

**EMERGING TECHNOLOGY OF BIOBASED FOOD GRADE
LUBRICANTS FOR SUGAR INDUSTRIES,
(SAVING ENERGY UPTO 15%)**

PRESENTED BY
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M/S. INTECH ENERGY SYSTEMS PVT LTD,

Dear Sugar Technologists,

Currently, Indian sugar industry is getting milled in 3 rollers. The main roller is rise in production cost, the second is food safety regulations along with pollution control laws & the third is requirement of continuous & meticulous observation of plant conditions like the patient in ICU.

I take the pleasure to present a new technology tool, which can provide you some solace (relief) from above milling rollers. Biobased Green lubricants is an emerging trend all over the world replacing petroleum based or synthetic lubricants. This technology tool can be presented by Sugar Technologists, to pacify your over strained management.

You will be curious to know what the Green lubricants have to do with cost saving. You may feel that, the new Green lubricants may be less expensive curtailing your lubrication bill. But this is not true. Biobased Food Grade Lubricants are more expensive than petro based or synthetic lubricants. Still **I would like to claim that, it is not the cost of the lubricants, but the huge cost of the energy saved by using our 'Dirghayu Biobased Lubricants', is the key of cutting production cost of sugar.**

It is unbelievable but true that, Dirghayu Gear oils can save upto 15% of energy. Normal milling gear boxes in a small or medium plant having per mill energy requirement of about 750 to 1000 HP, can save about 10% energy. This means energy saving of 75KW to 100KW per hour for each mill in your plant. Considering even the cost of energy @ Rs.6/- per KWH, the total net saving per day in each season will be Rs.10,800/- to Rs.14,400/-. In a season of 120 days, this means **saving of about Rs.13 Lakhs or Rs.17.25 Lakhs per mill.**

To get this saving, what is the expense involved? For above capacity gear box, the sump will be having capacity of 600 to 800 liters of Gear oil. Considering cost of Rs.400 per liter, the total investment involved is Rs.2,40,000/- to Rs.3,20,000/-. Thus you will find that, the total cost of our Gear oil gets paid off in less than 30 days. Moreover, the life of our Gear oil is more than 2 years. **Hence against revenue investment of Rs.2,40,000/-, you can earn more than Rs.24 Lakhs in 2 years i.e. 10 times the basic investment.**

Compared to present purchase cost of petro based or synthetic gear oils of approximately Rs.1 Lakh to Rs.1.5 Lakhs for the same capacity, but giving no relief of energy saving, the total returns on additional revenue investment will be 20 times.

You may think that, this is too hypothetical. **NO!** We have proofs of these results in 3 sugar factories in Maharashtra, who had ventured with us to test our gear oils in their milling gear

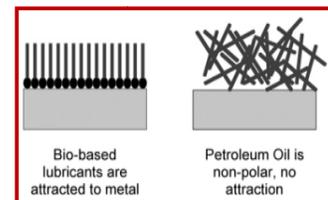
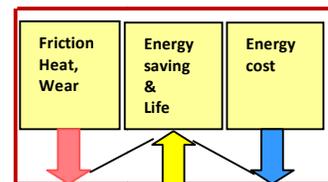
boxes. M/s. Shreenath Mhaskoba S S K Ltd, M/s. Purti Power & Sugar Ltd & M/s. Sant Tukaram S S K Ltd should get the credit for venturing in this technology first time in India. There are many other sugar industries, who have tested our gear oils in other gear boxes & have experienced the similar results.

We are greatfull to the management & chief engineers of these 3 units for giving us the opportunity, while enjoying their share of pleasure of cost saving & getting this prestige of venturing in new technology.

