CIRCULAR ECONOMY IN USED OIL WASTE

Niti Aayog | Ministry of Petroleum and Natural Gas

Report of the Expert Committee

August 2021

Contents

List of Abbreviations

API	- American Petroleum Institute
ASTM	- American Society for Testing and Materials
CEP	- Chemical Engineering Partners
CPCB	- Central Pollution Control Board
CPG	- Comprehensive Procurement Guideline
EPA	- Environmental Protection Agency
EST	- Environmentally Sound Technologies
EU	- European Union
GST	- Goods and Services Tax
KTI	- Kinetic Technology International
MoPNG	- Ministry of Petroleum & Natural Gas
MoEF	- Ministry of Environment & Forests
MRD	- Mineral ol Raffinerie Dolbergen
OEM	- Original Equipment Manufacturer
OMC	- Oil Marketing Company
NGO	- Non-Government Organisation
NMP	- N-methyl-2-pyrrolidone
PAH	- Polycyclic Aromatic Hydrocarbons
PCB	- Pollution Control Board
PCRA	- Petroleum Conservation and Research Association
PRAI	- Petroleum Re-refiners Association of India
PSO	- Product Stewardship for Oil Program
TDA	- Thermal De-Asphalting
SPCB	- State Pollution Control Board
WOGF	- Waste Oil Generation Factor
WOI	- Waste Oil Index
UK	- United Kingdom
UOP	- Universal Oil Products

Committee Members

No.	Name	Designation	Govt./Organisation
1	Shri Tarun Kapoor	Secretary	Ministry of Petroleum and Natural Gas
2	Shri Nareshal Pal Gangwar	Joint Secretary	Ministry of Environment Forest & Climate Change
3	Shri Rajnath Ram	Adviser(Power & Energy)	NITI Aayog
4	Shri Prabhjot Sodhi	Head, Circular Economy	UNDP India
5	Ms Vidya Amarnath	Founder and Director	Paterson Energy
6	Shri Satish Kumar	Director	Needa Green Energy Limited (NGEL)
7	Dr. C.S. Sharma	Faculty	IIT, Hyderabad
8	Shri R. Ramakrishnan	Global head – Customer Care – CVBU	Tata Motors Ltd.
9	Shri Satish Kumar Tiwary	Chief of Mechanical Maintenance (COMM)	Tata Steel Ltd
10	Shri Alok Bansal	Vice President (Civil, Utilities & Infra)	Maruti Suzuki India Ltd.
11	Shri Madanlal Khandelwal	President	Petroleum Re-refiners Association of India
12	Shri Philip Mathews	Secretary	Petroleum Re-refiners Association of India
13	Shri Anant Bhargava	CEO	IFP Petro Products(P) Ltd.
14	Shri Subimal Mondal	Executive Director (Lubes)	IOCL
15	Shri Sudheendranath R	Executive Director (Lubes)	HPCL
16	Shri Debashis Ganguli	Chief General Manager (P&A D)	BPCL

Executive Summary

In a rapidly changing world, the utmost concern today is pollution and scarcity of resources. One litre of used oil can contaminate one million litres of fresh water- a year's supply for 50 people, as it contains toxic substances such as benzene, lead, zinc, and cadmium, in addition to impurities such as dirt, metal parts and water. In reality, used oil is a valuable resource as oil doesn't wear out, it just gets dirty.

Globally, the massive consumption of oil after extraction from the earth, processing, manufacturing, transportation and disposal contributes substantially to release of greenhouse gases into the atmosphere thereby increasing pollution.

To mitigate this concern, concept of Circular Economy in used oil has gained momentum in past two decades, wherein we not only use the re-refined oil, obtained from used oil for manufacture of lubricants, but also conserve the precious petroleum reserves for safer and healthier tomorrow. Moreover, recycling has potential to reduce the rate of global climate change by reducing the extraction and the amount of fossil fuels burnt in the manufacturing processes. This helps in lowering carbon footprints in the ecosystem.

Re-refining of used lubricants could result in both environmental and economic benefits. Re-refining of used oil to manufacture base oil conserves more energy than reprocessing the used oil for use as fuel. The energy required to manufacture re-refined base oil from used oil is only one-third of the energy required to refine crude oil to produce virgin base oil. Therefore, re-refining is considered by many as a preferred option in terms of conserving resources as well as minimizing waste and reducing damage to the environment.

In line with global trends, Niti Aayog has also initiated the drive to increase the usage of used oil in India and formed a committee to investigate various aspects with the primary objective to increase the consumption of used oil in India and MoPNG has been made as the nodal coordinator to deliberate and formulate the strategy. In turn MoPNG co-opted additional members from auto-OEMs, Oil Marketing Companies and petroleum re-refiners in to the

committee for studying the issues related to the subject and for framing policies for way forward and suggest timelines for implementation of the suggested actions.

This report elucidates the concept of Circular Economy, re-refining of used oil, benefits of recycling of used oil, global trends, used oil management, major used oil generating segments, estimation of used oil, collection, challenges in re-refining, economics, involvement of stake holders and options available for implementation of circular economy.

The report concludes by giving specific recommendations covering various stake holders and detailed action plan for implementation.

Proceedings & Methodology

a) Niti Aayog initiated the process of movement towards a Circular Economy in all sectors and accordingly constituted committee on Circular economy in used oil waste (Annexure 1). Subsequently Niti Aayog made MoPNG as the nodal ministry for committee on used oil waste (Annexure 2). OMCs submitted two notes in Annexure 3 & 4 as introductory response to the topic.

b) Meetings of the members were called under the Chairmanship of Secretary, MoPNG on 09.04.2021, 20.04.2021 and presentation on "Reprocessing of used Lubricants" was made by Sh. Subimal Mondal, Executive Director (Lubes), IOCL. (MOM of meetings and presentation attached as Annexure 5-7). In these meetings Secretary, MoPNG advised the members to look into viability of the cost of collection and processing of used oil, involvement of auto OEMs and availability of various technology options and conduct recyclers survey.

c) Further, committee was expanded by MoPNG with addition of co-opted members (Annexure 8) from Auto OEMs, OMCs, Re-refiners and other stakeholders.

d) Recyclers' survey was conducted by OMCs and findings are enclosed as Annexure 9.

e) ATR of meeting held on 20.04.2021 is enclosed as Annexure 10.

f) Subsequently 3rd meeting of the committee was held under the Chairmanship of Secretary, MoPNG on 15.06.2021 and roles of all stake holders including OEMs, OMCs, PRAI and CPCB were identified, and action points were finalised to achieve the target of circular economy. (MOM enclosed as Annexure 11).

g) PRAI has made representations with CPCB and MoEF in the past on disposal of spent clay and process residue and restraining the use of used oil as fuel in cement, power, and steel industry (Annexures 12-14)

Committee Report

1.0 Circular Economy

Circular economy is an economic system that tackles global challenges like climate change, biodiversity loss, waste, and pollution by re-use and re-cycling of products multiple times thereby reducing greenhouse gas emissions and conserving precious resources.

Diagram 1 below reflects the contrast between linear and circular economy concepts. Most linear economy businesses take a natural resource and turn it into a product which is ultimately destined to become waste because of the way it has been designed and made. This process is often summarised by *"take, make, use, waste & pollute".* By contrast, circular economy employs *"reuse, sharing, repair, refurbishment, remanufacturing and recycling"* to create a closed-loop system, minimising the use of resource inputs and the creation of waste, pollution and carbon emissions. The circular economy aims to keep products, materials, equipment and infrastructure in use for longer duration, thus improving the productivity of these resources.

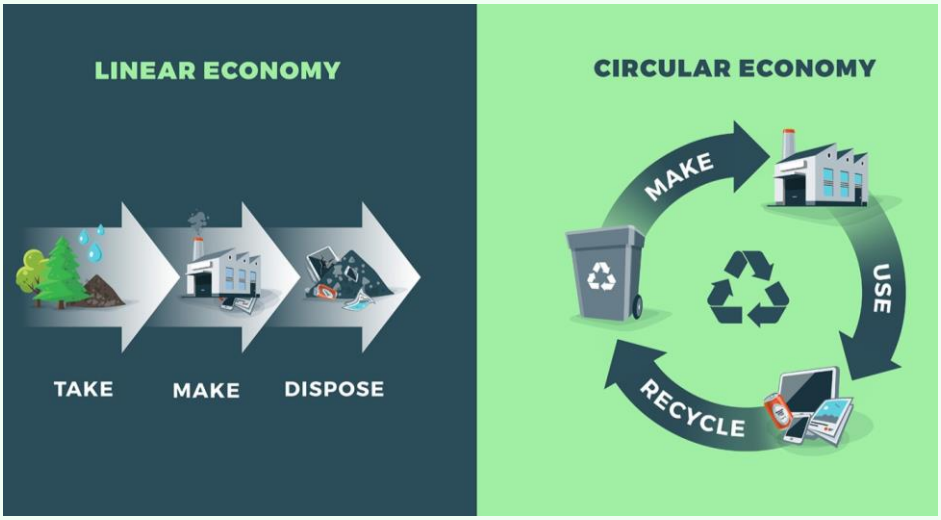

Diagram 1. Linear Economy vis-à-vis Circular Economy

As early as 1966, Kenneth Boulding raised awareness of an "open economy" with unlimited input resources and output sinks, in contrast with a "closed economy", in which resources and sinks are tied and remain as long as possible a part of the economy. Boulding's essay ["The Economics of the Coming Spaceship Earth"] is often cited as the first expression of the "circular economy".

Since the industrial revolution, humankind has been following a linear model of production and consumption. Raw materials have been transformed into goods that are afterwards sold, used and turned into waste that has been many times unconsciously discarded and managed.

In contrast, the circular economy is an industrial model that is regenerative by intention and design and aims to improve resources' performance and fight the volatility that climate change might bring to businesses. It has benefits that are operational as well as strategic and brings together a huge potential for value creation within the economical, business, environmental and societal spheres.

1.1 Environmental Benefits of The Circular Economy --Fewer Greenhouse Gas Emissions -

One of the goals of the circular economy is to have a positive effect on the planet's ecosystems and to fight the excessive exploitation of natural resources. The circular economy has the potential to reduce greenhouse gas emissions and the use of raw materials, optimize agricultural productivity and decrease the negative externalities brought by the linear model because of following features:

1.1.1 It uses renewable energy that in the long run is less polluting than fossil fuels.

1.1.2 Re-use and dematerialization result in use of fewer materials and production processes to provide good and functional product.

1.1.3 Residues are valuable, and they are absorbed

1.1.4 Preferred choices of energy-efficient and non-toxic materials and manufacturing ensure recyclability.

Global warming has been linked to the rise in occurrences of drought, wildfires, hurricanes, flooding, pollution and mosquito-borne illnesses that the world has seen in the past few decades. The first of its kind report on circular economy was released in 2013 by Ellen MacArthur Foundation As a matter of fact, an Ellen MacArthur Foundation study found out that a circular economy development path could halve carbon dioxide emissions by 2030, relative to 2018 levels. The need of the hour is to make a move towards a circular economy — wherein we use resources for as long as possible, get the maximum value from them while in use, and then reclaim and regenerate resources at the end of their service life.

The European Union, as well as the UK and Japan, have each already implemented a circular economy at some level, and have seen positive results. If the rest of the world were to follow

suit, we could reduce the demand for energy, raw materials and fossil fuels, and, consequently, the volume of greenhouse gases being released into the atmosphere would be greatly diminished to save our beautiful planet we call home.

The challenge for a developing country like India is to find a balance between developmental needs and minimizing the negative impacts associated with use of resources. Therefore, efficient use of resources is a necessity for achieving short and long-term sustainability goals.

Oil is one of the major sources of energy in various forms. Fuels constitutes the major chunk whereas lubricants form a small percentage of this basket but have varied applications for running all kinds of machinery, vehicles or in aerospace applications. Lubricants, whether mineral-derived or synthetic, are essential in a broad spectrum of processes, finding use as metalworking fluids, engine oils, coolants, gear oils, and transformer oils, among several other applications. We need to bring the concept of circular economy in Lubricants by re-cycling the used oil.

2.0 Re-refining of Used Oils

2.1 Defining Used Oil

US EPA defines used oil as any oil that has been refined from crude oil or any synthetic oil that has been used and as a result of such use, is contaminated by physical or chemical impurities. Simply put, used oil is exactly what its name implies—any petroleum-based or synthetic oil that has been used. Diagram 2 shows physical appearance of used oil and unused oil. Table 1 given below shows difference in composition of unused and used lube oil.

Diagram 2. Used Oil vis-à-vis Unused Oil

Constituent	Unused Oil	Used Oil
Base Oil	**70-99%**	**70-75%**
Additives	**1-30%**	**0**
Coolants	0	0.5%
Fuel	0	5-10%
Solvents	0	<1000 ppm
Water	0	10-20%
Sludge	0	1%
Spent Additives	0	10-20%

Table 1. Difference in Composition of Unused & Used Lube oil

Lubricants are used to reduce friction between bearing surfaces, are incorporated into other materials for use as processing aids in the manufacture of other products or are used as carriers of other materials. All lubricants start with a base oil. Typically, the ratio is somewhere around

90 percent base oil, plus 10 percent additives. Petroleum lubricants may be produced either from distillates or residues. Lubricants include all grades of lubricating oils from spindle oil, to cylinder oil, to those used in greases. Diagram 3 shows composition of finished lubricants.

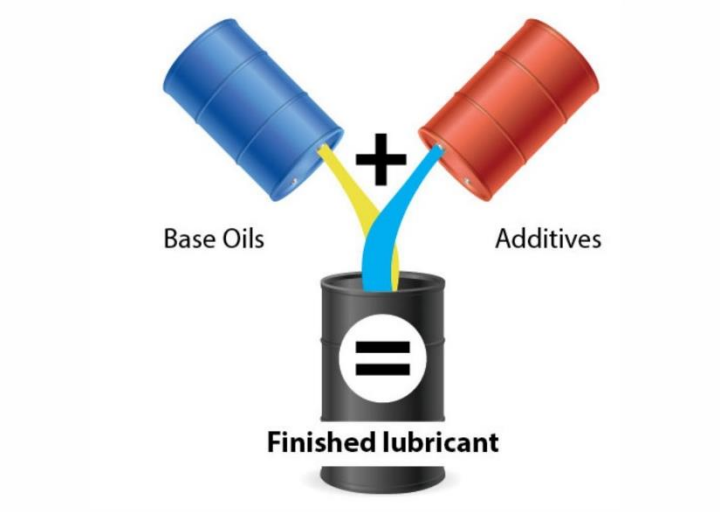

Diagram 3. Composition of Lubricants

During normal use, impurities such as dirt, metal scrapings, water, or chemicals can get mixed in with the oil, so that in time the oil no longer performs well. Eventually, this used oil must be replaced with virgin or re-refined oil to do the job at hand. EPA's used oil management standards include a three-pronged approach to determine if a substance meets the definition of used oil. To meet EPA's definition of used oil, a substance must meet each of the following three criteria:

2.1.1 **Origin** - Used oil must have been refined from crude oil or made from synthetic materials.

2.1.2 **Use** - Oils that are used as lubricants, hydraulic fluids, heat transfer fluids and for other similar purposes are considered used oil. Unused oils such as bottom clean-out waste from virgin fuel oil storage tanks or virgin fuel oil recovered from a spill, do not meet EPA's definition of used oil because these oils have never been "used". EPA's definition also excludes products used as cleaning agents or used solely for their solvent properties, as well as certain petroleum-derived products like antifreeze and kerosene.

2.1.3 **Contaminants** - To meet EPA's definition, used oil must become contaminated as a result of being used. This aspect of EPA's definition includes residues and contaminants generated from handling, storing, and processing used oil. Physical contaminants could include metal shavings, sawdust, or dirt. Chemical contaminants could include solvents, halogens, or saltwater.

2.2 Constituents of Used Oils

The main constituents of used oils are base oils, degraded additives, metallic debris, oxidation products and carbon soot. A large number of additives are used to impart performance characteristics to the lubricants. The main families of additives are antioxidants, detergents, anti-wear elements, metal deactivators, corrosion inhibitors, rust inhibitors, friction modifiers & others. During their use, these additives lose their characteristics and make the lube oil non-usable for lubricating purpose. During their use, various metal components, moisture, fuel, oxides etc also get mixed up the with oil as external contamination or wear particles. Table 2 below depicts the change in characteristics of engine oil after use:

Property or test	Fresh Engine Oil	Used Oil
Viscosity, at 40°C, cSt	100-150	90-110
API gravity, at 15.6 °C	25 on average	19.1 – 31.3
Specific gravity at 15.6 °C	0.85 to 0.92 on average	0.9396 – 0.8692
Water, vol %	Traces	0.2 – 33.8
Bottom sediment and water, vol %	Nil	0.1 – 42
Benzene insoluble, wt. %	Nil	0.56 – 3.33
Gasoline dilution, vol %	Nil	2.0 – 9.7
Flash point, °C	>200	79 – 220
Ash, Sulfated, wt. %	0.78 to 1.0 typical	0.03 – 6.43
Carbon soot, wt. %	Nil	1.82 – 4.43
Fatty oil, wt. %	Nil	0–60
Chlorine, wt. %	Nil	0.17 – 0.47
Sulfur, wt. %	Group I Oils >0.03	0.17 – 1.09
Zinc, ppm	Nil	260 – 1787
Calcium, ppm	Nil	211 – 2291
Barium, ppm	Nil	9 – 3906
Phosphorus, ppm	Nil	319 – 1550
Lead, ppm	Nil	85 – 21,676
Aluminum, ppm	Nil	<0.5 – 758
Iron, ppm	Nil	97 – 2401

Table 2. Typical properties of Engine oil before and after use

The contamination of oil by various ingredients getting added into the oil while in use, makes it hazardous. Therefore, proper handling, treatment, and disposal of used oil is of utmost importance. Increase in the number of motor vehicles and the spread of various types of industrial processes require a greater number of communities for wider dissemination of accurate and practical knowledge regarding their recycling and disposal.

2.3 Impact of Used Oils on Health and the Environment

Management of used oils is an issue of growing concern, particularly in industrial and urban areas. Generation of used oils is closely linked with increase in the numbers of automobiles and industries. Most of these oils contain degraded additives which, along with other contaminants, render them hazardous. The market for low-grade recycled oils is usually limited and the remaining used oils are either burnt in the open or indiscriminately disposed of, causing serious threats to both human health and the environment. The use of obsolete or inappropriate technologies results in serious environmental issues due to toxic air emissions and discharges of hazardous solid waste. These used oils may have a detrimental effect on the environment if not properly handled, treated or disposed of.

As compared to fresh oils, used oils contain more metals and heavy polycyclic aromatic hydrocarbons (PAHs) that contribute to chronic hazards including carcinogenicity. Improper disposal of used automotive oils is a significant source of possible entry into the water system. Oil concentrations as low as 1 ppm can contaminate drinking water for mammals and birds, harmful impacts include toxic contamination, destruction of food resources and habitats and impaired reproductive capability. Uncontrolled burning of used oils leads to emissions of metals and PAHs, adsorbed by air-borne particulate matter, and gets deposited in soil and water.

2.4 Recycling of Used Oil

The used oil can be:

a) Reconditioned on site by removing impurities from the used oil, which is then reused to prolong its life.
b) Sent to a petroleum refinery and introduced as a feedstock into refinery production processes.
c) Re-refined, which involves treating used oil to remove impurities so that it can be used as a base stock for new lubricating oil (re-refining extends the life of the oil resource indefinitely); and

d) Processed and burned as fuel to generate heat or to power industrial operations.

The latter is not as preferable (from a recycling perspective) as other options because it only allows for one reuse of the oil. Improper handling and burning of used oil raise environmental and health concerns due to uncontrolled release of hazardous emissions. As per EPA, re-refining used oil is the preferred form of recycling because it closes the recycling loop by reusing the oil to make the same product that it was when it started out, using less energy and less virgin oil. The key considerations for the reuse hierarchy include market needs, economic value, environmental benefit, energy value, infinite reuse, and upcycling.

Table 3 depicts the resource conservation hierarchy - waste management ranking based on various actions taken with waste oils.

Waste Management Ranking (from Environmental Perspective)	Option	Considered Action Step
Most Preferable  **Least Preferable**	Prevent the waste in the first place	Source reduction (e.g., extended oil drain intervals
	Re-use and reclaim the product	Re-refine used oil
	Recover energy by burning	Combustion of used oil for heating value recovery
	Dispose of the waste by land filling or incineration	Recover and collect used oil for proper disposal

Table 3. Resource Conservation Hierarchy

The first re-refining activities were carried out in Germany in 1921, and over the years the industry has developed its treatment technology from simple distillation over clay and sulphuric acid, to Vacuum distillation and hydrotreatment process technology of today.

Re-refining is essentially no different from standard refining in that it takes a feed stock and processes it into a higher value stream through a combined physical and chemical transformation. What makes re-refining different is that the feed stock is a used product.

Recycling of used lubricants is preferable to disposal and can provide great environmental benefits. Some of the many reasons to reuse and recycle used oils are:

a) Recycling used oil keeps it from polluting soil and water.

b) Less energy is required to produce re-refined base stock than a base stock from crude oil.

c) About 100 litres of used oil is required to produce 70 litres of re-refined base oil whereas one litre of virgin base oil is obtained by distilling 100 litres of crude oil.

