Key drivers of the global growth of transformers market are increasing demand for electricity, saturated grids in developing countries, and grid stability requirements

Power transformer – global market analysis

Capacity additions and aging infrastructure driving the growth

ABSTRACT

Global market for power transformers above 100 kV reached $18 billion in 2016. APAC region has the largest demand for power transformers, with China, India and Indonesia leading the market. Following APAC is the Americas market, with USA leading in terms of the market size owing to grid replacements and renewable integration. In EMEA, strong growth is driven by GCC countries and Sub-Saharan Africa owing to increased demand.

KEYWORDS

power transformer market, smart grid, asset health monitoring

1. Introduction

Power transformers market is expected to see a strong growth in years to come. Key drivers of the global growth are generation capacity additions to cater for an increased demand and electrification, high replacement rates in developed countries and strict grid stability requirements owing to renewables. These factors have contributed to a higher demand for power transformers which will continue to grow in years to come.

2. Importance of power transformers in the grid

Power transformers are a critical piece of equipment in the power grid. A failure or disruption in such a transformer can cause electricity outage for a very large area with thousands of customers. Often, apart from causing outage, transformer failure can have external impacts, such as huge explosions, fire and damage to the property and equipment around it, Fig.1. Therefore, timely repair and maintenance is of extreme importance for these transformers and drives the maintenance and replacement market globally.

Power transformers are a globally traded product with supply and demand connected between regions. These transformers are usually built by large Tier-1 manufacturers in limited locations for export globally. This impacts the supply-demand of power transformers beyond national, and even continental borders at times. Custom design for every project, special raw materials, extremely high efficiency and

testing requirements result in high prices and lead times of several months. Due to these factors, it is important to analyze the market of power transformers (>72 kV) distinctly from distribution transformers (<72 kV). There is a significant difference in market dynamics for both types of equipment even though they are both transformers.

3. Power transformers market overview

Globally, the market of power transformers is estimated at $18 billion in 2016 [2]. The drivers of growth are high capacity additions for electrification, high replacement rates in established markets resulting from aging equipment or weather phenomenon, and grid stability requirements becoming stricter in regions like EU. Recent months have also seen a rise in mineral oil alternatives for transformers (especially on sub-transmission level) and asset health monitoring systems being installed. Looking forward, there is a strong growth expected in emerging markets like Africa and Asia; and a slight but steady growth in the established markets with 100 % electrification.

To avoid power outages in large areas, including damage to the property and equipment, timely repair and maintenance is of extreme importance

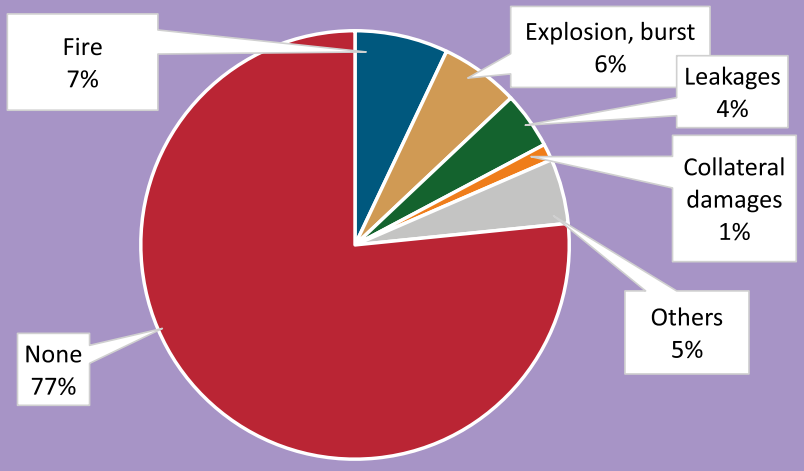

Figure 1. External impacts of transformer failure. *Source: CIGRE [1]*

3.1 Americas power transformers market

The combined market for Americas (North America and South America) power transformers was valued at $4.9 billion [2] in 2016 with the largest market being, as expected, USA at $2.9 billion, Fig. 2.