Is it any magic? **NO!** The new technology of biobased lubricants is tested & recognized all over the developed world & not only in India. Papers are available for reference. Moreover, we have certification from many gear box manufacturers, after due testing of our gear oil. M/s. Elecon Engg Ltd, M/s. Premium Transmissions Ltd, M/s. Cyclo Transmissions Ltd, M/s. Trans-precision Gears Pvt Ltd are some of them. **Thus this is not a magic, but a technology explosion.**

All biobased lubricants & particularly our 'Dirghayu Green Lubricants' are having following **Six Exclusive Properties:-**

1. **Very High Lubricity:-** Almost 4 times of petro based and 2 times synthetic (ref- IOWA University site). Both petro based or synthetic base oils derive their lubricity from additives, while biobased base oils are themselves lubricant. 'Scar diameter' in four ball test apparatus provides the lubricity index. While lubricity of our lubricants is between 2.5 to 4, synthetic are having 4 to 6 and petro base are above 6.
2. **Polar nature:-** Unlike petro based or synthetic, biolubricants are polar. They form thin, strong film on the surface having good adhesion with substrate.



Both these properties result in reduction in friction and energy saving to the extent of 15% in case of gear boxes. This further results in much longer life (almost 2 to 3 times) to the appliance and very little wear & tear. Besides the rise in temperature of gear box goes down by 40%, which directly confirms less power wastage in friction.

3. **High viscosity index:-** Almost 2 times petro based & 1.5 times synthetic.
4. **High Flash point & Low evaporation rate:-** This property makes biobased lubricants more suitable for high temperature applications.

Gear oil MP EP GO 100	
Viscosity index	160
Flash point	207
Mint EP-2 Grease	
Cone penetration	275
Dropping point	200

These two properties improve the performance in Gear oil as well as Hydraulic fluid. 68 grade Dirghayu Gear oil can replace petro or synthetic gear oils upto 320 grade & 90 grade Dirghayu Gear oil can replace 460 grade. This improves the gear oil reach & performance.

In case of hydraulic fluid, all above four properties result in 'Dirghayu' to be Super Efficiency Hydraulic Fluid. The net energy saving will be about 30% & there will not be much requirement of top-up. The complaints of the system also get reduced (for more details refer to our catalogue).

High temperature chain oils & Greases perform much better than petro or synthetic due to above four properties.

5. Biodegradable
6. Non toxic nature

Both these properties make biobased lubricants suitable for food grade & pharma grade. NSF registration for 'Dirghayu' will be received soon. These properties will make 'Dirghayu' grade lubricants for sugar factories, most suitable for approval of food and pharma grade audit & good international buyers for Indian sugar.

These properties can also simplify the disposal as compost. The disposed lubricants can be mixed with press mud. The resultant manure will have much higher organic carbon and will be much more productive for cane. This can eliminate the need for pollution control board approval.

Thus these exclusive properties can provide excellent relief from 3 milling rollers of Indian Sugar Industry mentioned above.

'Dirghayu' biobased products for sugar industry and their applications:-

1. Gear oil for milling gear boxes and other gear boxes.
2. Lubricant for open gears upto pinion.
3. Gear oil for cranes & conveyors.
4. Greases for conveyors.
5. Lubricants for Mill bearings: food grade.
6. Super Efficiency Hydraulic Fluid.
7. Other lubricants for Milling, centrifuge, co-generation boiler house, Turbines etc.
8. LB / GC Grease.

1. **'Dirghayu' Gear oil MP EP GO 100-S:-**

a. **Physiochemical properties:-**

Characteristics	ISO Vg grade 320 gear oil	Dirghayu MP EP GO 100-S Grade 68	Remarks
Appearance	Clear & bright	Clear & bright	
Density at 15 deg.c.	0.9046	0.90 to 0.91	
Kinematic viscosity index at 40 deg.c.	320.4	69	Lower viscosity replaces higher viscosity
Viscosity index	90	170	Almost double
Pour point deg.c.	-3	0 min.	
Flash point deg.c.	150	270	Higher
Copper corrosion test	1b	1a	Reduced corrosion
Foaming sequence	Nil	Nil	
Four ball scar diameter	Not mentioned	0.3 to 0.4	Excellent lubricity
Four ball weld load	Not mentioned	3000 N	High load carrying capacity

b. Field Experience:-

I. Electrical driven gear boxes:-

➤ **Shreenath Mhaskoba S S K Ltd, Pune.**

Respected Chairman – Shri. Pandurangrao Raut

Chief Executive Officer – Shri. D M Raskar. Works Manager – Shri. S G Pawar.