The used oil after proper re-refining becomes as good as the virgin base oil and can be used as input to manufacturing fresh engine oils or industrial lubricants as the case may be. Table 4 below shows a comparison of specifications of a virgin base oil and a re-refined base oil:

Tests	**Methods**	**Virgin SN 150 Base Oil**	**Recycled SN 150 Base Oil**
		Limits	**Limits**
Appearance	Visual	Clear & Bright	Clear & Bright
Colour, ASTM, max	D-1500	1.5	1.5
Flash Point ^{0}C, min	D-92	200	200
Pour Point ^{0}C, max	D-97	-6	(-) 3
K Viscosity @100^{0}C	D-445	Report	Report
K Viscosity @40^{0}C	D-445	27 - 32	28-33
Viscosity Index, min	D-2270	95	95
TAN mg KOH/g, max	D-664/D-974	0.03	0.03
Sulphur % wt max	D-129/6481/XRF	Report	1.2 max
Density @15^{0}C	D-1298/D-4052	Report	Report
Moisture	Crackle	No Crackle	No Crackle
Copper strip corrosion @100^{0}C for 3 hrs.	D-130	1 max	1 max
Saturates % wt, Min	D-5186	90	80
Emulsion @ 54^{o}C / 82^o C , Max	D 1401	40-37-3 (10')	40-37-3 (20')

Table 4. Comparison of specifications of a virgin base oil and a re-refined base oil

2.5 Challenges in Re-refining of Used Oil

The inappropriate disposal of used oils on land and in water has emerged as a major cause of environmental damage in many industrialized countries. It is therefore essential to have environmentally sound used oil disposal technologies in place to stop any further environment damage.

There are two alternatives for the disposal of used oils:

- Re-refining to produce lubricating base oils
- Burning as fuel

Many problems are likely in both options because of the presence of high amounts of metals and organometallic compounds in used oils, originating from lube oil additives. Some of the points are listed below.

2.5.1 Quality of Products

For a re-refiner's products to be able to compete with virgin base oils (which are derived from crude oil) and ensure profits for the re-refinery, its products must be of high quality. Products of lower quality will ultimately impact upon the commercial viability of the re-refining. The shift in the global base oil market currently underway towards greater use of Group II and also Group III base oils is expected to continue because of the increasing emphasis on fuel economy, extended drain levels and lower levels of emissions. For a re-refinery to maintain a sufficiently competitive product in future markets, it must adopt a technology system capable of producing API Group II and Group III base oils in an economically viable manner.

2.5.2 Consistency in Product quality

The technology must also ensure a high degree of consistency in product quality. Lube manufacturers produce/ procure base oils and combine them with chemical additives to create finished lubricating oils that are specific to applications. The finished lubricating oils undergo several quality control tests, with the final blend needing to be reformulated if stringent property standards are not met.

2.5.3 Base Oil Yield

The re-refining technology should have a high yield of base oil, which is the re-refined product having the highest value (twice the value of fuel oil, the next highest value product). A technology having a high base oil yield is one that is recovering the highest value used oil product. Base oil yield can be used as a yardstick for measuring the efficiency of the process.

2.6 Re-Refining Technologies

Recycling technologies, as the name implies, enable recycle/reuse of used oils, thus conserving precious resources that are mostly non-renewable. The flow chart shown in Diagram 4 below shows the generic steps of handling used oil. The steps involve safe handling, storage of used oil, actual re-refining and then careful disposal of different kind of residues as per prevailing legal provisions.

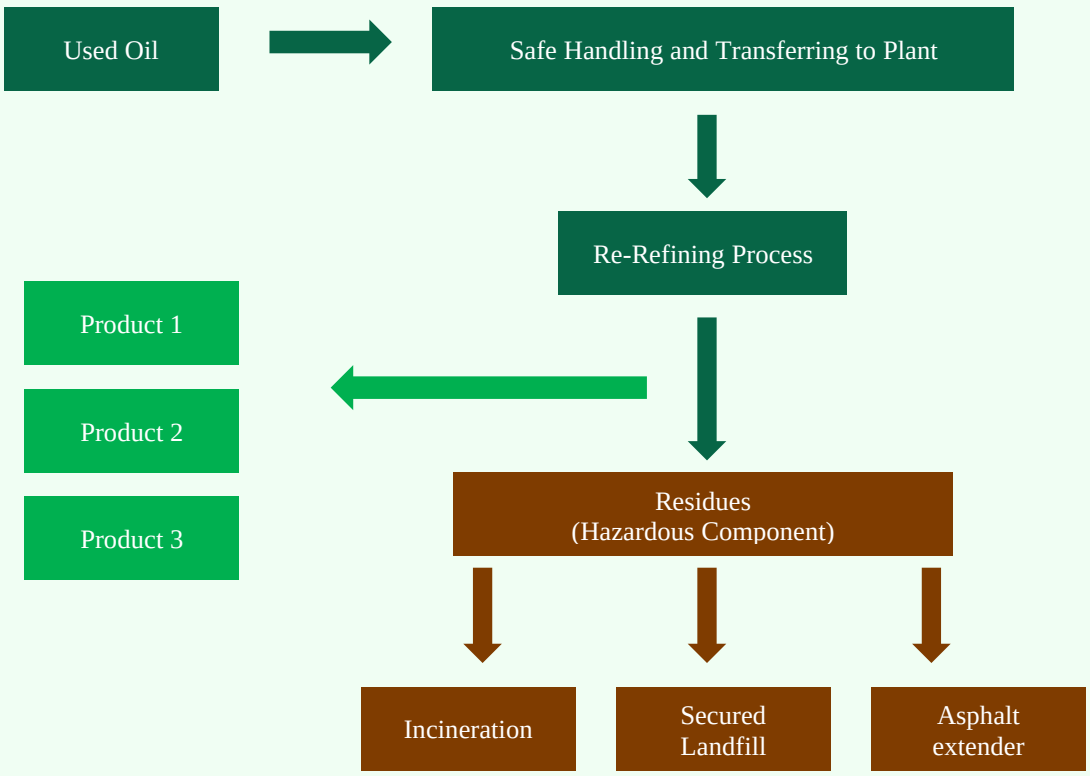

Diagram 4. The general schematic of a waste oil recycling process:

The used oil re-refining technologies are classified under three main titles. These technologies are:

a. Acid-Clay Process
b. Vacuum distillation
c. Hydro processing

2.6.1 Acid Clay Treatment Process

In this process, the used lubricating oil is settled or filtered after collection and is dehydrated. The oil is then treated with concentrated sulphuric acid to remove polymers, asphalts, degraded additives and other products of degradation. This method is no more a preferred method due to the additional hazardous waste (spent clay and acid sludge) generated during the process and the risks of contact with strong acids.

This process was first employed in the mid-1960s by many companies in United States, wherein large amounts of sulphuric acid and clay were used to treat waste oils. While the technology produced acceptable, although sub-standard, base oil, it also generated acid tar, oil saturated clay, and other hazardous waste by-products. Under increasing environmental pressure this technology has been banned in most countries, including many developing countries. This is still being used in India by many recyclers. The process is shown in Diagram 5.

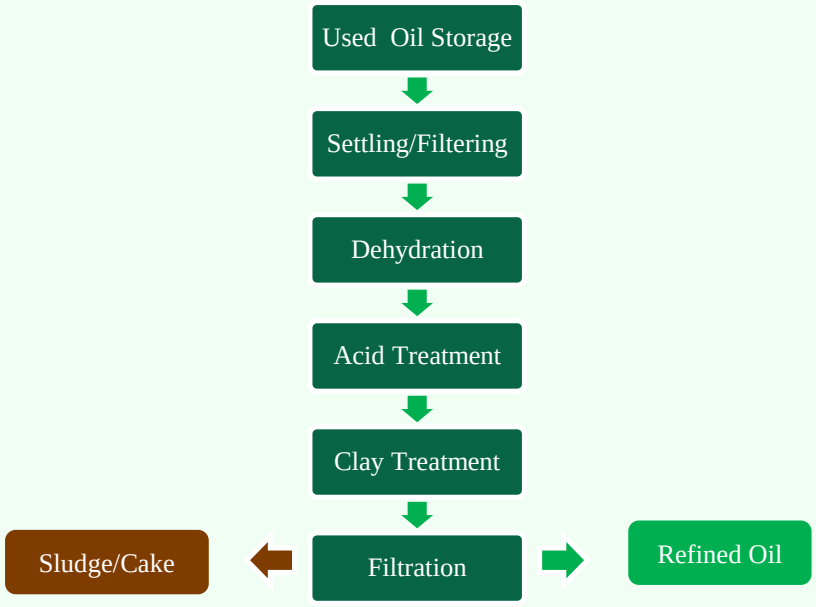

Diagram 5. Flow diagram of acid-clay refining process:

2.6.2 Vacuum Distillation Process

In this process, pre-treated used oils are distilled to separate off water and light hydrocarbons. The resulting water is treated and sent to a wastewater treating facility, while the light hydrocarbons are used at the plant as fuel or sold as a product. The water-free oil then undergoes high vacuum distillation using a conventional vacuum column or in a thin film evaporator for separation of diesel/lube oils. Lighter cuts are used as fuel. Colour improvement is done for lubricants produced from the process. The process is described in Diagram 6.

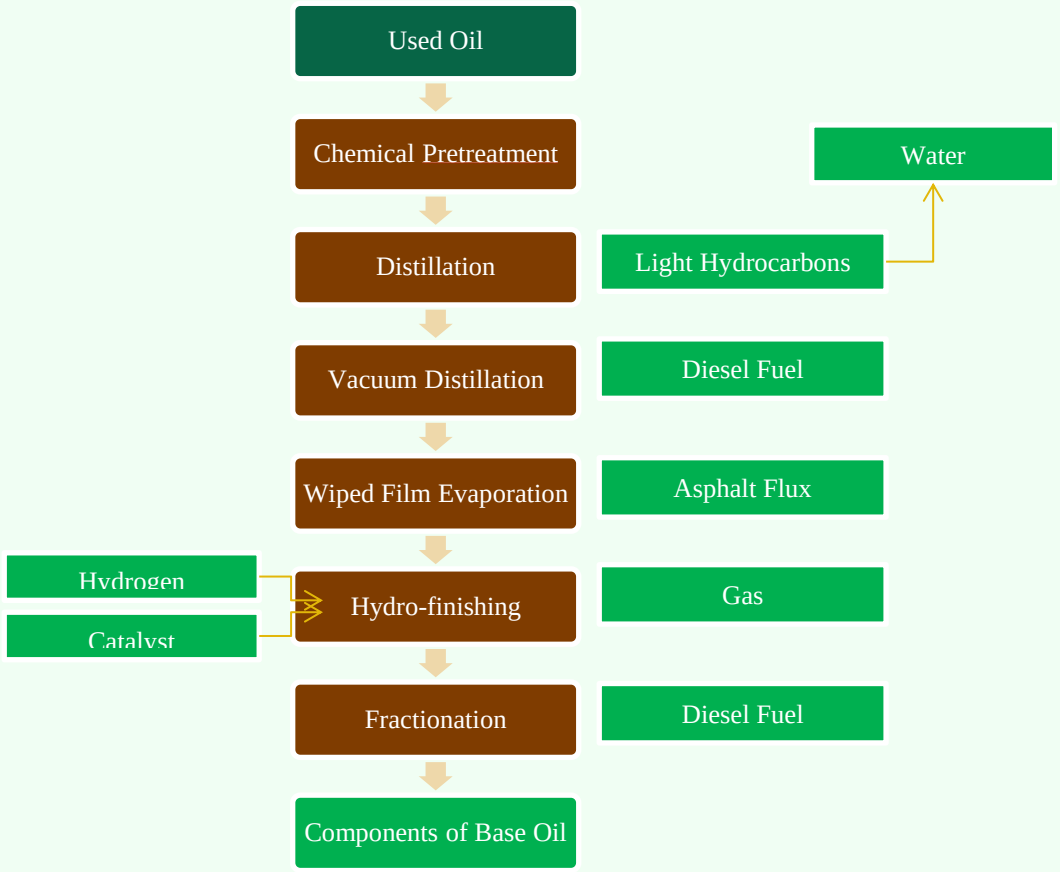

Diagram 6. Flow diagram of vacuum distillation-based process

2.6.3 Hydro Processing

This process refers to two separate but similar processes, hydrotreating and hydrocracking. It's the treatment of used oils with hydrogen by reacting with hydrogen in the presence of a catalyst to improve colour of lubricating oils and color stability. The process also reduces the level of halogen, sulfur, oxygen, nitrogen and metals compounds.

Despite the higher investment cost of Hydro processing, it is advantageous because of the Group II quality product output it produces independent of the quality and source of the feedstock. The major drawback of Hydro processing in this regard is that the catalyst used is sensitive to the quality of the feedstock. For example, using low quality oils, such as industrial waste oils, as feedstock might shorten the catalyst life. The process is shown in Diagram 7.

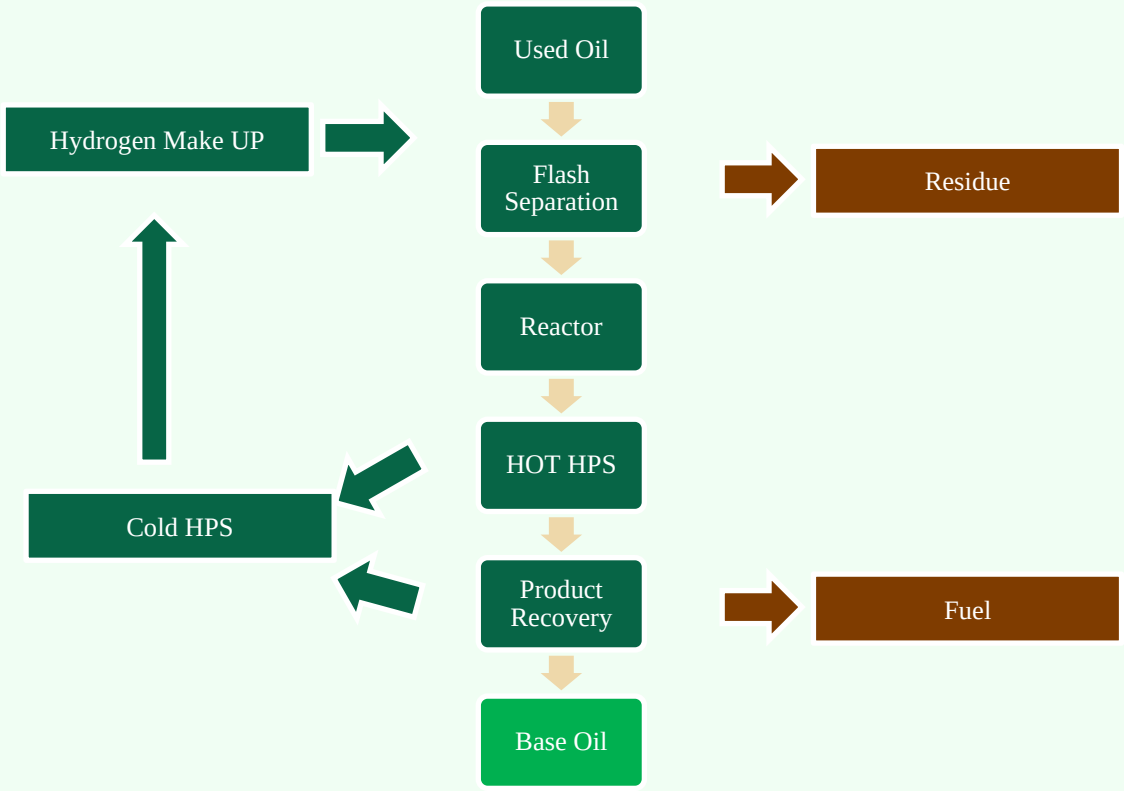

Diagram 7. Flow diagram of Hydro processing

2.6.4 Comparison of the Technologies

Table 5 below summarizes the advantages and disadvantages of different re-refining technologies.

Recycling Technique	Advantages	Disadvantages
Acid/clay	a) Historically proven. b) Lower cost of production. c) Simple process, easy to apply.	a) It generates acid sludge, which is considered hazardous waste. b) Causes corrosion of equipment and reduces its life. c) Low oil recovery
Vacuum distillation	a) Suitable for high capacity plants. b) Environmentally friendly process. c) Produces good quality base oils.	a) High capital investment required. b) Due to sophisticated equipment, highly skilled operators are necessary
Hydro-processing	a) Flexibility of feedstock. b) Lower cost product can be used c) Lower operating cost d) High profitability	a) Large quantity of catalyst are required b) Spent hydro processing catalyst is major solid waste c) High cost of installation

Table 5. Advantages and disadvantages of different re-refining technologies.

2.7 Technology Options for India

To summarize, though globally vacuum distillation and hydro processing technologies are popularly used for re-refining, in India we still have acid clay treatment methods in many places leading to low efficiencies and waste management issues due to high sludge generated. The process also gives lower quality of recycled base oils (typically Group I). Recyclers who are using vacuum distillation, use fullers earth clay for colour improvement of the product which also needs to be disposed of properly after use. Upgradation of technologies will help in sustainability of environment and control pollution.

Technologies based on vacuum distillation and hydro processing are implemented by major MNC companies and patented as various new technologies where operating conditions are varied and specialized catalysts are used. These have higher yields and better system efficiencies. These are used to manufacture superior group II and III base oil.

2.7.1 Cyclon Process

The process belongs to Kinetic Technology International (KTI) explained in diagram 8. In this process used oils taken from storage tanks are dewatered and the light hydrocarbons are removed by distillation. The heavier fraction is sent to high vacuum distillation, where the majority of base oil components are evaporated from the heavy residue. The oils in the residues are extracted with propane in

the de-asphalting unit and sent to the hydro processing unit where the other oils are processed. Then they are treated with hydrogen and fractionated based on the desired base oil features. The re-refined base oil products have high quality due to the hydrogenation.

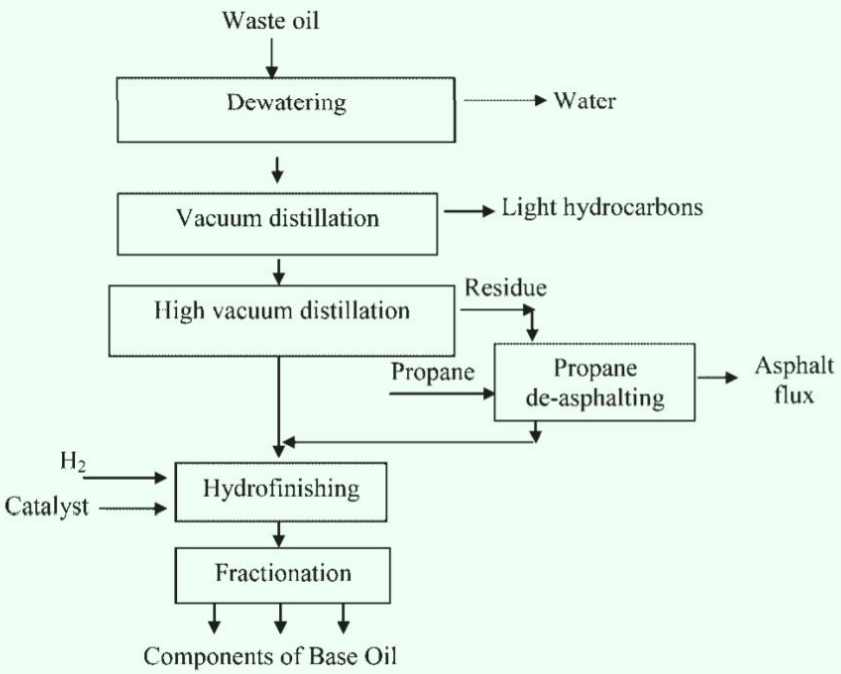

Diagram 8. Process flow chart of Cyclon Process

2.7.2 CEP Process

This technology is designed by Chemical Engineering Partners (CEP) explained in diagram 9, the engineering affiliate of U.S. company Evergreen Oil, Inc. CEP's technology for re-refining consist of three steps-Pretreatment of feedstock -Defouling & De- Poisoning, Thin film evaporation & Hydro processing.

2.7.2.1 Pretreatment of feedstock - Defouling, Dewatering & De- Poisoning

The chemical additives in the feedstock leads to fouling and corrosion of process equipment and poisoning of the hydrotreating catalysts. As the first step, the feedstock is analyzed and on the basis of analysis the feedstock is treated to minimize the fouling of the process equipment. The incoming feedstock is treated by neutralizing the remnants of the chemical additives through befouling reaction. Also, the chemical treatment is done to eliminate the water and the volatile compounds in the feedstock. The feed stock is passed through the De- Poisoning process where catalyst poisons are polymerized into high molecular weight compounds.

