

# Insights about Renewable Base Oils



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You've probably been reading about renewable lubricants and wondered what all the fuss is about. Can there really be high performance renewable lubes that I can use in my equipment? Here is information to keep you informed of new developments and help you decide what to use.

## Definition

Renewable lubricants are comprised of raw materials, mostly base stocks that are derived from natural sources. These can be either plant-based or animal-based, although most commercial materials are plant-based. Today, the most common sources are vegetable oils or esters based on vegetable oil products. More recent is the introduction of new hydrocarbon base oils, derived biosynthetically from sugar, and polyalkylene glycol (PAG) base oils made from renewable ethylene oxide, which comes from plant-based ethanol.

While it is obvious that certain base oils come from renewable sources, the official method of determining renewable content is the radiocarbon dating method ASTM D6866 and related methods<sup>1</sup>. These methods measure the amount of carbon that is less than five years old, which is regarded as 'renewable'. This is an unequivocal way to prove that you have a renewable base oil source.

Many customers will have concerns about whether a plant-based oil comes from an environmentally responsible source. Ecolabel 2018 Criteria 4 states: "(a) In the specific case of renewable ingredients from palm oil or palm kernel oil, or derived from palm oil or palm kernel oil, 100 % w/w of the renewable ingredients used shall meet the requirements for sustainable production of a certification scheme that is a multi-stakeholder organisation with a broad membership, including NGOs, industry and

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government and that addresses environmental impacts on soil, biodiversity, organic carbon stocks and conservation of natural resources.

*[The] Roundtable for Sustainable Palm Oil (RSPO) certificates or certificates of any equivalent or stricter sustainable production scheme demonstrating compliance to any of the following models: identity preserved, segregated, mass balance shall be accepted.*

Novvi uses the widely accepted Bonsucro, which is a multi-stakeholder organization to ensure that the claims of sustainability are valid.

### Types of Renewable Base Oils

There are several renewable base oil technologies to choose from when formulating a renewable lubricant<sup>2</sup>

- Vegetable oils such as soybean, canola (rapeseed), palm, known as HETG
- Synthetic esters that use fatty acids derived from vegetable oils by saponification, or HEES
- Hydrocarbons that are produced from renewable olefins like farnesene, known as HEPR
- PAG produced from renewable ethylene oxide, also called HEPG.

The choice of which renewable base oil to use is determined by the requirements of the application. Vegetable oils perform well in metalworking fluids and hydraulic applications where there is little heat or cold temperature exposure. Higher or lower temperature applications will need high performance renewable hydrocarbons or esters. Product cost is always a consideration, but the overall cost of ownership should be considered.

For example, shipowners, operators, and regulatory agencies are recognising the benefits of environmentally acceptable lubricants (EALs) in marine applications. In fact, the US EPA requires EALs to be used in any ship-board operation that might have 'oil-to-sea' interface; those rules are known as the Vessel General Permit (VGP) regulations. Such EALs potentially save an operator thousands of dollars in fines, cleanup costs and downtime, noted Dr. Larry Beaver, VP of R&D for RSC Bio Solutions.<sup>3</sup> Beaver points out that HEPRs can be used in VGP EALs; in fact, there is only one hydrocarbon base oil on the EU ECOLABEL LuSC list<sup>4</sup> that base oil is Novvi's NovaSpec EL34.<sup>5</sup>

### Environmental Specifications for Renewable Lubricants

Ecolabel 2011 (2015) contained the requirement that lubricants must contain 50% renewable content to be placed on the Ecolabel Approval List. Vegetable oils and ester base oils had renewable content determined by counting the carbons in the plant-derived portions of the structure. After the introduction of commercial renewable hydrocarbon base oils, it was recognised that D6866 radiocarbon dating was needed to certify renewable content. There was much debate as to whether Ecolabel 2018 –which will be put into effect as of January 1st, 2020 -- would increase or decrease the renewable content, but in the end, it was decided to only specify the renewable content if "bio-based" was included in the product claims.

*"(4b) If the term 'bio-based' or 'bio-lubricant' is used, the minimum bio-based carbon content in the final product shall be 25 % in accordance with EN 16807."*

The USDA Bio Preferred Program was established to give guidance to governmental agencies as to how to purchase products with renewable content, mandated under Federal and local laws. There are currently over 30 categories for finished lubricants, greases and cleaners and for chemical intermediates like base oils. The minimum renewable content was determined for each category by compiling the renewable content of relevant commercial products and establishing the minimum as just below the product with the lowest renewable content. For lubricant chemical intermediates, the minimum renewable content is 25%. All products must be registered with ASTM and submit D6866 results from an ASTM-approved laboratory.

The Bio Preferred Lubricant categories and the minimum renewable contents can be found here. <https://www.biopreferred.gov/BioPreferred/faces/pages/ProductCategories.xhtml>.

Note that other environmental specifications such as EPA Vessel General Permit 2013 do not require a minimum renewable content. Swedish standard SS155434 requires the minimum renewable content of 25% in accordance with EN 16807 for the lubricant to be called "bio-based".

### Applications for Renewable Lubricants

Renewable base oil can be used to formulate renewable lubricants that can perform in any

application. Many renewable lubricants are also ultimately biodegradable which is highly desired in the following:

- marine including stern tube, thrusters, on-deck or on-shore equipment
- mobile hydraulics in forestry and construction
- municipal/government vehicles
- garden and landscaping tools
- recreation including golf course equipment, jet skis, boats and snowmobiles
- transformers

HEPR has made and is expected to make more market inroads. A customer of Novvi's has a large ship owner operating in Asia that has converted around 30 vessels to an HEPR-based VGP product this year. This ship owner and its managers report being so pleased with the products performance they have made a fleet-wide commitment to convert to HEPR fluid technology. The ship owner indicated, based on the ease of fluid conversion in the stern tube application and fluid performance in the system, they see the

HEPR fluid to be a superior product to ester-based EAL fluids on the market.

However, there are far more applications where high-performance renewable lubricants add a dimension of environmental awareness and support for alternative supply chains. Engine oils, transmission fluids, compressor oils, gear lubricants, greases, metalworking fluids, rust preventatives, firearm lubes and cleaners, bicycle lubes and even musical instruments can all use renewable lubricants. Novvi has seen a growing interest with individual consumers—the B2C space -- for renewable, sustainable products. In addition, B2B customers, who are increasingly realizing that sustainability is good for business.<sup>6</sup> The rest is up to your imagination!

**LINK**  
[www.novvi.com](http://www.novvi.com)

<sup>1</sup> EN 16807, DIN CEN/TS 16137 (SPEC 91236), EN 16640 or EN 16785 are such selected methods-

<sup>2</sup> These four designations are used in ISO Standard 15380: "Lubricants, Industrial Oils and Related Products (Class L) -- Family H (Hydraulic Systems) -- Specifications for Hydraulic Fluids in Categories HETG, HEPG, HEES AND HEPR"

<sup>3</sup> Marine Propulsion and Auxiliary Equipment April/May 2019, Pages 102-103.

<sup>4</sup> LuSC List is at <https://ec.europa.eu/environment/ecolabel/documents/LuSC%20list%20for%20new%20criteria%20February%202019.pdf>

<sup>5</sup> IBID, Page 5

<sup>6</sup> Corporate Knights completed a study which identified a list of the Global Top 100 Sustainable companies; they showed that their 13-year economic return was higher than an index of unscreened peers. <https://www.corporateknights.com/reports/2019-global-100/2019-global-100-results-15481153/>