



OFI Middle East Conference

20 - 21 March, 2007

Cairo, Egypt

Edible Oils and Fats

Trends in Raw Materials, Processing and Applications

Production and Processing an Overview of Future Trends



Ken Carlson - Technical Director, Oils & Fats
Crown Iron Works Company



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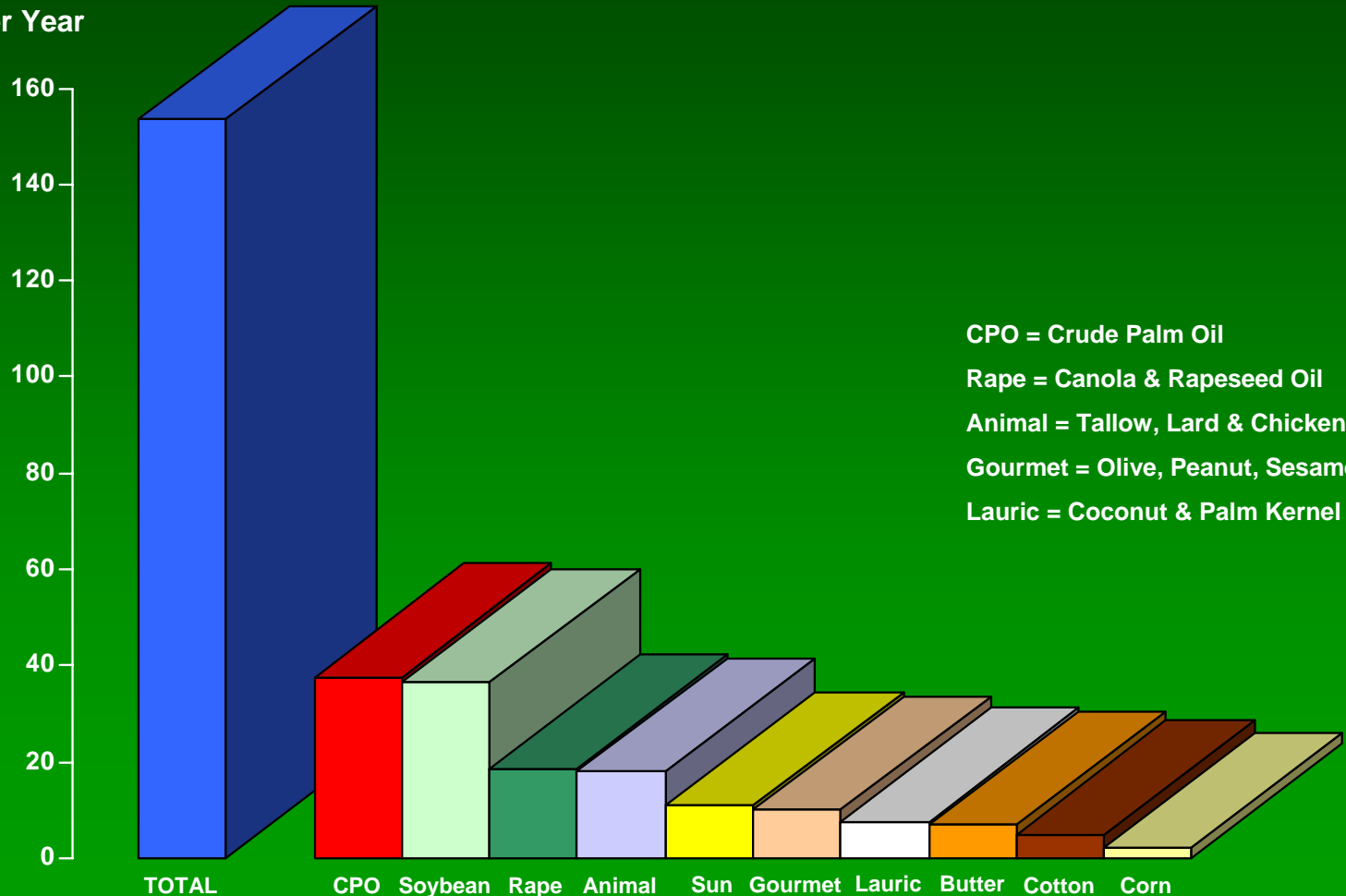
Oils and Fats Production and Processing

An Overview of Future Trends

World Production 2007

153 Million MT

Million MT
per Year



CPO = Crude Palm Oil

Rape = Canola & Rapeseed Oil

Animal = Tallow, Lard & Chicken

Gourmet = Olive, Peanut, Sesame, etc.