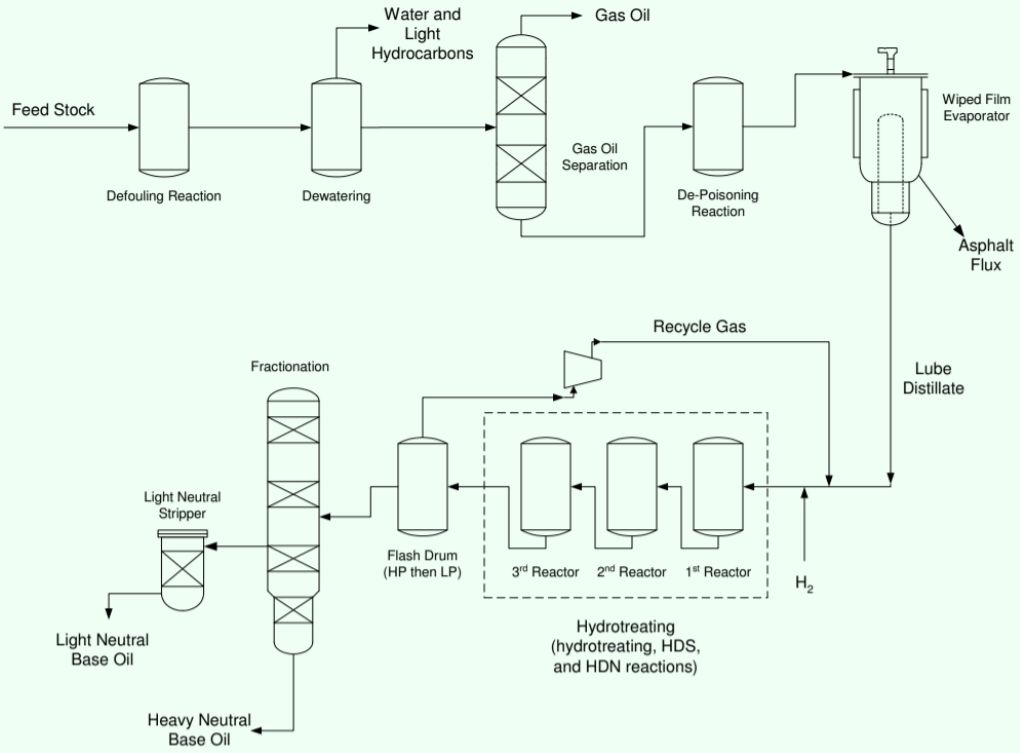

Diagram 9. Process flow chart of CEP Process

2.7.2.2 Thin film evaporation

After the pre-treatment, the feedstock is delivered to a wiped film evaporator that operates under vacuum. Used oil is mixed and coked by continuously rotating pedals in the evaporation tank. The polymerized poisons are separated and removed from the lube base oil as the wiped film evaporator bottom product, asphalt flux. The vacuum allows separation at temperatures below oil cracking temperatures.

2.7.2.3 Hydro processing

In the final stage of the process, three hydro treating (Hydro finishing) reactors are used in series to reduce sulfur to less than 300 ppm and increase saturates to over 90%, meeting the key specifications for API Group II base oil. The final step is vacuum distillation to separate the hydro treated base oil into multiple viscosity cuts in the fractionator. Hydro processing technology is one of the most widely used distillation processes to eliminate undesirable components such as Sulphur, nitrogen, metals or unsaturated hydrocarbons.

2.7.3 HyLube Process

The HyLube process (explained in diagram 10) in is a proprietary process developed by Universal Oil Products (UOP) for the catalytic processing of used lube oils into re-refined lube base stocks lube base oils. This is the first re-refining process in which as received used oil is processed, without any pretreatment, in a pressurized hydrogen environment. A typical HyLube process feedstock consists of a blend of used lube oils containing high concentrations of particulate matter such as iron and spent additive contaminants such as zinc, phosphorous, and calcium. The first part of the process involves separation of the lube range and lighter components of the feed from the non-distillable residue portion. After the separation step the light feed is flowed through the so-called ‘guard’ reactor where metal-containing compounds and other impurities are accumulated in the large pore size catalyst.The treated feed is hydrogenated in the main reactor before the second separation step. The Hylube unit operates with reactor section pressures of 60–80 bar and reactor temperatures in the range 300–350 deg C. As the feed is processed in hydro-finishing reactors, contaminants are removed and the quality of the lube base oil is rejuvenated and enhanced. In addition to converting hetero-atoms such as sulfur and nitrogen, the catalyst is able to increase the viscosity index via saturation of multi-ring aromatic compounds. After the hydrogenation, products are stripped and separated in the fractionation tower to gasoline, petroleum, gas oil and base oil fractions. Light ends from the high temperature separator are blended with sodium carbonate and flowed to the low

temperature separator, where the waste water is settled and separated. The hydrogen rich vapor from the cold separator is scrubbed, compressed, reheated and returned to the mixer. The hydrocarbon liquids collected in the separators are sent to the product fractionation section where the products are separated into various cuts to meet the desired lube oil viscosity grades. The processed feedstock is converted into a wide boiling range hydrocarbon product, which is subsequently fractionated into neutral oil products of different viscosity to be used for lube oil blending. Due to hydrogenation the properties of three different base oil products are the same as the properties of fresh Group II base oils. The Hylube process achieves more than 85% lube oil recovery from the lube boiling range hydrocarbon in the feedstock.

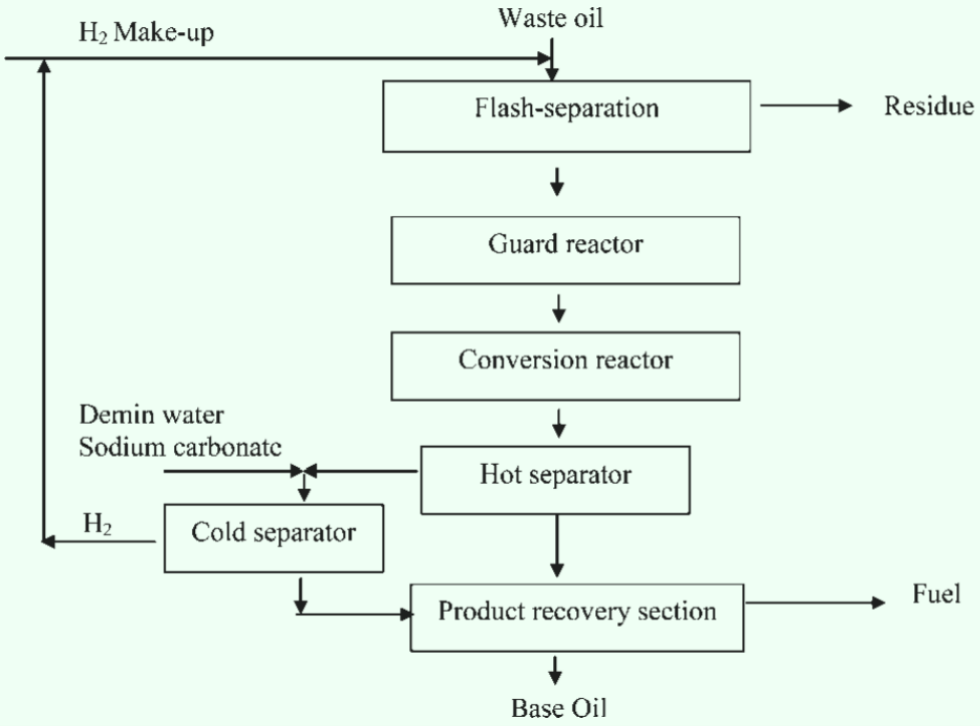

Diagram 10. Process flow chart of HyLube Process

2.7.4 Revivoil Process

Revivoil™ process (Explained in diagram 11) an advanced technology enabling recovery of base oils from used oils with properties similar to those of virgin base oils was developed jointly by Axens and Viscolube. This process produces base oils with API Group II characteristics, (low Sulphur and unsaturated content and very low aromatics content) through a treatment with hydrogen at high pressure. It is made up of three sections: Pre-Flash, Thermal De-Asphalting and High-Pressure Hydro finishing.

2.7.4.1 Pre-flash

Pre-flash stage, the used oil is heated up to 140°C and then distilled in a vacuum column where water and light ends are separated.

2.7.4.2 Thermal De-Asphalting

In the Thermal De-Asphalting (TDA) stage, the dehydrated oil is distilled at 360°C in a vacuum de-asphalting column (TDA) where the asphaltic and bituminous products remain on the bottom. Three side cuts at different viscosities are fractionated. An intermediate gas oil is distilled at the top of the column. The three side fractions and the gas oil are sent to storage to be subsequently hydrofinished by campaign in a high pressure (100 bar) catalytic plant.

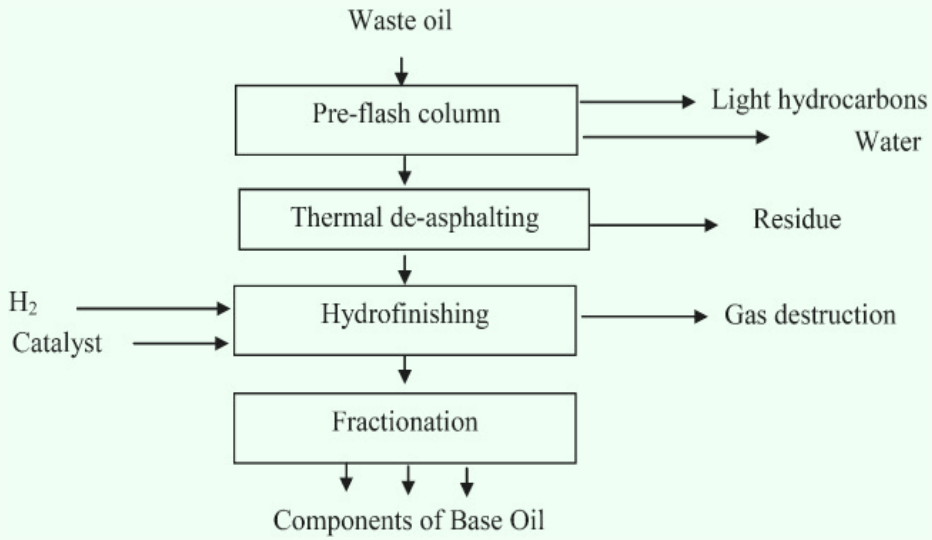

Diagram 11. Process flow chart of Revivoil Process

2.7.4.3 Hydro-finishing

The final stage is Hydro-finishing, and the process starts in a fired heater where the oil and hydrogen are heated up to 300°C and are subsequently sent to a reactor containing a catalyst favoring the hydrogen reaction with the unsaturated compounds, Sulphur and nitrogen. The reactor effluent is then separated into two phases, the vapor phase and the liquid phase; the first one is washed with water in order to remove the chlorine and Sulphur compounds, the second one is stripped with steam to eliminate the most volatile compounds and restore the flash point. The water contained in the oil after stripping is then removed in a vacuum dryer. The streams containing Sulphur are sent to an amine plant where the hydrogen sulphide is separated from the other compounds and then to a Claus plant where H2S is transformed into pure liquid

Sulphur. The final result is clear oil with very low Sulphur and Polynuclear Aromatics (PNAs) content.

2.7.5 MRD Solvent Extraction Process

The applied oil re-refining process is based on a patent held by AVISTA OIL. The 'Enhanced Selective Refining' process uses solvent N-methyl-2-pyrrolidone (NMP), which is commonly used in the petroleum refining industry. The MRD solvent extraction process (explained in diagram 12) uses the liquid–liquid extraction principle. Vacuum distillates from the flash distillation are used as feed. These distillates are processed in a production cycle which can be adjusted to the quantity to be processed. Before the distillate enters the extraction column, any residues of dissolved oxygen in the distillate are removed in an absorber using steam. Thereafter the distillate is sent to the bottom part of the extraction column. As the distillate rises, undesirable aromatic hydrocarbons and other contaminants are separated out by the counter-flowing heavier solvent, N-methyl pyrrolidone, which is fed in at the top of the extraction column. The solvent containing raffinate phase leaves the extraction column at the top and is routed to the downstream raffinate recovery section consisting of a distillation and a stripping column where the solvent is removed. The extract phase is continuously withdrawn from the bottom of the extraction column, cooled down to a defined temperature and separated in a separation drum from the separated secondary raffinate. The latter is returned to the extraction column in order to optimize the process yield. The extract phase from the secondary separation drum is sent to the extract recovery section where the solvent is removed. The extract recovery section also consists of a distillation and a stripping column. The resulting extract is routed to the intermediate storage tank and used within the refinery as an energy carrier or mixing component for heavy oil. The dry solvent separated in the distillation columns of the raffinate and extract recovery sections is returned to the solvent tank. The moist solvent separated in the stripping columns of the raffinate and extract recovery sections is returned to the solvent drying column, where excess water is removed. The average base oil yield within the process is about 91%. The process is characterized by optimized operating conditions which allow elimination of toxic polyaromatic compounds from the re-refined base oil and preservation of the synthetic base oils like polyalphaolefin (PAO) or hydrocracked oils, which are increasingly present in used oils.

Used oils taken from storage tanks are dehydrated and the light hydrocarbons are removed by distillation. The oils in the residues are extracted with propane in the de-asphalting unit and sent to the hydro processing unit where the other oils will be processed. Then they are treated with

hydrogen and fractionated based on the desired base oil features. After the additives are added they are ready for sale. Cyclon Hellas SA operates a re-refining plant based hydro treatment technology in Aspropyrgo, Attica (Greece).

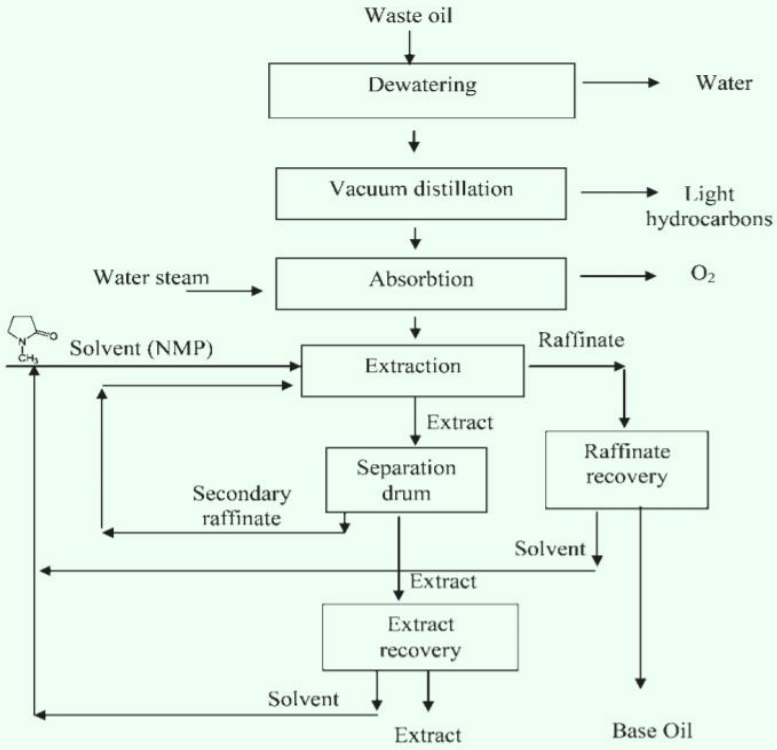

Diagram 12. Process flow chart of MRD Solvent Extraction Process

Diagram 13. Typical Used Oil Recycling Plant in India

3.0 Global Trends in Re-refining of Used Oils

3.1 Worldwide Total Lubricant Demand

The data as per Table 6 clearly illustrates that Asia-pacific region is the highest consumer of lubricants in the world due to presence of India & China. However, per capita consumption of Asia-pacific region is considerably lower than USA and Europe and thus, this area has potential for significant growth. Accordingly, this region is the largest source of used oils.

Region (Year)	Demand, Billion (Gallons/Year)	Per Capita Demand (Gallons/Year)
Asia-Pacific (2017)	5.1	1.5
United States (2017)	2.5	7.6
Western Europe (2015)	1.2	3.3
Latin America (2017)	1.1	1.7
Eastern Europe (2015)	0.8	3.5
Middle East (2017)	0.6	1.4
Africa (2017)	0.5	0.4
Total (2015; 2017)	11.8	1.8
Per capita data based on respective year statistics		

Table 6. Worldwide lubricant demand by region

3.2 Process Flow of Used Oil Utilization

It is essential to understand the steps through which oil is manufactured, used, drained, collected, processed and disposed, to draw out plans and programs to enhance recycling and reuse of used lubricants and usher circular economy. The diagram 14 describes schematically generation and utilization of used oil:

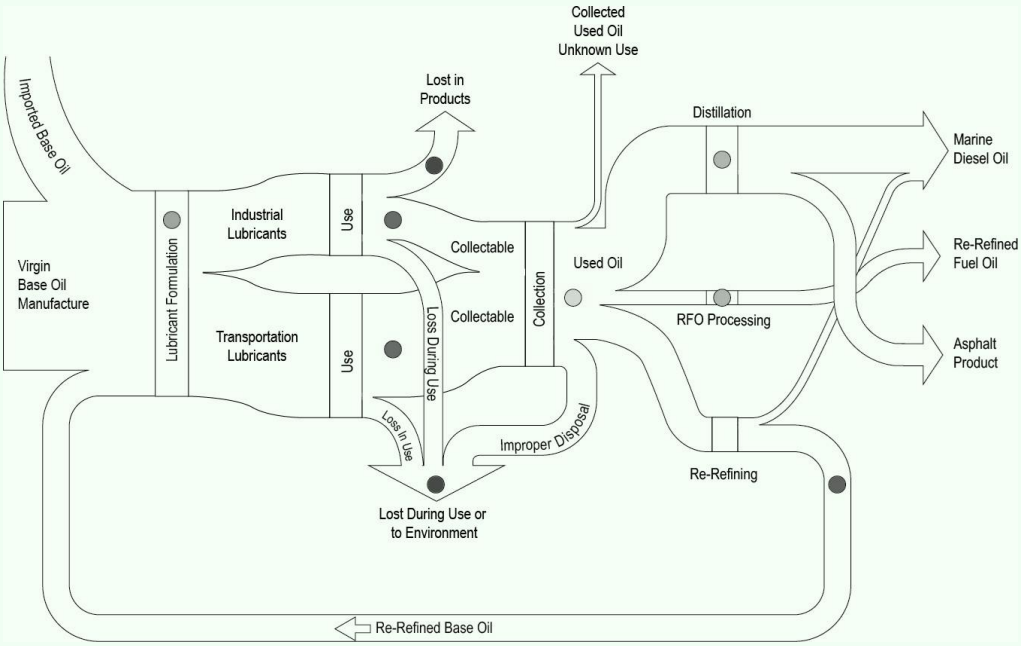

Diagram 14. Schematic diagram for generation and utilization of used oils

3.3 Worldwide Used Oil Management Practices

Used oil management has evolved over recent years to reflect an increase in used oil collection and refinement. However, used oil management practices vary considerably between nations and global regions. There are no common models of how governments or industry associations in place of governments establish used oil refining and collection incentives. Below is the glimpse of the used oil management practices of some prominent countries or regions.

3.3.1 United States

Used oil management is driven by the U.S. Comprehensive Procurement Guideline (CPG) program (part of Sustainable Materials Management initiative). This program promotes the use of materials recovered from the municipal solid waste stream, and buying products made with recovered materials ensures that the materials collected in recycling programs will be used again in the manufacture of new products. The re-refined lubricating oils have been designated under the CPG program to include engine lubrication oil, hydraulic fluids, and gear oils. The designation specifically excludes marine and aviation oils. EPA recommends that procuring agencies set their minimum re-refined oil content standard at the highest level of re-refined oil that they determine meets the statutory requirements, but not lower than 25 percent re-refined oil.

Also, the law requires Federal agencies to procure designated items composed of the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition. There are 61 products designated in eight categories. Procuring agencies may decide not to procure such items if they are not reasonably available in a reasonable period; fail to meet reasonable performance standards; or are only available at an unreasonable price.

Along with the procurement guidelines, the government imposes sales taxes to subsidize collections and classify used oil as hazardous waste to discourage illegal dumping. The percentage of used oil recycling in United States is about 12 percent.

3.3.2 Canada

In Canada the used oil regulation is done by authority delegating individual provinces. The authority focuses on incentives on used oil collection. Federal used oil regulations are largely non-existent, and provinces have implemented their own regulations surrounding used oil. Inter-provincial cooperation of the provincial Used Oil Management Associations is formalized through the council, which coordinates Canada-wide used oil and antifreeze materials recycling efforts and encourages national standards. The council's goal is to have fully integrated programs in all of Canada's provinces and territories.

All retailers, wholesalers, or first sellers of lubricating products are charged with Environmental Handling Charge (EHC) ranging from $0.08–$0.17/gallon. An Incentive is paid to private sector collectors and processors to pick-up used oil and deliver it to government-approved recycling facilities.

3.3.3 European Union (EU)

EU regulations establish general principles via Directives for used oil classification and the priorities for its use, but individual member states are obliged to transpose the Directives into national law and are free to establish their own regulations within the framework of the EU Directives. Used oil's hazardous waste classification and waste hierarchy encourage used oil refining. Extended Producer Responsibility (EPR) schemes are encouraged, with the burden imposed on the lubricant blender/marketer. Used oil burning is approved only within strict guidelines and only after demonstration that refining is infeasible.

Italy is the leading example of a well-managed used oil market that has gone well beyond the EU basics, introducing significant subsidies to encourage the collection and refining of used oil. The used oil market is administratively managed through an industry consortium and funded

through a “contribution fee” levied on lubricants producers. Funds are disbursed to approved used oil collectors and refiners, with the level of subsidies determined annually by consortium.

