

Natural ester dielectric fluids for safer, cleaner and more cost-effective transformers

More utilities are beginning to make the move from mineral oil to renewable alternatives in order to better meet rising energy demands. Dave Roesser of **Cargill** discusses the advantages of its ester-based Envirotemp FR3 fluid.

Mineral oil may still account for most of the dielectric fluid market, but utilities are beginning to realise that alternative products can have numerous benefits. Enter Cargill's Envirotemp™ FR3™ fluid – a natural ester dielectric fluid, derived from renewable vegetable oil. The product is used by some of the largest utilities and transformer manufacturers globally.

As FR3 fluid, a biodegradable natural ester fluid*, is classified as carbon-neutral by the Building Environmental Economic Sustainability (BEES®) life-cycle analysis and is suitable for areas near waterways due to its non-toxicity, it certainly has more environmental benefits than mineral oil. But that isn't its only benefit.

"Probably the most important value proposition we see in utility use of FR3 fluid across the globe is its high fire point," says Dave Roesser, global general manager of dielectric fluids at Cargill.

FR3 fluid has a fire point of 360°C, almost twice that of mineral oil. This property greatly improves the safety of a transformer, particularly in heavily populated areas. For mining utilities in particular, a product with a high fire point provides a significant advantage over traditional mineral oil.

FR3 fluid is classified by Underwriters Laboratories and FM Global as a less flammable fluid. Improved fire safety enables utilities to reduce clearance around buildings and equipment, eliminate the need for additional expensive fire-mitigation systems, and potentially reduce insurance premiums and liability reserves.

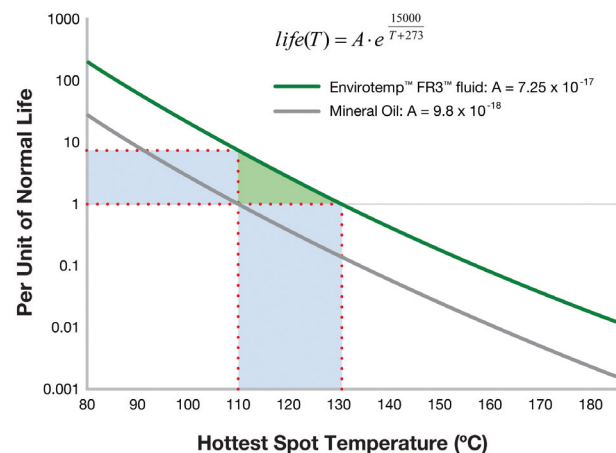
"We have more than 500,000 transformers on the grid on the distribution side and haven't had one single fire. It's almost impossible for the transformer to catch fire," points out Roesser.

Load up

Electrical transformers commonly fail when the solid insulating system degrades because the temperature operating limits of a transformer are constrained by the thermal capabilities of the insulating system. For FR3 fluid, this is far less of a problem.

"A transformer filled with FR3 fluid can operate at 20°C warmer than the mineral oil equivalent while maintaining the same life expectancy**," explains Roesser.

A higher temperature can increase loadability by up to a fifth, meaning utilities can increase capacity without changing transformers.



FR3 fluid can operate at 20°C warmer than mineral oil, providing the flexibility to increase load capability up to 20%, increase insulation system life or both.*

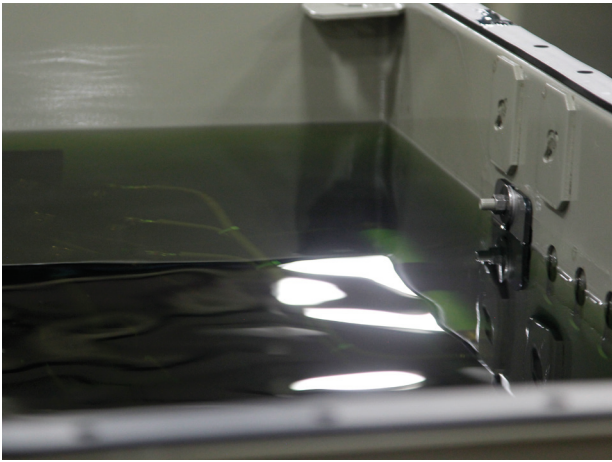


The dielectric fluid is a natural ester and has been classified as carbon-neutral by the BEES 4.0 life-cycle analysis.

