	kW	260	60	80 + 250 for chilling Unit	41	32	120	**843**
4	**Power Consumption (indicative inside process house)**	**kWH/T oil pro.**	**8**	**2.0**	**3 + 8 (chilling Unit)**	**1.3**	**0.3**	**4.5**	**27**

SCOPE for ENERGY EFFICIENT PROCESSES in FATS & OILS PROCESSING

PLF WASTE STEAM – HEAT REG. TO HEAT PROCESS WATER

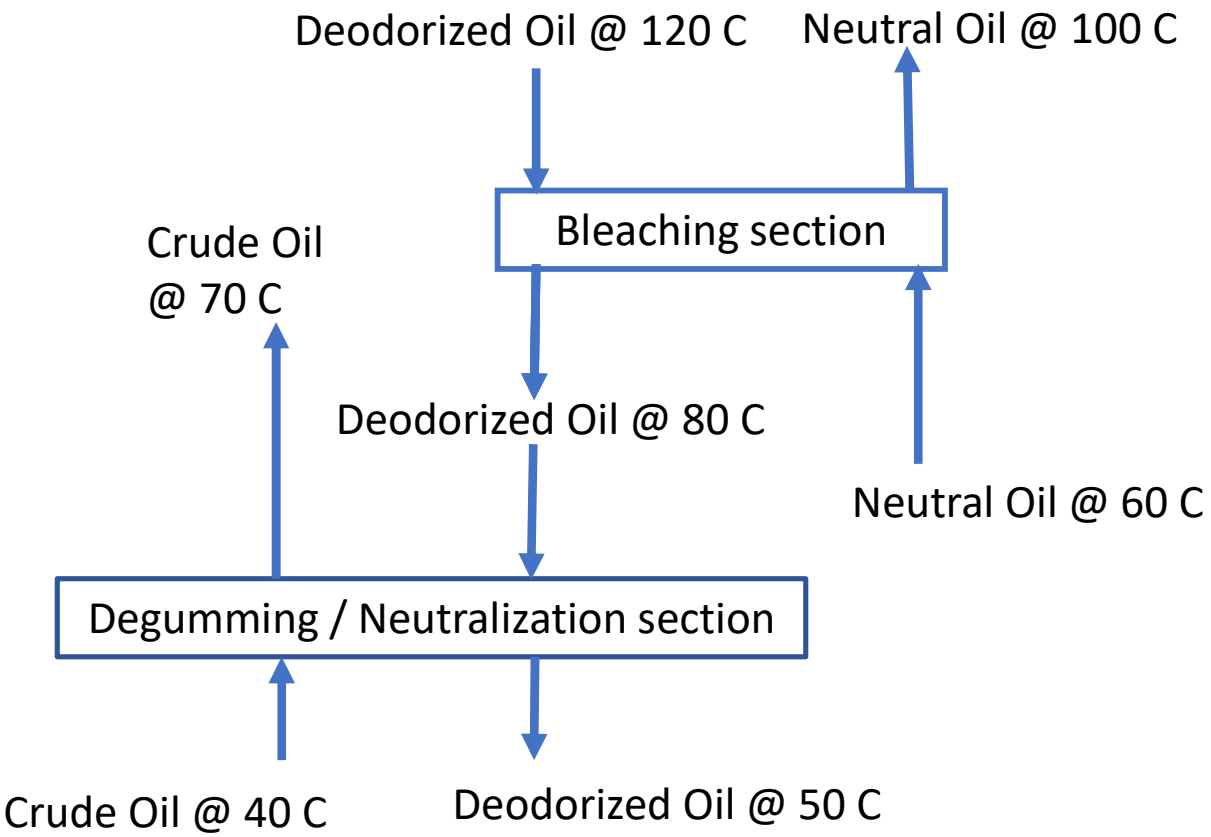


HEAT RECOVERY IN DEODORIZATION SECTION