Other EU countries—such as Spain, Portugal, and France (with used oil recycling percentages of about 47, 64 and 42 percentage respectively) have also introduced incentivized sectoral used oil management systems, which have fostered the growth of used oil refining. Some EU member countries, notably Germany and the United Kingdom (with used oil recycling percentages of 41 and 51 respectively) , rely on market forces to determine the appropriate level of used oil refining investment over time. Government taxing levies also have a substantial impact on used oil management. For example, in the UK, the total exemption of waste oil burning as a fuel makes waste oil very attractive for combustion processes, and this is the reason that the UK imports large quantities of waste oil from other EU countries and creates a shortage of raw material for re-refiners. This is one distinguishing feature of the UK market compared to most other countries in Europe.

Also, it can be noted that, the Waste Framework Directives by the European Parliament are structured and detailed with respect to defining the waste oils (used), priority order in waste prevention and management and accountability of member state in waste oil management.

3.3.4 Australia

The Australian Government runs Product Stewardship for Oil Scheme (PSO) aimed at supporting and encouraging environmentally sustainable management of used oils.

Under the program, a levy (in the form of excise and customs duty) is collected on all petroleum-based oil or their synthetic equivalents produced in or imported into Australia. This levy is used to provide benefits to recyclers of used oil and users of gazetted oils.

The framework and incentives paid are set under the Product Stewardship (Oil) Act 2000.There are two parts to the arrangements - Product Stewardship Levy & Product Stewardship Benefits.

<u>Product Stewardship levy</u>

The product stewardship levy is payable by oil producers and importers for petroleum-based oils and their synthetic equivalents.

The levy offsets the costs of benefits paid to oil recyclers as an incentive to undertake increased recycling of used oil.

No oil is levied twice, no 'eligible' lubricant escapes the levy, imported and domestically produced oils are treated equitably (to the extent possible), and exported oil is not levied. Levied oil, which is incorporated into products that are subsequently exported, may be subject to input tax credit.

Product Stewardship benefits

The Product Stewardship for Oil Program (PSO) encourages increased collection and recycling of used oil in Australia by providing oil recyclers with product stewardship benefits. These volume-based benefits support existing appropriate recycling activities and provide incentives to maintain a diverse range of recycling options for used oil.

The benefit paid to oil recyclers is 62c/L.

Social Impact of Product Stewardship for Oil Scheme (PSO)

The offset ensures that some of the costs of used oil recycling are borne by the markets that gain the benefit from the production and use of that oil, rather than from public money or other markets. In economic terms, it 'internalises the externalities'

With PSO Scheme Australia collects 350 million litres (350 TKL) of waste lube oil every year which is 50 % of oil used. And out of this 50 % ,17 % of gets recycled and the rest 33% gets consumed by the explosive industry

3.3.5 Japan

Although primarily applied to waste cooking oils, the system adopted in certain locations in Japan could be modified to a suitable and appropriate system for the collection of waste oils in general. The bus services provided by the organized sector is used for collection of the waste petroleum-based oils. Local governments cooperate with local residents' associations, gas stations, community councils, and companies to involve citizens.

The system works in such a way that citizens or small generators of waste oil collect the oil in a standardized or typically found bottle or container (supplied by the authorities) to be handed over to a bus driver when boarding the bus. In return they receive an "eco-friendly" voucher which can be used as a fare ticket, with a value in proportion to the quantity of waste oil they deliver.

3.3.6 Middle East

Being at the epicenter of oil production, historically, the region never saw the reason for re-refining used oil. Owing to this reason Middle East had discouraged or overlooked the value of used oil. Within the Cooperation Council for the Arab States of the Gulf, used oil refining is a relatively new consideration. The United Arab Emirates (UAE) and Saudi Arabia have led the increased focus on this practice. Also, it must be noted that many local governments discouraged waste oil refining, as it was perceived as competition to the state-owned grease and lube manufacturers. Hence, the used oil recycling percentage in the middle east is about 16 percent only.

3.4 Key Drivers for Growth of Re-cycling of Used Oil

Some countries have regulations that penalise the disposal of used oil in waterways and landfills, stop it from being mixed with several finished products and prevent its combustion in power generation units. This is expected to give a totally new economic rationale for the use of used oil in the region. In Europe, the availability of public or private entities with the capabilities to collect used oil and to make it available at reasonable costs to users varies significantly from country to country. Eventually worldwide growth of re-cycling of used oil will depend on following factors:

a) Growth in demand for high quality base oils
b) Increased desire to be more sustainable
c) The need to realise energy savings
d) Attractiveness of a wider supplier base
e) Suppliers' ability to produce products of sufficiently high quality.

4.0 Used Oil Management - India

4.1 Used Oil Generation and Recycling Scenario in India

As per CPCB survey report of 2013, in India there are 36,165 hazardous waste (HW) generating industries, attributing to 62,32,507 metric tons of HW every year. Generation of recyclable HW accounts for 49.55% of the total HW generated followed by land disposable (43.78 %) and incineration (6.67 %) respectively.

Out of 49.55% recyclable hazardous waste, 45% is spent oil. 46.67 % of spent oil is categorized as used oil and rest 55.33 % as waste oil. Table 7 describes hazardous waste generation.

Disposal method	Annual HW generation MTA	%
Land Fillable	27,28,326	44%
Incinerable	4,15,794	7%
Recyclable	30,88,387	49%

Table 7. Waste generation in India- CPCB survey report 2013

4.2 Methodology for Estimating Used Oil Generation

There is a need to assess the generation of used oil from various sources. Inclusion of all possible sources must be ensured. Different types of used oils are generated from different sources; therefore, it is desirable to prepare an inventory for each type of used oil. For performing this, the best and most reliable methodology would be to carry out statistically representative population of each category or source and then extrapolate the results to cover the entire population. An alternative way could be to determine specific waste oil generation factors (WOGF) or waste oil indices (WOI) for different sources.

In many of the lube oil applications like Rubber process oils, white oils, all loss lubricating oils in industries, the oils are used up as raw material or leaked out and there are hardly any quantities left for recycling.

Used oils generated from automotive sector, industrial gear oils, hydraulic oils, other industrial oils constitute the larger chunk of used oil (refer Diagram 15).

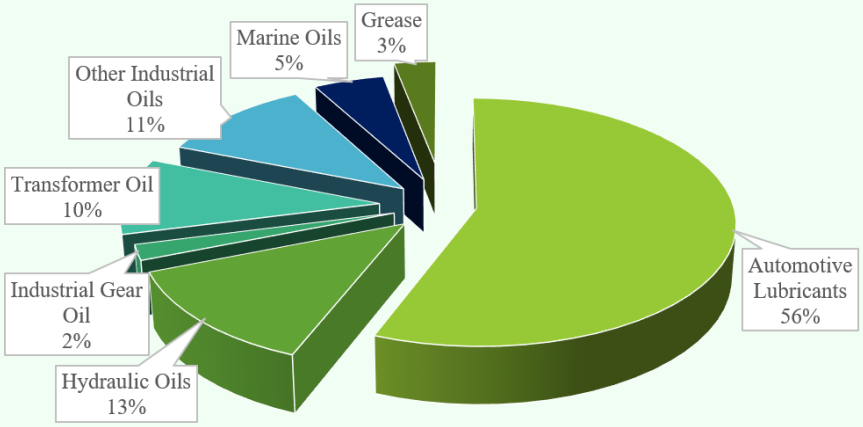

Diagram 15. Global Segment wise Lube consumption

4.2.1 Sources of Used Oil- Primary Market

Indian lubricant market Size is approximately 3.08 MMT. Lubricant market was de-regulated on 30th June 1992. Lube Industry has grown at CAGR of 2 % in the last 10 years. Finished lubricants market account for approximately 57 % (1.7 MMTPA). Process Oils consisting of Rubber Process Oils, Transformer Oils, White Oils/ Light Liquid Paraffin account for approximately 43 % (1.3 MMTPA). The segment wise market is represented in Diagram 16.

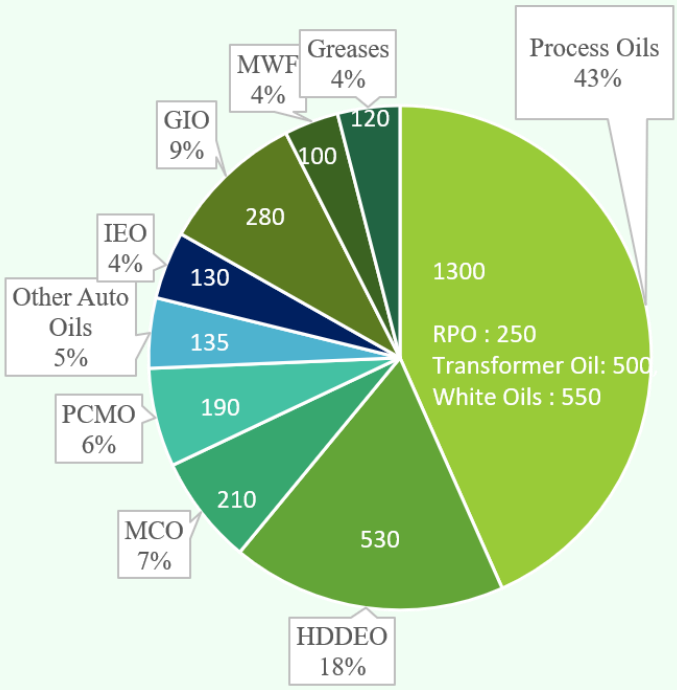

Diagram 16. Segment wise Indian Lube Market (Numbers are in TMT)

4.2.1.1 Industrial Sector

The generation of used oil from primary market is typically industrial oils that may be either lubricating or non-lubricating and include turbine oils, gas engine oils, refrigeration oils, heat transfer oils, compressor oils, hydraulic oils and metal cutting oils, among others. The used oils generated at industrial plants are generally mixtures of various oils and greases including synthetic oils, solvents and cutting oils. Typical impurities include the products of oxidation and decomposition with fine suspended dust and metal particles.

The Power Sector is also a significant generator of used oils. Transformer oils are subject to electrical and mechanical stresses while a transformer is in operation. In addition, there is contamination due to chemical interactions with windings and other solid insulation, catalyzed by high operating temperatures. The used oil generated in this segment is of very low viscosity with limited applications.

Diagram 17. Power Plant

4.2.1.2 Others

The other major sources of used oil are railways, marine and mining operations and allied sectors. India's industrial lubricant market stood at USD 1.54 billion in FY2019 and is projected to grow to USD 1.91 billion by FY2027, on the back of strong growth in construction & mining sectors across the country. Accordingly, used oil generation is also expected to see a continuous growth in coming years.

Diagram 18. Marine Oil used in Vessel

4.2.2 Sources of Used Oil- Secondary Market

4.2.2.1 Automotive

The generation of used oil from secondary market is composed of mainly the OEM service stations and independent garages in automotive sector. This segment is major source of used oils as retrieval is easier and higher recovery rates can be achieved. OEM service stations have control over their service stations and thus segment can be targeted easily through OEM intervention.

Independent garages are unorganized with hardly any control where strict implementation of discipline in collection and disposal of used oils is necessary to get improved results of collection of used oils.

As per Nielson Study-2020 and OMC estimates, the potential of auto lubricants consumption in India is as under:

Channel Type	**No. of Stores**	**Volume of Lube Sales/consumption (KL) Yearly**
OEM service stations	36321	3,22,700
Independent Garages	2,48,974	6,72,400
India Market	**2,85,295**	**9,95,100**

Table 8. Estimate of potential of auto lubricants in India

Diagram 19. Independent Garage

Diagram 20. Auto OEM Workshop

The network of 36321 dealership / Service Stations network of Auto OEMs is a huge source of used oils. The details are given in the Table 9 below.

Dealership / Service stations network of Auto OEMs					
Name	**Segmentation**	**No. Of Dealers**	**Name**	**Segmentation**	**No. Of Dealers**
Ajax Engg.	Off Highway	101	Kia Motors	Passenger Vehicle	152
Ashok Leyland	Commercial Vehicle	443	Kobelco	Off Highway	130
Asia Motor Works	Commercial Vehicle	130	Komatsu	Off Highway	113
Atul Auto	Three wheelers	220	L&T Construction	Off Highway	30
Audi India	Passenger Vehicle	60	Liebherr	Off Highway	100
Bajaj Auto	Two/Three Wheelers	966	Liugong	Off Highway	22
BEML	Off Highway	12	Mahindra & Mahindra	PV/CV/Farm Equipment	1580
Bharat Benz	Commercial Vehicle	225	Maruti Suzuki India Ltd	Passenger Vehicle	3658
BMW India	Passenger Vehicle	40	Mercedes-Benz India	Passenger Vehicle	94
Case New Holland	Off Highway / Farm Equipment	1566	MG Motors	Passenger Vehicle	65
Caterpillar	Off Highway	100	Piaggio	Two/Three Wheelers	278
Citroen	Passenger Vehicle	10	Renault Nissan	Passenger Vehicle	636
Daimler	Commercial Vehicle	225	Royal Enfield	Two wheelers	349
Escorts India	Farm Equipment	185	SAME Tractors	Farm Equipment	300
Fiat India	Passenger Vehicle	46	SANY Heavy Ind.	Off Highway	28
Force Motors	Commercial Vehicle/ Farm Equipment	62	Scania	Commercial Vehicle	21
Ford	Passenger Vehicle	376	Suzuki Motorcycles	Two wheelers	547
Greaves Cotton	Farm Equipment	380	Swaraj Tractors	Farm Equipment	958
Hero Moto Corp	Two wheelers	6000	TAFE	Farm Equipment	1000
Honda Cars	Passenger Vehicle	231	Tata Hitachi	Off Highway	60
Honda2 Wheelers	Two wheelers	3071	Tata Motors	PV/CV	946
Hyundai	Passenger Vehicle	1013	Toyota	Passenger Vehicle	318
Hyundai Construction	Off Highway	40	TVS Motor	Two/Three Wheelers	4100
International Tractors	Farm Equipment	1750	VECV	Commercial Vehicle	150
Isuzu Motors	PV/CV	49	Volkswagen	Passenger Vehicle	151
JCB India	Off Highway	650	Volvo	Off Highway	29
John Deere	Off Highway	900	Volvo India	Commercial Vehicle	35
Kawasaki	Two wheelers	26	VST Tillers &Tractors	Farm Equipment	294
Kerala Agro Mach. Corp. Ltd	Farm Equipment	100	Yamaha	Two wheelers	1200

Table 9. Auto OEM dealership /Service stations network

4.2.3 Estimated Generation of Used Oil in India

Based on consumption patterns and the estimated recyclability of used oil for different applications, it has been estimated that India generates about 1.4 MMT of used oils which can be recycled as per Table 10.

Sector wise estimated Used Oil Generation in MT		
Segment	**All India EYC (in MT)**	**Estimated Used Oil Generation (in MT)**
CEMENT	8000	2634
COAL	33000	10864
DEFENCE	12000	4850
ENGINEERING	35000	11522
FERTILISER	3000	988
MARINE	12000	3950
MINING	12000	3950
MISCELLANEOUS	185000	60902
OEM	80000	105344
RO & BAZAR	1200000	987600
PETROLEUM	18000	5926
POWER	15000	4938
RAILWAYS	24000	7901
STEEL	35000	11522
STU	20000	6584
SUGAR	4500	1481
TEXTILE	6500	2140
TYRE	17000	5596
WHITE OILS	667000	0
RUBBER PROCESS OILS	200000	0
TRANSFORMER OIL	500000	164600
TOTAL	**3087000**	**1403292**

Table 10. Segment wise estimated used oil generation

4.3 Re-refiners in India

In India used oil refining is done by Re-refiners in the private sector. These re-refiners need to be registered with MoEF through Central Pollution Control Board (CPCB), based on assessment of required facilities, technical capabilities, and equipment to re-refine the used oils collected and disposal of the hazardous wastes generated. .

As per last survey of CPCB in 2013, there are 257 authorized re-refiners in India, licensed by CBCB/ SPCB, with combined capacity of 1.5 MMTPA of re-refined oil. These re-refiners are distributed across 124 districts spread over 19 states. Seven re-refiners have capacity between 10,000 to 20,000 MTPA. Capacity of most re-refiners vary between 360 to 10,000 MTPA. Therefore, India has adequate re-refining capacity to achieve circular economy in used oil.

A survey of recyclers was conducted where feedback was sought on various points as per questionnaire. (Recycler survey is enclosed as Annexure 9). Used oil is mainly sourced from auto service stations & independent garages. Also, different industries, transport undertakings, mines, defense forces, power generating plants etc act as source of used oils through traders. Non-availability of used oil as per capacity installed is a major concern for all recyclers. As a result, most of the units are running below 30% of installed capacity in India.

Aspects affecting commercial viability include capital and operating costs in addition to the amount and quality of products to be made by a re-refiner were also analyzed. Due to low supply and higher cost of collection, the recycled oil costs are typically higher than the corresponding virgin base oils by 8-10%. To improve the viability for the re-refiners and have lower cost of procurement of used oils, implementation of an effective collection system is necessary along with legislative measures.

The used oil recycling industry in India is not a structured one compared to most developed countries although there is a good potential available. The primary market of lubricants consists of institutional buyers like industries, mines, power plants etc. The secondary market consists of independent garages and OEM workshops. The collection of used oil from the primary market is easier because of their organized structure, however, collection from the secondary market is difficult, though having high potential, due to the following issues:

4.3.1 Unorganized Nature of Collection –The handling of used oil, especially in the retail market, is informal and unstructured. Most of the used oil is burned as industrial fuel or is used in adulterated lubes or fuels.

4.3.2 No use of proper documentation of sales and procurement of used and finished base oils. Due to tax implications many transactions are not recorded on paper.

Diagram 21. Typical Recycling Unit in India

4.4 Collection Centers and Aggregation Points

The key to a successful recycling program for used oil is to implement a robust collection system where used oils from large and small generators can be collected, stored and transported to a recycling/disposal facility. Collection centers should typically accept used oil from multiple sources that include both businesses and individuals. Aggregation points are needed to be set up where larger volumes can be handled. The stake holder responsibility matrix in used oil collection and recycling is described in Diagram 22 below.

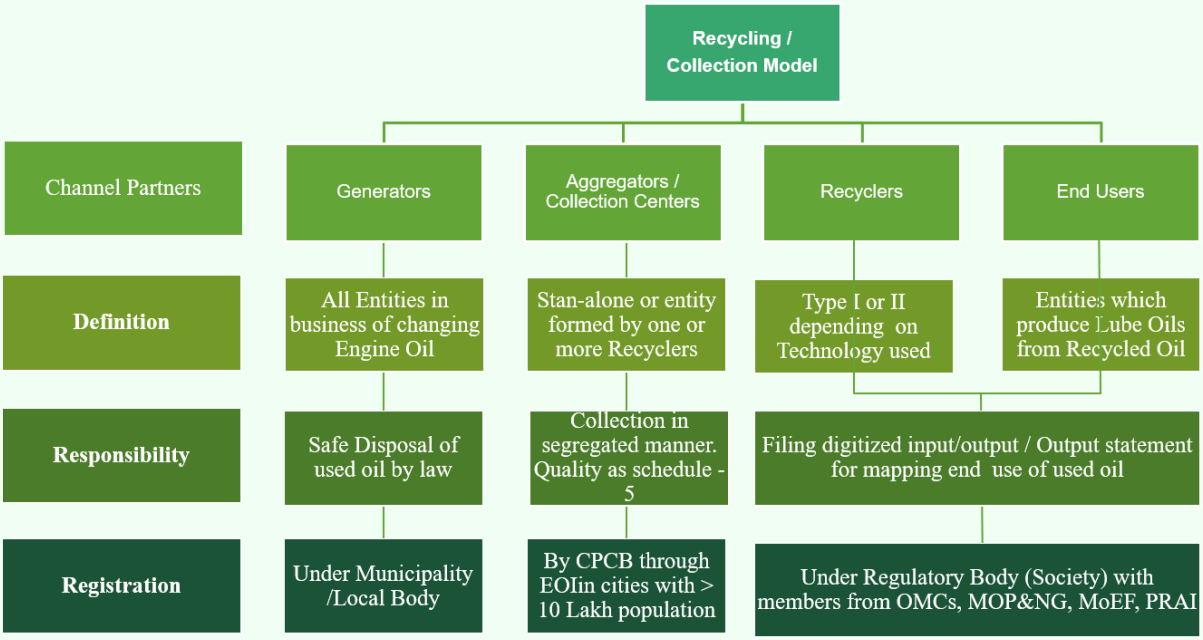

Diagram 22. Stake holder responsibility matrix

4.5 Record Keeping

Used oils are classified hazardous materials. They need to be handled under controlled conditions to ensure human safety and avoid environmental mishaps. In USA the regulatory body called EPA (Environmental Protection Agency) frames laws and policies for environment protection including waste management. They recommend 12-digit identification (ID) numbers to track used oil, which helps in traceability. Transporters hauling used oil must have a valid license and ID number, and generators, collection centers, and aggregation points must use only such transporters for shipping used oil off site. For example, the EPA has specified that generators, collection centers, aggregation points, and any handler that transports used oil in shipments of less than about 210 liters do not need an ID number but may need a state or local permit.