Lauric = Coconut & Palm Kernel Oil

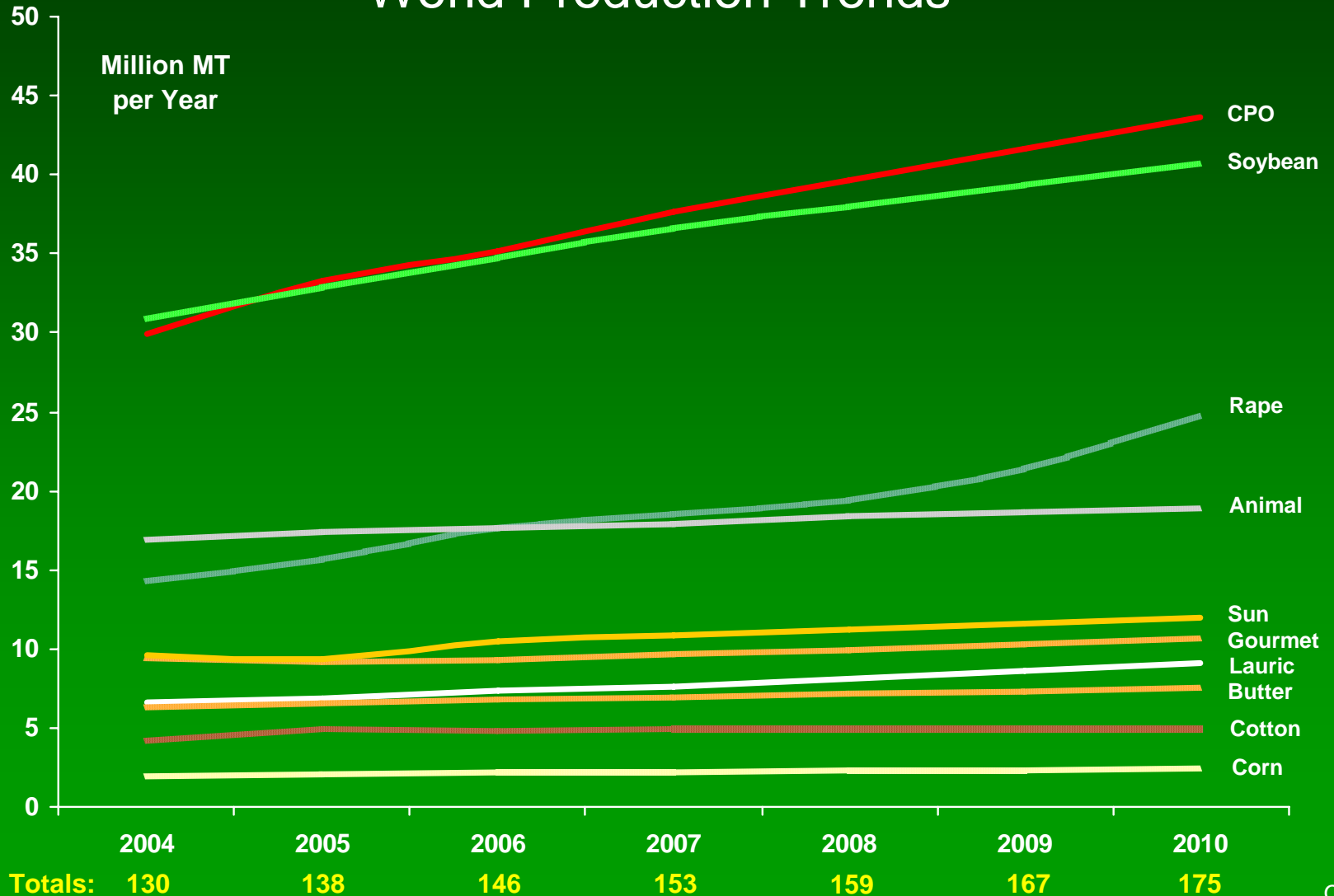


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World Production Trends



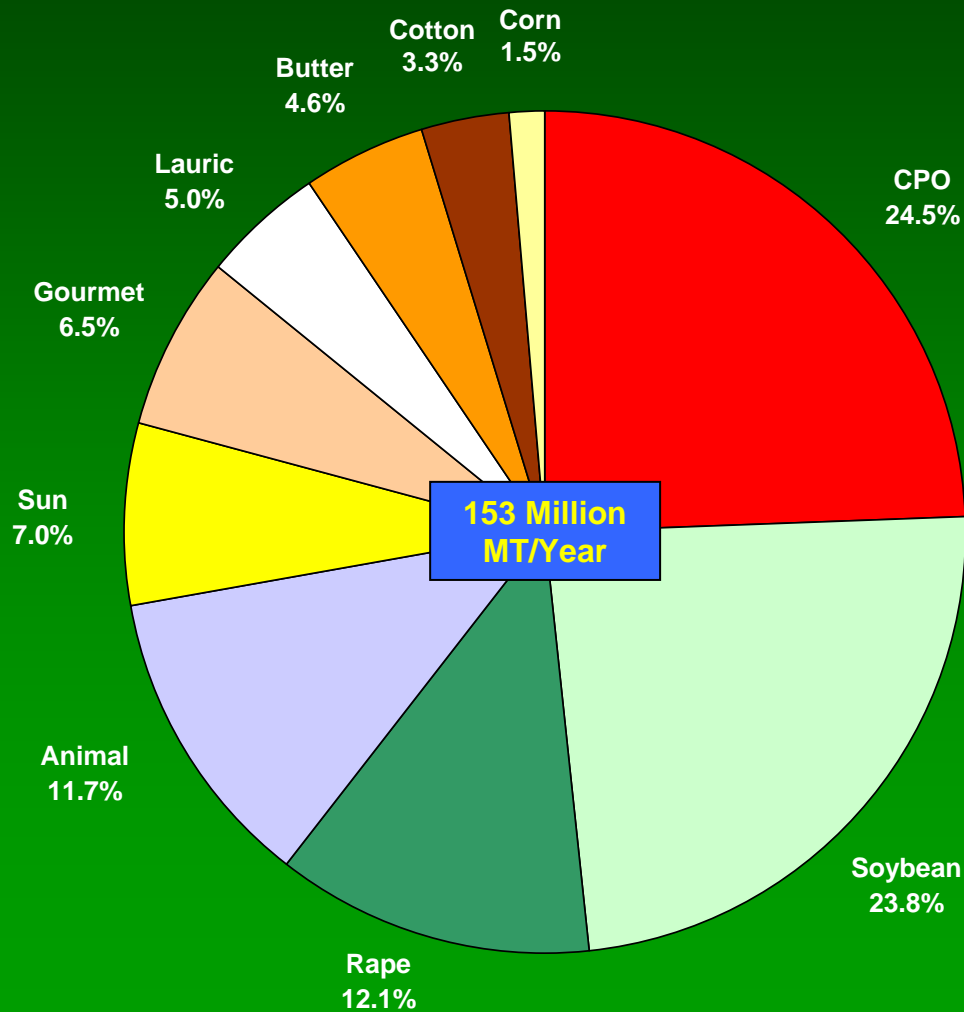


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World Production Shares



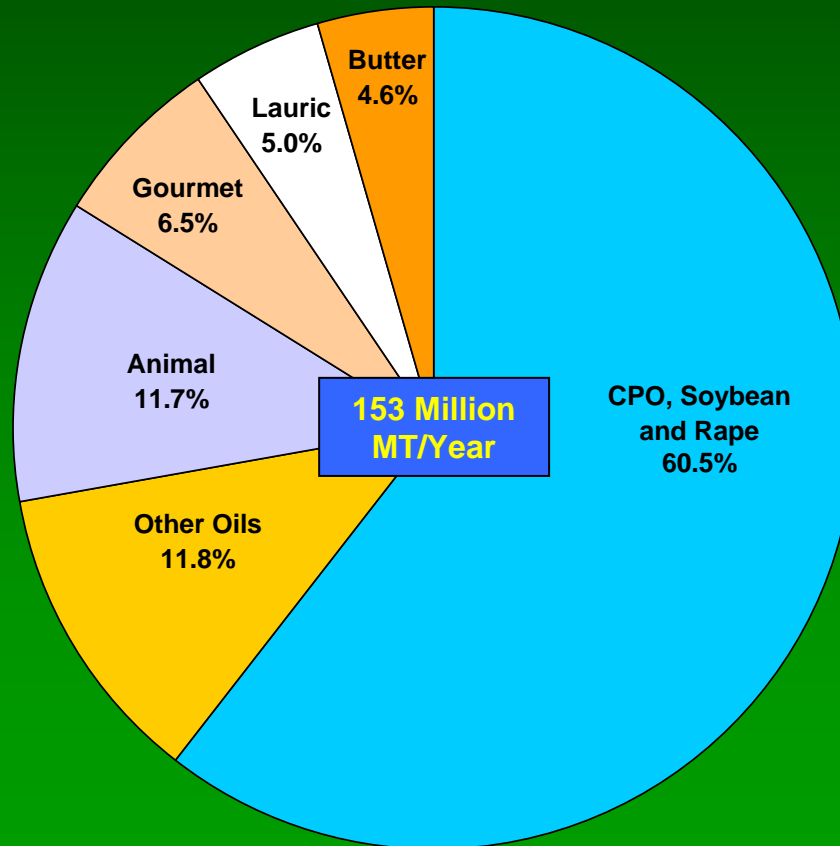


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World Production Categories



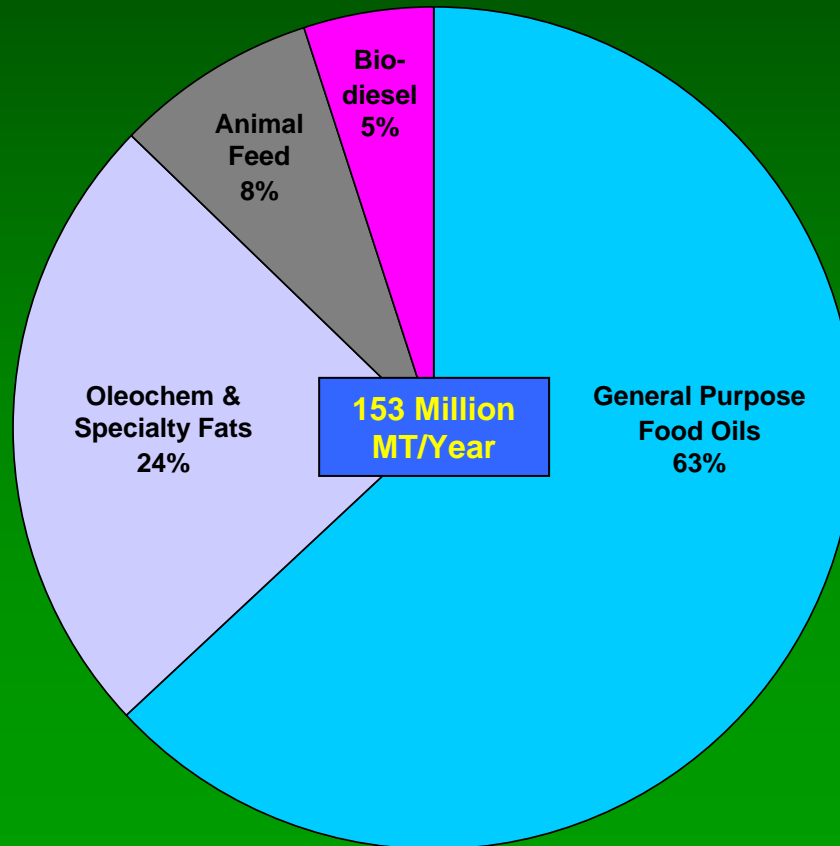


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Current Applications (2007)



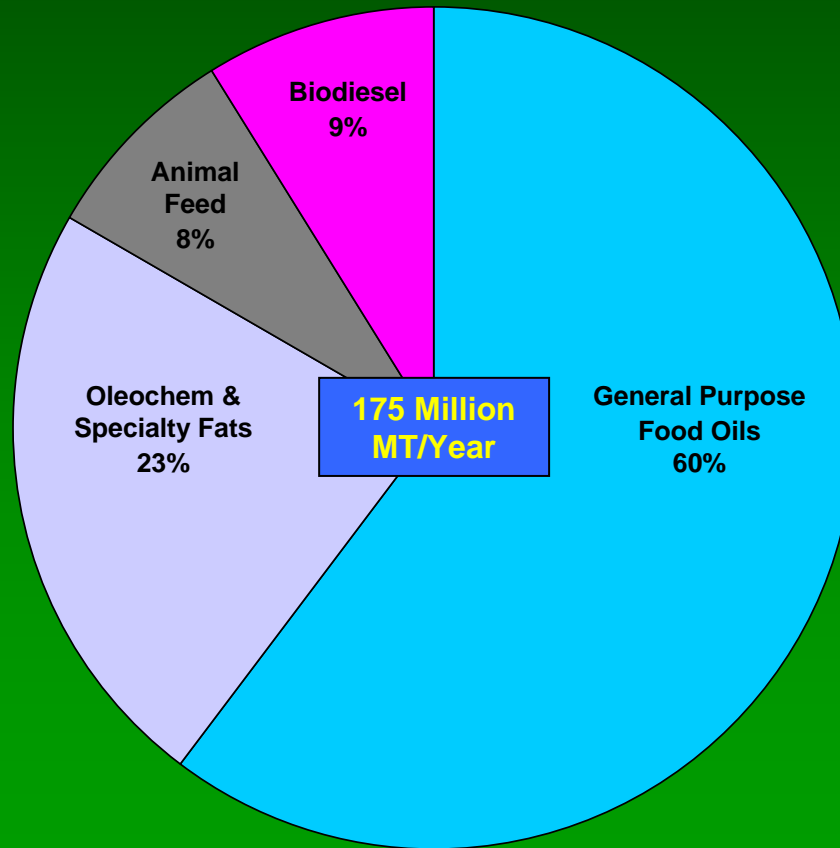


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Future Applications (2010)



