

Power transformers - Market development to 2030

A Newton's cradle with five silver spheres hanging from black strings against a light gray background with faint white geometric shapes.

The global market for power transformers has continued to grow since the global crash in 2008, and furthermore shows good potential for the ten years at least. This sector of the market should be the most stable of the whole family

of transformer markets, given that power stations are planned at least ten years ahead and major grid works are at least five years in the planning. The transformers associated with these projects are ordered two years ahead of need when it comes to generator step-

up transformers (GSU) while most transmission transformers are ordered at least one year ahead. It therefore follows that the market for these tailor-made units is highly predictable – all bar a few emergency replacements and unexpected developments.



The power transformers market is highly predictable – all bar a few emergency replacements and unexpected developments

The global installed generating capacity as shown in Table 1 has increased at between 2.1 % and 4.4 % per annum (p.a.) every five years between 1990 and 2015, and we conservatively expect the rate to continue at about 4.2 % p.a. up to 2030.

1. GSU - Generator step-up transformers

The increased capacity each year provides a direct correlation of the (GSU) Generator step-up transformer capacity that is required. These figures are the

total installed capacity at the end of each year; the amount of plant which has been installed to achieve that total is a combination of the additional installed new generating capacity and that which must have been installed to replace the old and retired plant.

Table 1. Global installed generating capacity – 1990 to 2030 [GW]

Year	1990	1995	2000	2005	2010	2015	2020	2025	2030
GW installed	2,674.80	2,974.00	3,361.60	4,006.50	4,920.50	6,100.20	7,509.40	9,258.80	11,393.80
CAGR	2.82 %	2.14 %	2.48 %	3.57 %	4.20 %	4.39 %	4.24 %	4.28 %	4.24 %

The current demand for transmission power transformers is in the order of 650 GVA, and for GSU transformers slightly more than 300 GVA

Table 2 shows the detail of these two components. Five-year intervals have been used for simplicity, but it must be noted that these are “spot figures” for each year and not the total for the five-year period.

Table 2 illustrates, in five-year steps, the total transformer production capacity that must exist globally in order to supply the demand for GSU transformers. In 1990 there must have been 74,707 MVA of capacity, by 1995 this must have increased to 161,076 MVA, and so on, through to a projected 514,475 MVA by the year 2030. This is of course the theoretical minimum; in reality the capability must be much higher than that. To begin with, most GSU transformers

are oversized by at least 10 %; secondly, no individual plant can operate at 100 % capacity over a 40-year period; thirdly, order placement and phasing would not align so neatly in chronological order on a global scale; fourthly, the size profile of the units and hence the production requirements changes year on year and over time; and fifthly, this is a global picture – there are regional variations (which will be explored later) and production capacity cannot be whisked around the globe at will!

Nevertheless, Table 2 illustrates the development of the GSU part of the power transformer market, to which must be added the system or transmission or network transformers

to provide the whole picture. Before addressing that aspect of the market, it is worth comparing the global annual capacity with the total MVA requirement over time. The figures above were single-year snapshots. Table 3 shows the effect of adding together each of the annual figures and hence the total MVA demand over the period and the annualised demand resulting from it.

By comparing the results of Table 2 and Table 3, it can be seen that the annualised demand from Table 3 is lower in each case than the total capability at five-year intervals in Table 2.

2. Transmission power transformers

The second component of the global power transformer market is the transmission transformer segment, which interfaces between GSUs and distribution transformers in the transmission and distribution (T&D) network. This segment in MVA terms is much larger than

Table 2. Global new and replacement installed generating capacity and GSU MVA at five-year intervals – 1990 to 2030

Year	1990	1995	2000	2005	2010	2015	2020	2025	2030
GW	2,674.80	2,974.00	3,361.60	4,006.50	4,920.50	6,100.20	7,509.40	9,258.80	11,393.80
New MW	63,222	140,195	116,613	154,434	279,718	245,153	315,276	376,602	464,552
Replacement plant MW	11,485	20,881	27,841	35,727	45,435	26,418	32,180	42,897	49,923
Total GSU MVA	74,707	161,076	144,454	190,161	325,154	271,571	347,456	419,499	514,475

Table 3. Total GSU transformer demand at five-year intervals and derived annualised demand – 1990 to 2030

Total MVA required	1991 to 1995	1996 to 2000	2001 to 2005	2006 to 2010	2011 to 2015	2016 to 2020	2021 to 2025	2026 to 2030
Total new MVA	399,827	452,583	715,296	1,050,473	1,272,423	1,430,172	1,753,379	2,135,056
Replacement of retired plant	139,207	139,207	162,864	203,864	124,018	151,841	201,470	234,424
Total GSU MVA	539,034	591,790	878,160	1,254,337	1,396,442	1,582,013	1,954,849	2,369,480
Annualised MVA	107,807	118,358	175,632	250,867	279,288	316,403	390,970	473,896

Table 4. Total power transformer demand at five-year intervals and resulting growth rates – 1990 to 2030

Year	1990	1995	2000	2005	2010	2015	2020	2025	2030
Total GSU MVA	74,707	161,076	144,454	190,161	325,154	271,571	347,456	419,499	514,475
Transmission transformer MVA	171,826	380,944	343,802	475,278	777,779	649,194	877,069	1,008,274	1,237,100
Total power transformer MVA	246,533	542,020	488,256	665,440	1,102,933	920,765	1,224,525	1,427,773	1,751,575
Five-year CAGR		17.07 %	-2.07 %	6.39 %	10.63 %	-3.55 %	5.87 %	3.12 %	4.17 %

the GSU segment, but it is less easy to estimate. The structure and topography of the T&D network varies from country to country and so does the demand for transmission transformers. There are many factors which impact this market segment including, but not limited to, movements in load centres, changes in the number and type of generating facilities, the development of smart grid technology, changes in voltage levels and the need for increased efficiency and reducing transmission losses.