Used oil transporters, processors, burners, and marketers also must record each acceptance and delivery of used oil shipments. Records can take the form of a log, invoice, or other shipping document and must be maintained for a specified amount of time (say for 3 years records)

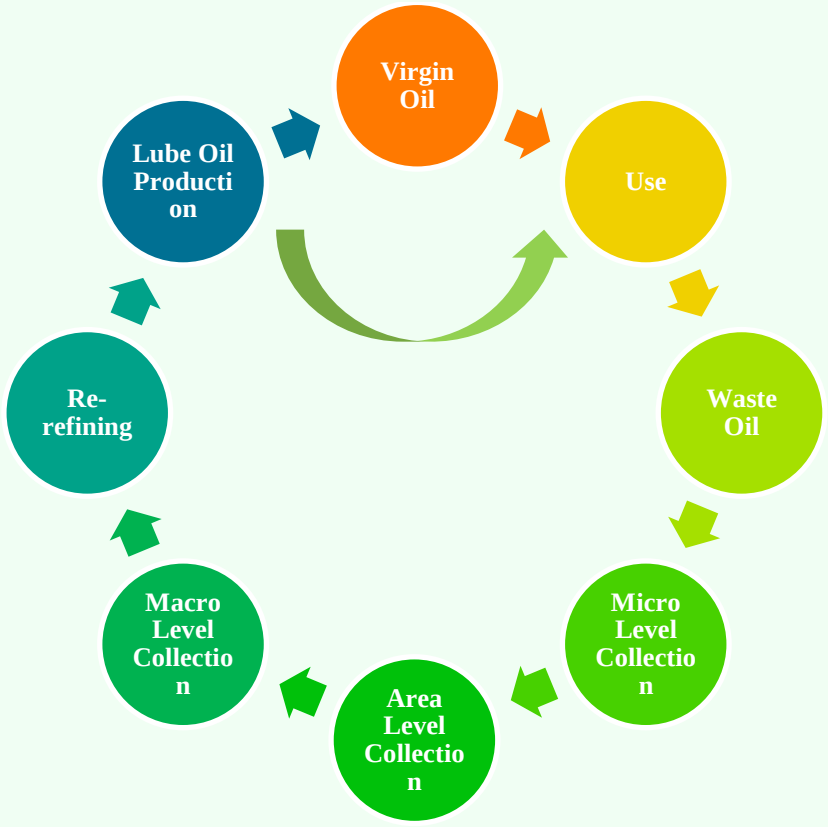

Diagram 23. Used oil cycle

4.6 Recommended Procedures for Collection Centers

Collection centers need to maintain logbooks as one aspect of their tracking mechanism. The centers may require used oil generators to record not only the amount of oil deposited but also identifying information (e.g., name, address) and a signature.

While visual inspection and scanning needs to be done for checking quality of used oil, water contamination etc. Use of a halogen detector to scan incoming oil is suggested to minimize contamination of the collection tank. Staff at these centers should be provided nitrile gloves, chemical splash goggles and other such protective clothing to prevent contact with the skin and the eyes.

When accepting incoming used oil, the centers must use a wire mesh to strain out foreign particles from oil received at the collection tank. The storage tanks must be locked and secured when not being supervised. The collection/storage tanks must be periodically checked and inspected.

4.7 Treatment and Disposal of Residual Hazardous Waste after Recycling of Used Oils

It is the hazardous residues from the process that requires very special attention in handling and disposal. CPCB guidelines are available in India for implementation. However, following issues raised by PRAI on the use of spent clay and bottom residue for value added purposes needs to be looked into.

a) Disposal of spent clay from the re-refining process as value added product.
b) Allowing utilization of bottom residue generated from the re-refining process in cement plants.
c) Review of current HW rules for used oils,

4.8 Involvement of Relevant Stakeholders

To ensure the sustainability of this kind of a project, it is necessary that all the stakeholders associated, whether directly or indirectly, play their part in achieving the objective of circular economy in used oil. The final recommendations will constitute involvement of following major stake holders:

Generators	Collection	Processing	Manufacturing	Perception about used oil	Legal framework and incentives
Industry OEM Garages Independent Garages	Collectors authorized by municipalities and PCBs	Re-refiners Registered by PCBs	Registered lube oil manufacturing companies	All OEMs	Government of India

5.0 Options available for implementing a Circular Economy

Based on the deliberations made during the various meetings held by the committee under the chairmanship of Secretary, MoPNG the following is a synopsis of the options available for moving towards a circular economy. This needs active Involvement of Important stake holders as given below.

5.1 Auto OEMs:

The auto OEMs are having large network of dealerships which is estimated to be about 36000 of authorized service stations where vehicle servicing including oil change is done, thereby making the OEM authorized service stations the largest network of organized used oil collection points. OEMs have a very important role in controlling their network in such a manner that disposal of the used oil collected by their network is accounted for by proper disposal to registered re-refiners.

Lubricants made out of usage of certain % of re-refined base oils need to be promoted by the OEMs. Such communication should be part of the service manuals and warranty agreements with customers of the OEMs. Additionally, OEMs should adopt base oils made in India and certain % of used oils in their formulation for manufacture of their genuine oils as well as their branded oils. Such a provision would be equally applicable to Industrial OEMs as well.

5.2 Institutional Buyers (industries, mines, transport undertakings, railways, defence, etc,):

Institutional buyers of lubricants are organized users. Each of such organized users needs to play its role by ensuring collection of used oil within their premises and then disposal of used oil properly to authorized re-refiners. None of such users should burn used lubricants in their furnaces or kilns.

5.3 Unorganized/ Independent garages:

It is estimated that there are more than 2,48,000 independent garages of different sizes, which regularly change oil in all kinds of vehicles. There is no way to find out what these garages do with the collected used oil. It is necessary to bring visibility into the activities of these independent garages. Such garages need to be made aware about their role in proper disposal of used oil.

5.4 Lubricant Manufacturers:

All lubricant manufacturers need to adopt new formulation of finished lubricants using used re-refined oils in mixture with virgin base oils to push demand for used lubricants for the right applications.

5.5 Pollution Control Board:

The PCBs need to keep a watch on proper collection and disposal of used lubricants by stakeholders mentioned above by making filing of mandatory online returns on collection and disposal of used oils.

5.6 Municipalities:

They have a very important role in ensuring segregated collection points across strategic areas of the municipality and appointing collection agents who would pick up the collected oils for disposal to authorized re-refiners. This practice is prevalent in most European countries and other developed countries.

5.7 Re-refiners:

Re-refiners are going to play the most important part in ensuring supply of re-refined oil as per demands of both quality and quantity. India has sufficient installed capacity for re-refining used lubricants. What we need is efficient utilization of capacity & upgradation of technology required to be looked into by them with the help of PRAI.

In developed countries like USA, there are smaller number of re-refiners who are using expensive hydro-processing techniques with economies of scale which brings down the cost of re-refining. On the contrary in India, most re-refiners are MSMEs who rely on cheaper technologies based on solvent extraction, use of fuller’s earth filtration and acid clay treatment.

Some of the popular global technologies based on vacuum distillation and Hydro processing are explained in the section below. These technologies are patented by major global players and commercialized in various countries across the world. Reputed research institutes like CHT, IIP, Dehradun and IOC R&D should evaluate the technologies in terms of efficacy in cost economics considering smaller size plants in India as well as quality of product output.

5.8 Extended Producer Responsibility:

This may be defined as a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially the take-back, recycling and final disposal of the product. The system is based on the premise that producers are required to provide financial incentive to the collection systems, processing facilities and the recycling industry to collect and process waste in order to meet the targets set out by the Government.

The interpretation of the Plastic Waste Management Rules, 2016 illustrates the primary responsibility for collection of used multi-layered plastic sachet or pouches or packaging is of Producers (manufacturers, importers and users(brand owners)), Importers and Brand Owners who introduce the products in the market. They need to establish a system for collecting back the plastic waste generated due to their products. For the overall implementation of the EPR framework it is important that the producer/ importer/brand owner should be involved in overall implementation of the projects and not only the collection.

On similar lines, EPR for used oil may be implemented by involving lube oil producers to incentivize the collection system, re-refining and residue disposal management through purchase of re-refined base oil of requisite quality at a premium. This will help in disposal of by-products of re-refining and also buy back a percentage of recycled oil from re-refiners for use in blending of finished lubes.

5.9 PCRA

This government body can play an important role in creating awareness through campaigns amongst public and mechanics about oil recycling benefits and along with OEMs can help in promotion of lubricants made from re-refined base oils. This will help to change the perception of used oils in the minds of customers in India from calling it a cheap, non-standard product to a value-added resource conserving option for a better environment and sustainability for the country.

6.0 Recommendations & Action Plan

The quantity of used oils recycled in India today is at a low level of about 15%. To enhance the environmental and economic benefits, and also to reduce the carbon footprint on the ecosystem, this percentage has to be substantially enhanced. After several deliberations the committee has arrived at the following suggested year wise targets to reach a desired level of recycling of 50% within the next 5 years:

Year	Recycling % estimate	Remarks
April 2021	15	Current status
April 2022	20	Target
April 2023	25	Target
April 2024	30	Target
April 2025	40	Target
April 2026	50	Target

A continuing study can be conducted by an institution or agency regarding generation and recycling of used oils in the country. To that effect, formation of an institution/ body consisting of members from MoPNG , MoEF, Niti Aayog, ministry of commerce(DPIIT), OMCs,IIP and leading recyclers may be considered. To promote the concept of Circular Economy and to enhance the quantity of Used Oil recycled, the committee proposes the followings Specific Initiatives targeting various segments for implementation:

6.1 Action Plan for Auto OEMs

1. OEMs to finalize alternate Lubricant specification of their plant fill lubricants and aftermarket genuine oils with at least 25% of recycled base oils. Target date August 2022
2. OEMs to start procurement of their plant fill lubricants and aftermarket genuine oils from manufacturers where minimum 25% of recycled base oils have been used. Target date August 2022
3. Necessary recommendations to customers of use of recycled lubricants in their vehicles, needs to be updated in user manuals of the vehicles sold. This will help to bolster the confidence of the owners and improve customer perception on used oils and sustainability. Target September 2022

4. OEMs to implement the system of mandatory retrieval of minimum 75% of drained used oils in their Authorised Service Stations and ensure disposal of such used oils by the Service stations only to registered re-refiners. Monitoring of this activity to be done by the OEMs through a digital tracking system. Target date – December 2021.

6.2 Action Plan for Independent Garages

Enforcement of the provisions of Hazardous Waste Rules 2016 on all garages by PCBs.

Mandatory disposal of used oil by Independent garages to registered re-refiners and filing of returns with SPCB. The garages need to have a timebound target for enhancing collection and disposal as suggested below. The collection of generated used lubricants to be brought to the level of 75% in line with OEM workshops within the next 5 years:

Year	Collection of used oils %	Remarks
April 2021	15	Current status
April 2022	25	Target
April 2023	35	Target
April 2024	50	Target
April 2025	65	Target
April 2026	75	Target

Monitoring of this activity to be done by the SPCB by a system of monthly returns.

6.3 Action Plan for Industrial Units and Institutional Users/Generators

Enforcement of provisions of Hazardous Waste Rules 2016. Mandatory disposal of used oil by industrial units to registered re-refiners and filing of returns with SPCB.

The industries and institutional users need to have a timebound target for improving collection and disposal as suggested below. The collection of generated used lubricants needs to be increased to 40% level within the next 5 years (exceptions for industries using rubber process oils, white oils, process oils):

Year	Collection of used oils %	Remarks
April 2021	10	Current status
April 2022	15	Target
April 2023	20	Target
April 2024	25	Target
April 2025	30	Target
April 2026	40	Target

Monitoring of this activity to be done by the SPCB by a system of periodic returns.

6.4 Action Plan for Lubricant Manufacturers

Lubricant Manufacturers need to freeze specifications of recycled base oils and identify grades with formulations using minimum 25 % recycled base oils for sales to the market. This will be the first step towards implementation of EPR. Subsequently, subject to meeting quality requirements of finished lubricants for different types of applications, the lube manufacturers can consider increasing this percentage to a higher level. They should initiate discussions with Auto OEMs for approval for the identified grades for use by customers in their vehicles. Lubricant manufacturers will have to start marketing finished lubricants manufactured with at least 25% re-refined oil by December 2021.

6.5 Role of Municipalities/ Local Bodies

Municipalities and Local Bodies to set up large number of collection centres for collection of used oils in their jurisdictional area. This will enable small units and garages to dispose of used oils as prescribed. The used oils so collected can be auctioned/sold to the authorised re-refiners.

Target date September 2022

Action by Municipalities/Local Bodies

6.6 Action Plan for Technology Shift for Higher Process Efficiency

There is a need for re-refiners to adopt a shift in Technology for higher process efficiency. In India most recyclers use standard distillation processes or acid clay treatment in many cases. Most of the units are not energy efficient and generate hazardous waste. There is a need for upgradation in technology in line with advanced countries like Europe and US.

In the coming years, Indian re-refiners need to upgrade the technology as practised in developed nations.

The available technologies need to be studied with help of research institutes like CHT, IIP Dehradun and IOC R&D for identification of suitable technology that can be adopted by the Re-refiners in India. Techno-commercial feasibility studies need to be conducted by PRAI with concerted efforts of industry members for successful implementation in a time bound manner. Study on cheaper technologies available may be conducted by the research institutions for suggesting to PRAI which can be implemented by the smaller MSME re-refiners.

It is also suggested to develop co-processing facilities near major oil refineries which are in closer proximity to large collection centres near industrial hubs.

Following Incentives are suggested for Recyclers who upgrade technology:

1. Through suitable/tax benefits or subsidy on Investments made in technology.
2. Preferential Treatment / Empanelment by lube manufacturers for procurement of quality base oils (Group II & III) from Re-refiners. Policy on preferential treatment by Oil PSUs to such units to be issued by MoPNG.
3. Government may look into providing capital subsidy to those re-refiners who will adopt more advanced technologies for their operations.

Target date for feasibility report by August 2022. Target for implementation of recommended advanced technologies by all registered re-refiners by 2028.

6.7 Action Plan for CPCB

1. The following issues raised by PRAI needs quick resolution by CPCB – Target date: October'21
   a) Disposal of spent clay from the re-refining process as value added product.

b) Allowing utilization of bottom residue generated from the re-refining process in cement plants. PRAI is awaiting final report from CRRI (Central Road Research Institute) on usage of the bottom residue generated from re-refining for road construction along with Bitumen. CPCB may consider the same suitably.

c) Review of current HW rules for used oils, and developing a system for monitoring adherence to the provisions of the Rules.

2. It is suggested to implement a system of awarding a Green Tag certification to units complying with the provisions of the laws mandated by CPCB. A rating system with multiple criteria can be formulated to determine the qualifiers. Implementation of such a system by PCBs will help increase awareness on the subject and helps to promote the cause of Circular Economy. A suitable Logo which winning units can display to be developed.
   Target Date : December,2022

6.8 Taxation Provisions

Due to high cost of procurement of used oils and shortage of the right quality of used oils, cost of re-refined oil is high for re-refiners in India. The price of recycled base oils sold by re-refiners is at least 10 % higher than virgin base oils. Hence, it is suggested that Re-refiners need to have a lower GST of 5 % on purchase of used oils from the current GST of 18 % and also similar 5% GST for sales of re-refined base oils against the current rate of 18%.

To motivate Lube manufacturers to use recycled base oils in their lubricant formulations, it is suggested that a lower GST of 5% may be charged for Finished lubricant sales (blended with at least 25% re-refined base oils) in place of current rate of 18%.

This will boost consumer demand and increase sales of lube oils blended with recycled base oils.

Target date December 2021

Action by MoPNG.

6.9 Change in Legislative framework for stakeholders

Act applicable	Rule implication	Stakeholder applicable	Suggested change in provision
Hazardous Waste management Rules 2016 Rule 4(3)	The hazardous & other wastes generated in the establishment of an occupier shall be sent or sold to an authorized actual user or shall be disposed of in an authorized disposal facility.	Occupier of establishment which implies the factories where used oils are generated	Independent garages, OEM workshops and Individual users of lubricants (those who change oil in their own 2 wheeler/car/ generator) or other oils- Need to be brought under the purview, with necessary penal provisions.
Hazardous Waste Management Rules 2016 Rule 4(3)	The hazardous & other wastes generated in the establishment of an occupier shall be sent or sold to an authorized actual user or shall be disposed of in an authorized disposal facility.	Occupier of establishment which implies the factories where used oils are generated	Specific provision required which will ban unauthorized burning, draining which causes soil and water pollution. Strict implementation of disposal of used oil from the premises of factories to be implemented within stipulated time period of 90 days as per the existing rules.

Hazardous waste management Rules 2016 **Rule 6(8)**	Handing over of the hazardous & other wastes to the authorized actual user shall be only after making entry into the passbook of the actual user.	Passbook is a manual system physically done. Passbook was introduced by CPCB to check trading in HW by unscrupulous recyclers. This is now under purview of SPCB.	System of electronic passbook is suggested to replace manual system to have greater transparency and compliance. Filing of returns for used oils also can be integrated in this electronic system.
Lubricating oil and Greases Control Order 1987	Control of Processing, manufacturing, packaging, selling, re-refining under Essential Commodities act	This is applicable to Lube manufacturers and re-refiners	Should continue for re-refiners. This may be brought under other acts as EC is not relevant for Lubricants today.

Target date -December 2021

Action by MoPNG, CPCB and SPCBs

In the legal framework provisions proposed, there is a need to have monitoring and penal provisions also. Necessary inclusions may be suitably made in the law at the time of drafting the same.

Summary of Annexures

1. Niti Aayog OM dated 04.03.2021
2. Niti Aayog OM dt. 30.03.2021
3. Note by OMCs on used oil reprocessing
4. Note by OMCs on used oil reprocessing dated 17.03.2021
5. ATN- Presentation of reprocessing of used lubricants dated 09.04.2021
6. MOM of meeting held on 09.04.2021 on “Used oil Recycling” under the chairmanship of Secretary MoPNG
7. MOM of meeting held on 20.04.2021 on “Used oil Recycling” under the chairmanship of Secretary MoPNG
8. Constitution of Committee formation on circular economy on used oil by MoPNG
9. Recyclers survey on used oil by OMCs -April 2021
10. ATR of meeting on used oils held on 20.04.2021
11. MOM of meeting held on 15.06.2021 on “Used oil Recycling” under the chairmanship of Secretary MoPNG
12. Guidelines issued by Member Secretary to MoEF on usage of spent clay and process residue obtained from recycling of used oil
13. PRAI representations –Letter of correspondence with CPCB on Disposal of spent clay and process residue
14. PRAI representations –Letter of correspondence with CPCB on restraining the coprocessing of used oil and waste oil as alternative fuel in cement, power, and steel industry.

Annexure 1

Niti Aayog OM dated 04.03.2021

F. No 13(26)/2021-I&M(I)
Government of India
NITI Aayog

Sansad Marg, New Delhi
4th March, 2021

OFFICE MEMORANDUM

Subject: Constitution of Committee for Circular Economy in Used Oil Waste

The world is increasingly becoming conscious to the pattern and efficiency of resource utilization. The convergence of different disciplines- industrial ecology, environmental sustainability, sustainable production and consumption, end of life management of products – have evolved to an overarching vision of Circular Economy. The new paradigm emphasizes the need for taking a comprehensive view on products and processes to achieve minimization of resource use, increasing useful life of products, recovery of embodied resource at the end of used products, and thereby aims to reduce the footprint of economic activities as well. The turf of completion is also changing around these issues. Our production systems have to quickly adopt systems and practices around the principles of circular economy so that they don't only reduce the resource dependency but gain competitiveness also.

2. Within circular economy, a shift from the conventional recycling techniques of incineration and landfilling by transforming End of Life (EoL) products, scraps and waste into useful raw materials to be fed back to the economy is happening. The material recycling is one of the building block of resource efficient circular economy. The recyclable materials are resources. They have critical role in economy and sustainable development.

3. Eleven EoL products/recyclable materials/wastes that either continue to pose considerable challenge or are emerging as new challenge areas need to be addressed in a holistic manner. A brief note on the identified eleven EoL products/recyclable materials/wastes is attached. To deal these products/recyclable material/wastes in circular economy framework is the way forward.

4. Circular Economy in Used Oil Waste is one such area that require a comprehensive action plan. Accordingly, a Committee under the chairmanship of Secretary, or nominated Special Secretary/Addl. Secretary by Secretary, Ministry of Petroleum & Natural Gas for preparation of action plan for transformal change in this domain has been constituted.

5. The terms of reference and a tentative composition of the Committee are given in Annexure-I and Annexure-II respectively. The secretarial assistance to the Committee will be provided by the nodal Ministry/ Department. The final comprehensive action plan shall be prepared within 45 days from the constitution of the committee.