Dirghayu biobased Gear oil MP-EP-GO-S 90 grade was used on FMG mill drive **gear box no. 2** having 750 HP electrical motor. This was in replacement of SP 460 gear oil. Total sump capacity was of 600 liters. Additionally, 70 liters top-up was necessary during one month due to leakage. The gear box was driving 2 open gears of 2 milling machines 2a and 2b.

The **gear box no. 1** having 750 HP electrical motor was also driving 2 open gear boxes with 2 milling machines, 1a and 1b.

Average sugar cane crushed per day was about 3000 tons. Trials were conducted upto 16th January for petroleum based and from 17th January till end of the season for Dirghayu gear oils on **Gear Box No. 2**.

Separate energy meter with clampable CT's was installed on this gear box from January & energy consumption readings were recorded every day in all 3 shifts.

It was observed that, temperature of the gear box dropped down from 52 deg.c to 40 deg.c and average 5% to 10% power saving was observed. The gear box & motor were 50% loaded, drawing about 400 amps current.

This gear oil will also be used in the season of 2013-14 for gear box no.2.

Saving of Energy Cost & Cost justification of Dirghayu MP EP GO 100:-

For gear box no. 2 driving mills 2a and 2b:-

Power consumed = $1.73 \times 420 \text{ Volts} \times 400 \text{ amps} \times 0.95 \text{ pf} = 275 \text{ KWH per hour}$

Average power saved = 7.5%. Hence power saved is = 20.625 KWH per hour.

$20.625 \times \text{Rs.6/- per KWH} \times 24 \text{ hrs} \times 240 \text{ days} = \text{Rs.7.12 lakhs for 2 seasons.}$

Cost of Gear oil MP EP GO 100 = Rs.400/- per liter x 680 = Rs.2,72,000/-.

Returns on revenue cost = Rs.7.12 Lakhs per milling gear box as net profit for 2 seasons on investment of Rs.2.72 Lakhs.

Note:- It should be noted that, the actual power consumed is considered for above cost justification. The gear box motor was loaded upto 50% only, while the sump is for 750 HP. **For fully loaded motor gear box of serial no. 1 with open gears 1a and 1b**, the prospective cost saving will be Rs.11.27Lakhs for 2 seasons.

Cost of Gear oil MP EP GO 100 = Rs.400/- per liter x 680 = Rs.2,72,000/-.

Returns on revenue cost=Rs.11.27 Lakhs per milling gear box as net profit for 2 seasons on investment of Rs.2.72 lakhs (more than 4 times).

Conclusions:-

Average saving of 7.5% of Energy on fully loaded gear box can provide complete pay off of investment **in 45 days** and additional profit of Rs.8.55 lakhs or more than 3 times of investment on Dirghayu Gear oil.

II. D. C. Drive:-

- Purti Power & Sugar Ltd, Nagpur.
- Joint Managing Director- Shri. Nikhil Gadkari.
- Dy. General Manager – Shri. Kishor Deodhe

Mill gear boxes of Purti are being run on DC supply. The drive motor was 600 HP DC from INTEGRATED ELECTRICALS BANGLORE RPM-1000 and the gear box is of flender Ltd, Kharagpur, RPM 1000. The gear oil SP 460 and qty. is 420 liters, Siemens make Thyssen control panel, motor draws 540 amps current from AC mother panel. There are 4 mill drive gear boxes.

