FAQS FOR SUSTAINABLE FUTURE & HVO

SUSTAINABLE FUTURE

Sustainable Future is the name of Rehlko Power Systems' new communication campaign, reflecting the strategy to offer clean energy solutions. Developing the technologies to make them possible demands knowledge, creativity, and long-term commitment. Rehlko has the designers, engineers, and vision to deliver innovation in mission-critical power generation, to find new ways to fight climate change, and to leave the world a better place.

Q1. What are the major engineering developments that have resulted in emission reductions in diesel generator technologies in recent years (improved engine optimization, more efficient fuel burn, improved aftertreatment technologies)?

For more than twenty years, the use of high-pressure common rails and piloted injections have enabled us to reduce emissions, mainly soot or black smoke emissions. Currently selective catalytic reduction (SCR) post-treatment systems are more widely used to greatly reduce nitrogen oxide emissions.

Q2. What are the pros and cons of the two «revolutionary» technologies—fuel cells and batteries scaling up and infrastructure?

In the future, we will have a choice between several solutions in function of specific needs, like the automotive market.

The biggest problem with batteries is the need to scale up. For example, to deliver enough power output to run facilities like data centers it would require several enormous battery packs.

Battery solutions are better suited for short-term storage, dedicated purpose like rental/event, or grid frequency maintenance. The main advantage is the technology is already available with high efficiency (close to 90 percent). The disadvantages are the high carbon footprint, long recharge cycle, and the use of raw materials.

Fuel cells using only "green" Hydrogen (H2) produced from electrolyzers (renewable energies or nuclear electricity) or from biomass, will be more adapted for backup applications with long-term storage. The pros are that it has a lower carbon footprint compared to batteries and can be quickly refueled with pressured or liquid H2.

The cons of fuel cell include bad efficiency of the total chain of production (well-to-wheel is roughly 25 percent), the underdeveloped H2 distribution infrastructure, and large footprint requirement compared to diesel generators. For instance, on-site storage can be done either with H2 as a compressed gas or in liquid form. Neither is ideal though. Compressed gas is not ideal if traveling over 200 miles. Liquid storage is also not ideal since it would continuously convert to vapor and need to be vented from the tank. In both instances the required space for the H2 tanks is also much larger than diesel tanks.

Q3. What are the major engineering developments that have enabled the diesel generator to improve its environmental efficiency over recent years?

Diesel engines have advanced a lot in the past 20 years and emissions have been reduced dramatically due to escalating U.S. EPA and European emission regulations. The primary enabling technology is the common rail high-pressure injection fuel system that allows electronic injection management. We can reduce black smoke emission and NOx emission with SCR aftertreatment of the exhaust.

HVO

Q1. What is HVO?

HVO is Hydrotreated Vegetable Oil (HVO), which can also be referred to as renewable diesel (RD), it is a paraffinic biobased liquid fuel originating from many kinds of vegetable oils, such as rapeseed and sunflower, as well as animal fats. It can be used in conventional diesel engines, pure or blended with fossil diesel (petrodiesel).

It is a high-quality replacement of fossil diesel made from waste vegetable oils and other sustainable materials that reduces carbon emissions by 90 percent. It allows generator users to adopt low-carbon, renewable energy without compromising performance.

Q2. How is HVO made?

HVO is made by reacting vegetable or other oils with hydrogen at high temperature and pressure. The process itself is fairly energy intensive and currently the hydrogen comes from natural gas. In the future HVO might come from biogas or via electrolysis, creating an even more sustainable solution.

Q3. What makes HVO different to biofuels?

Biodiesel receptor-mediated endocytosis (RME) is based on plants (typically rapeseed) and is a first-generation biodiesel that meets the European standard EN14214 and U.S. standard ASTM D6751 for biodiesel. HVO is based on advanced raw materials such as residues and waste. HVO is a second-generation biodiesel and meets the European standard EN15940 for paraffin fuels. In the U.S., HVO is so close in chemical composition to fossil diesel that it falls into the same ASTM D975 specification as fossil diesel.

The primary difference is the method in producing the two fuels. Traditional biodiesel is produced by reacting the feedstocks with methanol in a process called transesterification which creates a product called FAME (fatty acid methyl ester). HVO is produced by reacting feedstocks with hydrogen (hydrotreat and isomerize) which creates the paraffins.

Q4. Is HVO better for the environment than fossil diesel?

HVO fuel is significantly better for the environment compared to fossil diesel and is therefore key in helping the world achieve its net-zero carbon target.

Q5. In what form is HVO available?

Liquid form. HVO can often be used without modification in diesel engines and machinery.

Q6. Can HVO be mixed with fossil diesel?

It can. It can be mixed at any ratio and still perform efficiently. In Europe it is called HVO because it has its own fuel standard associated with it. In North America there is no difference in the fuel standard. It's all under ASTM D975 so it can be mixed at any percentage of blend with no difference in the standard.

Q7. How should HVO be stored?

HVO does not oxidate or absorb water. It's resilient in cold weather down to -32 degrees C, so it will flow easily right through winter. Its minimum flash point of 61 degrees C makes it extremely safe in warmer conditions as well.

Q8. How long can HVO be stored?

For up to 10 years. In comparison, traditional biodiesel diesel can only be stored for 6–12 months.

Q9. Is it a true slot-in solution, i.e., no modification to diesel engines?

Yes, HVO is a diesel fuel with characteristics close to fossil diesel and compliant to the same EN15940 norm.

Q10. Are any other companies making progress with HVO?

