

ENEL Green Power chooses SPL transformers filled with FR3 fluid to advance sustainability goals in solar power

ENEL Green Power, one of the world's largest and most innovative renewable power developers, chooses more sustainable and higher performing* Sustainable Peak Load transformers filled with Cargill's FR3[®] dielectric fluid for the first time in their VIDCO Cluster Solar projects in Spain.

Situation

In 2020, ENEL Green Power (EGP) kicked-off a project to specify a better transformer for their ambitious "net zero" strategy to eliminate carbon emissions from their value chain by 2040. In the past, EGP specified only mineral oil-filled transformers and dry-type transformers in their solar power generation plants, but were searching for a more sustainable, more reliable, and higher performing transformer to use in their future solar projects. These types of transformers would first be implemented in their VIDCO solar cluster in Extremadura, Spain, formed by PV AGRIPA, PV ALAUDAE and PV GEMINA, totaling 136 MW.

As solar plants become larger and generate more power, new challenges are emerging that require special attention. Mineral oil-filled and dry-type transformers have limitations that make it difficult to increase their power density to meet the need of handling more power while also being able to integrate into existing cabins on the skid.

The idea of utilizing a Sustainable Peak Load (SPL) transformer, one designed to run at a higher temperature in order to get more power density, filled with a biodegradable ester insulating fluid, emerged as the technology that could help EGP meet their net zero goals. The SPL transformer would be realized by utilizing and taking advantage of the biodegradable ester fluid's properties to

*Compared to mineral oil

CASE STUDY



One of the 5000kVA rated/7000kVA peak power SPL transformers filled with FR3 fluid in the solar skid.

tolerate higher heat than mineral oil and better overcome the demanding load fluctuations, while also being more sustainable. EGP searched for a biodegradable fluid that was proven, tested, and had a knowledgeable team behind it to help realize their goals. For the VIDCO projects the insulating fluid selected was Cargill's FR3 natural ester.

Goal

The goal of EGP's project was to advance their mission of sustainability and net zero carbon emissions, but without sacrificing the reliability or performance of their products. Silvia Gasperetti, the Head of the Circular Economy Unit in 2022 for EGP, realized after the team's research that the use of a bio-based and biodegradable ester fluid in the transformer could help EGP achieve a more sustainable transformer that also had an increased power density. "As we got further into our research and realized that a biodegradable ester fluid could not only help lower our CO₂ footprint, but also help increase the power density and performance of the transformer, it became clear that this was the insulating fluid we wanted to use to help achieve our goals" she explained.

During their analysis, EGP realized that many transformers using mineral oil were over designed and built larger than needed for solar load profile applications, wasting valuable resources like aluminum, steel, copper, and other materials. Being derived from petrochemicals, mineral oil is also not a sustainable fluid, further setting back the net zero goal.

Solution

EGP conducted an in-depth study on insulating fluids to understand which fluid would help meet their net zero goals. They evaluated characteristics like dielectric strength, heat transfer ability, oxidative stability, fire safety and flammability, biodegradability, carbon footprint, and recyclability to determine which insulating fluid would work best. They also analyzed the impact of the fluid on the transformer and substation design to ensure a smooth integration into the power grid.

After much analysis, EGP determined that biodegradable natural ester fluids were one of the best solutions and utilized Cargill's FR3 fluid as one of the preferred products to help make it a reality. EGP used FR3 fluid because it is 100%

"Cargill's FR3 fluid team was instrumental in helping us further understand the power of what natural ester and FR3 fluid could do to advance transformer design and help us reach our net zero goals. They were open and collaborative from the very beginning of the project. We look forward to continuing our partnership and working with the FR3 team to further achieve our sustainability goals in more solar and wind power projects in the future."

Alberto Pico Fernandez,
EGP Technology Design to
Value expert



biodegradable, carbon neutral, and possesses high temperature capabilities to help ensure more reliability and higher loading capacity. FR3 fluid also has superior fire safety with a 360°C fire point and has excellent moisture handling capabilities to help extend paper insulation life and create a more robust transformer.

Results

EGP was able to transform their vision into reality and design an SPL transformer that uses natural ester at a cost equal to, or even lower than, the more conventional alternatives that use mineral oil. SPL transformers get more power in the same sized package, helping save valuable materials and when filled with natural ester, also helps eliminate CO₂ from the supply chain.

The SPL transformers for the VIDCO projects will use nearly 14 tons less of valuable materials, including iron, aluminum, and insulating paper, along with being more sustainable, thanks in part to the use of FR3 natural ester fluid. One of the reasons for the success of the project was the close collaboration between the EGP and the Cargill FR3 fluid teams.

EGP's first project used 21 SPL transformers filled with FR3 fluid in the VIDCO solar cluster in Extremadura, Spain. Initial testing of the transformers was completed and the transformers were commissioned and energized at the end of 2022.

Key Learnings

After all the analysis and planning for the project, EGP learned not only how natural ester helps enable SPL transformers that are more sustainable and more reliable, but also about how important the support and collaboration with the Cargill FR3 fluid teams was to making the project a success.

“Working with the EGP team to advance their mission of a more sustainable, more reliable, and higher performing transformer was something we knew we could help make a reality and are goals that both companies are very passionate about,” explained Arune Pasukonyte, European Renewables Sales Leader for Cargill. “We were happy to bring our expertise in SPL transformers and learnings from many successful applications in solar power to help advance EGP's net zero goal.”



If you have further questions do not hesitate to **reach out to your local representative.**



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