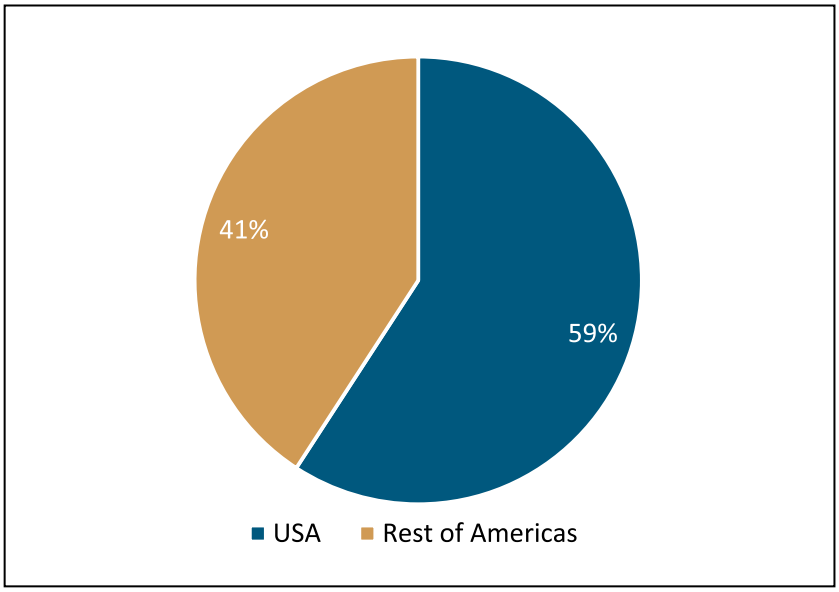

Figure 2. Americas power transformers market ($B). *Source: Power Technology Research [2]*

The trends in Americas are turnkey projects, installation of monitoring systems, physical protection, back-up units for utilities, and increased presence of foreign manufacturers

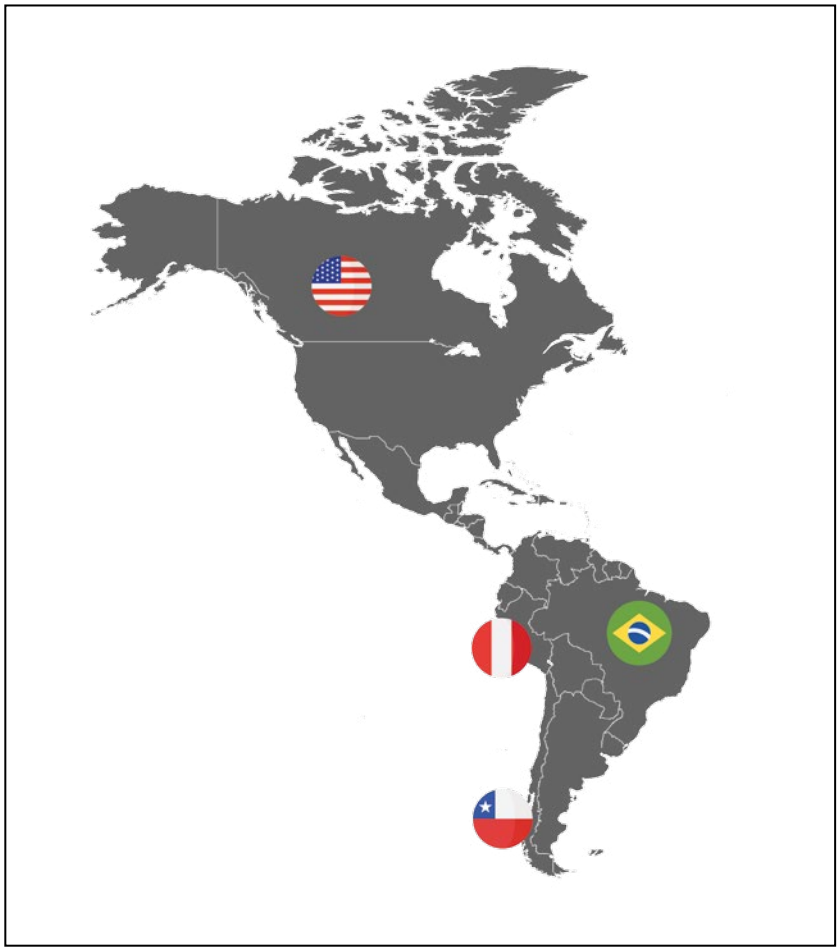

Figure 3. Key Americas markets to keep an eye on over the next three years. *Source: Power Technology Research [2]*

Key drivers of the market in the region are a steady penetration of renewables, high replacement rates of equipment in USA, and network strengthening in case of Brazil, Peru and Chile. A significant number of these transformers are going to be installed at sub-transmission voltage levels between 100-200 kV for the upcoming generation capacity additions. In USA, beyond 2019, the market will see a significant growth due to the planned grid replacements of power transformers kicking in (over 65 % transformers in the USA grid are more than 25 years old [3]). For Canada, Peru and Chile, in the near term, power transformer market will be driven by the need for transmission system reinforcement for increased system reliability while catering to higher load. Figure 3 shows important markets to follow in Americas region in the coming years.