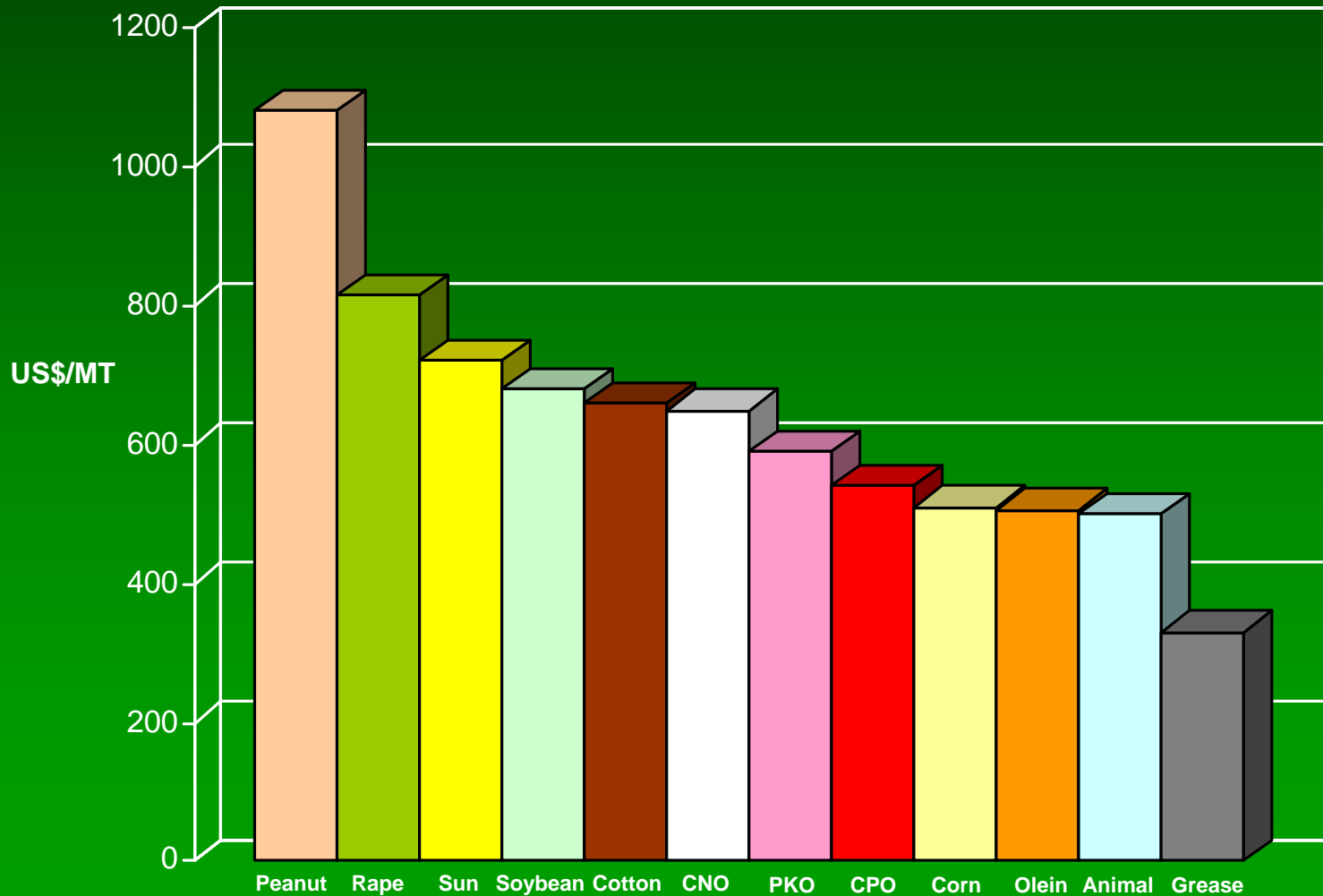


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Typical Crude Oil Prices (2007)



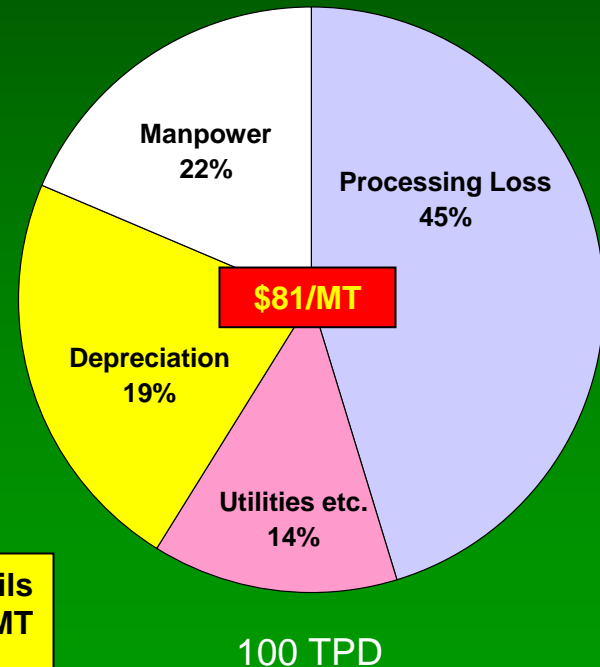
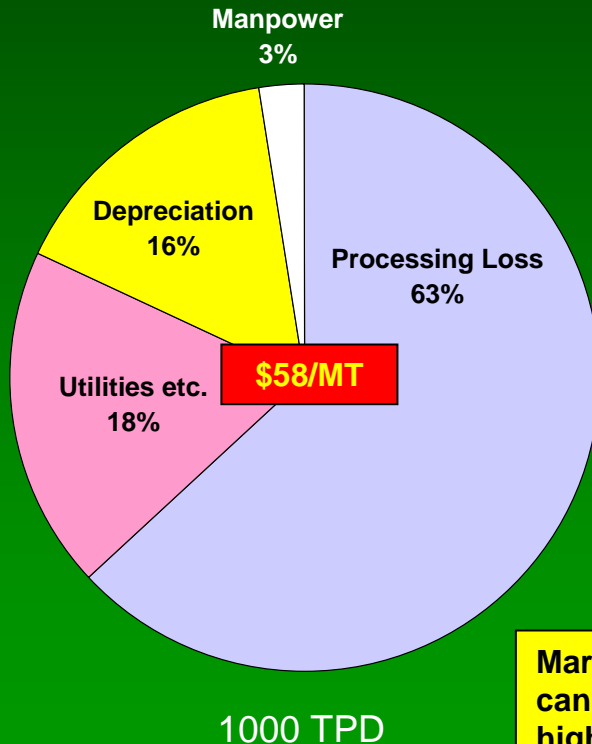


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Typical Operating Costs Oil Refining



Market price for refined oils
can be more than \$150/MT
higher than crude oils

Rapeseed Oil @ \$800/MT, processing loss: 4.6%, by-products & effluents not considered
Investment (all except land and civil structures): \$ 15,000,000 & \$3,000,000 respectively
Manpower: 8 full time operating personnel + 2 for other (\$500,000/year)