6. The Committee may co-opt outside experts and institutions for assistance and advice.

7. This issues with the approval of Vice Chairman, NITI Aayog.

Sudhir Kumar

(Sudhir Kumar)
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Circular Economy)
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Sh. Tarun Kapoor
Secretary
Ministry of Petroleum and Natural Gas
A Wing, Shastri Bhawan
New Delhi

E-File

Annexure-I

F. No. 13(26)/2021-I&M(I)

NITI Aayog

Constitution of Committee for Circular Economy in Used Oil Waste

Terms of Reference:

i. The committee shall work towards producing a comprehensive action plan for implementation of circular economy in the area for which it has been constituted.

ii. The action plan produced must be thorough and comprehensive and should clearly list out the actions, the stakeholders which are required to take action as well as the timelines which are necessary for achieving the aim of transitioning from a linear to a circular economy in the particular area.

iii. The action plan must also build on previous studies undertaken and previous reports published. The findings of such reports, studies and action plans must be studied in depth and the status of the findings and recommendations must be brought out in the report which shall be submitted.

iv. For the purposes of producing this report, the committee shall strive to carry out extensive stakeholder consultations with the public and private sector, academia, think tanks, ministries, departments of central and state government, ULBs and all other relevant stakeholders (as necessary).

v. Global as well as domestic experiences and best practices must be brought out in this report along with how these can be practiced / implemented in India.

vi. The Chair of the committee shall nominate domain experts as well as industry representatives as Members of the sub-committee.

vii. Further, the Chair may co-opt any other experts / individuals as members of this committee to aid the functioning.

viii. Each committee shall have one representative from the Ministry of Environment, Forests and Climate Change (MoEF&CC) so as to bring synergies between the functioning of each committee and MoEF&CC. The representative shall be nominated by Secretary, MoEF&CC.

ix. The committee shall meet periodically to review the progress made.

x. The committees shall interact with each other to ensure that synergies are drawn between the action plans which are evolved for various focus areas.

xi. The final comprehensive action plan shall be prepared within 45 days from the constitution of the committee.

xii. Post the submission of the report, the committee shall carry out modalities necessary to ensure the effective implementation of the findings and recommendations.

F. No. 13(26)/2021-I&M(I)

NITI Aayog

Annexure-II

Constitution of Committee for Circular Economy in Used Oil Waste

Composition:

1.	Secretary, Ministry of Petroleum & Natural Gas, or nominated Special Secretary/Addl. Secretary by Secretary
2.	Representative of MoEF&CC (not below the rank of JS)
3.	Rajnath Ram, Adviser(Power & Energy), NITI Aayog
4.	Prabhjot Sodhi, Head, Circular Economy, UNDP India
5.	Pierroberto Folgiero, CEO, NextChem
6.	Vidya Amarnath, Founder and Director, Paterson Energy
7.	Satish Kumar, Director, Needa Green Energy Limited (NGEL)
8.	CS Sharma, Faculty, IIT Hyderabad and Founder, Restero Technologies
9.	Any other official, industry representative, subject matter expert, academic or any other member to aid the functioning of the committee, as nominated by the Chair

Annexure 2

Niti Aayog OM dt. 30.03.2021

F. No 13(26)/2021-I&M(I)
Government of India
NITI Aayog

Sansad Marg, New Delhi
30th March, 2021

OFFICE MEMORANDUM

Subject: Constitution of Committee on Circular Economy in 11 Areas – development of Action Plan- review meeting on 5th April, 2021 at 2.30 PM by CEO, NITI Aayog

Kindly refer NITI Aayog OM No. 13(26)/2021- I&M (I) dt. 4.3.2021 (copy attached) whereby the NITI Aayog constituted Committees on Circular Economy for 11 End of Life Products/ recyclable materials/ wastes under the chairmanship of respective nodal Ministry/Department Secretary, or Special Secretary/ Additional Secretary nominated by Secretary. While constituting the Committees, it was envisaged that the comprehensive action plan for the promotion of Circular Economy shall be prepared within 45 days from the constitution of the Committees.

2. The list of eleven focus areas, the respective nodal Ministries/ Departments and Chairs is enclosed (Annexure-I) for ready reference. A Sr. Adviser/Adviser level officer from NITI Aayog and a Joint Secretary level officer from Ministry of Environment and Forest and Climate Change have been included in all the eleven Committees.

3. NITI Aayog vide email dt. 9.3.2021 from Dr. K. Rajeswara Rao, Additional Secretary, NITI Aayog requested Secretaries of the nodal Ministries/ Departments for convening of the first meeting of the Committee and to provide details of the nodal officer. The Chairs of four Committees (Municipal Solid and Liquid Waste, Lithium Ion Batteries, Toxic and Hazardous Industrial Waste, and Tyre and Rubber Recycling Industry) have already convened the first meeting. The meeting of Committee for Circular Economy in Gypsum is scheduled on 31.3.2021. The Chairs of the following six Committees are requested to convene the first meeting on priority:

   i. Circular Economy for End-of-life Vehicles - Ministry of Road Transport and Highways
   ii. Circular Economy in Scrap Metal (ferrous and non-ferrous) –Ministry of Steel
   iii. Circular Economy in Electronic Waste - Ministry of Electronics and Information Technology
   iv. Circular Economy in Solar panel waste- Ministry of New and Renewable Energy
   v. Circular Economy in Used Oil Waste - Ministry of Petroleum & Natural Gas
   vi. Circular Economy in Agriculture Waste- Ministry of Agriculture and Farmers Welfare

4. A meeting with Chairs of the Committees to have feedback and review, under the chairmanship of CEO, NITI Aayog and Secretary, MOEF&CC has been convened on 5th April, 2021 at 2.30 PM. The web meeting link is as follows:

   https://aim.webex.com/aim/j.php?MTID=mcbd4ec71cacc209b095c7a0a5a20f34f

   Meeting number: 184 891 7940

   Password: ghNhPm6AZ28

5. The Chairpersons of the Committees are requested to make it convenient to attend the scheduled meeting on 5th April, 2021 at 2.30 PM.

Sudhir Kumar

(Sudhir Kumar)
Adviser (Industry & Circular Economy)
Ph: 011-23096741
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Chairpersons of the Committees on Circular Economy

(as per list attached)

Annexure-I

NITI Aayog

(Industry Vertical)

Constitution of Committee on Circular Economy in 11 Areas and respective Ministries/ Departments vide NITI Aayog OM dt. 4.3.2021

	List Chairpersons	Focus Area	Nodal Ministry/ Department
1.	Sh. Kamran Rizvi Additional Secretary Ministry of Housing and Urban Affairs asd-mhua@nic.in	Committee on Circular Economy in Municipal Solid and Liquid Waste	Ministry of Housing and Urban Affairs
2.	Secretary Ministry of Steel Secy-steel@nic.in Ruchika.govil@nic.in	Committee for Circular Economy in Scrap Metal (ferrous and non-ferrous)	Ministry of Steel
3.	Secretary Ministry of Electronics and Information Technology secretary@meity.gov.in akumar@meity.gov.in	Committee for Circular Economy in Electronic Waste	Ministry of Electronics and Information Technology
4.	Dr. K. Rajeswara Rao Additional Secretary NITI Aayog asrao.niti@gov.in	Committee for Circular Economy in Lithium Ion Batteries	NITI Aayog
5.	Secretary Ministry of New and Renewable Energy secy-mnre@nic.in	Committee for Circular Economy in Solar panel waste	Ministry of New and Renewable Energy
6.	Shri Anil Agrawal, Joint Secretary Department for Promotion of Industry and Internal Trade Agrawal.anil@gov.in	Committee for Circular Economy in Gypsum	Department for Promotion of Industry and Internal Trade
7.	Shri Samir Kumar Biswas Additional Secretary Department of Chemicals and Petrochemicals Samir.biswas@gov.in	Committee for Circular Economy in Toxic and Hazardous Industrial Waste	Department of Chemicals and Petrochemicals
8.	Secretary Ministry of Petroleum & Natural Gas Sec.png@nic.in	Committee for Circular Economy in Used Oil Waste	Ministry of Petroleum & Natural Gas
9.	Dr. Alka Bhargava Addl. Secretary Ministry of Agriculture and Farmers Welfare Alka.b87@gov.in	Committee for Circular Economy in Agriculture Waste	Ministry of Agriculture and Farmers Welfare

10.	Sh. Ravi Agarwal, Additional Secretary Ministry of Environment and Forest and Climate Change Ravi.agrawal@nic.in	Committee for Circular Economy in Tyre and Rubber Recycling Industry	MOEF& CC
11.	Secretary Ministry of Road Transport and Highways Secy-road@nic.in	Committee for Circular Economy for End-of-life Vehicles	Ministry of Road Transport and Highways

Annexure 3

Note by OMCs on used oil reprocessing

Areas of Focus: Used Oil Recycling (used automotive Oil and Industrial Oil – from machine tools & automotive):

OMC are ready to evaluate & consider use of re-refined base oil in the larger interest of circular economy of this country as mentioned the mail from MOP&NG on "NITI AAYOG- AATMA NIRBHAR BHARAT ABHIYAAN" initiative.

As the quality and consistency of re-refined base oil has been changing constantly. it is important to evaluate latest samples from re-refiners to establish its conformity with the required specification. After the testing of re-refined base oil samples in OMC R&D labs, OMC can establish its suitability for formulations of targeted grades according to the specifications in a joint meeting of OMCs.

Due to COVID-19, most of the used oil re-cyclers are operating their units at very low capacity and base oil market is also fluctuating resulting delay in process. Collection of re-refined base oils are in process for testing at OMC R&D Centers. The properties of re-refined base oil shall be finalized jointly by OMCs as per test reports.

Based on test report of base oils, OMC may establish its suitability for lubricant product and issue formulation of targeted product for trial introduction.

Annexure 4

Note by OMCs on used oil reprocessing dated 17.03.2021

As per last survey CPCB of 2013, 257 authorized recyclers, licensed by CBCB/ SBCB, with combined capacity of 1674139 KLPA. (equal number of unauthorized collector/ recyclers, with unknown capacity) .

Collection at present is just about 20%, therefore attempts are required to collect at least 50% of the recyclable lube oils. Generation of used oil is estimated to be about 20% of total lube oil consumption in all sectors except in OEM after market where it is about 80%. Out of this 50% is recoverable as per last CPCB report.

Environment protection bodies across the globe have formulated strict regulations to control the disposal of used oil

A refinery needs to process 100 litres of crude oil to produce one litre of base oil. On the other hand, only 1.4 litre of used oil is sufficient to manufacture one litre of base oil. This makes recycling of used oil a fairly viable process for base oil manufacturing. France collects 78% of used oil and 42% is reprocessed by Govt directed re-refiners associations. In Germany, 48% of total lubes sold are recovered, 41% of used oil re-refined. In Canada, 51% of total lubes sold is recollected & re-refined.

OMC level meeting with the Used Oil refiners to seeking specs/samples of re-refined used oil

These samples to be tested at the R&D of the 3 OMCs for analysis and preparing specs

The working group to study the model operating in other developed economies where use of Re-refined oil is established and well accepted by society. Public relation exercise to be developed to improve public opinion

Issues:

As per Govt. mandate is to use 25% recycled base oil by 2023 and oil PSUs are working on this. But legislations are required for implementing Govt mandate.

The major issues are:

1) Unstructured, uneconomic collection system.
2) Non-availability of used oil leading to unutilised re-processing capacity
3) Absence of structure to map user responsibility

4) Quality of re-refined oil

Interventions Required:

Organized Sector:

- All Industrial Houses, STUs, Railways, Defence, electricity boards, users of lubricating oils to stop burning the used oil in furnaces and to dispose of used lubricants only to authorized re-refiners. A return to be filed to PCBs stating quantity generated and disposed off (including name of party to whom disposed off).

- All OEMs having service station network and doing oil changes are to collect the used oil and dispose off only to registered refiners. They will also need to file return with the PCB stating quantity and name of re-refiners.

Non-Organised: All non-OEM auto garages to be brought under purview of PCBs. They will have to dispose off used lubricants only to registered re-refiners and submit returns to the PCBs. The GST on recycled base oil is currently 18% , Ministry may kindly consider to reduce it to 5% to improve viability .

Lubricant Manufacturers : Recycled Oil to be purchased by Lubricant manufacturers for use in manufacture of certain finished Lubricants.

Annexure 5

ATN- Presentation on reprocessing of used lubricants dated 09.04.2021

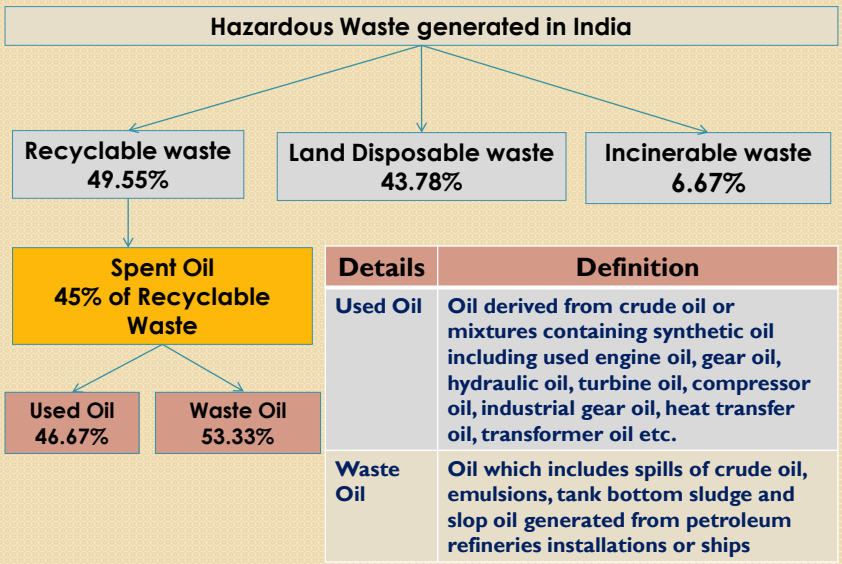
Annexure - 5

REPROCESSING OF USED LUBRICANTS

ATN -Way Forward

April 2021

HAZARDOUS WASTE GENERATION



Details	Definition
Used Oil	Oil derived from crude oil or mixtures containing synthetic oil including used engine oil, gear oil, hydraulic oil, turbine oil, compressor oil, industrial gear oil, heat transfer oil, transformer oil etc.
Waste Oil	Oil which includes spills of crude oil, emulsions, tank bottom sludge and slop oil generated from petroleum refineries installations or ships

Based on last CPCB Report

RE-REFINING OF USED BASE OIL

- MoEF, has categorized used lubricating oil as hazardous product and to be handled/disposed off as per HW Rules.
- As per last survey CPCB of 2013
  - 257 authorized recyclers, licensed by CBCB/ SBCB, with combined capacity of 1674139 KLPA.
    (equal number of unauthorized collector/ recyclers, with unknown capacity) .
    There are 36165 industries generating 62,32,507 MTs of Hazardous Waste every year
  - 7 having capacity between 10,000 to 20,000 KLPA
  - None with large capacity of more than 20,000 KLPA
  - Mostly having small capacity of 360 to 10,000 KLPA
  - Distributed across 124 districts spread over 19 states.

Capacity Utilization: Re-refiners

- **Capacity Utilisation**: 15 to 20% capacity.
- **Manpower:** 12 to 15 persons. Few plant have 40 to 60 people.
- **Investment on Plant and Machinery:** average Rs 2 -3 crore with investment of Rs 7- 8 crore in some cases (excluding land).
- **Annual turnover:** Rs 2 -12 crore
- **Type of Used Oil**:-Industrial and automotive with no segregation.
- **Collection Mechanism**: Garages/ kabadi walas /service centres etc. are though bazar trade and from big corporates through tenders. In bazar trade part of it goes as burning depending on the demand.
- **Base Oil Average Yield:** ~ 70%
- **Cost of Reprocessing:** Rs 8 - 9 per litre (in some cases Rs 3 - 4 per litre, where simple filtration employed)
- **Margin for re-refiner (Rs per litre)**: Used oil purchase rates tend to vary with base oil prices as well as with LDO price.

Economics of used oil: 2018

	Rs/ Litre	Remarks
Used oil procurement cost	24	varies with base oil prices as well as with Fuel Oil price – during May–Aug17 varying from 18 to 24
GST @ 18%	4.32	
Used oil procurement cost	28.32	
Cost of reprocessing (incl ~ 7 % yield loss)	8	Residue disposal cost included
Cost of re-refined oil Ex Re-refiner	36.32	
Re-refiner margin, say 15% of variable cost	5.50	This needs to be adjusted to compete VBO & FO price
Price of re-refined BO Ex Re-refiner	41.82	
GST on re-refined BO @ 18%	7.53	
GST Credit (-)	4.32	
Re-refined BO selling price	45.03	
Virgin base oil price	36-42	Depends on International prices
Fuel oil price (LDO type)	40-46	Market dynamics

ISSUES IN RECYLCING IN INDIA
COLLECTION SYSTEM

- Collection of used oil is the starting point for successful re-refining, which depends on collection effectiveness - used oil availability, and Composition of used oil – Quality.
- Collection at present is just about 20%, therefore attempts are required to collect at least 50% of the recyclable lube oils .
- Generation of used oil is estimated to be about 20% of total lube oil consumption in all sectors except in OEM after market where it is about 80%. Out of this 50% is recoverable as per last CPCB report.
- Details of sector wise recyclability is given in subsequent slide.

INTERNATIONAL PRACTICES IN USED OIL MANAGEMENT

- Countries all over the world including United States, UK, France, Italy, Canada, South Africa, Israel, Australia and New Zealand etc. re-refine used oils into lubricating oil base stocks. New Zealand is a country who are using recycled base oils since last 50 years.

- Regulations/Rules to handle and process used oil(s) exist in each of these countries. In India , we need to make regulations for the same.

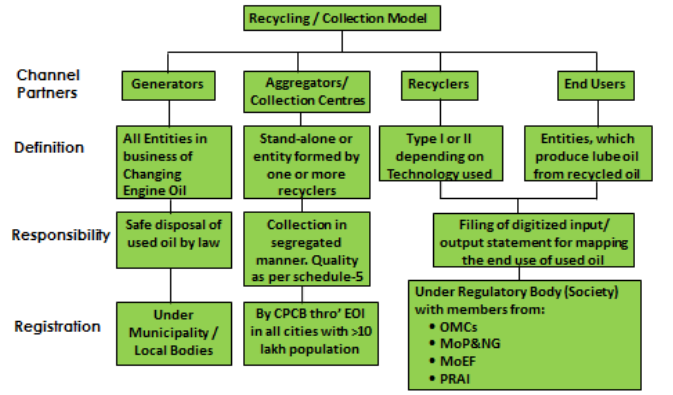
USED OIL MANAGEMENT: INTERNATIONAL PRACTICE

Country	Features of Used Oil Management
Australia	• High subsidies for re-refining • Low subsidies for low grade burning oil • None for reclaimed industrial oils • 38% of total lube sold collected • Organizations are there for collection from spots
Germany	• 48% of total lubes sold are recovered • 41% of used oil re-refined • 35% burnt in cement kilns
Japan	• No national level program of recycling • High %age of used motor oil recovered, treated and burnt for heating value • Limited re-refining

USED OIL MANAGEMENT: INTERNATIONAL PRACTICE

Country	Features of Used Oil Management
• Italy	• Mandated use of re-refined oils in motor oils • 6 operating re-refining plants • Collectors & Re-refiners both subsidized • Tax advantage granted only if used oil for re-refining collected from Italy
• Canada	• Focus on increasing collection • 51% of total lubes sold collected
• USA	• Implemented broad range of recycling programs • Subsidised collections • Discourage illegal dumping of used oil • Disposition of used oil as a fuel encouraged
France	• 78% collection of used oil • Government funded programs • Fees imposed on virgin lube producers • 42% of used oil is re-refined by Govt directed re-refining associations

Recycling / Collection Model



Separate sub-rules may be made for mandatory re-refining of used oils under Hazardous Waste Rules.
Norms to be developed for Collection Centres including conduct of business, facility design and area jurisdiction.

USED OIL MANAGEMENT: INTERNATIONAL PRACTICE

Country	Features of Used Oil Management
• Italy	• Mandated use of re-refined oils in motor oils • 6 operating re-refining plants • Collectors & Re-refiners both subsidized • Tax advantage granted only if used oil for re-refining collected from Italy
• Canada	• Focus on increasing collection • 51% of total lubes sold collected
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France	• 78% collection of used oil • Government funded programs • Fees imposed on virgin lube producers • 42% of used oil is re-refined by Govt directed re-refining associations

PROPOSED INITIATIVES

1. Auto OEMs : Huge network of service stations and collection of used oil. OEMs to ensure sale of the used oil only to registered re-refiners. Return to be filed with PCB with all details to PCB.
2. All industrial buyers/STUs/Railway/Defence/ Fleet Operators to collect used oil and sale only to registered re-refiners. No burning of used lubricant to be allowed. They may be allowed to get used oil re-refined for lesser applications. Return to be filed with all details to PCB.
3. Lubricant manufacturers to ensure use of re-refined base oil to create demand. Road map to be prepared by all registered Lubricant manufacturers.
4. Quality of re-refined oil being major issue in increasing its usage, OMC's to finalise minimum specifications and test facilities at the end of re-refiners.
5. Civic authority operated/appointed collection aggregators to boost collection.
6. Awareness campaign may be conducted by PCRA to educate user regarding adverse impact of careless disposal of used lubricant.