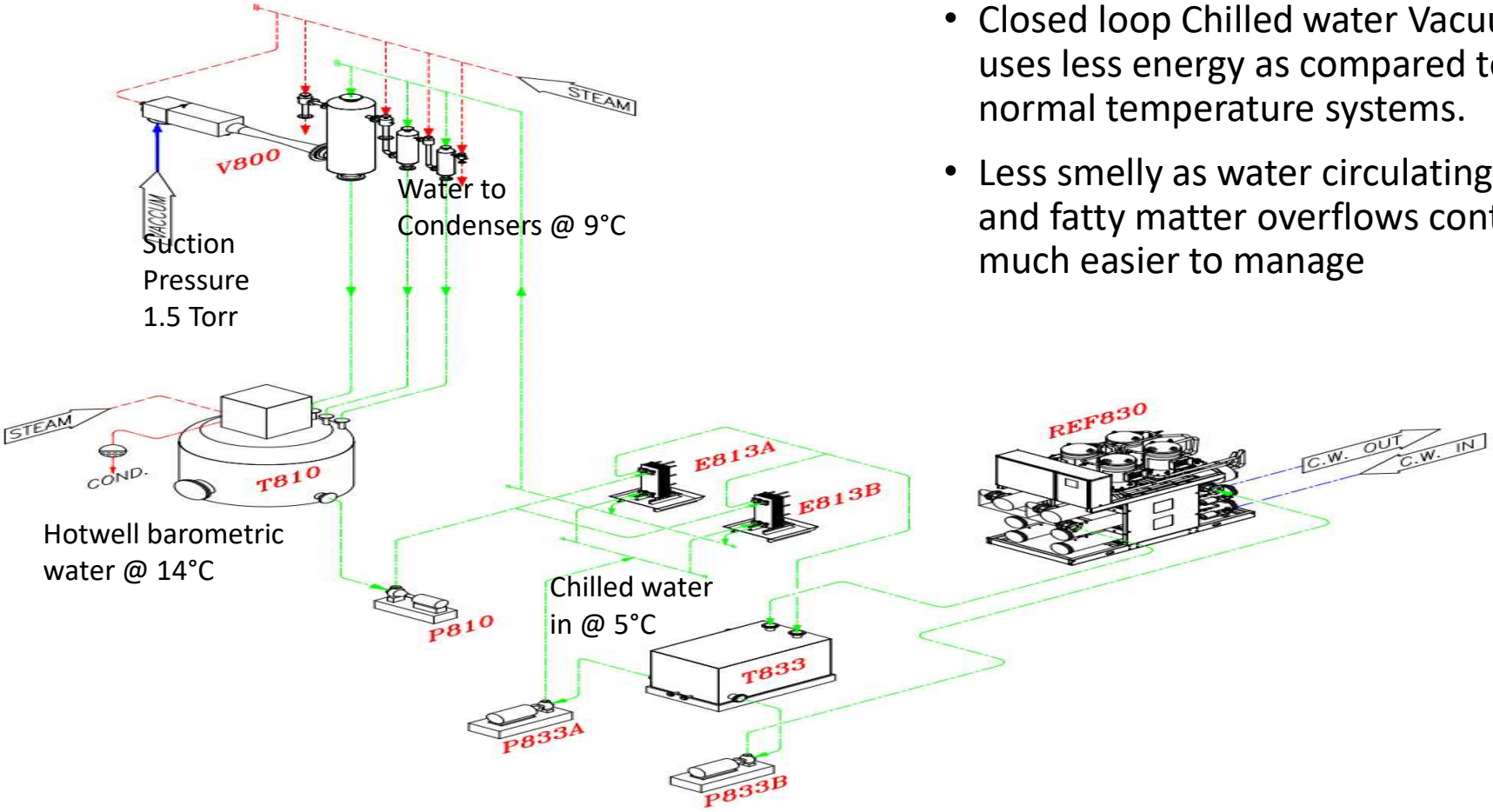


- Typical heat regeneration heats oil up to 200-205 deg C. Required energy to reach 245-250 deg C – 25,000 kcal/Ton of oil
- With upgraded regeneration systems or by adding additional heat recovery system – 225 deg C can be achieved
- Required energy to reach 250 deg C – 15,000 kcal/Ton of oil.
- Reduction of about 10,000 kcal/Ton of oil – i.e. 40%.