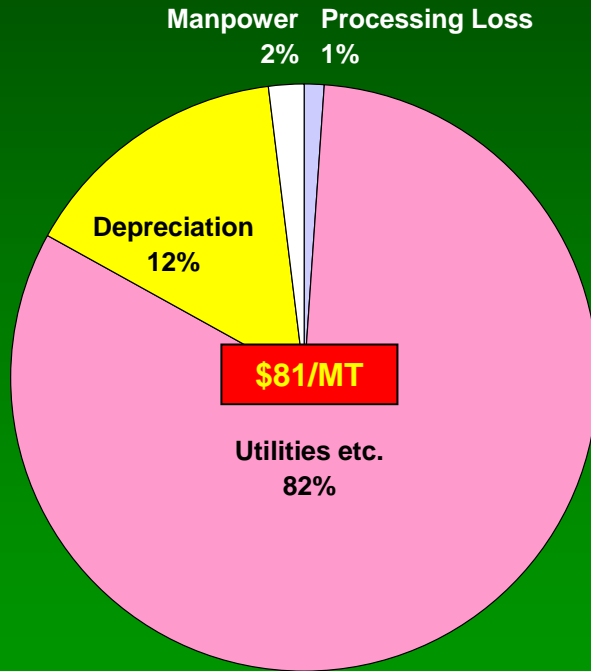


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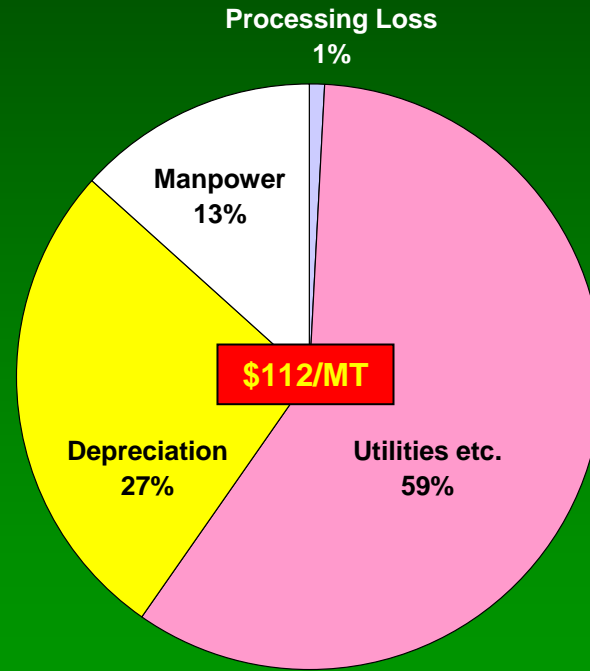
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Typical Operating Costs Trans-esterification (Biodiesel)



1000 TPD



100 TPD

Assume 99.9% conversion, pretreatment not included, glycerin & effluents not considered
Investment (all except land and civil structures): \$ 20,000,000 & 5,000,000 respectively
Manpower: 8 full time operating personnel + 2 for other (\$500,000/year)

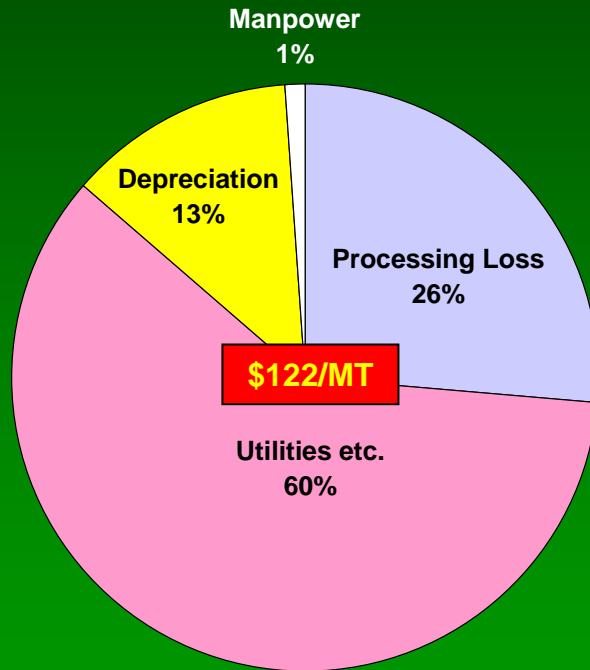


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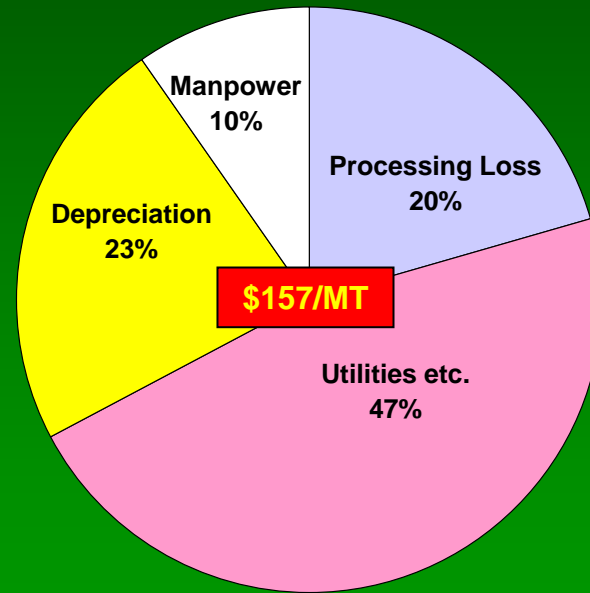
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Typical Operating Costs Trans-esterification including Pre-treatment



1000 TPD



100 TPD

Rapeseed Oil @ \$800/MT, processing loss: 3.6%, by-products & effluents not considered
Assume 99.9% conversion, glycerin & effluents not considered
Investment (all except land and civil structures): \$ 25,000,000 & 6,000,000 respectively
Manpower: 8 full time operating personnel + 2 for other (\$500,000/year)

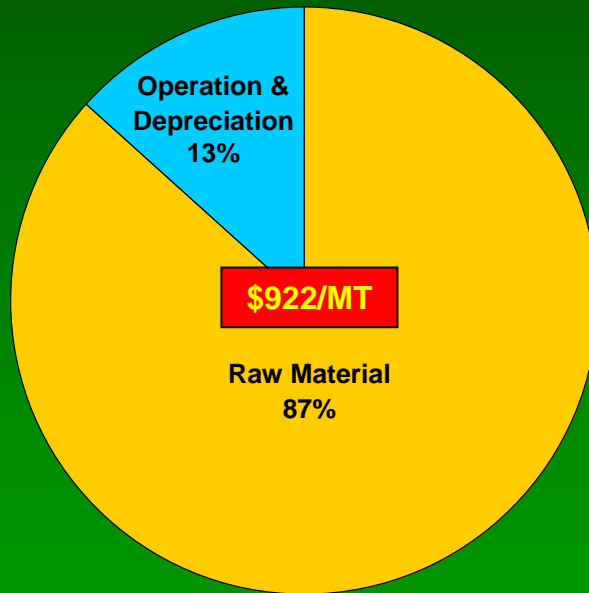


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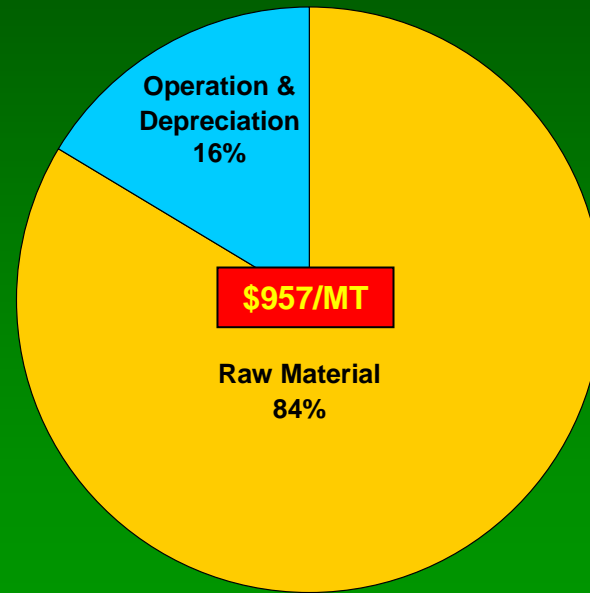
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Production Trends



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Production Trends

- ❖ Demand for Raw Materials outpacing Supply
 - Low cost oils & fats for low income markets & biodiesel
 - “Nutritional” oils & specialty fats for high income markets
 - Production increase from Palm, Soybean and Rapeseed Oils
- ❖ Up to 50% of new demand driven by Biodiesel
- ❖ Prices increasing for oils & dropping for meal
 - Price increases threatening profitability of Biodiesel (even including subsidies) and driving development of alternative feed stocks (Algae, Jatropha, etc.)
 - Increased meal competition from Distillers Grain (DDGS)
- ❖ Reduced Income from By-products
 - Recycling gums/soapstock to meal increasingly difficult
 - Low profitability from acidulation of soapstock (acid water)
 - Glycerin from biodiesel plants rapidly losing value



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Processing Trends



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Processing Trends

- ❖ Plant capacities continuing to get larger
- ❖ More specialized plants (GMO, multi-feed, regional)
- ❖ Trans fatty acid limitations drives increased use of palm oil combined with blending, interesterification and fractionation
- ❖ “Replaced” soybean oil used for biodiesel
- ❖ New processes for handling of by-products and effluents e.g. gums, soapstock, spent earth, distillate and glycerin
- ❖ Total system (integrated) Heat Recovery
- ❖ “Zero” Effluent for Crushing and Refining
- ❖ “Gentle” processing to increase nutritional qualities



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Capacity Trends (MTPD)