Testing was conducted in April at the end of the season. It was observed that, **power saving was 11.26% and reduction in temperature rise was by 8 deg.c. (40%).**

420 liters of MP EP GO 100-S gear oil grade 90 was used for the trials. Energy consumption was assessed based on 1 week for SP 460 & 1 week for MPEPGO 100-S. Separate energy meter with clampable CT's was installed for these trials. Motor was fully loaded with 540 amps current.

Saving of Energy cost & Cost justification of Dirghayu MP EP GO 100-

For gear box no. 1:-

Power consumed = $1.73 \times 420 \times 540 \text{ amps} \times 0.95 \text{ pf} = 375 \text{ KWH per hour.}$

Average power saved = 11.25%. Hence power saved per hr is 42.2KW per hr.
= $42.2 \times \text{Rs.}6/- \text{ per unit} \times 24 \text{ hrs} \times 240 \text{ days} = \text{Rs.}14.58 \text{ lakhs for 2 seasons.}$

Cost of gear oil MP EP GO 100-S is Rs.400/-per liter x 420 liters Rs.1,68,000/-

Returns on revenue cost=14.58 for 2 seasons on investment of 1.68 lakhs.

Conclusions:-

Average saving of 11.25% of energy was observed, by using biobased Dirghayu MP EP GO 100-S. Complete pay off of investment in lubricant was **in 30 days.**

Thus on investment of Rs.1.68 lakhs, the net earnings are Rs.14.58 lakhs in 2 seasons, almost 9 times the investment.

III. Steam Turbine Drive:-

- Shri Sant Tukaram Sahakari Sakhar Karkhana Ltd, Pune.
Respected Chairman- Shri. Navale.
Managing Director- Shri. M P Durve. Chief Engineer – Shri. P S Bhagat

In this factory, on mill no. 1, small speed gear box driven by HSGB & turbine with steam chest pressure at 9kg / cm² was facing the problem of high temperature of gear box & also requirement of frequent top-up. The oil used was SP 460. The sump capacity was 180 liters & additional 40 liters were in the cooling system. Thus total 220 liters were required for the sump. There was a provision for pump to circulate gear oil through cooler so as to keep the temperature low.

By 3rd week of February, our oil MP EP GO 100-S of 90 grade was introduced in this gear box. As the steam turbine was driving unit, it was not possible to measure the steam consumption or saving. Hence only temperature was monitored. It is noted and certified by Respected Chief Engineer, Shri. P S Bhagat that, temperature dropped from

54 deg.c. to 42 deg.c. while ambient temp. was 32 deg.c. Thus the drop was of 40% in normal rise of temp. with petroleum or synthetic gear oils.

Mr. Bhagat has certified that, during one month's trial, there was no requirement of top-up. He also admitted that, reduction in temperature is an indication of reduced friction and thus reflects in steam saving. Moreover, he has also observed that, the disposed oil need not be sent to ETP & can be composted being biodegradable.

However, it was not possible to provide cost justification and net earnings of energy saving. Hence with the consent of M.D., another test was conducted on crushing mill gear box having 60HP motor. The oil sump capacity was just 20 liters & the oil was having SP 320 grade. Hence MP EP GO 100-S of 68 grade was used for trials.

The testing was conducted from 20th March to 27th March and the deductions were amazing. The energy saving was found to be 14.35%. The rise in temperature of gear box was 50% lower.

On the basis of these readings, the cost justification of Gear oil is given below for 60HP motor of cane carrier.

Saving of Energy cost & Cost justification of Dirghayu MP EP GO 100-

For 60 HP gear box of cane carrier-

Power consumed=35KWH per hour=35xRs.6/- per unit x 24=Rs.5040/- per day
Energy saved=14.35x35x6x24/100=Rs.723.25 per day.

Total energy saved in 2 seasons=723.25x240=Rs.1,73,580/-.

Total cost of the oil=20 liters x 400/- = Rs.8000/-.

Thus the net profit will be Rs.1,65,580/- on investment of Rs.8,000/-.

