



Meeting the widely varying load capacity that comes with solar energy production.

Sprng Energy Private Limited, amongst the large renewable energy platforms in India, chooses Cargill's FR3™ natural ester transformer fluid to enable smaller installations, a reduced carbon footprint, and increased environmental and fire safety, over mineral oil.

Case

Sprng Energy, one of India's large renewable energy platforms, has built up a renewable power portfolio of 2.55 GW and it continues to grow rapidly.

Sprng Energy is committed towards ensuring safety and sustainability for its stakeholders, the environment, and the community. In line with this commitment, Sprng Energy envisioned building their 125MW Sprng Ujjvala Energy project, located in Banas Kantha, Gujarat.

This 125 MW project was built to supply competitive power at tariff of INR 2.20/kWh to Gujarat Urja Vikas Nigam Ltd. (GUVNL).

Sprng Energy's main concern while looking for a solution was to get transformers that are able to handle widely varying load capacity, which comes with solar energy production, whilst also allowing for more compact transformers that require low or no maintenance and provided adequate safety for the environment and people.

CASE STUDY

As an increasing number of nation-states are adopting aggressive Renewable & Alternative Energy Portfolios, the Indian solar energy market is nearly doubling year over year.

Pain point:

With this aggressive growth comes even greater scrutiny when sizing solar farms. The use of mineral oil in transformers adds liability related to fire safety and environmental exposure. Mineral oil is also not able to withstand the high heat and difficult harmonics from the frequent tripping of the invertors that occurs with solar power generation, which results in excessive gassing.

Goal:

The transformer needed to be able to meet the widely varying load capacity that comes with solar energy production. Optimal transformer sizing was required to allow for more compact, power dense units, allowing for higher peak loads without increasing transformer size, combined with very low maintenance and additional environmental and fire safety. All these requirements can be achieved by changing from conventional mineral oil to FR3™ natural ester fluid in the transformer.



Fig.1. FR3 filled 2 nos. of 52.5/63MVA, 66/33KV power transformer placed at Sprng Ujjvala Energy solar plant in Banas kantha without NIPS system.



Fig.2. FR3 filled 10 nos. 12MVA ,33/0.63 KV IDT overloaded upto 13.125 MVA placed at Sprng Ujjvala Energy solar plant in Banas kantha.

Solution:

After the team of Sprng Energy met with Cargill's power systems sales team to discuss FR3™ natural ester fluid and all the benefits it could bring to their project, it became clear that there was a better solution than using mineral-oil-filled transformers to meet their project goals. FR3-fluid-filled transformers can also be installed with highly simplified containment systems because the fluid is non-toxic and 100% biodegradable. Since it is a K-class fluid with a 360°C fire point (compared to only a 160°C fire point for mineral oil), using FR3™ natural ester can eliminate the need for costly fire-mitigation systems (In this case the removed NIPS system shown in Fig 1), while also lowering insurance premiums. FR3 natural ester fluid provides a safer transformer for solar applications compared to mineral oil, especially during periods of high ambient temperature and unit overloading. Additionally, FR3™ fluid is a very low to zero maintenance fluid, saving valuable time and costs.

FR3™ fluid is the most proven and validated natural ester in the world and is increasingly becoming the new standard for transformer oil in solar power generation. FR3™ fluid has been validated in over 250 tests, is used in more than 3 million distribution and power transformers across six continents and is proven in transformers through 750 kV. It meets all IEC and IEEE specifications and is UL Certified and FM Global Approved.

Compared to mineral oil, FR3 fluid allows Sprng the flexibility to safely increase loading capacity up to 20% without any accelerated aging of the transformer. FR3 fluid filled transformers will efficiently and easily



handle peak load times for solar power generation applications. And since transformers designed for FR3 fluid can be more compact than mineral-oil-filled transformers, they can offer more capacity in a smaller footprint—plus less costly transport and installation.

Following initial consultations, Sprng Energy and Cargill partnered with De-Voltrans Pvt Ltd, a well-known manufacturer qualified to make FR3 natural ester filled transformers. FR3™ fluid’s high temperature

property (IEC 60076 part 14) allowed De-Voltrans to successfully design, manufacture and test 2 power transformers with increased load capacity (63 MVA vs 52.5 MVA nominal rating) with voltage class 66/33KV and 10 Inverter duty transformers IDT (13.125 MVA vs 12 MVA nominal rating) of voltage class 33/0.63 KV with a small footprint. These units are operational since December 2022.



Optimal Sizing



Safer & Better for planet



Increase capacity

Results:

The FR3 fluid filled transformers provide reliable power in a smaller, lower weight package, making them easier to install and maintain. In the unlikely event of a leak, FR3™ fluid 100% biodegrades and is also non-toxic, so it won’t negatively impact soil and water life in the area. It also handles higher peak loads than a mineral oil filled transformer, so Sprng Energy can be assured of high performance even during peak power generation. Because of FR3 fluid’s ability to absorb high amounts of water, continuously drying the paper insulation in the transformer, no maintenance is needed under normal operating conditions. The operator is very satisfied with the benefits and performance he observed with the use of a transformer filled with FR3. With the success of this

project, Sprng energy anticipates using FR3 in future solar projects as well. Because of the success of the first application of FR3 fluid, an additional order for 2* 110 MVA, 220 KV transformers filled with FR3 natural ester on DE-Voltrans to be used in a 220 MW onshore solar project at Rajasthan has also been placed. Sprng is also evaluating using FR3 fluid filled transformers in their other renewable energy projects, including wind projects, to help ensure more reliable, higher performing, and sustainable projects.



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

FR3_fluid@cargill.com
FR3fluid.com



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