	Typical	Max
❖ Commodity Crushing:	1,500 - 6,000	12,000
❖ Commodity Refining:	500 - 1,500	2,500
❖ Specialty Crushing:	100 - 500	1,500
❖ Specialty Refining:	30 - 100	500
❖ Biodiesel:	30 - 300	800



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Degumming/Neutralizing



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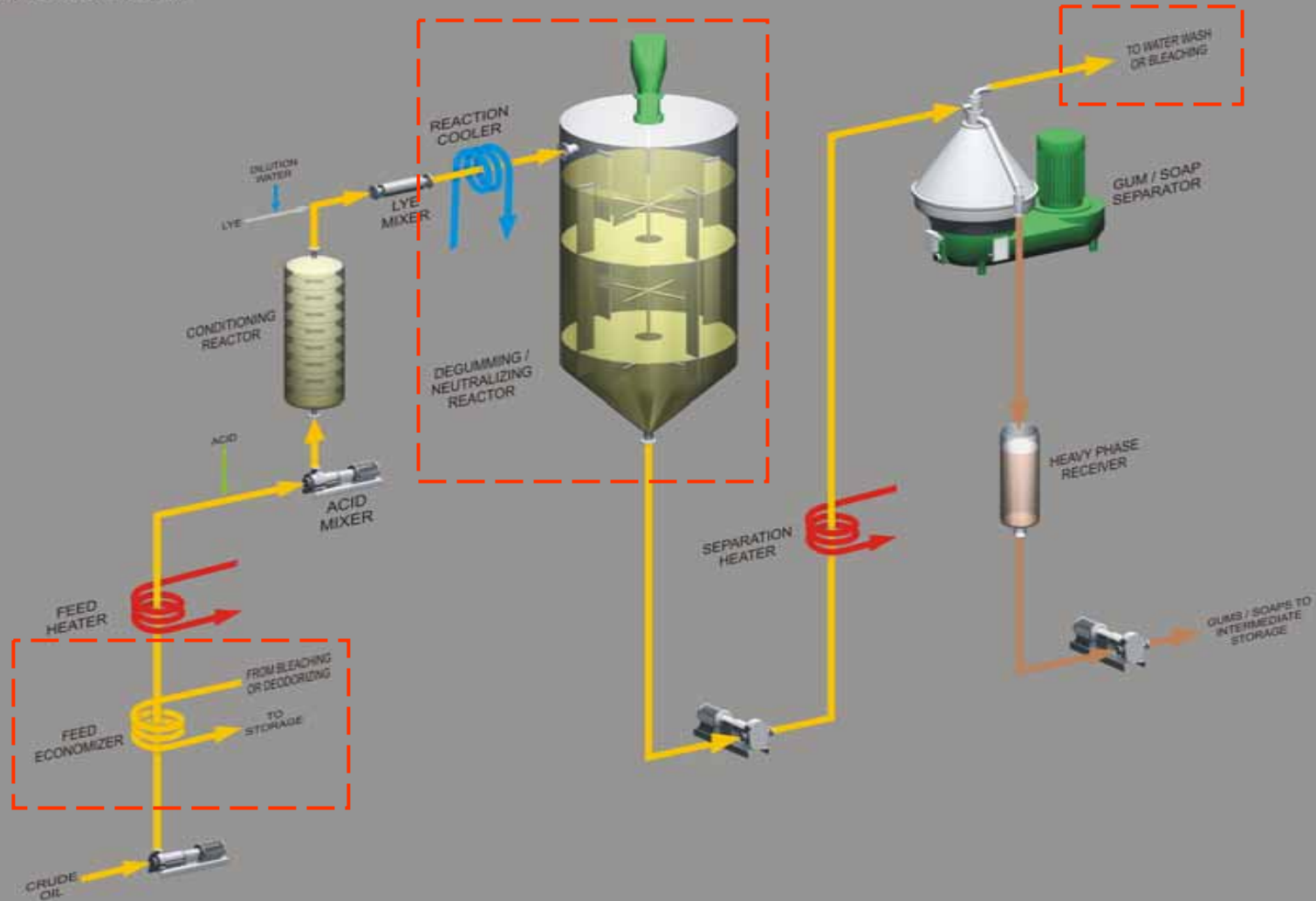
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Degumming/Neutralizing

- ❖ Water degumming for lecithin production only
- ❖ More enhanced degumming options for PR, e.g. enzymatic
- ❖ Neutralizing increasingly recognized as “degumming” process
- ❖ Longer retention time in neutralizing eliminates need for degumming crude seed oils unless acidulating soapstock
- ❖ Increased use of KOH instead of NaOH for neutralizing when acidulating soapstock (acid water used as fertilizer)
- ❖ Water washing replaced by special adsorbents in bleaching
- ❖ Process normally linked directly to bleaching - no drying, cooling or intermediate tanks



MULTIPURPOSE DEGUMMING AND NEUTRALIZING SYSTEM





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Bleaching



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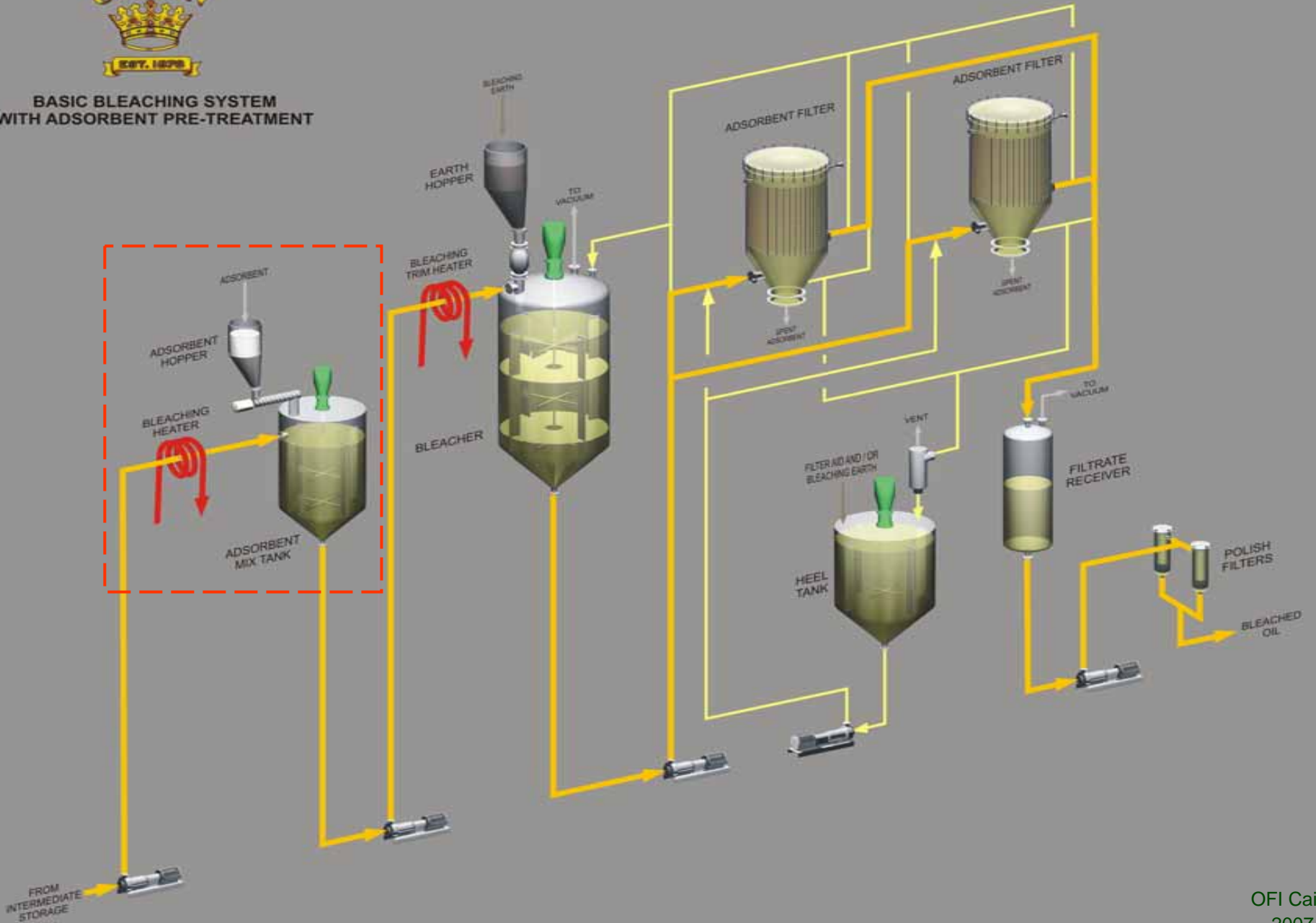
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Bleaching