"I've got a fluid allowing you to manufacture a transformer that in the same footprint gives 20% more capacity than mineral oil, or can be made 20% smaller for the same capacity thus leading to reduced costs. From a total cost of ownership perspective, not only can we give you fire safety and environmental benefits, but we can also give you a product that is less expensive than a mineral oil transformer. For a country or nation, or an area that's looking at high demand and low supply, that's a huge benefit for utilities."

Roesser is keen to point out that the key to Cargill's success so far is the recognition that what utilities seek in a transformer fluid often depends on their location.

"Some places are growing, some places are trying to rebuild infrastructure and some places are growing so fast they can't



The requirement for less dielectric fluid is one of the modifications possible in transformers designed with a high-temperature insulation system.

keep up. We have a small part to play in helping alleviate some of those issues," he says.

FR3 fluid is deployed globally, and fast-developing companies with increased energy demands are testing out the alternative dielectric fluid.

"India is looking at how it can deal with increased demand and how to make sure its network grid is robust so they don't have issues with blackouts. FR3 fluid can help play a role in some of those issues by increasing capacity," says Roesser.

“From a total cost of ownership perspective, not only can we give you fire safety and environmental benefits, we can also give you a product that is less expensive.”

Some countries are particularly concerned about the impact their increased energy demands will have on the environment.

"If I look at other areas, like Asia and Brazil, that are growing by leaps and bounds, the environmental impact is important, because where they're getting most of their energy is in forested areas. They're very concerned about environmental issues, which FR3 fluid can help with as well."

On the grid

But it's not just developing countries that are jumping on the bandwagon; there has been much interest from traditional markets that are struggling with cost pressures and environmental legislation. Efficient infrastructure is the prime concern with ever-rising grid-maintenance costs. The grid has to be upgraded for future generations, so the need for a more efficient transformer is pressing.

"For one particular large utility in the West Coast of the US, all the distribution transformers are using FR3 fluid," says Roesser. "The reason for this is the added benefit of extended life. When they looked at their net present value (NPV) calculations on their grid, they realised it was a significant saving for them, even though the initial cost is



Flexible load handling and an enhanced life cycle help to improve the reliability and stability of the power grid.

a little higher. Over the course of a ten-year period, FR3 fluid could provide millions of dollars' worth of savings for that generator."

There are clear business, environmental and safety advantages for utilities switching from mineral oil to a renewable product, but Roesser is not unrealistic. He is aware that a change to renewable fluids will take time in a conservative industry.

"At the end of the day, I do think there will be significant investment in renewable fluids, and products like FR3 fluid will be significant players in the global market," he adds.

FR3 fluid was originally formulated in the mid-nineties by Eaton's Cooper Power Systems. Cargill and Cooper continued to co-develop FR3 fluid over the next decade. In June of 2012, Cargill purchased all the data, information and intellectual property rights for FR3 fluid, completely taking over the business. The product is currently manufactured in the US and Brazil.

"We intend to grow the business significantly over the next ten years," says Roesser. "No one else has the technical expertise that Cargill has. We're a large refiner of vegetable oils around the world, which means we can provide a global solution to the industry."

Looking to the future, FR3 fluid will be manufactured and supported in many more places around the world.

"In the next two years, we will have manufacturing in Mexico, India and in Asia-Pacific. It's about growing the business long term, and to do that we need to support it from the technical and commercial sides, as well as the operations side."

*** BEES 4.0 life-cycle analysis. Meets IEEE and IEC standards.**

****See IEEE C57.154 standard for the design, testing, and application of liquid-immersed distribution, power and regulating transformers using high-temperature insulation systems and operating at elevated temperature.**

Further information

Cargill
www.envirotempfluids.com