HEAT RECOVERY FROM DEODORIZED OIL – OIL REFINING SECTION

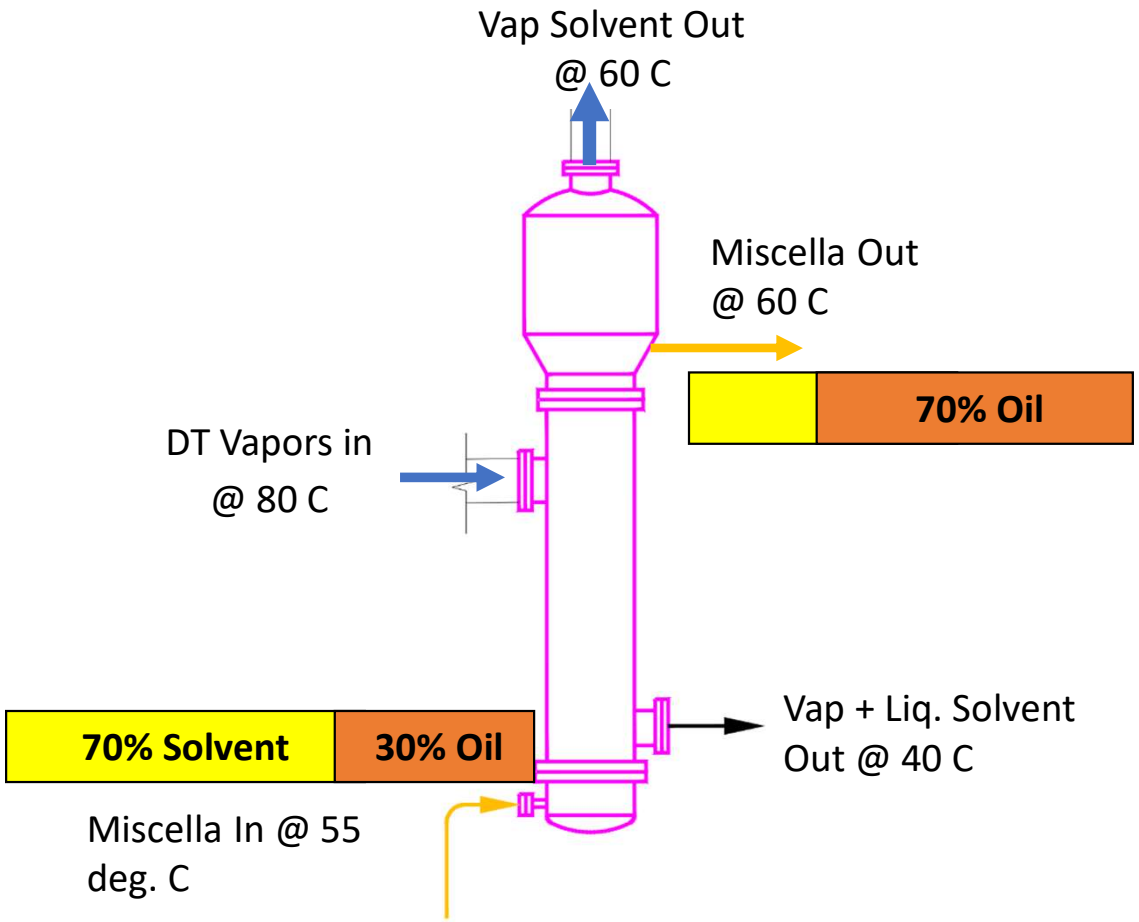


DEODORIZER VACUUM SYSTEM – CHILLED WATER



- Closed loop Chilled water Vacuum system, uses less energy as compared to traditional normal temperature systems.
- Less smelly as water circulating in closed loop and fatty matter overflows continuously and is much easier to manage

SOLVENT EXTRACTION PLANT – ECONOMIZER DIST.