Annexure 6

MOM of meeting held on 09.04.2021 on "Used oil Recycling" under the chairmanship of Secretary MoPNG

1. A meeting was held through video-conferencing on 09.04.2021 at 1615 hrs. under the chairmanship of Secretary, MoPNG on "Used Oil Recycling". List of participants is annexed.
2. Dr. Navneet Mohan Kothari, JS(M), MoPNG gave a briefing about the general scenario on generation and disposal of used lubricants in India vis-à-vis the practices followed internationally in countries like France, Germany, Canada, Australia, Italy.
3. Shri Tarun Kapoor, Secretary, MoPNG advised Shri Subimal Mondal, ED(Lubes) IOCL to make a presentation on the preliminary work done by the OMCs about the entire aspect of used oil generation and current practices.
4. Shri Subimal Mondal, ED(Lubes) IOCL made a detailed presentation (copy enclosed) covering the following aspects:
    a. Estimated generation of used lubricants from different sectors of the economy.
    b. Current re-refining capacity of registered re-refiners, their cost-economics and present usage of re-refined lubricants.
    c. Issues faced relating to collection of used oil, quality aspects of re-refined oil, low-end usage of re-refined oil.
    d. Practices followed in countries like Australia, Germany, Japan, Italy, Canada, USA and France. Details of how Australia has adopted incentivization of re- cyclers through Product Stewardship (Oil) Act 2000 were also shared.
    e. Some suggestions were made regarding bringing responsibility of proper disposal of used lubricants through registered re-refiners by all generators of used lubricants, like OEM service Stations, Independent garages, and Industries to improve availability of used oil into the re-cycling system.
    f. Use of recycled oil as input to certain finished lubricants by lube manufactures with proper quality control to improve demand and quality of recycled oil.
5. Secretary, MoP&NG advised the following:
    a. OMCs to conduct a survey among re-refiners (covering large scale as well as smaller recyclers) covering aspects like problems faced by them, prices, taxation, collection issues, technical issues, viable products that can be manufactured out of recycled oil etc.

b. Members from OEMs like Maruti Suzuki, Tata Motors, Re-refiners and Industry to be co-opted into the committee formed by NITI Ayog.

Meeting ended with vote of thanks to the chair.

List of participants in the Meeting held on 09.04.2021 on “Used Oil

1. Dr. Navneet Mohan Kothari, Joint Secretary (Marketing), MoPNG
2. Shri Deepak Srivastava, Deputy Secretary (Marketing), MoPNG
3. Shri Rakesh Misri, Director (Marketing), HPCL
4. Shri Arun Kumar Singh, Director (Marketing), BPCL
5. Shri Subimal Mondal, ED(Lubes), IOCL
6. Shri Rajesh Nambiar, CGM (Technical Services), IOCL
7. Shri Debashis Ganguly, CGM, BPCL
8. Shri N.K. Jha, GM (Technical Services), BPCL
9. Shri Vishal Bajpai, GM (Technical Services), HPCL

Annexure 7

MOM of meeting held on 20.04.2021 on "Used oil Recycling" under the chairmanship of Secretary MoPNG

1. A meeting was held through video-conferencing on 20.04.2021 at 1730 hrs under the chairmanship of Secretary, MoPNG on "Used Oil Recycling". List of participants is annexed.
2. Shri Tarun Kapoor, Secretary, MoPNG advised that a comprehensive action plan is required for moving from a linear to circular economy in respect of used oil. He flagged the following as 3 main issues:
    a. The viability of cost of collection and processing of used oil needs to be looked into.
    b. There is need to enforce collection of used oil mandatory for industry and garages. Auto OEMs need to play a vital role here due to large network of service stations under them.
    c. Technology options available need to be studied for viable cost of processing.
3. Presentation made by Shri. Subimal Mondal, ED Lubes IOCL on used oil scenario and current issues which provided useful inputs for the discussions. He explained how OEMs, Garages and industry can contribute to used oil collection. Recycler survey has been started by oil industry to get their feedback and global scenario is also being studied for inputs on used oil management.
4. Mrs. Vidya Amarnath, Managing Director, Paterson Energy Pvt. Ltd. suggested use of CSR funds from Oil PSUs and Auto OEMs to incentivize collection of used oils.
5. Shri Prabhjot Sodhi, Head (Circular Economy), NDP suggested
    a. To maintain traceability to understand usage pattern and extended producer responsibility.
    b. Study to bring informal sector to formal sector as per presentation by ED Lubes IOCL.
    c. Improved process technology required
    d. Improved supply chain management with use of Artificial intelligence and machine learning
6. Shri Rajnath Ram, Adviser, Niti Aayog asked the house if only used oil is being studied or waste oil also is in agenda. He advised study of better technology options for viability and suggested to incentivize collection of used oils by generators.

7. Shri Tarun Kapoor, Secretary, MoPNG concluded by saying that the two main stake holders i.e. Oil Producers and OEMs need to work together to look at viable processes and create a good market for re-refined base oils in India. In the next meetings, other stake holders like OEMs/users/re-refiners and their members can join to discuss. At later stage smaller sub-committees can be formed for micro-level studies if required.

Meeting ended with vote of thanks to the chair.

List of participants in the Meeting held on 20.04.2021 on "Used Oil Recycling" under the chairmanship of Secretary, MoPNG

1. Shri Tarun Kapoor, Secretary, MoPNG
2. Shri Navneet Mohan Kothari, Joint Secretary(Marketing) ,MoPNG
3. Shri Deepak Srivastava, Dy Secretary(Marketing), MoPNG
4. Shri S M Vaidya, Chairman, Indian Oil
5. Shri Rajnath, Adviser, Niti Aayog
6. Shri Prabhjot Sodhi, Head (Circular Economy), UNDP
7. Shri Rakesh Misri, Director Marketing HPCL
8. Shri Subimal Mondal, ED-Lubes, Indian Oil
9. Shri G Krishna Kumar, ED-Lubes, BPCL
10. Shri PS Ravi, ED-Retail, BPCL
11. Shri R Nambiar, CGM-TS, Indian Oil
12. Shri Debashis Ganguly, CGM(P&AD), BPCL
13. Shri V Bajpai, GM-TS, HPCL
14. Shri NK Jha, CM-TS, BPCL
15. Shri Ashish Khanna, DGM-International, HPCL
16. Mrs Vidya Amarnath , Paterson Energy
17. Dr. Chandra Shekhar Sharma, Associate Professor, IIT Hyderabad

Annexure 8

Constitution of Committee formation on circular economy on used oil by MoPNG

M-11045/21/2021-Distribution-PNG
Government of India
Ministry of Petroleum and Natural Gas

Shastri Bhawan, New Delhi
Dated the 27th May, 2021

OFFICE MEMORANDUM

Subject: Constitution of committee for circular economy in used oil waste - reg.

The undersigned is directed to refer to the OM No. 13(26)/2021-I&M(I) dated 04.03.2021 from NITI Aayog regarding constitution of Committee for Circular Economy in Used Oil Waste.

2. It is stated that the following individuals have been co-opted into the above mentioned committee chaired by Secretary, Ministry of Petroleum & Natural Gas and the details are as given below:

a) Shri R. Ramakrishnan, Global Head- Customer Care-CVBU, Tata Motors Ltd.
b) Shri Satish Kumar Tiwary, Chief of Mechanical Maintenance(COMM), Tata Steel
c) Shri Alok Bansal, Vice President (Civil, Utilities & Infra), Maruti Suzuki India Ltd.
d) Shri Madanlal Khandelwal, President, Petroleum Re-refiners Association of India
e) Shri Philip Mathews, Secretary, Petroleum Re-refiners Association of India
f) Shri Anant Bhargava, CEO, IFP Petro Products (P) Ltd.
g) Shri Subimal Mondal, Executive Director (Lubes), IOCL
h) Shri Sudheendranath R, Executive Director (Lubes), HPCL
i) Shri Debashis Ganguli, Chief General Manager (P & AD), BPCL

3. This issues with the approval of competent authority.

Ashish Kumar Agrawal
Under Secretary to the Govt. of India
Ph. No. 23070323

To
Shri Sudhir Kumar,
Adviser (Industry II & Circular Economy), Niti Aayog,
Sansad Marg, New Delhi,

Copy to:
1. R. Ramakrishnan, Global Head- Customer Care-CVBU, Tata Motors Ltd.
2. Satish Kumar Tiwary, Chief of Mechanical Maintenance (COMM), Tata Steel
3. Alok Bansal, Vice President (Civil, Utilities & Infra), Maruti Suzuki India Ltd.
4. Madanlal Khandelwal, President, PRAI
5. Philip Mathews, Secretary, PRAI
6. Anant Bhargava, CEO, IFP Petro Products (P) Ltd.
7. Subimal Mondal, Executive Director (Lubes), IOCL
8. Sudheendranath R, Executive Director (Lubes), HPCL
9. Debashis Ganguli, Chief General Manager (P & AD), BPCL

Annexure 9

Recyclers survey on used oil by OMCs -April 2021

1. A survey of recyclers was conducted by us where feedback was sought on various points as per a questionnaire.

2. They have replied general points but some important questions were not replied. We have taken verbal feedback from most of them as it was felt that most parties were not comfortable or transparent in replying to all the questions being asked in mail.

3. Many of the parties were apprehensive about sharing information on sales and procurement as they see IOC as representative of Government. This may be because they do not maintain proper documentation of sales and procurement of used and finished base oils.

4. Due to tax implications many transactions are not recorded on paper and our survey yielded little factual data on actual sales or utilisation capacity of the plants.

5. The feedback of Recyclers on various questions asked to their representatives is given below:

    a. **Licensed capacity:** The capacities of registered recyclers varies from 3000 to 20000 KLPA.

    b. **Whether MSME:** Most of the units are covered under MSME.

    c. **Status of registration:** All units are registered with SPCB/CPCB/MoEF.

    d. **Base Oil produced:** Recycling units on an average produce 8-10% of 2-3 cSt oils, 70-75% of 40-60 cSt oils (@ 40 deg C) & rest nearly Bitumen /Waxy RPO. Some of the units produce 60-75 cSt base oil at 40 deg C also. SN 70/SN 150/SN 220 are mainly produced and a few produce higher viscosity base oil (eg.SN 500) also but due to non availability of required inputs, they are presently not producing the same.

    e. **Lube Oil testing facility:** All units are equipped with basic testing facilities for testing Density, Viscosity, VI, TBN and Flash point.

f. **Process used for processing base oil:** Most of the re-refiners are using vacuum distillation for production of base oils. However, a few recyclers are also using outdated method of acid-clay treatment for producing base oils.

g. **Customers of re-processed base oils:** The re-processed based oils are supplied to local lubricant manufacturers for making Engine oils for Tractors, Auto, Tempo, and multipurpose Greases. The low viscosity base oil (2-3 cSt) are supplied to non-organised sector as cleaners/solvents for auto Service centres who procure for cleaning spare parts, sweet shops for fuels. General purpose hydraulic oils are made for VG 32, 46 & 68 & supplied to Industries. Some processors are directly selling these base oils for low end hydraulic oil applications at low rates due to absence of proper orders from established user industries.

h. **Source of used base oil for processing:** Used oil is mainly sourced from auto service stations & Garages. Also, some Industries are a source of used oils through traders.

i. **Any Quality issue with input used oil:** No quality issue was reported by any of the parties surveyed.

j. **Problem faced in running the unit:** Non-availability of used oil as per capacity installed is a concern for all recyclers. As a result, most of the units are running below 30% of installed capacity.

k. **Support required from Government for sustaining the unit in terms of taxes/incentives**: Available Legislation to be strictly implemented by SPCB. Garages/Industries shall sell used oil only to registered recyclers/oil collectors. Incentives for used oil collectors, Penalty on Garages/Industries selling used oil to traders/non registered recyclers. A high percentage of purchased quantity of Lube oil should be sold mandatorily as used oil to recyclers. Some suggested a lower GST of 5% on blended Lube oils.

l. **Suggestion for efficient collection of used oil:** Making mandatory to Industries/Garages to sell used oil to registered recyclers only and proper collection system needs to in place through legislation by government.

Annexure 10

ATR of meeting on used oils held on 20.04.2021

Name & Design	Recommendation	Action Needed/Taken
Mr. Tarun Kapoor, Secretary MoPNG	a) A comprehensive action plan is required for moving from a linear to circular economy.	Following actions suggested: Legislation for mandatory disposal of used oil by OEM garages, industrial houses, STUs, mines, independent garages etc to registered re-refiners and filing return with PCB. OMCs to finalize specification of used lubricants and all lube manufacturers to adopt mandatory usage of used lubricants for manufacturing finished lubricants.
	b) Cost of collection and processing unviable so this needs to be looked into.	Initial survey with 12 recyclers was conducted and reported. Suggestions made for reduced GST on input used oil and system for mandatory use of a percentage of recycled base oils based on virgin oil consumption by Lube Manufacturers.
	c) We need to enforce collection of used oil mandatory for industry and garages. Auto OEMs need to play a vital role here due to large	Suggestions made for mandatory retrieval of 75% of virgin oil consumption at garages & OEM workshops. Green tag certification of

	network of service stations under them.	compliant garages to promote the cause. Strict action needed for non-compliance on proper disposal.
	d) Technology options available need to be studied for viable costs of processing.	Global trends in technology options being looked into. PRAI should also come forward with plan for adoption of newer technology and assistance required.
Mrs. Vidya Amarnath from Paterson Energy	CSR funds from Oil PSUs and Auto OEMs to be used for incentivize collection of used oils.	CSR funds may not be sufficient considering the vast spread of used oils generated across all segments. Unless operation of collections points and stricter implementation of collection norms are defined, such initiative may not succeed. Involvement of civic authorities like other developed Nations is a necessity.
Mr. Prabhjot Sodhi from UNDP suggested	a) To Maintain traceability to understand usage pattern and extended producer responsibility.	Currently sector wise traceability of lubes sold by OMCs is available for each sales segment. However, traceability is required for independent garages and workshops through pollution control boards and system of return filing for Lube oil usage may be implemented through CPCB/ MOEF.
	b) Study to bring informal sector to formal sector as per	During survey with recyclers the feedback was taken to

	presentation by ED Lubes, IOC.	understand their issues and incentivize them with lower GST/tax rates. Their senior members from PRAI have also been included as part of co-opted members committee for discussions.
	c) Improved process technology required.	This is being looked into.
	d) Improved supply chain management with use of Artificial intelligence and machine learning.	This can be considered after establishment of basic infrastructure for processing and supply of used lubricants.
Mr. Rajnath, Advisor, Niti Aayog	a) Asked the house if only used oil is being studied or waste oil also is in agenda.	Only Used oil is being studied currently. Waste oil may be taken up at a later stage.
	b) He advised study of better technology options for viability and suggested to incentivize collection of used oils by generators.	Global trends in technology options being looked into. PRAI should also come forward with plan for adoption of newer technology and assistance required. Suggestions have been made for better collection as mentioned above.
Mr. Tarun Kapoor, Secretary, MoPNG concluded the meeting by the remarks	The two main stake holders i.e. Oil Producers and OEMs need to work together to look at viable processes and create a good market for re-refined base oils in India.	OMC representatives and Senior executives of two leading OEMs - Tata Motors and Maruti have been co-opted in committee for future discussions and way forward.

Annexure 11

Minutes of Meeting (MOM) held on 15.06.2021 on "Used Oil Recycling" under chairmanship of Secretary MoP&NG

1. **Shri Tarun Kapoor, Secretary MoP&NG** chaired the 3rd meeting with the committee members on used oil recycling. He told the house that based on discussions held and action points flagged in the previous two meetings, good progress has been made by the committee with the help of OMCs and that the committee has been expanded to include major OEMs (automobile manufacturers), representatives of industry as well as Re-refiners of used lubricants.

2. **Dr. Navneet Mohan Kothari, Joint Secretary (Marketing) MoP&NG** requested Shri Subimal Mondal, ED(Lubes), IOC to make a presentation on the progress made so far by the committee on reprocessing of Lubricants and Circular Economy.

3. The following points were brought out in the presentation:

   3.1 Circular economy is based on an economic approach aimed at eliminating waste and repeat use of resources by recycling. Recycling is a globally practised concept. Used lubricating oils are reprocessed to obtain base oils which can be used to manufacture finished lubricants and it is happening in European countries, Australia, Canada etc. This in turn helps in sustainability.

   3.2 In line with 'Aatma Nirbhar Bharat Abhiyan', Govt. of India through Niti Aayog has initiated steps to study and implement recycling of used lube oils. Meetings with OMCs were initiated by Secretary MoP&NG to work in this direction, followed by the meetings of the committee members appointed by Niti Aayog under chairmanship of Secretary, MoPNG.

   3.3 The progress made so far was apprised. As per MoP&G advice, a committee of the representatives of OMCs was formed to take the initiative forward. IOC was asked to coordinate. In the meeting chaired by Secretary MoP&NG on 9th April 2021, a presentation was made by ED (Lubes) on behalf of OMCs. The MOM dated 09-04-2021 is enclosed as Annexure I. Subsequently, meeting of the committee members were held on 20-04-2021. In this meeting also ED(Lubes) IOCL was advised to make a presentation and accordingly detailed presentation was made and discussions held.

The MOM dated 20-04-2021 is enclosed as Annexure II. The summary of discussions is as under:

3.4 **Generation & Collection:** The generation of used oils in India is to the tune of 1.40 MMTPA. But the quantity recycled is very low (less than 20%) compared to the western countries. The potential segments for generation of used oils are industries/institutional users of lubricants (Steel, Cement, Power, Railways, Mines, Other Industries, Defence, STUs etc), Auto OEM workshops & independent garages. The collection system in India needs to be improved by bringing the end users (both formal and informal channels) under purview of existing legislations of MoEF and CPCB. This will improve supply of used oil. There is also a need to increase demand of used oil by making the mainstream.

3.5 **Practices in other countries:** Other parts of the world have adopted several measures to increase the % recycling of used oil ranging between 50% to 90% in certain European countries like UK, Germany, Italy etc. EU regulations establish general principles via Directives and individual member states are obliged to transpose those Directives into national law. Some countries like Italy has gone well beyond the EU basics in managing the used oil market. In Italy a Consortium funded through a "contribution fee" levied on lubricant producers, disburses fund to approved used oil collectors and refiners, with the level of subsidies determined annually by the consortium. Due to growth in recycling technology, Italy has achieved regeneration of 90% of the collected waste. In Germany, used oil management is governed by The Waste Oil Ordinance which is in force since 1987.

Australia and Canada have also adopted extensive measures to recycle used oil. Such measures include government sponsored used oil collection systems, levies of virgin base oils (whether imported or domestically manufactured) to fund collection of used oil and to incentivize recycling, mandatory adoption of recycled base oil to manufacture finished lubricants by lube manufactures and also adoption of newer through legislations like Product Stewardship Act etc and more efficient and environment friendly technology to re-process used oil.

3.6 **Indian Re-refining status**: In India, the used oil recycling is not a very regulated industry. As per last survey report of CPCB (year 2010), there are 257 authorized oil recyclers with capacity of 1.70 Million KLPA spread across 124 districts.

Additionally, high number of recyclers are reportedly operating which are yet to be registered.

3.7 The problems faced by recyclers is availability of adequate quantity used oil, high procurement cost and taxation issues. Most of them report capacity utilization of 15 to 20 percent. There is little transparency in the system which needs to be addressed. As per feedback from PRAI, there are issues involved with CPCB and MoEF which need to be resolved. MoEF has classified used lube oils as hazardous to be handled and disposed off as per HW (Hazardous wastes) rules. This may be required to be reviewed which can help to improve recycling efficiency in the country which is lower than 20 percent today.

3.8 **Direction from Secretary, MoPNG:** Secretary MoPNG had advised that, there is a need for Auto OEMs & industries to collaborate with OMCs for synergized effort in this direction. He advised OMCs to co-opt members from Auto OEMs & industries. He had also advised that there was need to understand problems faced by the re-refiners and we need to involve them as well. Accordingly, members from Tata Motors, Maruti Suzuki, and representatives from PRAI (Petroleum Re-refiners Association of India) were co- opted as members of the committee along with nominees from OMCs.

3.9 **Survey of Recyclers:** Based on direction of Secretary, MoPNG, a survey of recyclers was carried out by IOC and the feedback was submitted to MoP&NG.The main issues which emerged in the survey conducted were as follows-

- Most recyclers do not maintain proper records of sales and procurement of used oils and their finished base oils.
- Due to tax implications transactions are not recorded on paper and our survey yielded little factual data on actual sales or utilisation capacity of the plants. Cash transactions take place in most cases
- The licensed capacities of registered recyclers varied from 3000 to 20000 KLPA.
- Most of the units are covered under MSME.
- All units surveyed were registered with SPCB/CPCB/MoEF.

- Recycling units produce 2-3 cSt oils, 70-40-60 cSt oils (@ 40 deg C) & rest nearly Bitumen /Waxy RPO.

- All units are equipped with basic testing facilities like Density, Viscosity, VI, TBN, Flash points. There is a need for improving testing facilities.

- Most of the re-refiners are using vacuum distillation for making base oil. However, a few recyclers are also using acid clay system for producing base oils. Acid clay system is not environment friendly.

- The processed based oil supplied to local lubricants manufacturer for making Engine oils for Tractors, Auto, Tempo, and Grease. The low viscosity base oil (2-3 cSt) are supplied to non-organised sector as fuels.

- Used oil is mainly sourced from auto service stations & Garages. Industry also directly supplies to recyclers.

