

# Underground MV Switchgear Market and the Rise of Solid Insulation in the US

by Saad Habib  
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The US has set ambitious goals to shift 50% of its distribution network underground by 2040. This shift will increase the demand for MV switchgear, enhance the reliability and resilience requirements of the electrical grid, and pave the way for innovations in technologies like solid insulated switchgear (SIS).



Saad Habib works as a Research Analyst, specialized in High Voltage (HV) and Medium Voltage (MV) switchgear within the power systems field. His expertise focuses on MV and HV switchgear market dynamics, with a keen eye on emerging trends, such as the adoption of SF6 alternative solutions that are poised to reshape the global switchgear market. Saad has an extensive track record, engaging in both tailored projects for leading global companies and providing off-the-shelf services. Armed with a background in Electrical Engineering from FAST and an MBA from CBM, Saad seamlessly blends technical prowess with business acumen. With over five years of Project Management experience, he is celebrated for delivering invaluable insights into the ever-evolving power grid industry, contributing to a more sustainable and efficient future.

## DRIVING THE FUTURE

- The US has set ambitious goals to shift 50% of its distribution network underground by 2040, driving the demand for underground MV switchgear upwards.
- The growth drivers for the MV switchgear industry are increasing grid resilience and reliability requirements, integrating renewable energy resources, grid expansion of EVs and DERs, and the Inflation Reduction Act (IRA).
- Solid insulation offers robust protection against environmental factors with compact designs and reduced maintenance requirements, making it an ideal choice for underground electrical distribution network.

Photo: Adobe Stock

As the United States continues to modernize its electrical infrastructure, one of the most notable trends in the energy sector is the increasing adoption of underground electrical distribution networks. This transformative approach to electricity distribution

and management is particularly prominent in urban and densely populated areas. The US has set ambitious goals to shift 50% of its distribution network underground by 2040. This shift will increase the demand for **MV switchgear**, enhance the reliability

and resilience requirements of the electrical grid, and pave the way for innovations in technologies like solid insulated switchgear (SIS). This article delves into the market of MV switchgear and the future of SIS MV switchgear in the US.

# DRIVING THE FUTURE

As the MV switchgear industry grows, new technologies, such as solid insulated switchgear (SIS), are gaining popularity.

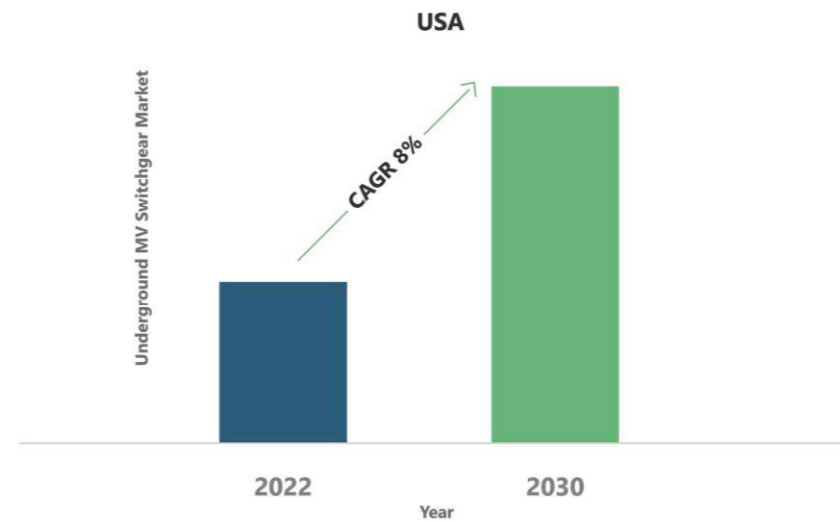
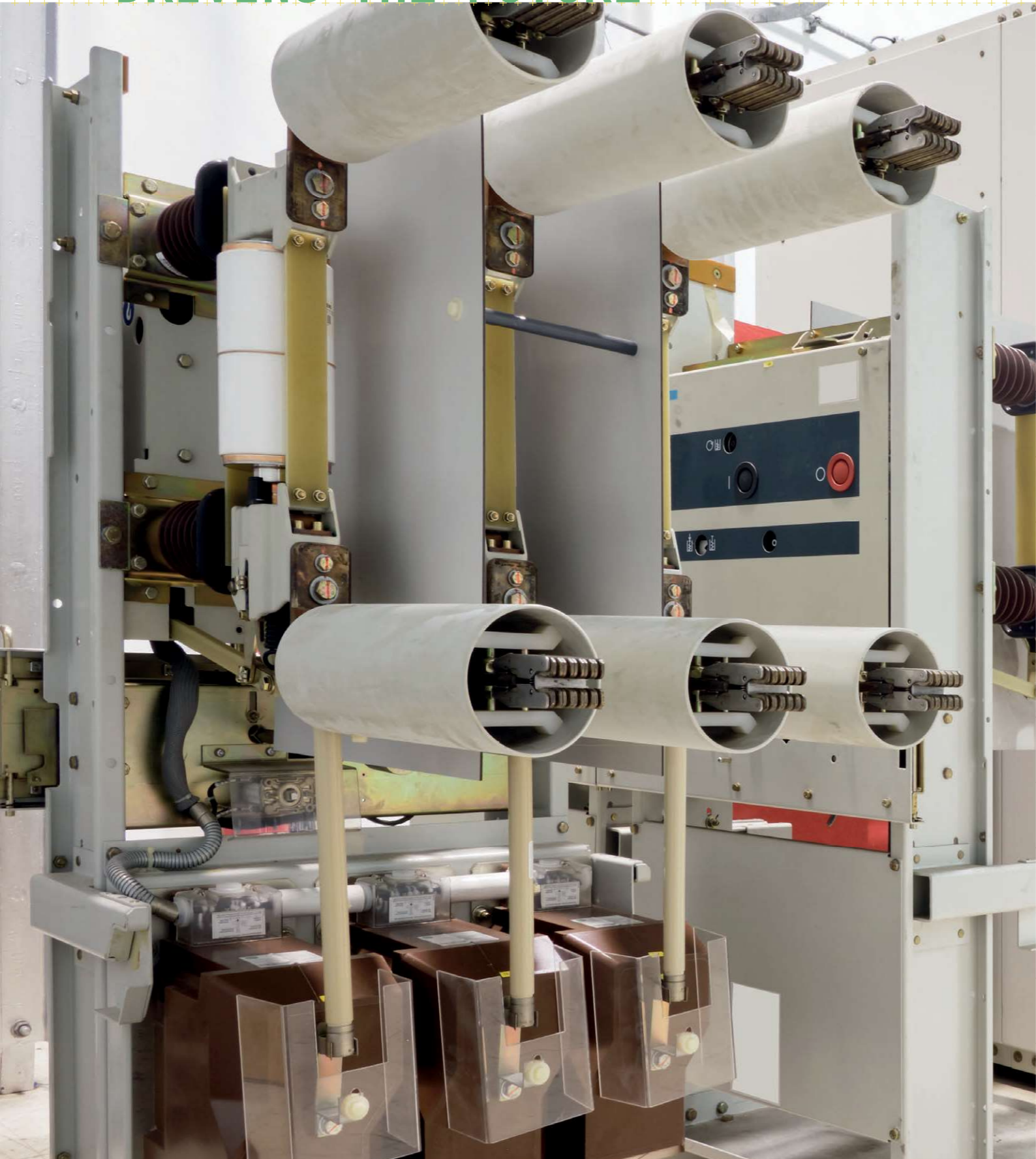