- ❖ Elimination of water washing in neutralizing through use of Special Adsorbents (silica) for removing soap, gums and metals
- ❖ Reduced earth consumption by pre-treating with silica and re-utilizing spent earth from filters, e.g. “Double Pass” method
- ❖ Reducing earth consumption and related oil losses with new chlorophyll reducing bleaching earths
- ❖ Bleacher agitators in some cases replaced by steam agitation
- ❖ Practice of pre-coating filters increasing

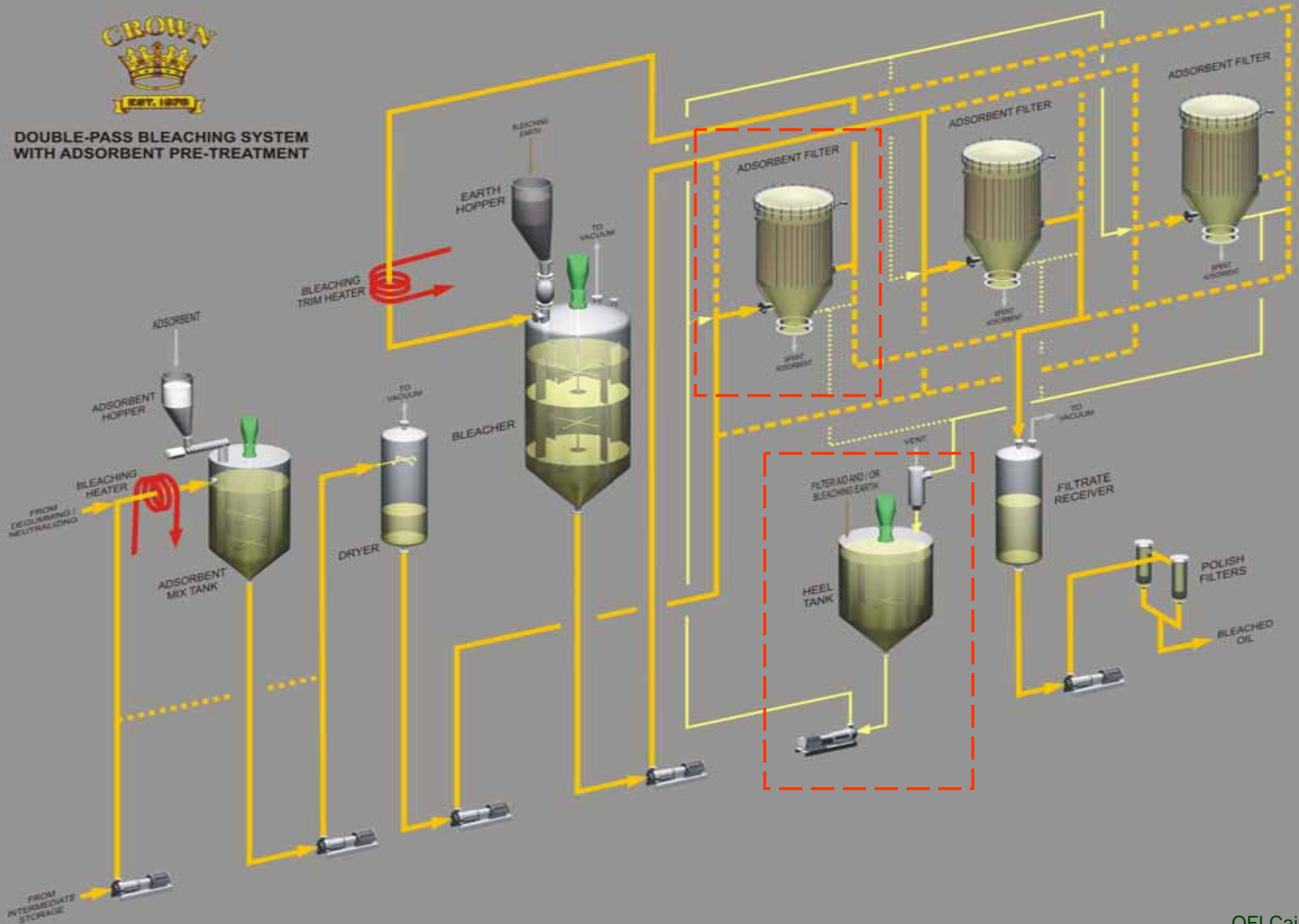


**BASIC BLEACHING SYSTEM
WITH ADSORBENT PRE-TREATMENT**





DOUBLE-PASS BLEACHING SYSTEM WITH ADSORBENT PRE-TREATMENT





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Hydrogenation



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Hydrogenation

- ❖ Process use decreasing due to trans issue (except full hydro)
- ❖ Single use of catalyst versus reuse increasing
- ❖ Improved batch agitation designs for less trans
- ❖ Loop reactors for high catalyst operations
- ❖ Candle filters replacing press and leaf filters for catalyst separation



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Interesterification

- ❖ Practice increasing resulting from by trans issue
- ❖ Enzyme based process competing with chemical process
- ❖ Silica instead of water washing for soap removal
- ❖ Increased focus on safe handling of catalyst (sodium methoxide)



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Fractionation &
Winterization



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Fractionation

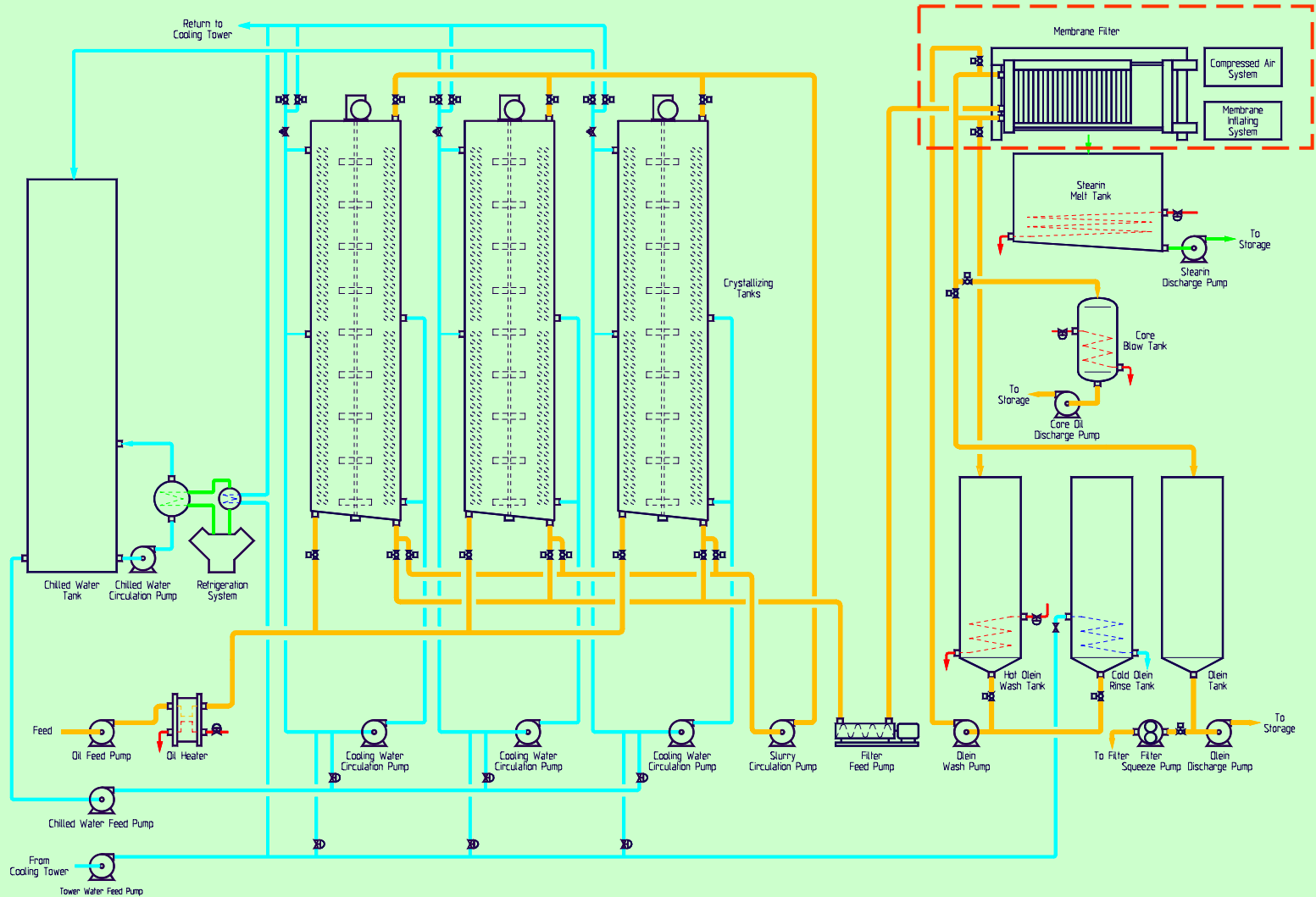
- ❖ Higher yields with membrane presses designed for higher inflation pressures
- ❖ Reduced cooling (turn-over) times with crystallizers designed with higher relative cooling surface areas
- ❖ Centrifuges (without wetting agents) in some cases replacing filters for certain applications
- ❖ Solvent fractionation of increasing interest for certain high cost specialty fats
- ❖ Will there ever be a continuous process ?