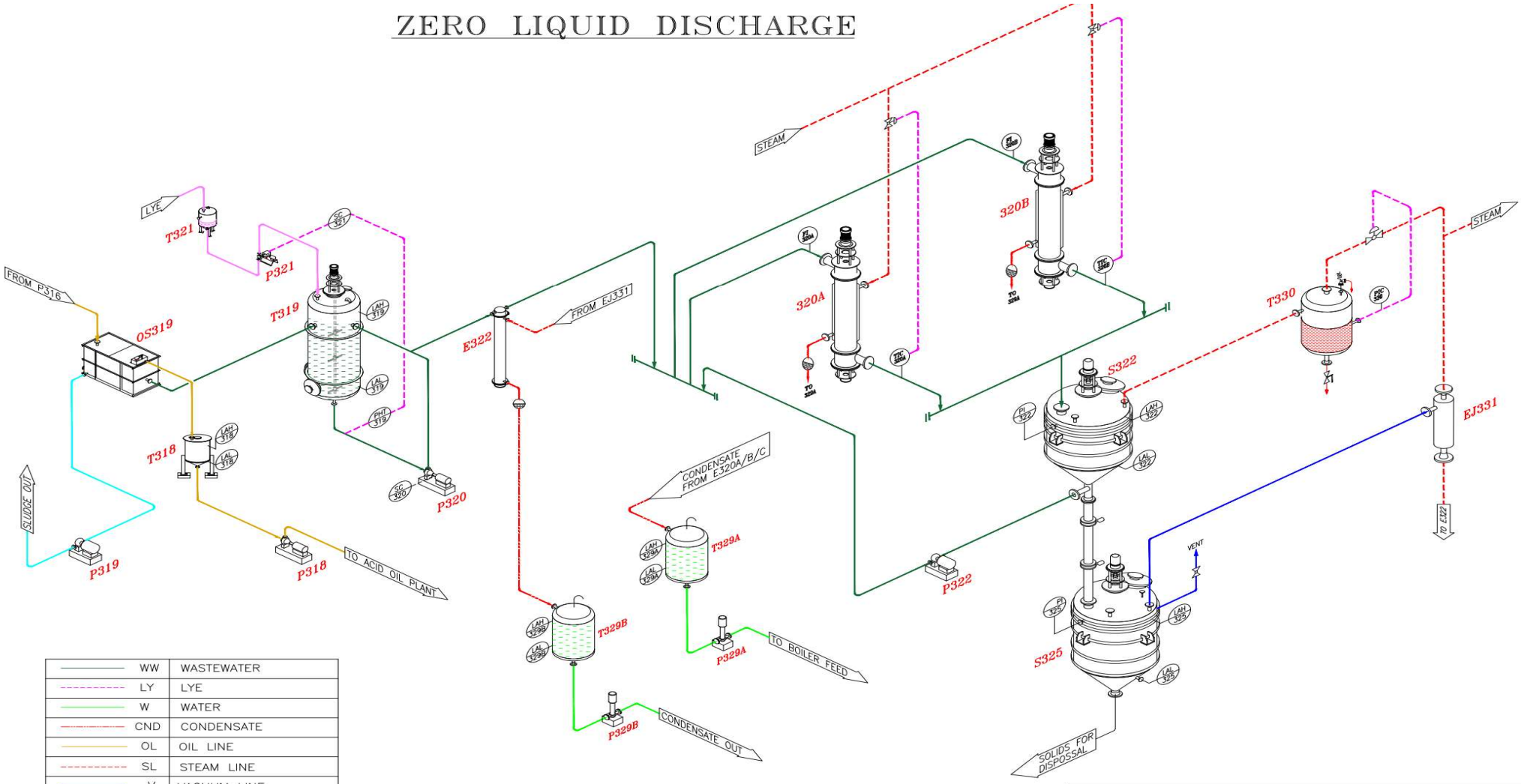


By using heat from DT vapors, we can vaporize around 75% of solvent present in incoming Miscella

ZERO LIQUID DISCHARGE PLANT (ZLD)

- Any oil traces remains were skimmed off from acidic water received from acid oil plant
- Acidic water is subjected for pH balancing by caustic lye making it near neutral
- Incorporated Scrapped surface exchangers as evaporators to generate binary LP steam, used for process heating (water / oil)
- Residual semi solid sludge with moisture content up to 7% max discharged from system
- Evaporated water in form of binary steam after use in process get condensed and can used as process water effecting as zero discharge to environment