The following are some of the most important trends in the region:

- High number of projects will be awarded on a turnkey basis. Currently, there is a big share of original equipment manufacturer (OEM) based engineering, procurement, and construction (EPC) companies doing business in the market. According to a study conducted by Power Technology Research [2], this share is going to decrease and pure-EPC are going to get a higher involvement in the turnkey process.

- Asset health monitoring market is going to rise in the future. With high failure rates of the transformers, and utilities investing a lot in new equipment, there is going to be a natural shift towards more health monitoring systems being installed on the transformers for functions like condition monitoring and predictive maintenance.

- In addition to transformer monitoring, utilities in USA are investing in bushing monitoring solutions. As bushings are a key point of failures, utilities are turning their focus towards bushing monitoring to identify and predict failures before they happen.

- Considering natural disasters e.g. hurricanes in USA and earthquakes in Chile, and increase in vandalism of transmission substations, utilities are implementing physical protection for power transformers including ballistic

protection against firearms. Additionally, unavailability of critical power transformers after such events has instigated multiple equipment sharing initiatives involving key stakeholders.

- At the moment, large utilities are partnering to generate database of critical transmission assets including power transformers so that backup can be made available without long lead times. In future, such initiatives can include top-tier transformer manufacturers so that custom-designed power transformers can be kept as potential back up for certain utilities.

- USA continues to reduce its dependence on imports by increasing local production. Manufacturers from Asia and South America are trying to strengthen their presence in the region via acquisitions or new manufacturing facilities. In South America, considering that Brazil is a closed market for imports, foreign manufacturers are increasingly shifting the focus towards Peru and Chile as potential export markets in years to come.

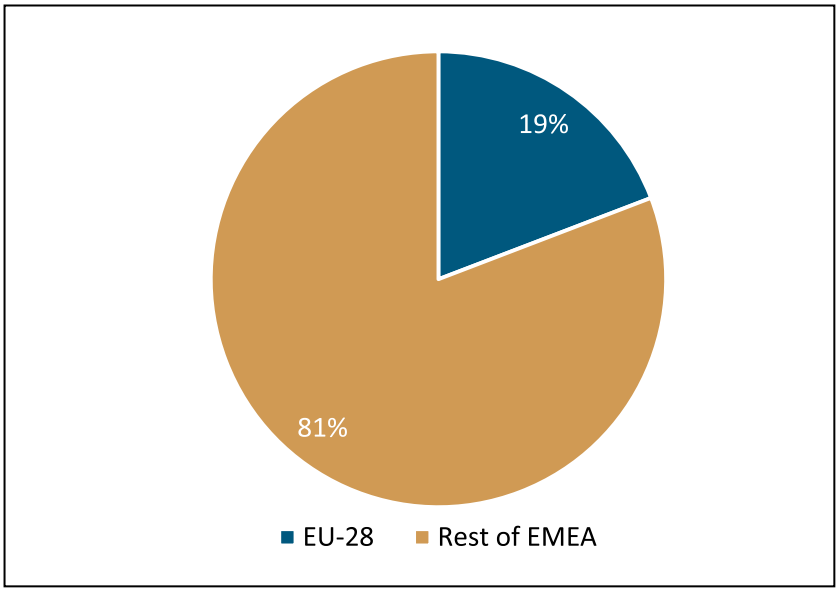

Figure 4. EMEA power transformers market ($B). *Source: Power Technology Research [2]*

Growth drivers in the EMEA region are cross-border interconnections, new generation capacity, added renewables, E-Vehicle penetration, and increased electrification in Africa

3.2 EMEA power transformers market

Europe, Middle East, and Africa (EMEA) region is exhibiting a strong growth with 2016 market size estimated at $4.95 billion. EU-28 region is estimated at $0.9 billion, with Middle-East and Africa, and Rest of Europe contributing the remaining $4 billion, Fig. 4.