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Fractionation



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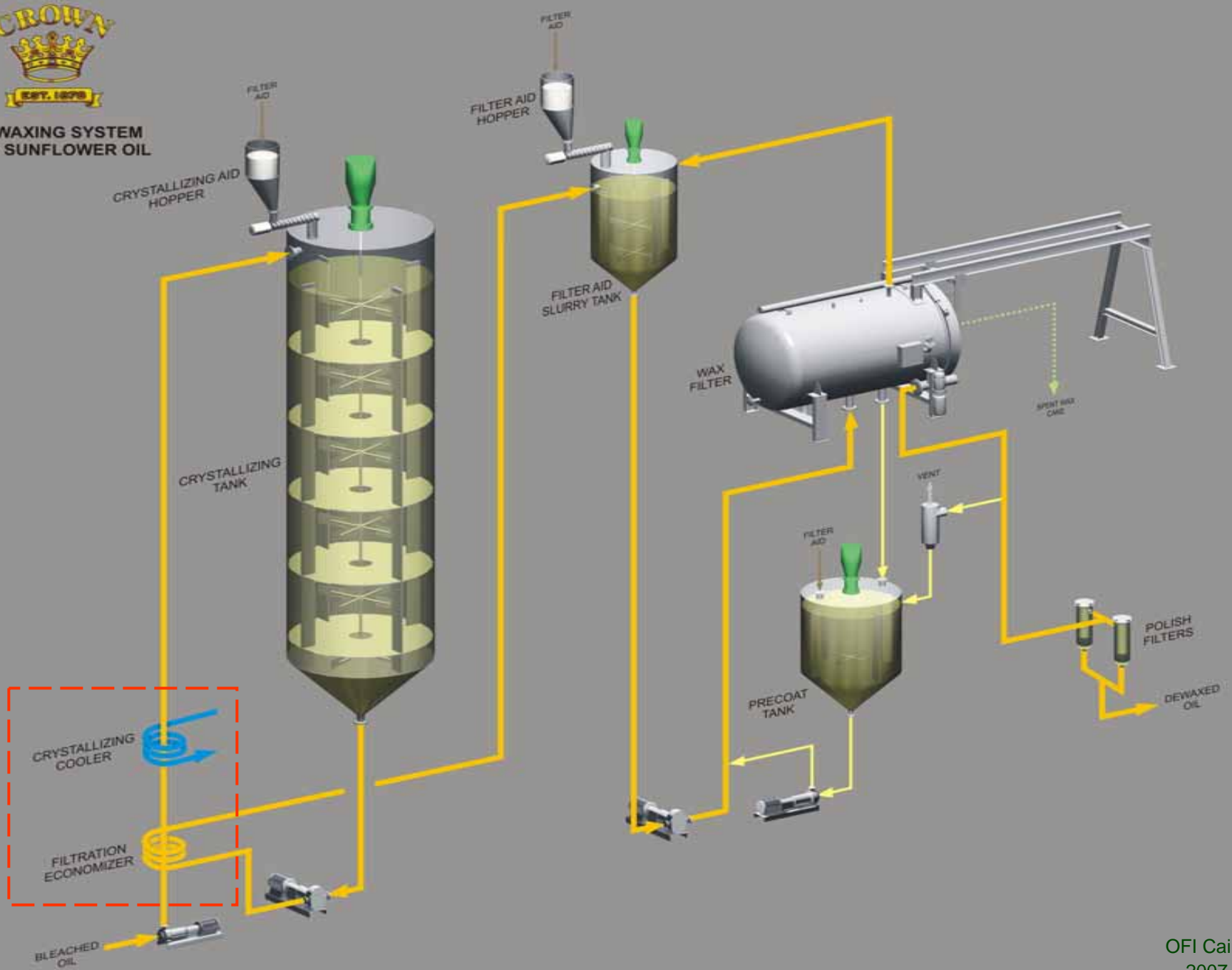
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Dewaxing

- ❖ Choice between centrifuge or filtration based process still not obvious. Depends on wax content and oil quality
- ❖ For best cold test (post) filtration always required
- ❖ Cooling coils in crystallizing (maturing) tanks not required. External coolers give equal results



**DEWAXING SYSTEM
FOR SUNFLOWER OIL**





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Deodorizing



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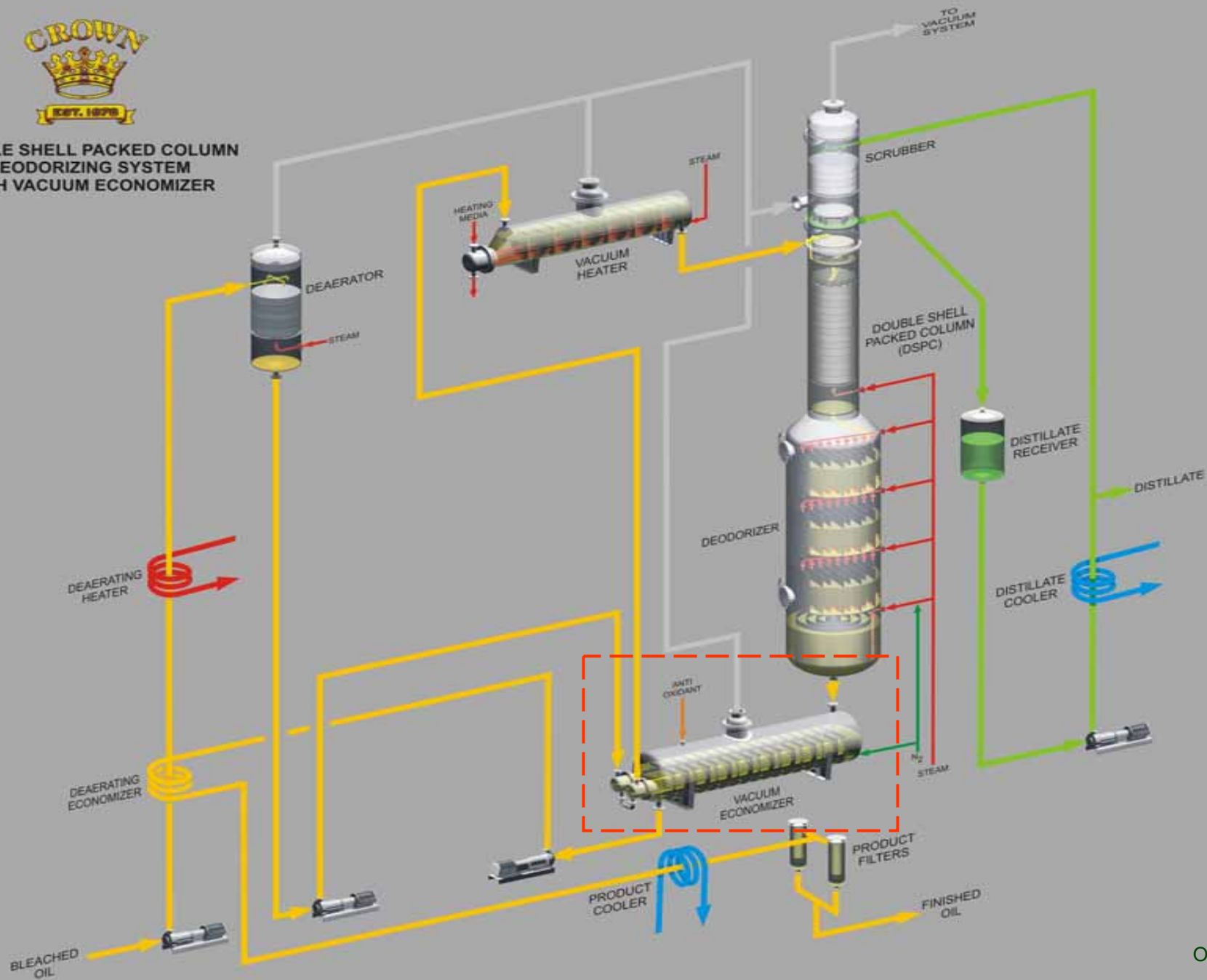
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Deodorizing

- ❖ Thin film (packed column) designs increasing in popularity over traditional tray designs (driven by lower energy cost)
- ❖ “All-in-One” designs (e.g. DeSmet’s Qualistock) increasing in popularity (driven by lower installation cost)
- ❖ Increasing use of welded plate heat exchangers combined with “Post Deodorizing” (e.g. Crown’s “Max Efficiency”) for optimum flavor (driven by lower energy cost)
- ❖ Increasing use of refrigerated (ice condensing) vacuum systems to reduce energy and effluent water
- ❖ Semi-Continuous deodorizers with reduced energy consumption coming back into favor for new “Switch” plants processing multiple feed stocks (driven by the increasing use of palm oil)