Figure 1: Expected CAGR of Underground MV Switchgear Market from 2022 to 2030. Source: PTR Inc.

### Growth Drivers for the MV Switchgear Market

The US underground MV switchgear market is poised for significant growth, projected to achieve a compound annual growth rate (CAGR) of approximately 8% from 2022-2030.

There are several drivers of growth in the MV switchgear market including grid resilience and reliability requirements, integration of renewable energy resources, distribution grid expansion, and the Inflation Reduction Act.

#### Increasing grid resilience and reliability requirements

As the **grid landscape** evolves, the emphasis on grid resilience and reliability drives the demand upward for advanced MV switchgear solutions that can withstand various challenges, including extreme weather events and cyber security threats.

#### Integration of renewable energy resources

Integrating renewable energy sources like solar and wind into the

grid requires flexible and reliable MV switchgear systems capable of managing variable power flows.

#### Distribution grid expansion for EVs and DERs

As EVs and DERs are gaining traction, distribution grids are expanding to accommodate these new energy sources. This growth requires new MV switchgear capable of handling increased capacity and ensuring smooth integration.

#### Inflation Reduction Act (IRA)

By promoting economic stability, reducing interest rates, and potentially increasing infrastructure investments, the Inflation Reduction Act is creating a conducive environment for sustained growth and innovation in the MV switchgear industry. Moreover, the focus on sustainability and energy efficiency aligns with the broader goals of modernizing the electrical grid, further improving the prospects of the MV switchgear industry. As the MV switchgear industry grows, new technologies, such as solid insulated switchgear (SIS), are gaining popularity.



## DRIVING THE FUTURE



## Future of SIS MV Switchgear in the US

Modernizing the electrical grid infrastructure has become crucial due to climate change-induced extreme weather events and increasing demand for uninterrupted power supply in urban and rural areas. This has led to multiple advancements in the MV switchgear technology. Firstly, there is a substantial uptick in demand for pad-mounted underground switchgear, which offers a more resilient and secure solution than traditional overhead systems.

Secondly, there is a preference for solid insulation in these systems. Solid insulated switchgear (SIS) is favorable due to its properties for safeguarding underground networks. Solid insulation offers superior protection against moisture, contaminants, and other environmental factors, making it a dependable choice for underground installations. Moreover, SIS technology provides compact and maintenance-free solutions, further enhancing its appeal to the evolving needs of the underground MV switchgear market. As the industry continues to innovate and adapt to the changing landscape of the energy sector, solid insulation is expected to be at the forefront of this journey towards a more resilient and reliable underground electrical grid.

