FUTURE-PROOF AND DECARBONISE YOUR DISTRIBUTION NETWORK

Improve network efficiency, sustainability & reliability

How to decarbonise & future-proof the UK's distribution network by tapping into 33kV transformer assets.

The UK was the first major economy to embrace a legal obligation to achieve net zero carbon emissions by 2050.

To accelerate the path to Net Zero, HM Government published 'The Ten Point Plan for a Green Industrial Revolution' in November 2020. Subsequently, Ofgem, in its open letter on the Energy Network Association (ENA) Green Recovery Scheme, confirms its "significant impact on the electrical distribution networks over the next 10 years"

These commitments create new challenges to electricity distribution networks and will require our industry to provide agile and adaptive solutions to future-proof the network whilst decarbonising and enabling a "lower-cost zero-carbon future".

For example we will have 33kV power transformers that have been in-service for 40 years but showing potential for a further 20+ year's in-service. However, restrictions such as the limitation of reverse power flow need to be addressed to ensure the transformer can meet the rigours of a modern network.

These are complex tasks and - in order to succeed - new, innovative approaches are required. This white paper will illustrate such an approach for a critical element in the network: the 33kV power transformer.

The power transformer is an integral part of the electrical distribution network. With an extended lifespan (25+ years often being extended beyond 50 years), it lends itself perfectly to not only demonstrate the challenges of future-proofing our networks under the premise of 'lower cost zero-carbon', but also showcases how simple infrastructure decisions can help to facilitate the transition.

Maintenance free for 300,000 operations

100% reversed power flow

A perspective from a DNO/DSO "The UK's Network transformers have proved to be a very long lasting and robust asset and this has resulted in a high number of older units still being in service and in good health today. As we see changes in the requirements of a modern distribution network we must consider the capabilities of our older equipment and ensure that this equipment meets the challenges set by a modern network.

How?

The current backbone of our electricity transmission and distribution systems was built at a time when generation was dominated by large, centralised structures. Similar to the Victorian railway system not being able to adequately support modern high-speed rail, the growth of renewables and the electrification of transport mean that large parts of our infrastructure are no longer fit for purpose. For example, a power transformer in an existing network might no longer meet technical requirements due to capacity constraints or limitations in view of operational flexibility). To address such changes in technical requirements two fundamental, short term strategies are available: (1) asset replacement or (2) asset retrofit.

While the asset replacement will provide an improved asset (providing enhanced operational flexibility or improved efficiency) in the context of lower cost zero-carbon, the straightforward looking replacement strategy will need to be questioned. If, in addition, the 'Reduce, Reuse, Recycle' (3R) approach is considered, any straight forward replacement strategy would need to answer further questions in view of resource efficiency considerations. Continuing the DNO/ DSO's viewpoint "We require modern equipment that has the capabilities to be retro-fitted to our older fleet that will give us the option to assess and reuse where appropriate the older equipment extending its working life and reducing the carbon footprint."

Taking these two principles (lower cost zero-carbon and 3R) into account, an asset replacement will require significant capital investment, potentially a power transformer with a remaining lifespan will be replaced, and this replacement will generate a significant carbon footprint (just think of the raw materials and energy required to make the asset, number of vehicles involved for the site installation or the associated oil consumption).

> **Compared to the asset replacement, a successful asset retrofit could reduce the required capital investment, the remaining lifespan of the transformer could be utilised, if not even extended, and the associated carbon footprint could also be reduced.**

Obviously, a decision for asset replacement or retrofit is highly dependent on the circumstances (to name just a few: the overall strategic plan to develop the electrical distribution network, the technical requirements at hand, and the asset condition), but without a suitable retrofit solution the available choices are reduced to asset replacement or to continue to operate the existing asset which may drive a longer term / more complex strategy.

Main advantages:

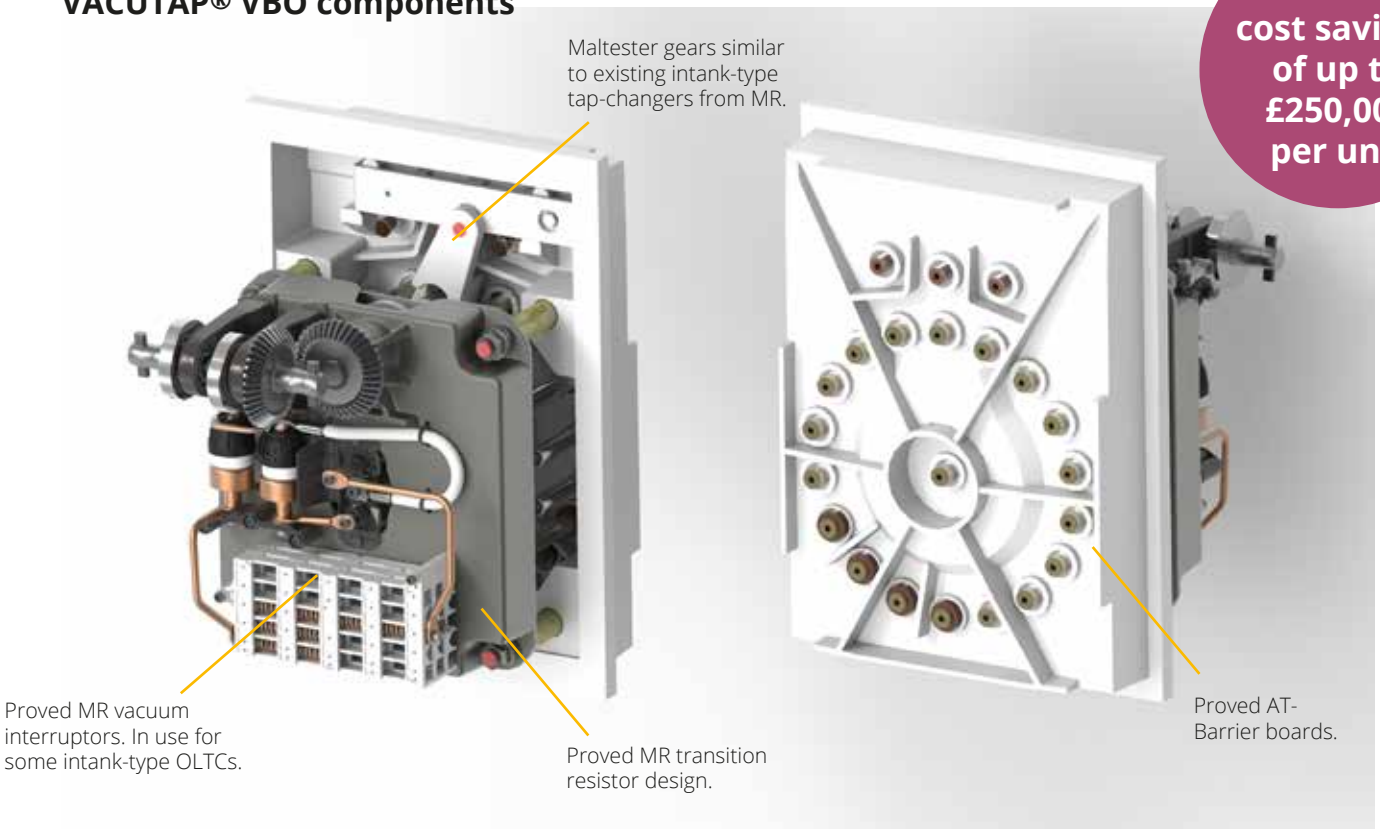
- Maintenance free for 300,000 operations
- 100% reversed power flow
- Upfront capital costs offset by lifetime Opex savings
- Maximum reliability and reduced network risks
- Lower carbon footprint
- Smart infrastructure solution & Net Zero enabler

The Vacutap® VBO® On Load Tap Changer (OLTC) for 33kV power transformers (VBO) uses vacuum technology with an innovative drive system, developed by MR in collaboration with BRUSH, is such a suitable retrofit solution. It is maintenance free for up to 300,000 operations, and allows 100% reverse power flow, and the bolt-on design facilitates easy installation.

With the installation of the VBO to an existing 33kV power transformer, the required capital investment is reduced when compared to an asset replacement, in particular when taking the tap changer maintenance savings into consideration (up to £250,000 per unit over its life). The remaining lifespan of the transformer will be utilised, if not even extended, and the associated carbon footprint will be reduced. The 100% reverse power flow capability will provide the necessary operational flexibility.

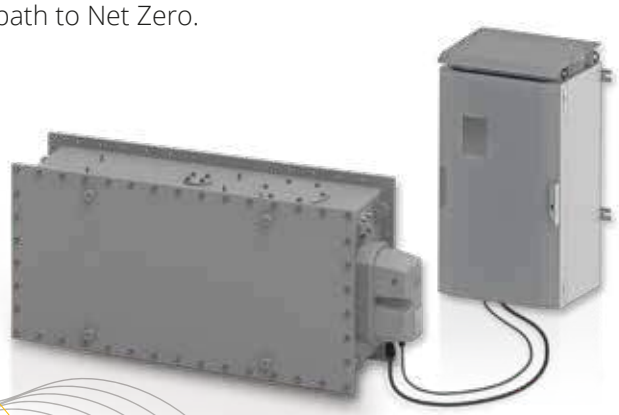
Provides cost savings of up to £250,000 per unit

VACUTAP® VBO components



For both short-term scenarios, asset replacement and retrofit, VBO is an agile and adaptive solution to future-proof the electricity distribution network while building on the principles of lower cost zero-carbon and 3R.

Vacutap® VBO® On Load Tap Changer (OLTC) for retro-fit applications in 33kV power transformers is BRUSH's contribution for a smart infrastructure and a further step on the path to Net Zero.



VBO transformer at High Voltage test bay