ZERO LIQUID DISCHARGE



WW	WASTEWATER
LY	LYE
W	WATER
CND	CONDENSATE
OL	OIL LINE
SL	STEAM LINE
V	VACUUM LINE
LINE CODE	

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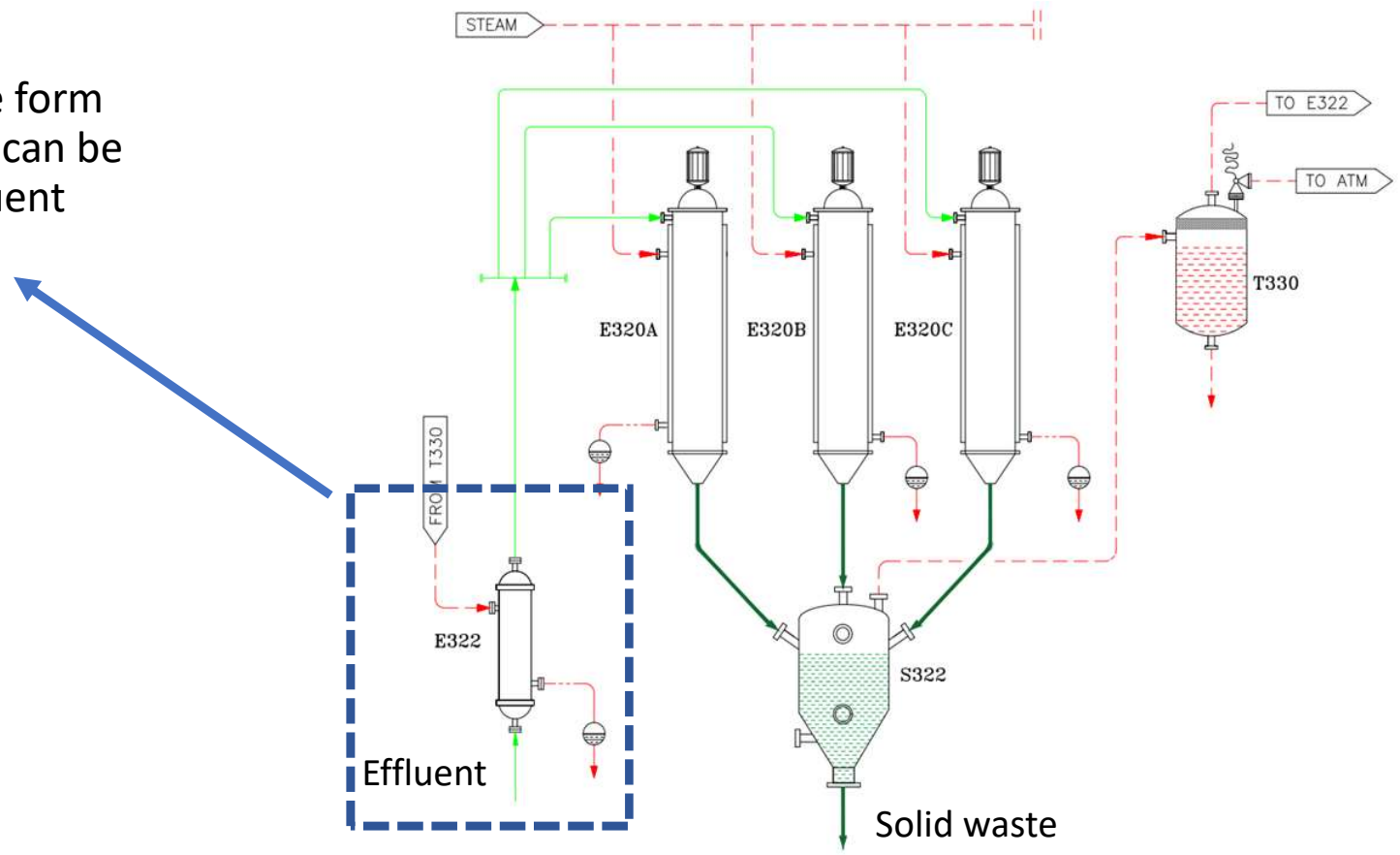
WASTE WATER – LOW PRESSURE STEAM GENERATION

Water separated in the form of low-pressure steam can be used pre-heat the effluent feed.