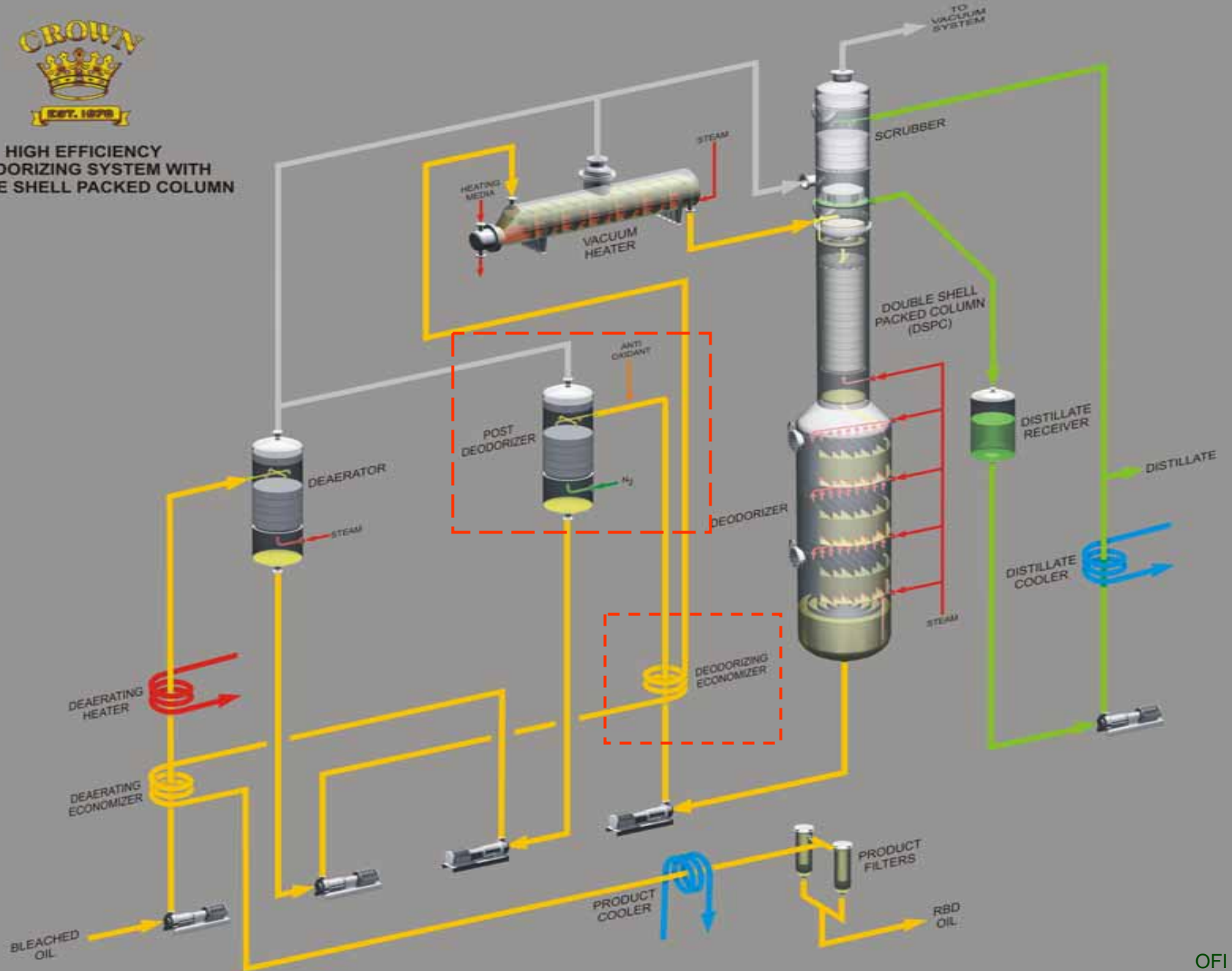


DOUBLE SHELL PACKED COLUMN DEODORIZING SYSTEM WITH VACUUM ECONOMIZER





**HIGH EFFICIENCY
DEODORIZING SYSTEM WITH
DOUBLE SHELL PACKED COLUMN**





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Controls & Instrumentation



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Controls & Instrumentation

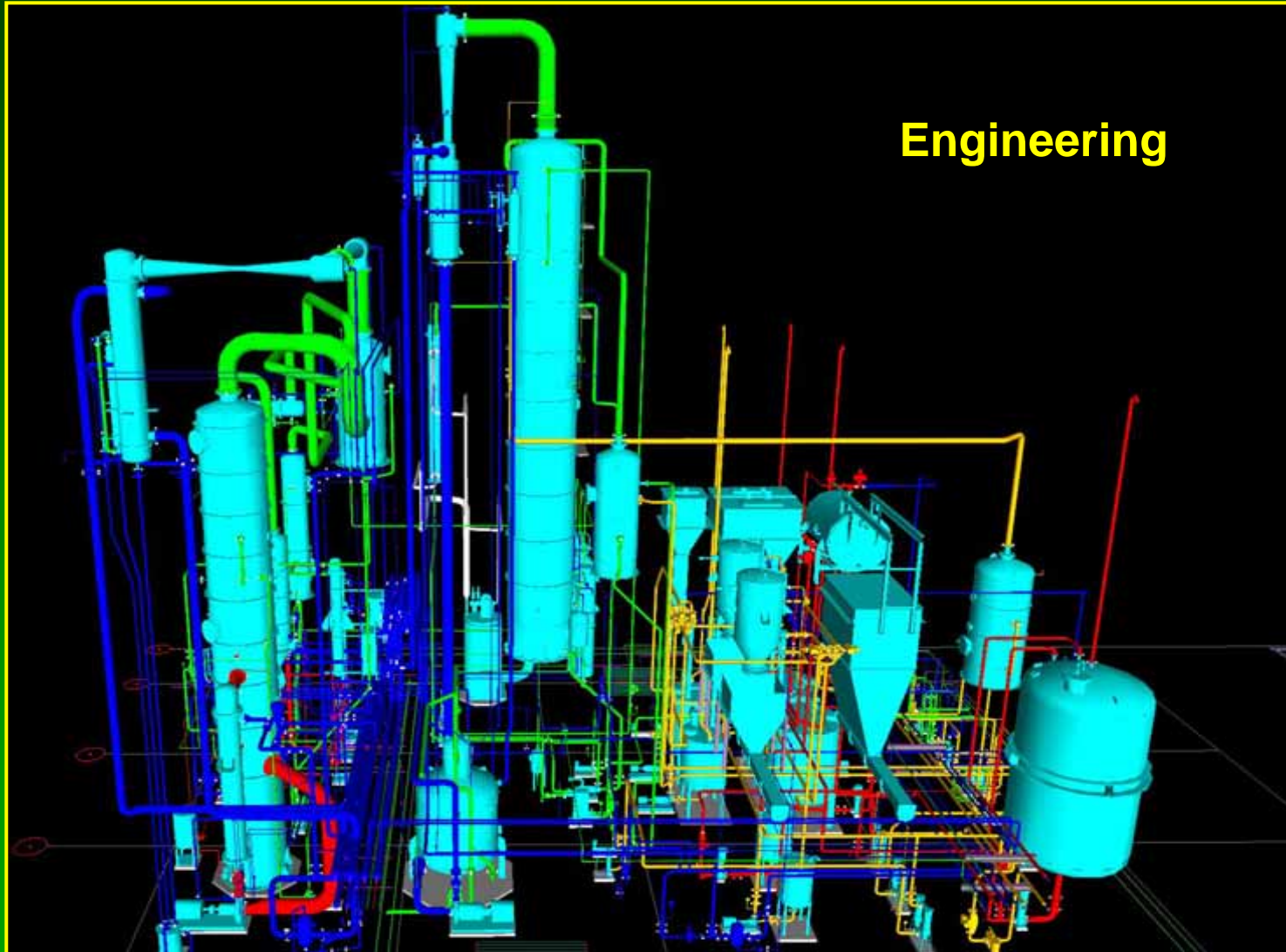
- ❖ PLC/PC technology becoming the norm for improving supervision and control and recording operation history
- ❖ Increasing use of “Smart” field instruments combined with fieldbus (distributed network control) for reducing wiring and maintenance cost and improved communication
- ❖ Reduced cost for many high end instruments thanks to increasing use and competition
- ❖ New analytical instruments for fast and accurate analysis of stability, fatty acid profiles, trace metal and phosphorus etc.



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Engineering

- ❖ Reduced design time and improved accuracy and automatic code calculations for equipment with new generation design software
- ❖ Increased accuracy and reduced installation time/costs for equipment and piping installation with new generation 3D piping software



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Thank You for Your Attention