Biggest markets in the EU-28 region are UK and Germany, while in the Middle-East this is Saudi Arabia. From 2013-2015, power transformers market in Germany grew because of price increase; however, market growth in the last couple of years is purely driven by an increase in volume as the prices have gone down during this period. Transmission projects in EU-28 countries are driven by standards set by ENTSO-E to realize a stable interconnected grid through cross-border HVDC and HVAC systems. In Africa, South Africa, despite Eskom's credit ranking issue, remained the largest market in terms of absolute size, driven by the need for network strengthening for IPPs coming online. Following South Africa, Eastern African countries like Kenya and Tanzania are interesting markets to look at, also due to the addition of generation capacity resulting in a need for stronger transmission network to transport generated capacity. Growth drivers in the market are increased generation capacity additions, with planned renewable additions in Western Europe and Gulf Cooperation Council (GCC) countries and the push towards higher electrification in Africa. In the long term, E-Vehicle penetration, especially in Western European countries like Norway, Germany and France will also

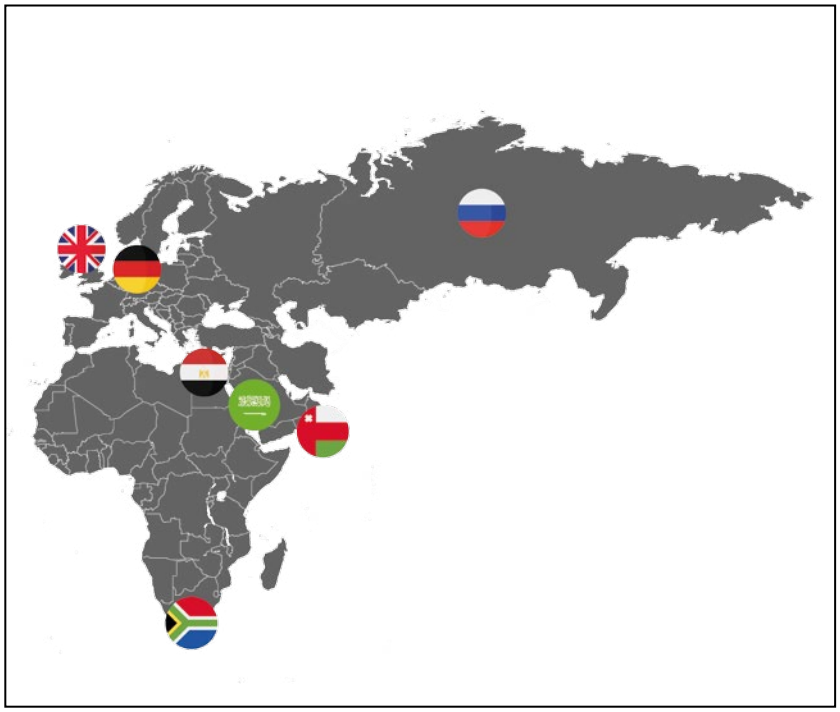

Figure 5. Key EMEA markets to keep an eye on over the next three years. *Source: Power Technology Research [2]*

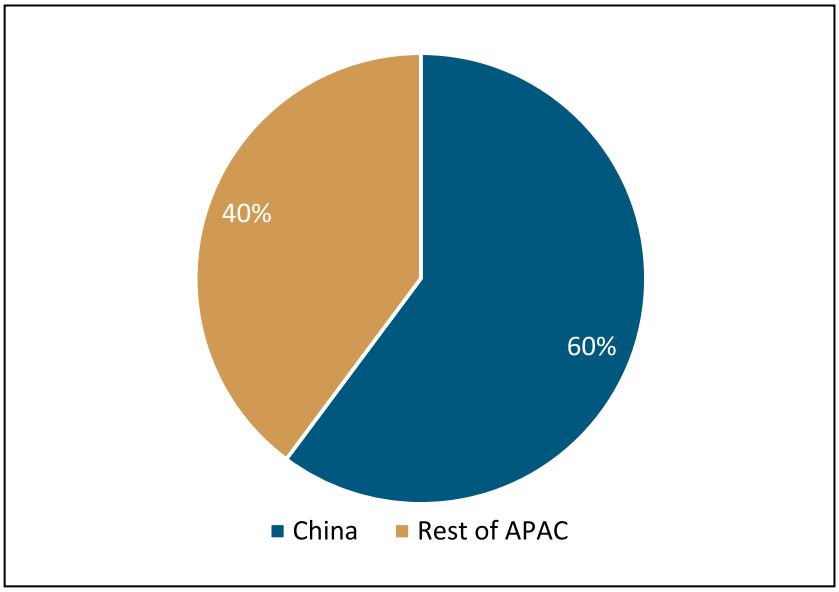

Figure 6. APAC power transformers market ($B). *Source: Power Technology Research [2]*

The trend in the APAC region that will drive growth is increased electrification, with utilities' preference for local manufacturers and turnkey projects

contribute to the increase in demand for power transformers for grid strengthening.