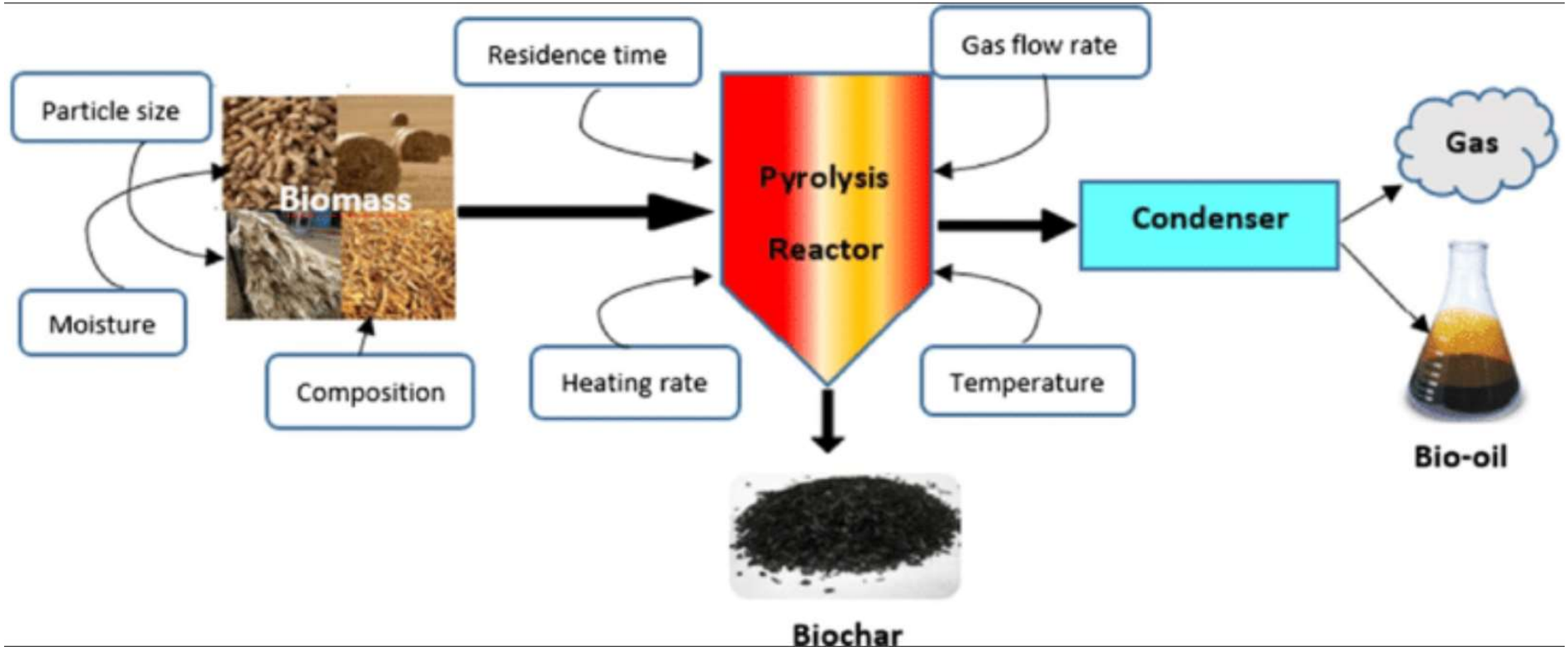
RE-DEFINING THE PROCESS & EQUIPMENT DESIGN IN EXISTING PROCESS PLANT

- 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.

SUSTAINABILITY

- By-products generated during refining process like acid oil (2.5 – 3%), oil extracted from spent earth (0.3%) and fatty acids from deodorizer distillates (0.3%) totalling around 3.5% can be further processed to produce bio-diesel
- The quantity of biodiesel can be produced from 500 TPD Refinery around 15 TPD
- Produced bio-diesel can be used to produce electrical power & steam to run process plant facility
- Running processing facility on biofuel will leave net zero impact on environment