- No quality issue was reported by any of the recyclers surveyed. The recyclers requested for following government support:

- Available Legislation to be strictly implemented by SPCB. Garages/Industries shall sell used oil only to registered recyclers/oil collectors. There should be incentives for used oil collectors, penalty on garages/industries selling used oil to traders/nonregistered recyclers. 80% of purchased quantity of Lube oil should be sold mandatorily as used oil to recyclers.

- The garages/workshops that vehicle owners take back used oil after servicing. This is not true in most cases and should not be allowed by law.

- For efficient collection of used oils, it is necessary to make it mandatory for Industries/Garages to sell used oil to registered recyclers only.

3.10 Way forward suggestions made:

3.10.1 Technology for Re-refining

Following major Advanced Re-Refining Technologies with solvent extraction and hydro processing are used in Italy and other developed countries:

- Cyclon
- CEP Process
- Hylube
- MRD
- Revivoil

PRAI has an important role to play in adoption of these technologies for more efficient recycling of used oils.

3.10.2 **Collection/Supply:**

1. Legislation is suggested for mandatory disposal of used oil by OEM garages, industrial houses, STUs, mines, independent garages etc to registered re-refiners and filing return with PCB.

2. Municipalities to coordinate with Pollution Control Boards to set up large number of collections centres for collection of used oils.

3. Mandatory retrieval of 75% of virgin oil consumption at garages & OEM workshops. Green tag certification of compliant garages by PCBs to promote the cause. Strict action needed for non-compliance on proper disposal.

4. Collector of waste oil should be adequately incentivized for collecting the waste oil from various locations and transporting it to re- refiners.

3.10.3 **Demand/Consumption:**

1. Required legislation mandating use of certain % of used oils by all registered lube manufacturers in place of virgin base oils for sustained supply by recycling units

2. OMCs to finalize specification of used lubricants and all lube manufacturers to adopt mandatory usage of used lubricants for manufacturing finished lubricants.

3. The procurement guideline can be setup suggesting the institutional buyers of the lubricating oil to procure certain percentage (say 25%) of their lubricant made from the re-refined oil.

3.10.4 **Taxation incentives & suggestions**

- Nominal level of 5% GST or no tax may be imposed on input of used oil collected for

reprocessing.

3.10.5 **Recycling Tax**

- Additional levy of 1 to 5% on lubricants manufactured from virgin base oils. Consumers will have to pay for it. This money to be used for setting up collection points under municipalities.

3.10.6 **Strict enforcement of legislation** for users required which will prevent-

- Burning of used lube oils
- Draining of used oils in sewers
- Selling to unauthorized parties
- Non-filing of used oil utilization returns periodically to SPCB

3.10.7 Other Points discussed:

- On the issue of traceability, independent Auto garages need to be brought purview of Pollution Control Board with system of periodic return filing.
- Improved supply chain management with use of Artificial intelligence and machine learning. It can be considered after establishment of basic infrastructure for processing and supply of used lubricants.

4. **Shri Tarun Kapoor, Secretary MoP&NG** asked the OEMs how they can exercise control on their workshops for proper used oil collection and also mentioned about critical role of the Lube Companies.

5. **Shri R.Ramakrishnan, Global Head-Customer Care, CVBU, Tata Motors** made a presentation, the points covered are as under:

i) They are connected to about 1500 garages handling used oil.

ii) Their larger workshops have >10 Bays.

iii) Smaller workshops have 5 to 7 Bays.

iv) Used oil is collected from drain points & barrels. Disposal is done through

authorized agent (weekly, fortnightly, monthly/ Bi- monthly).

v) OEMs can implement system for improved collection by verification of invoices sold to dealer vs estimation of oils disposed through billed invoices using the same system.

vi) Fixation of prices of used oil will be required.

vii) Incentives for workshops can be given or necessary penalties in case of non-compliance.

viii) 20 to 25% of oil change is carried out in authorized workshops. Rest is carried out in customer premises or at informal garages.

ix) Tata Motors has approximately 50000 mechanics of informal garages enrolled in their loyalty program. Tata Motors is willing to work with them towards more effective collection and disposal of used oil.

x) 10% of the Lube oil is bought as genuine oils by their customers from their dealerships, rest from the market.

xi) All the dealers follow the company policies hence Auto Industry can be regulated by OEMs through proper directives and framing internal policies.

6. **Mrs. Vidya Amarnath, MD of Paterson Energy** informed that their company is setting up a Lube plant for re-processing with a capacity of 24 KL per day. It will produce SN 100 grade with quality of base oil with 23Cst viscosity, 200 deg Flash Point and color in the range of L2 to L3. The Plant is scheduled to start on 15th July 2021 at Chengalpattu near Chennai. She expressed concern on availability of used oils for her plant. The bi- products are 1. Distillate 2. Base stock of high viscosity and carbon with calorific value in excess of 10500 Kcal. These two are blended and used as fuels in their heaters.

7. **Shri Alok Bansal, Vice President of Maruti Suzuki India Ltd**, confirmed that they also follow all CPCB guidelines on disposal of waste oil at their plants and confirmed that they would be ready to implement any guidelines issued by authorities for action by their channel.

8. **Shri Madanlal Khandelwal, President, PRAI** raised the following issues-

Taking a cue from presentation by ED (Lubes), IOC on why many recyclers are not

declaring their actual usage of used oils transparently, he elaborated on the following issues:

He informed that some issues are pending for more than 8-12 years for appropriate and judicious decision or directions to relieve their members from various operating and commercial problems in respect of recycling of used and waste lube oils.

8.1 He explained that as per the recycling technology approved by CPCB during 2005, most of their members have been deploying "The thin film distillation of used or waste oil "and "Total distillation both under high vacuum" wherein both of the processes generate two types of wastes during final production of end products that is lubricating oil of required specification. The SPENT CLAY is used to remove the color from re-refined oil after distillation and therefore it is not at all hazardous practically containing no metals. As such it is neither to be disposed through incineration nor should it go to secured land fill. Thus CPCB issued recommendation to MOEF vide letter No. B-290 16/1(Reg)/07/HWMD dated 16th July 2007 that such clay can be used for brick manufacturing. Hence recyclers could easily dispose it off through sale or otherwise to supply to brick manufactures. Such directions from MOEF are still awaited as on date.

8.2 Another waste is process residue generated from used oil re-refining which is a hazardous waste having calorific value of the order of more than 7000 KCal/kg and is a valuable & commercially selling product and should neither go for hazardous waste incineration nor it is to be burnt in cement kilns under co-incineration as advised by CPCB for the following reasons:

As directed by CPCB vide their letter dated 25-10-2006, PRAI had undertaken R&D efforts to explore the possibility of disposal of bottom residue in environmentally sound manner for which a detailed presentation with all practical citations with all laboratory test results (by Shri Ram Lab - Delhi) was presented in a meeting held in CPCB on 8th June 2007 the subject was waste generated in used oil re-refining and their suitability for various application.

- Covering both kinds of residues, PRAI once again wrote to CPCB vide letter dated 27-08-2010 outlining the need for a decision on their disposal.

- UPL Environmental Engineers Ltd, New Delhi has also submitted the

detailed study report on utilization of process bottom residue and its various applications.

- Both the above reports are recommending that bottom residue can very well be used for heat recovery as supplementary fuel with coal or any other fuel in the furnaces and cement kilns.

8.3 However with all above applications the bottom residue should not be mandatorily forced to re-refiners for forwarding it either for hazardous waste incineration or to cement kilns for co-incineration and pay the charges for such controlled burning.

8.4 CPCB has also promised during 2010 that they will approach and request to IOC, R&D to study other environment-friendly application of process residue but feedback is still awaited.

8.5 PRAI is still awaiting the directions from MOEF and CPCB for proper disposal of bottom residue as per the recommendations.

8.6 CPCB issued "Guidelines on co-processing in cement / power / steel industry" published in February 2010, legally entitling the co-processing of used oil and waste oil in cement / power / steel industry. In-fact it may be noted that used oil and waste oils are precious wastes which are being recycled / re-refined as per 3rd point in the hierarchy "Reduce, Reuse and Recycle". The used oils and waste oils have already been defined under para 3(ze) and (zf) and specified vide part A and Part B of schedule V of HW(MH&TM) Rules 2008 and such waste are meant for recycling. Therefore, PRAI requested CPCB to delete the used and waste oils for co-processing by cement kilns etc. as mentioned in the above guidelines in the interest of re- refiners. No such directions or amendments have been issued till date.

8.7 Even if bottom residue being hazardous is burnt in cement kiln or the furnace the owner should at least pay its price equivalent to coal or any other fuel to our recyclers without harming their commercial interests.

9. **Mr. Philip Mathew, Secretary, PRAI** expressed his pleasure on the fact that Government of India has taken up such an important activity of moving towards a circular economy. He made a short presentation covering the following points-

Out of the total quantity of used oils generated in India only 30 percent of it reaches the authorized recyclers for re-processing. This is from institutional sellers only who follow some rules.

The rest 70 percent are generated in independent garages, small industrial units, shops using generators using engine oils etc.

This part is the leakage happening in the used oils cycle, which needs to be focused upon by all of us.

Out of this 70 percent, 40 percent can be controlled through OEMs, if they are able to track actual invoices billed for fresh oil usage vs used oil disposal through registered re- refiners.

The small collectors in the system sell the smaller quantities to the bigger channel eg the kabadiwallah, who in turn sells it to recyclers. These B2B sales needs to have a firewall which is like check for invoicing with GST as per norms. This will bring in transparency and traceability in the system.

Concessional GST is also proposed for products blended with recycled base oils.

10. **Mr Anant Bhargava, from IFP Petro products** had a presentation to share for which he asked permission of the chair to share amongst committee members later. This was granted to him.

He mentioned that with reverse logistics in place and other tax concessions and incentives, India can reach 90 percent plus recycling level in line with European countries from less than 20 percent today.

He suggested additional custom duties for base oils and lubricants and also creation of cess for oil companies to encourage collection, recycling, and indigenization of lube manufacturing.

He mentioned that many countries have been practicing recycling for the last more than 50 years and we should promote the campaign for- ‘proud to recycle’ for the country. Recycling should not be for commercial and legal reasons only.

He mentioned that they have taken up projects along with IIT Mumbai for implementation of better technologies in this segment.

11. Mr. Prabhjot Sodhi, Head, Circular Economy, Centre for environment education

elaborated on the following points:

11.1 What and how can we bring the extended producer responsibility (EPR) systems across stakeholders whether it is the oil companies, the vehicle manufacturers or the producers and brand owners of the lubricants or the oil companies to ensure better energy recovery and recycling business models promoting circular economy. We really need to see how the traceability, pricing and efficiency in the collection systems can be enhanced from present 20% for the used base oils.

11.2 Supporting Mr. Khandelwal, he stated that we need to also include waste oil refining, usage which emerges from the crude oil manufacturers as residues. Likewise, we also need to explore the possibilities of refining the waste oil from the sludge as residues, which is emerging in the shipping industry and in the furnaces within the way large industries this waste oil also can be put to greater use as it has a high calorific value and should not be burnt away. It can easily be seen as a raw material promoting the circular economy concepts of product shelf- life extension.

11.3 As the ministry is very proactively leading the show under the leadership of the Secretary, MoPNG, we may kindly need to look into the standards for the used oils and if so they need little tweaking and be more focused and also need to look into the verification processes of the standards in order to ensure that there is proper regulation and there are no leakages; better trace ability and transparency in the systems.

11.4 We also need to promote the digitization, traceability and transparency with the OEM and the small workshops and industrial garages because much of the used oils which are collected are sold to the non-registered traders (for more profit margins) and much of this is largely being done in cash not through invoices or billing. Leakages need to be addressed and stopped. (Through various incentives and punitive measures as said by Mr Ramakrishnan). What measures can be put into place and at what levels are to be decided.

12. **Mr. Tarun Kapoor, Secretary, MoP&NG** closed the meeting and informed that the minutes of the meeting will be shared. He wanted that the draft report for submission to Niti Aayog should be prepared for discussion by the committee in the next meeting.

List of participants in the meeting held on 15.06.2021 on Used Oil Recycling" under chairmanship of Secretary MoP&NG

1. Dr. Navneet Mohan Kothari, Joint Secretary (Marketing), MoP&NG
2. Shri Satyender Singh, Adviser, MoEF&CC
3. Shri Rajnath Ram, Adviser, Niti Aayog
4. Shri SM Vaidya, Chairman, IOCL
5. Shri Prabhjot Sodhi, Head, Circular Economy, Centre for environment education.
6. Smt. Vidya Amarnath, Managing Director, Paterson Energy Pvt. Ltd.
7. Shri B. V. Satish Kumar, Director, Hydroxy systems
8. Dr. Chandra Shekhar Sharma, Associate Professor, IIT Hyderabad
9. Shri R. Ramakrishnan, Global Head- Customer Care- CVBU, Tata Motors
10. Shri Satish Kumar Tewary, Chief of Mechanical Maintenance (COMM), Tata Steel
11. Shri Alok Bansal, Vice President (Civil, Utilities & Infra), Maruti Suzuki India Ltd.
12. Shri Madanlal Khandelwal, President, PRAI
13. Shri Philip Mathews, Secretary, PRAI
14. Shri Anant Bhargava, CEO, IFP Petro Products (P) Ltd.
15. Shri Subimal Mondal, Executive Director (Lubes), IOCL
16. Shri Sudheendranath R, Executive Director (Lubes), HPCL
17. Shri Debashis Ganguli, Chief General Manager (P & AD), BPCL
18. Shri R Udaya Kumar, Chief General Manager (LS), IOCL

19. Shri Rajesh Nambiar, Chief General Manager (TS), IOCL

20. Shri N K Jha, General Manager (TS), BPCL

21. Shri Ashish Khanna, General Manager(TS), HPCL

Annexure 12

Guidelines issued by Member Secretary to MoEF on usage of spent clay and process residue obtained from recycling of used oil

REGISTERED POST

No. B-29016/1(Reg)/07/HWMD

July 16, 2007

To,

Shri. M.Subba Rao, Additional Director
HSM Division,
Ministry of Environment & Forests,
Paryavaran Bhawan, CGO Complex,
Lodi Road,
New Delhi-110 003

Sub: *Utilization of Process Residue and Spent Clay generated from used oil re-refining process.*

Sir,

This has reference to presentation made by *The Petroleum Re-refiners Association of India* on "**Utilization of Process Residue and Spent Clay generated from used oil re-refining process**" before the Registration Committee Members during the 29th Registration Committee held in this office on 8th June, 2007. The presentation material is enclosed with this letter. The Minutes of the meeting as approved by the Competent Authority (Copy enclosed) have been sent to you vide letter dated June 25, 2007

The issue was examined by the Committee Members. The following points have been recommended by the Committee:

(i) *The spent clay, which is used for removing colour from base oil after distillation can be used for brick manufacturing*
(ii) *The process residue generated from used oil re-refining can be used in the cement kiln subject to the condition that the final emissions are within the stipulated norms"*

It is requested that in view of the above, further necessary action in this regard may kindly be taken by MoEF.

This issues with approval of Competent Authority

Yours faithfully,

(Dr.B.Sengupta)
Member Secretary

(Dr.B.Sengupta)

Copy to:

PS to MS

Annexure 13

PRAI representations –Letter of correspondence with CPCB on Disposal of spent clay and process residue

PETROLEUM RE-REFINERS ASSOCIATION OF INDIA

DELHI OFFICE : B-2, AKASHDEEP BUILDING, BARAKHAMBA ROAD, NEW DELHI-110 001
PHONE : 23324444, 23355678, FAX : 23354567 CELL : 9810002445

PRAI/CPCB-MOEF/2010-11/2708 **Date: 27-08-2010**

The Member Secretary
Central Pollution Control Board,
Parivesh Bhawan, East Arjun Nagar,
Delhi

Matter regarding disposal of spent clay and process residue generated during processing of used oil.

Dear Sir,

We wish to draw your kind attention to our previous correspondence together with oral discussions held several times in your office including our last letter no. PRAI/CPCB-MOEF/2007-08/2210 dated 22-10-2007 on the above matter and in response to the presentation made by PRAI and discussions held in your conference hall on 08-06-2007, we regret to inform you that no policy decision for disposal of spent clay and process residue has been conveyed to us from your end. Nevertheless we have received your letter B-29016/1(Reg.)/07/HWMD/4258 dated 16-08-2007 (Copy enclosed). We submit our views as follows for your kind perusal:-

1. We have generally agreed with the para (i) i.e. the spent clay, which is used for removing colour from base oil after distillation can be used for brick manufacturing.
2. Regarding disposal of process residue we explained its suitability for various other applications which are environmentally friendly and which are not abusing its commercial value and for which the decision is to be kept pending till the studies are completed by IOC Faridabad or any other agency engaged by you. We understand that CPCB has made efforts to obtain the report from private agency / NGO on the application & utility of process residue. Hence, we request you to please expedite and inform the same on urgent basis as the matter is already delayed by more than FOUR YEARS.
3. As desired by you we are enclosing the copy of the report **"Characteristics of Wastes Generated in Used Oil Re-refining and their suitability for various Applications"** together with test reports of the various samples drawn independently by Shri Ram Institute for Industrial Research – Delhi, presented by PRAI on 8th June 2007 in the office of CPCB.

In view of the seriousness of the matter and in the interest of our members we request you to kindly convey your decision as requested for disposal of above wastes.

Thanking you,
Yours sincerely,
For Petroleum Re-refiners Association of India

M.L.Khandelwal
President

Encl. As Above.
CC.: The Secretary, MOEF, Parayavaran Bhawan, New Delhi.
(With our prayer to kindly intervene the matter for its earliest decision)

REGISTERED OFFICE : SHETH VIRCHAND UMERSEY BLDG. 3RD FLOOR, 13-21 3RD PANJARAPOLE LANE, MUMBAI - 400 004
President : Sh. M.L. KHANDELWAL, Vice President : Sh. NARESH GIGLANI, Gen. Secretary : Sh. SATYAVIR HOODA, Treasurer : Sh. RAVI BANSAL

"We Cannot Command Nature except by Obeying her"

Annexure 14 :

PRAI representations –Letter of correspondence with CPCB on restraining the coprocessing of used oil and waste oil as alternative fuel in cement, power, and steel industry.

PRAI/2010-11/CPCB/1503 **Date: 15-03-2011**

The Chairman
Central Pollution Control Board,
East Arjun Nagar,
Delhi

Reg.: Restraining the co-processing of used oil and waste oil as alternative fuel by co- processing in cement / power /steel industry.

Dear Sir,

We draw your kind attention to the "Guidelines on Co-Processing in Cement / Power / Steel Industry published in February 2010" wherein you have legally entitled the co-processing of used oil and waste oil in Cement / Power / Steel Industry. In fact used oils and waste oils are precious wastes which are being re-cycled / reprocessed / re-refined in India as per third point in the hierarchy "Reduce, Reuse and Recycle". The HW (MH&TM) Rules 2008 stipulates recycling / re-refining of used oils and waste oils separately defined and specified to recover precious base lube oil and fuel oil by the re-processers. Almost about 258 numbers of reprocessing units in the country have installed EST & registered by CPCB / MOEF to process the used and waste oils. Hence at this stage forwarding the used oils and waste oils for co-incineration shall render such approved / registered units to fall in short of their raw materials and shall come under severe financial crises. We feel that Government should not contradict the policies once framed by CPCB / MOEF in the interest of environment protection only.

We therefore request you to please amend the following in "Guidelines on Co-Processing in Cement/Power/Steel Industry":

- Para 5.0(4) under Suitability of Substances for co-processing,
- Para A. 2 of Annexure – 1 i.e. Categories of Hazardous Waste Substances,
- Para 1.0 (1.1 & 1.2) of Appendix A i.e. Substances having potential to be used in Co-processing in Cement plant under "A. Industrial Wastes".

by deleting used oils and waste oils from the above paras. You may kindly note that the used oils and waste oils already defined under para 3(ze) & (zf) and specified vide Part A & Part B of Schedule V of HW(MH&TM) Rules 2008,

In view of above circumstances, you will therefore appreciate that used and waste oils should not be permitted to go for co-processing in Cement / Power / Steel Industry to enable re-refining industries to survive.

Page 1 of 2

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The suitable amendment be issued in "Guidelines on co-processing in Cement / Power / Steel Industry published in February 2010" on your website on urgent basis please.

Thanking you

Yours Sincerely,
For Petroleum Re-Refiners Association of India

M.L. Khandelwal
President

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3. Report on Used Oil Management and beneficial reuse options to address by UP Department of Energy dated Dec'20 (https://www.energy.gov/sites/prod/files/2020)

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6. Paper on CPCB Survey report of 2013

   (https://www.sciencedirect.com/science/article/pii/S18780296130

7. Used engine oil recycling techniques: a comparison

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8. HAZARDOUS WASTE MANAGEMENT RULES-2016

9. Standard Operating Procedure for Registration of Producers, Importers & Brand-Owners (PIBOs) Under Plastic Waste Management Rules 2016 (as amended)- CPCB March 2021

10. Uniform Framework for Extended Producers Responsibility

    https://www.aipma.net/Environment/Summary-Uniform-EPR-Framework.pdf

11. Spent oil management and its recycling potential in India inventory and issues

    https://www.sciencedirect.com/science/article/pii/S1878029613002338