As in the case of North America, most of this spend will be at sub-transmission level in Europe and Africa. Renewables in Germany and UK (especially wind) are getting connected at sub-transmission level, which requires system operators to enhance grid capacity at this stage of network, hence replacements of aged power transformers and new additions are necessary. In case of GCC, a large number of 380 kV projects are coming online in Saudi Arabia, while Oman is strengthening its 400 kV backbone to connect new generation capacity to demand centers. In Qatar, new power transmission assets installed will not only serve the upcoming football world cup but will also help the network in the long term. As a result, there will be a strong demand for extra-high voltage transformers in the next few years. Right now, in EMEA, new additions of power transformers are higher than replacements because of new capacity being added in central European and GCC countries at a rate higher than replacement in Western European countries. Figure 5 shows important markets to follow in EMEA region in the coming years.

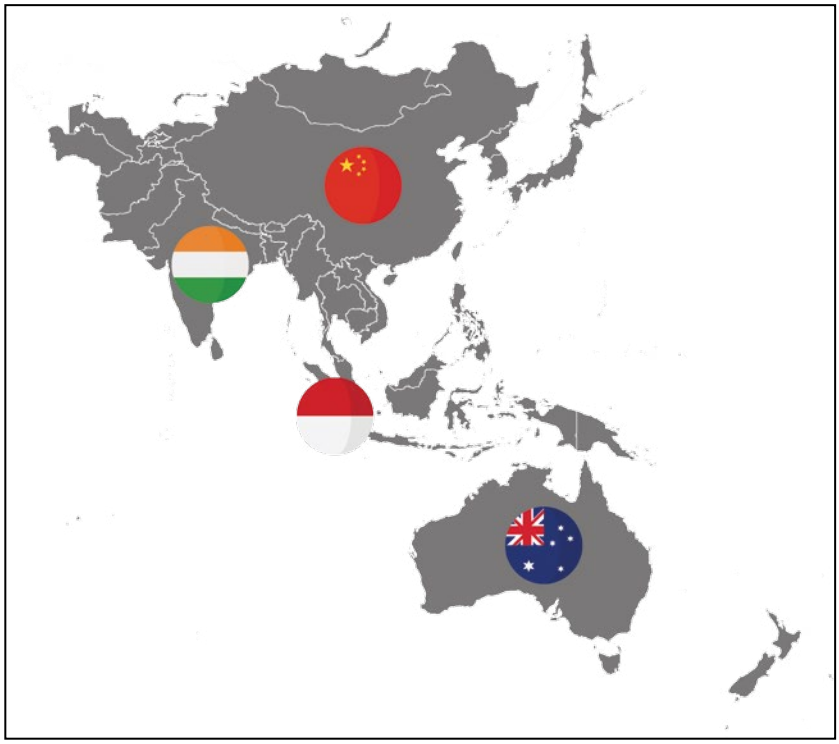

Figure 7. Key markets in APAC. *Source: Power Technology Research [2]*

Some of the key trends to look out for in EMEA market are:

- There is a significant effort going on to connect grids in Europe and GCC. ENTSO-E has already worked to develop and maintain the interconnections between different country grids within Europe. Now with utilities like TEIAS joining the European network, and interconnections increasing in GCC, power transformers market will increase due to the impact of these interconnections on the transmission grid.

- Asset health monitoring, including condition monitoring and predictive maintenance, is on the rise, as in North America. Utilities in Europe and Middle-East are spending money to digitalize their substations and install monitoring systems on critical equipment like transformers.

- In Europe, as E-Vehicle penetration increases, this will present new challenges for the transmission grid, leading to grid expansion and reinforcements. This is something to keep an eye on if you are interested in supplying to EU region.