It is unbelievable 20 times.

Saving of energy cost and cost justification of Dirghayu MP EP GO 100-

For 250KW steam turbine

Considering high pressure boiler of 35 kg capacity, the energy cost can be worked out as below:-

Bagasse is @Rs.2/- per kg. 1 kg bagasse produces 2.2 kg steam.

Hence 1 kg steam =Rs.2/2.2=Rs.0.909/-.

35kg high pressure boiler will produce 9kg steam equivalent to 1KW.

Hence cost of 1KW = 9x0.91=Rs.8.18.

Cost of energy for Mill gear box of 250 KW will be 250x8.18 =Rs.2,045/-per hr.

Thus the energy cost of steam turbine driven HSGB gear box per day will be =Rs.2045x24=Rs.49,080/- per day. Considering the 14.35% energy saving, the cost of energy saved will be Rs.49,080 x 0.1435 (saving) x 240 =**Rs.16.90 lakhs.**

The cost of Dirghayu MP EP GO 100-S gear oil = 220 x 400 = Rs.88,000/-.

Net profit will be about Rs.16 lakhs on investment of Rs.88,000/-.

Similar energy saving was observed by many sugar factories in their lower HP gear boxes.

Conclusion:-

Use of biobased lubricants particularly Gear oils can save huge energy loss, & also can save the cost of production of sugar. This takes care of the first serious concern of cost of production in sugar industry.

As the gear oil is biodegradable and non toxic, disposed oil can be composted without bothering about ETP, which is second concern. All of you may be aware that, food safety regulations are being implemented by Govt. of India. With NSF certified biobased Dirghayu lubricants, you will not be bothered anymore for disposal or accidental contact of our lubricants with cane juice. In the audit of Renuka Sugars, Munoli works, our gear oil was satisfactorily used for centrifuge. Our greases and chain oils can also be used without botheration of above law.

Due to very high lubricity of our gear oils, the temperature of the gear boxes get reduced to almost ambient temperatures. The noise & vibrations improve. The wear and tear due to friction will also be substantially reduced. Your plant, the ICU patient, can now be transferred to general ward & you can also enjoy the sound sleep every night. There will be almost no break downs in the plant.

2. Dirghayu Mill Bearing Oil MP MB 100 SM:-

Petroleum based or synthetic mill bearing oils will be fully banned for use under the provisions of food safety act as there are many chances of its mixing with cane juice. This item is of major consumption for every sugar plant. The meticulous observation of temperature of bearings also becomes necessary for mill bearings, as it can get easily damaged, if proper care is not taken.

Our mill bearing oil was tested in Sant Tukaram S S K Ltd at the end of the season and we have received their certification. The consumption of our oil was almost 25% compared to presently used mill bearing oils. Moreover, there is energy saving because of the high lubricity. The temperature of the bearings and their wear and tear also gets in safe limits. It does not require meticulous observation. There is no danger to the cane juice even if our mill bearing oil gets mixed up accidentally. It is totally non toxic.

'DIRGHAYU' MILL BEARING LUBRICANT: MP MB 100 SM

Properties	Petro based	Imported	MP MB 100-SM
Colour	Black	Amber	Black
Specific gravity	0.910	0.920	0.896
Viscosity at 40 deg C/ cst	1516	8000	1700
Viscosity at 100 deg C/ cst	99	440	125 to 130
Viscosity index	143	211	180
Flash point deg C	204	>249	>210
Copper corrosion	Not mentioned	1A	1A

BENEFITS:-

- ***Bio based & non toxic***
- ***Excellent lubricity and load carrying capability***
- ***Superior thin film formation and tackiness***
- ***High protection against wear and seizure***
- ***Higher viscosity index --reduced thinning of the oil and thus reduced spillages***
- ***Any spillages /leakages can be mixed with press mud for composting.***

Thus this product can give complete relief from 3 major serious issues.