This is a fuel source which is getting a lot of traction in the market. We've seen recent news stories about big

automotive brands looking to move some of their cars and automated vehicles to this fuel source in the future. So beyond just industrial applications, we can see that this is gaining traction.

Q11. What is the cost of a liter/gallon of HVO in comparison to a liter/gallon of diesel?

Currently production of HVO is limited so stocks are limited. The price is roughly twice that of fossil fuels. As fuel providers continue to build out their global production capability, HVO availability will grow and the cost will drop.

Q12. Will Rehlko transition entirely to using only HVO with their generators?

Flexibility is key here since HVO is not available in all regions yet and may not be available during an emergency response situation where our products are built to operate. All Rehlko® diesel generators are certified to run on HVO as well as fossil diesel. Therefore, our customers can choose the fuel that best meets their needs for a given site and situation.

Q13. Why has Rehlko chosen to transition to HVO?

The introduction of HVO is part of a broader shift towards clean energy solutions which will be a critical component in the fight against climate change. Rehlko's team of designers and engineers has the knowledge and creativity to develop technologies that improve the efficiency and accuracy of systems monitoring, reduce emissions during operation, and lower environment impact throughout the product life cycle.

This shift to clean energy will also come from the introduction of renewable energy fuels, like HVO, for backup power as well as advancing revolutionary systems such as battery stores and fuel cells. Rehlko has the power to create a more sustainable future in residential and industrial markets.

Q14. Due to the existing supply shortage, finished fuel has to be shipped long distances causing negative impacts on the environment. Does this make the switch to HVO counterproductive?

Renewable hydrocarbon biofuels can be produced from various biomass sources. These include lipids such as vegetable oils, animal fats, algae and, in the future, cellulosic material such as crop residues, woody biomass, and dedicated energy crops which, means that there are many opportunities to produce this locally thus negating the shipping requirement.

Of course, if HVO is produced from soy or palm oil coming from other areas of the planet, that can have a negative impact. However, as global HVO supply chains mature, this current downside to renewable fuels is expected to be mitigated with local production.

Q15. Would HVO cause greater damage to the environment in the event of a spill?

HVO is biodegradable, nontoxic, odorless, and insoluble in water, all characteristics that make it safer to the environment and surroundings in the event of a spill compared to fossil diesel.

Q16. Is it true that HVO leads to a slight reduction in horsepower (2–3 percent) and slower transient response time than fossil diesel in event of power failure?

There is no reduction of power output, just a slight increase of fuel consumption (3–4%) due to the slightly lower density of HVO versus fossil diesel. The transient response impact is negligible when operating the generators with an emission-optimized configuration.

Q17. Has Rehlko partnered with an ethical HVO supplier?

We are currently holding discussions with several ethical HVO suppliers.

Q18. Land being used to grow fuel instead of food is leading to deforestation, which is said to be contributing 18 percent to global emissions. Is the claim of a 90 percent reduction in greenhouse gas emissions when using HVO accurate? Are there certifying bodies that guarantee this?

Many suppliers are offering certified traceability of their raw material supply chain producing HVO, which ensures customers are not contributing to deforestation and other environmental problems. Organizations such as

International Sustainability and Carbon Certification (ISCC) confirm authentication of feedstocks on a global scale, providing details of where fuel was made, its exact composition, and the amount of greenhouse gas emitted during its production and transportation. This level of traceability provides end users with guarantees around environmental and ethical sustainability, ensuring for example that production of the fuel has not resulted in damaging activities such as deforestation or land-intensive feedstocks.

Furthermore, the first generation of biodiesel used fruits or plants. The second generation uses only waste parts of vegetables. The third generation will use algae. HVO can also be produced from animal fats or old cooking oils.

This fuel is not like biofuel. Biofuel and ethanol are made from corn. Farmers must grow corn thus building the process of fuel through it. Here we are using waste, which is the beauty of this ecology.

Q19. Is there a supply and demand issue with HVO?
This is region specific. Currently the supply lines in EMEA and in North America both have a growing supply of HVO. With increased demand comes an increase in local refineries being built so any supply and demand issues are short term.

Q20. How can you guarantee supply of HVO?
We are in discussions with local suppliers. The ability for HVO to be interchanged with petroleum diesel allows great flexibility. Guaranteed supply is expected to improve as fuel companies build out their global production footprint.

Q21. How will HVO benefit customers?
The major benefit of HVO for customers is that it is fossil-free and reduces carbon emissions; thus, helping companies become more sustainable and therefore enhancing their environmental credentials.

Q22. What are the risks associated with such a transition?
All new transitions can be risky, but risks are relatively low with HVO. We want to offer our customers greater choice and inform our customers that there is a solution to have a more sustainable backup combustion engine.

Q23. When will the Rehlko emissions data sheets be updated to show emissions with HVO?
There are no immediate plans to update the emissions data sheets to show emissions with HVO. As our engine partners test their fleets with HVO and publish emissions data, Rehlko will publish emission data sheets.

Q24. Do the engines require changes to their fuel mapping when operating on HVO?
No, there are no fuel map changes required.

Q25. Will the standard warranty be affected if running the generator set on HVO versus diesel?
No, warranty coverage will remain the same whether the generator set is run on HVO or diesel and so long as the fuel standards are met (ASTM D975/EN5940).

Q26. Are there any other fuels on the market that you are considering?
HVO is currently the best alternative to fossil diesel on the market; both for its efficiency and its carbon footprint.

Q27. What does HVO mean for Rehlko's ongoing commitment to battery and fuel cell research?
We will continue with our battery, fuel cell, and new technology research. We will also continue researching new fuel moving forward.