PYROLYSIS OF BIO-WASTE



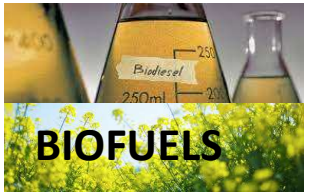
INTEGRATION OF RENEWABLE ENERGY & CONVENTIONAL SOURCES

GRID POWER

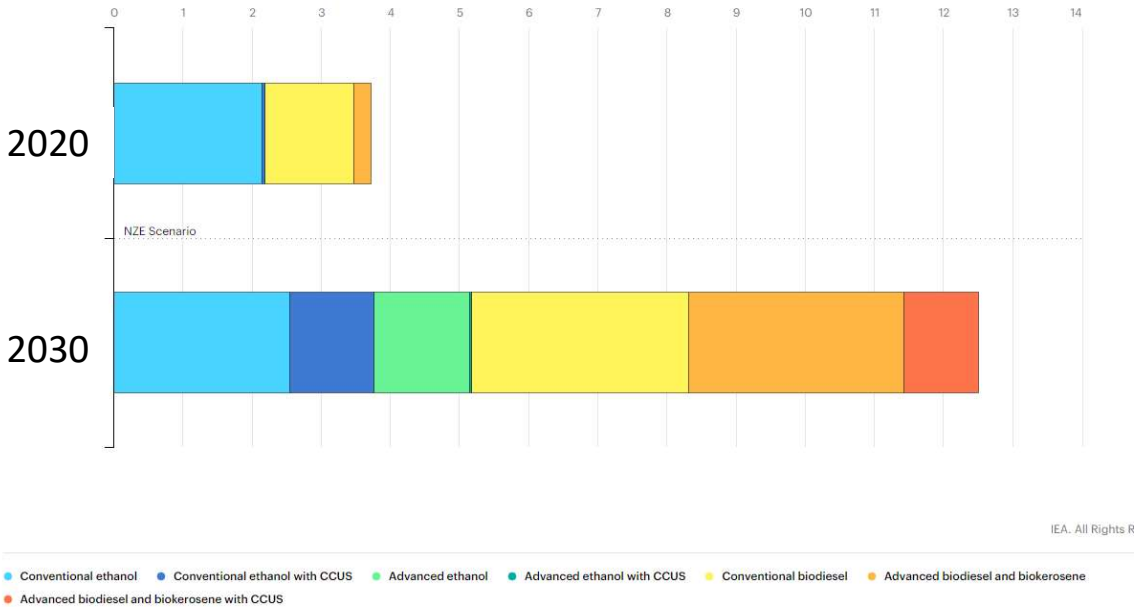
INTEGRATOR & POWER BANK

TO PROCESS PLANT

FUEL FROM PYROLYSIS PROCESS



BIOFUELS



- As of 2020, Biofuels account for only 3% of transport fuel globally.
- To achieve Net Zero by 2050, there should Annual growth of consumption of atleast by 14% every year.
- Europe, America and Asian countries are implementing policies on this path to increase biofuel demand.
- In biofuels, there are two major sources- Biodiesel and Bio-ethanol.
- Indian government is targeting 20% ethanol blending by 2025.

BIOFUELS

- Biodiesel – raw materials – Palm Oil, Stearin, PFAD, crop based oils like soya, corn etc.
- Concerns remain about using crops for fuel instead of food production.
- Limitation of resources like land for having additional crops for biofuel production – can lead to deforestation that will ultimately lead to a bigger deficit in Net Zero emissions.
- More focus on biofuels produced from waste and residue resources to meet 45% of total biofuel demand by 2030 like Used Cooking oil, Animal fat, Distillates FFA, Acid Oil etc.
- Biodiesel manufacturing can be easily integrated in existing oil processing houses. This will make processors self sustainable for their energy needs.

SUMMING UP

- Oil refining plant can be **self sustainable** provided adopting updates in process design and techniques in case of **energy efficiency** as well as **process automation**
- By-products like lecithin and toco-rich constituents can **add value to process economics** make it viable
- Applying efficient processing techniques not only saves on processing cost like energy consumption but also produces better quality products like low-trans refined soy oil
- By-products like acid oil and FFA from deodorizer distillates and oil from spent earth can be processed to produce biodiesel can full fill energy requirement to some extent
- Zero liquid discharge system is need of the time to make refining operations environment friendly

THANK YOU!

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Technology with Innovation

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