- Increased electrification and establishment of microgrids is driving the current equipment needs in Africa. A significant portion of Sub-Saharan Africa needs to be connected to the grid, and with increasing population, the need for increased generation capacity and cor-

responding transmission infrastructure is higher than ever.

- There is an increasing influence of China in Africa on investments in the power sector, which is enabling Chinese manufacturers to penetrate the market. In Africa, the source of funding for the projects impacts the choice of manufacturer.

3.3. APAC power transformers market

Asia-Pacific (APAC) is by far the biggest market for power transformers at $8.14 billion, with China contributing the biggest share at $4.9 billion, followed by India and Indonesia. It is important to note here that China is also the biggest market globally for power transformers, Fig. 6.

As is the case with Middle-East and Africa, the growth in Asia is also strongly influenced by increased electrification and grid reinforcements. A big portion of the market is coming from substation transformers installed to cater for the increase in generation capacity, including renewables, installed at the sub-transmission level. Figure 7 shows important markets to follow in APAC region in the coming years.

Some key trends observed in the market are:

- High number of turnkey projects to be awarded by utilities. In most countries in Asia, utilities prefer turnkey solutions for substations to the 'equipment-only' approach, meaning EPCs are going to be the direct customers for power transformers instead of utilities. An exception are replacements, where utilities sometimes buy transformers themselves and in-house teams install them.

- Utilities in Asia are also inclining towards blanket agreements spanning multiple years, with one vendor supplying equipment for a few years before they shift or take bids from new vendors.

- Increasing electrification is a strong driver of market growth and will stay so in the years to come. A significant population in Asia is not electrified, and with region's current economic growth, electrification is one of the highest priorities. Countries like India and Indonesia have huge generation capacity additions planned in the next 10 years, which will lead to a need for significant expansion of transmission infrastructure in these countries. Utilities like PGCIL and PT PLN are planning ahead of time and are proactively expanding their transmission networks to support the flow of generated electricity to load centers.

- Renewable capacity additions in China and India will contribute to a significant market growth in sub-transmission segment. However, having strong local manufacturers and an inherent preference of utilities towards locally manufactured equipment, it will be difficult for foreign manufacturers to supply to these markets from outside.

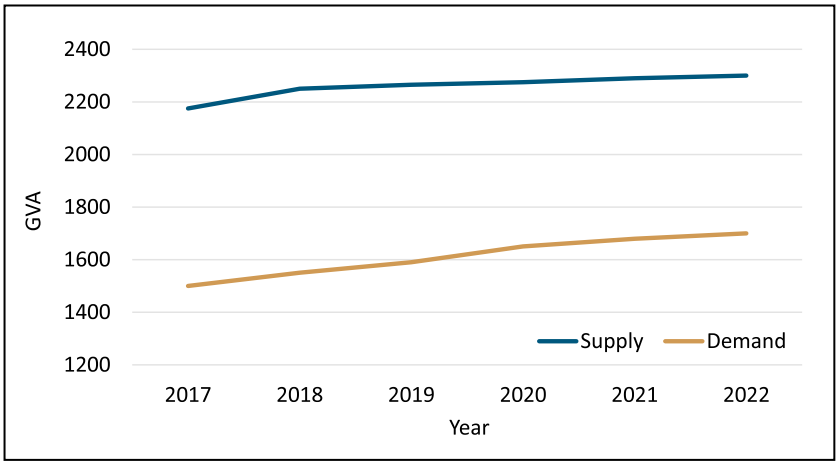

Figure 8. Global supply-demand gap. *Source: Power Technology Research [2]*

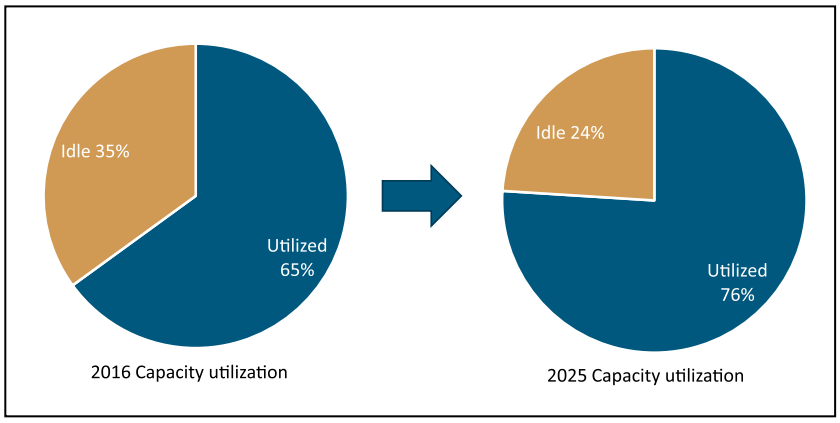

Figure 9. Evolution of capacity utilization over the next ten years. *Source: Power Technology Research [2]*

