Ahead of their time

Redesigned Distribution Transformers filled with natural ester dielectric fluids are helping Tata Power resolve multiple challenges in providing electricity—safely and economically—to its customers in Mumbai, India.

With more than 22 million residents, Mumbai, India, is the third-most densely populated urban area on Earth. This "mega-city" is home to more than 53,000 people per square mile—roughly twice the current population density of New York City. As a result, electric power companies in Mumbai are facing space-constraint issues that will soon be a challenge for other large cities around the world. Thanks to the foresight of The Tata Power Company Limited, headquartered in India, other power generation and distribution companies would soon have a roadmap to refer to for their future.

TATA POWER
Lighting up Lives!

"Natural ester dielectric fluids offer a number of advantages over mineral oil—especially when it comes to operating in densely populated areas,"

R. Pillai, Chief Corporate Operations (Transmission and Distribution), The Tata Power Company Ltd.

FR3 FLUID DELIVERS SMART, POWERFUL SOLUTIONS TO THE GRID

The Tata Power Company Limited is India's largest integrated power company with a growing international presence, serving more than 600,000 residential and commercial customers in Mumbai and more than 1,400,000 customers in New Delhi.

It began exploring the use of natural ester fluid filled transformers in 2003, according to Pillai, but didn't have a local manufacturer to provide the product and fluids expertise. In 2013, Tata Power began working on a prototype for a more compact power transformer filled with Envirotemp™ FR3™—the natural ester fluid most widely used in transformers – and tapped into the expertise of Cargill's dielectric fluids team.

"Key drivers for us were the space constraints to install the transformer and increased fire safety—plus the Indian government's push toward smart cities and a smart grid," said Pillai. "But the other properties of FR3 fluid—its high temperature capacity and environmentally friendly characteristics—coupled with a need for additional capacity, were also attractive to us."

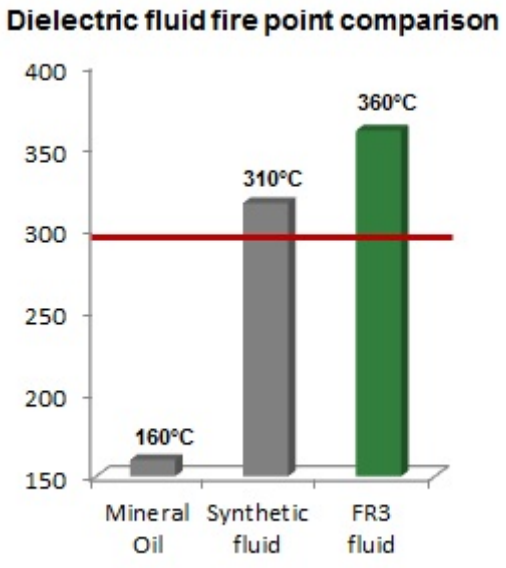
Tata Power's engineers, collaborating with Cargill's dielectric fluids team and a transformer manufacturer, leveraged FR3 fluid's capabilities to develop a new design for a 20MVA transformer that could increase capacity by 25%. After refining the initial design scheme, Tata Power's engineers built a prototype. Factory-based tests of the prototype revealed even better performance than the engineers had actually planned for, according to Pillai.

Tata Power's new 20MVA design achieves continuous loading of 25/30MVA (KNAN/KNAF) for 25% capacity increase in a space constrained area.

FR3
ENVIROTEMP™ NATURAL ESTER FLUID

The new 20MVA design achieved continuous loading of 25/30MVA (KNAN/KNAF):

- 25% capacity increase in space constrained area:
  - 20/28 MVA with traditional temperature rise
  - 25/30 MVA utilizing FR3 fluid thermal capabilities (per IEC 60076-14)
- Increased fire and environmental safety in densely populated area
- Multiple economic benefits including:
  - Total ownership cost is similar to functionally equivalent (25 MVA) mineral oil transformer
  - Slower aging/extended life and higher reliability of assets by extending insulation life
  - Incorporated ester-filled on-load tap changer manufactured by Easun-MR
  - Lower land costs due to smaller footprint
  - Elimination of firewalls/suppression systems



As successful as it was, the initial redesign didn't even take full advantage of FR3 fluid's high-temperature functionality. The transformer could safely perform at temperatures as much as 20 degrees centigrade higher; which means the transformer could operate at a higher capacity—or be redesigned with an even smaller footprint.

A NEW INDUSTRY PARADIGM

Since completing their tests and gaining statutory approvals, Tata Power has installed two of these new FR3 fluid-filled transformers in Mumbai's financial district.

"Our team has created an awesome new transformer," Pillai said, "but we're not finished yet. We plan to refine the design to further decrease the footprint and improve performance. This could change the landscape of the power industry in India and create a new paradigm that can be adopted successfully by any country in the world."

For more information visit envirotempfluids.com or contact us at fr3fluid@cargill.com