Apart from solid insulation, other insulation technologies include **gas-insulated switchgear (GIS)** and dry air technology. Some key aspects to consider when opting for different types of MV insulation are dielectric strength, environmental impact, maintenance requirements, safety, longevity and reliability, regulatory compliance, and application-specific requirements. Figure 2 and Figure 3 show the comparison of dielectric strength and maintenance requirements between different types of insulation technologies, respectively.

SIS generally has lower maintenance requirements than GIS, mainly due to the absence of SF<sub>6</sub> gas handling and associated concerns. Different OEMs use SIS in the US due to its properties, which are favorable for underground installations.

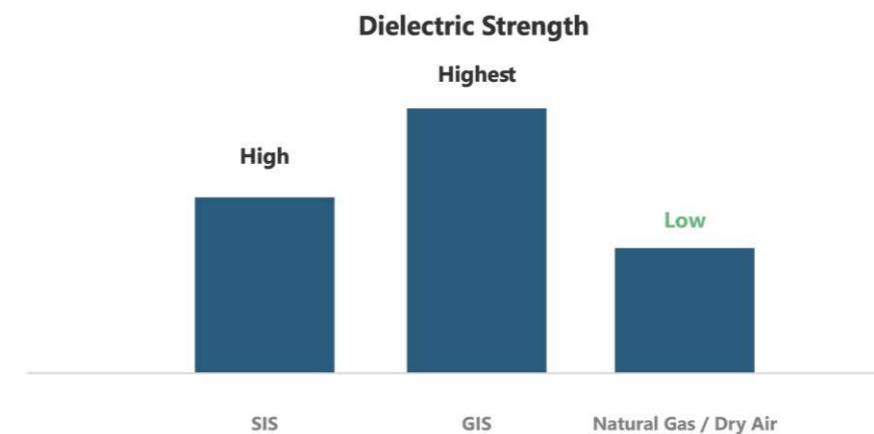


Figure 2: Comparison of Dielectric Strength between Different Insulation Types. Source: PTR Inc.

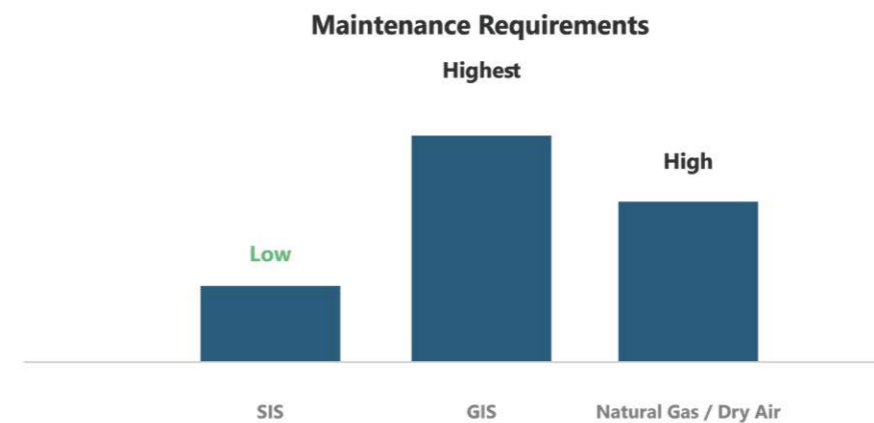


Figure 3: Maintenance Requirements as per Insulation Type. Source: PTR Inc.

SF<sub>6</sub> gas, generally used in GIS, has an exceptionally high dielectric strength. The environmental concerns associated with it have urged the exploration of alternative material insulation. Solid insulated switchgear (SIS) provides a viable option, particularly in medium voltage applications, offering good dielectric properties and environmental benefits. Gaseous alternatives like nitrogen and dry air are also being considered, especially for air-insulated switchgear (AIS), due to their lower environmental impact. However, they may have lower dielectric strength than SF<sub>6</sub>.

SIS generally has lower maintenance requirements than GIS, mainly due to the absence of SF<sub>6</sub> gas handling and

associated concerns. Natural gas MV switchgear falls between SIS and GIS in terms of maintenance requirements, with a focus on gas quality, leak detection, and some mechanical components. Different OEMs use SIS in the US due to its properties, which are favorable for underground installations.

## Looking Ahead

Technological advancements are set to shape the future of underground switchgear, with SIS technology expected to take the lead. Solid insulation offers robust protection against environmental factors with compact designs and reduced maintenance requirements, making it an ideal choice.



Considerations such as dielectric strength, environmental impact, safety, longevity, and regulatory compliance are significant in choosing medium voltage insulation. While SF<sub>6</sub> has long been the go-to dielectric medium, alternatives like solid insulation, nitrogen, and dry air are gaining traction, with solid insulation standing out as a viable option, especially for underground electrical distribution networks.

With these considerations, the US MV switchgear market is poised for a sustainable and resilient future, aligning with global efforts to reduce greenhouse gas emissions and enhance the electrical grid's overall reliability and sustainability.