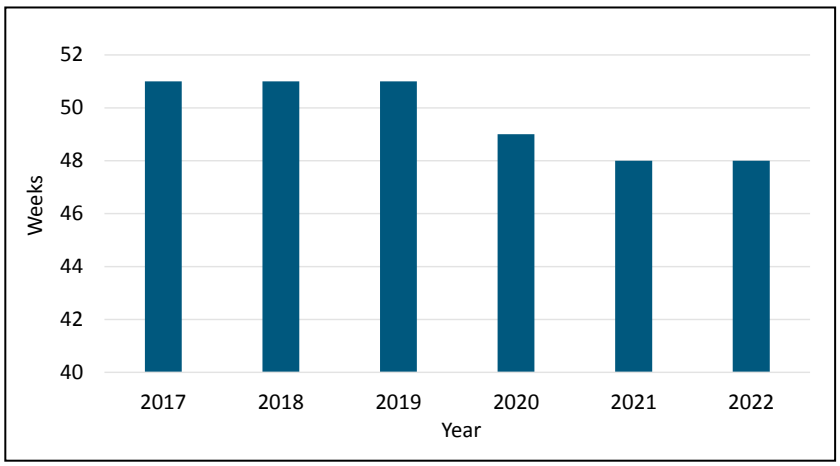

Figure 10. Estimated global lead times (weeks). *Source: Power Technology Research [2]*

In the next ten years, an increased demand for equipment in emerging markets and establishment of new manufacturing facilities closer to the customers will reduce the supply-demand gap and delivery times

4. Supply side analysis

Globally, there is a surplus in transformer manufacturing capacity, Fig. 8. Most of Tier-1 manufacturers are operating at 70-75 % of capacity utilization [2]. This is partially owing to the delays in expansion plans of some countries, e.g. South Africa due to Credit rating, India's generation plans getting delayed, etc.

This overcapacity will further increase over the next two years due to the installation of new manufacturing facilities in emerging markets. In the future, owing to the increased demand for equipment in emerging markets, the supply-demand gap is expected to reduce in the next ten-year window, Fig. 9.

Current overcapacity and increasing number of manufacturing facilities is affecting the lead times of the transformers. Although the supply-demand gap is decreasing, the lead times are still decreasing, Fig. 10, as new facilities are coming up in Africa and North America closer to the customers. This essentially means a significant decrease in shipment times.

Overall, there is a shift globally with large Tier-1 manufacturers shifting their focus towards emerging markets. With companies like ABB and Siemens focusing on Southern Africa and Indonesia by opening new manufacturing facilities and establishing partnerships, there is an indication of a shift in strategy. In the near future, Asian manufacturers will still be leading supply in the price-sensitive Asian and African markets, competing on their better prices against their European competitors, especially in the sub-transmission segment. In Europe, Middle-East and Americas, global players like ABB, Siemens and GE will dominate the market. It will, however, be interesting to note how the competition plays out. For the end customer, reduced transformer prices and a greater control over supply can be expected in the years to come.

Conclusion

Market outlook for power transformers in the next ten years is promising. Demand for power transformers will see a strong growth driven by renewable additions and replacements in North America and Europe, and generation capacity additions for increasing electrification in Asia and Africa. This growth will be experienced across all voltage segments: HV (100-200 kV), EHV (200-400 kV) and UHV (>400 kV).

A significant number of these transformers will be sold as part of turnkey tenders and sourced by EPCs, and the percentage of turnkey sales in relation to equipment-only sales will increase, although slightly. With strict grid safety standards in Europe and USA, automated data logging / monitoring systems will increasingly be installed by utilities in the future, especially on new assets. Moving forward, power transformer manufacturers should actively pursue alternatives to transformer oil and predictive maintenance solutions by offering pilot projects to utilities, which can eventually turn into good opportunities as utilities become more open to install these solutions on a bigger scale in their networks.

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