

SUCCESS STORY

EPRI's Novel Sealing Techniques Help UK Power Networks Reduce SF₆ Greenhouse Gas Leakages, Protecting the Environment while Increasing Efficiency



UK Power Networks owns and runs the cables and substations that deliver electricity from the national grid to 8.5 million homes and businesses across London, the South East and East of England, serving approximately 20 million people. As the country's largest electricity distributor, it has invested more than £6.4 billion in its electricity networks since 2011, focusing on safety, network reliability, sustainability and affordability. The company's ambitions include reducing carbon emissions, waste, water usage, and pollution while increasing biodiversity at many of its sites.

UK Power Networks saw an opportunity to reduce emissions and increase reliability by testing innovative SF₆ leak sealing materials and techniques at its Braintree substation as part of an EPRI field trial. The company enlisted EPRI's assistance with the research design and implementation, and one UK Power Networks field technician received training from EPRI for future applications.

REDUCE, CONTROL, AND SAFEGUARD

Sulphur hexafluoride, also known as SF₆ gas, has been extensively deployed in the electric power industry mainly due to its high dielectric strength and outstanding arc-quenching ability. Other remarkable properties of SF₆ include its thermal stability and conductivity, and that it is chemically inert, non-toxic, non-inflammable, non-corrosive, and non-condensable at low temperatures. Medium- and high-voltage electrical equipment contains SF₆ to insulate the live electrical parts and to switch the flow of electrical current on and off.

However, SF₆ is a potent Greenhouse Gas. According to the Intergovernmental Panel on Climate Change (IPCC), it's estimated that, over a 100-year period, SF₆ is 23,500 times more effective at trapping infrared radiation than CO₂, meaning that 1 kg of SF₆ has the same impact as 23,500 kg of CO₂. Once in the atmosphere, it has an atmospheric lifetime of 3,200 years. So, there has been global consensus to reduce and control its applications to safeguard the environment.

“ We learned EPRI was investigating solutions using commercially available material, so it was viable for us to engage in testing with them. With the training we received from EPRI, we can keep assets in service, keep the lights on, and keep SF₆ out of the environment. ”

~ AYODELE OGUNJUMO

Asset Engineer

UK Power Networks

Continuously ageing assets are the major contributors of SF₆ leakages in high voltage electrical apparatus. The International Electrotechnical Commission (IEC) recommends allowable leakage rates of 0.5% per year. UK Power Networks set a target of less than 0.15% over the RIIO-ED2 business control period (2023/24 to 2027/28).

The EPRI team traveled to South Eastern England and applied a lab-tested technique that does not require an outage or reduction in equipment pressure, and uses materials that are easy to procure, apply and remove. EPRI currently has three leak sealing techniques that can be used depending on the location of the leak and equipment geometry: compression tape and putty for sealing SF₆ Leaks in flange o-rings; an adhesive and vent-pipe method for leaks in bolts or threaded fittings; and a metal patch and adapter method for leaks on flange interfaces.

UK Power Networks tested the adhesive and vent-pipe method at its Braintree substation with successful results. When an unrelated leak developed on a switchboard at one of its 11kV primary substations, the UK Power Networks technician who participated in the EPRI field trial was able to use leftover materials and the same innovative method to seal that leak as well. This ensured that both halves of

the switchboard were available. Soon thereafter, there was a fault on a feeder. Due to the availability of the other half of the switchboard, UK Power Networks was able to switch and prevent power interruptions to those customers. The seal was still holding when the manufacturer was able to address the problem with a more permanent solution more than six months later.

SHARED SUCCESS

This applied research is expected to significantly support UK Power Networks goals in reducing SF₆ emissions, improving electric system reliability, and reducing operating and maintenance costs. Other energy companies can similarly benefit from these learnings to reduce their respective emissions.

Ongoing research tasks with EPRI's novel SF₆ leak sealing techniques include ongoing monitoring of the performance of field trials, investigations to find sealants that cure at lower temperatures, scaling existing techniques to large flanges, developing application guides and "how-to" videos for successful techniques, and continuing to search for innovative methods used by other industries.

About EPRI

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe. Together, we are shaping the future of energy.

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