The total demand for these transformers is shown in Table 4. Over the total 40-year period, the growth rate is a very healthy 5.1 %; however, the range covers a period between 2000 and 2010 where the rate exceeded 8.5 %, whereas in the

We can see a significant rise in demand for transformers in the Indian subcontinent and the former Soviet Union

following decade the overall figure falls to less than 1.5 %. Also shown in the table is the total power transformer demand over time. The demand which is currently in the order of 1,000 GVA, has increased from a quarter of that in 1990 and is forecast to increase by 75 % by the year 2030.

It is worth reiterating that these figures are five-year snapshot levels, not a total demand for five-year periods. The global production base must have had the capacity to produce 246.5 GVA in 1990,

542 GVA in 1995, etc. Clearly, the golden years of power transformer markets were in the decade 2000 to 2010; this has been followed by a less healthy five-year period to 2015, but it is encouraging to see that healthy growth is again predicted through to 2030.

There are two reasons for considering the market dynamics over five-year periods. Firstly, this does to an extent smooth out any individual year on year variations, and secondly – and more importantly – the process from the conceptual need for



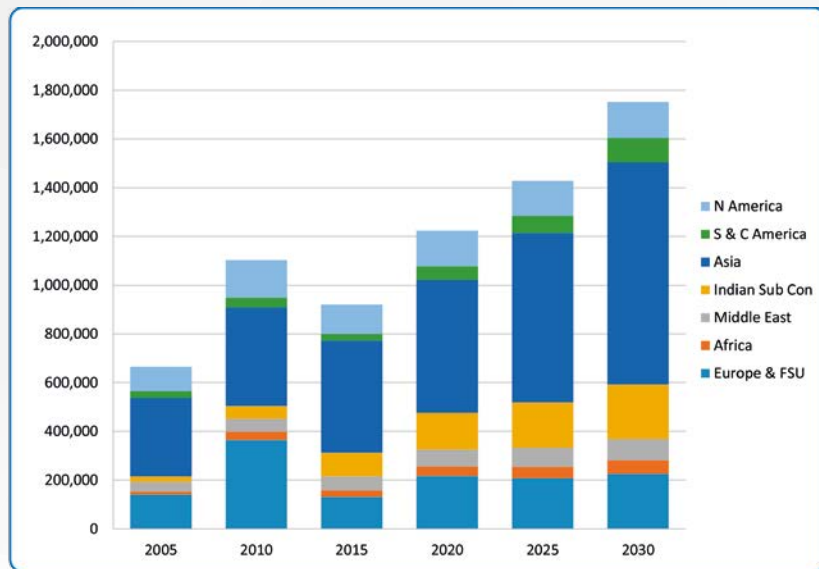


Figure 1. Power transformer demand by region – 2005 to 2030

a power transformer through to design, order, delivery and commissioning can take five years. All of the figures quoted in the tables are based on declared capacity in each individual country, and if the installed capacity in an individual country increased by 100 MW in 2015, this is

the result of the generating capacity (and GSU transformer) being commissioned in that year, which may have been ordered three years prior to that and certainly will have been taken as revenue by the manufacturer during the five-year period prior to 2015.

3. Regional power transformer demand

The demand for power transformers varies from region to region. Table 5 shows the development by region over time – the period before 2005 has been removed for simplification and it is the period 2020 to 2030 that is of most interest.

Figure 1 shows this in more graphic terms.

The fact that Asia dominates demand is probably no surprise to those who regularly study these markets, and a global share of around 50 % until the end of this forecast period is to be expected. What is less obvious is the significant rise in demand in the Indian subcontinent and the former Soviet Union (FSU). In 2020 the demand in Eastern Europe and the FSU will equal that of Western Europe, and by 2030 it will equate to 64 % of the total regional demand. It is also surprising to note that whilst demand in North America

Table 5. Total power transformer demand at five-year intervals by region – 2005 to 2030

	2005	2010	2015	2020	2025	2030
Europe & Former Soviet Union	140,534	364,182	131,329	216,755	207,428	226,029
Africa	11,692	35,134	26,745	39,559	47,061	54,642
Middle East	39,893	51,792	56,699	69,285	78,032	87,691
Indian Subcontinent	22,654	53,473	97,511	150,013	185,584	224,542
Asia	322,384	404,222	459,344	545,848	696,121	910,715
South & Central America	28,112	39,233	28,177	56,527	70,230	100,447
North America	100,171	154,896	120,960	146,539	143,316	147,510
Total	665,440	1,102,933	920,765	1,224,525	1,427,773	1,751,575

Table 6. Regional share of global power transformer demand – 2005 to 2030

	2005	2010	2015	2020	2025	2030
Europe & Former Soviet Union	21.12 %	33.02 %	14.26 %	17.70 %	14.53 %	12.90 %
Africa	1.76 %	3.19 %	2.90 %	3.23 %	3.30 %	3.12 %
Middle East	6.00 %	4.70 %	6.16 %	5.66 %	5.47 %	5.01 %
Indian Subcontinent	3.40 %	4.85 %	10.59 %	12.25 %	13.00 %	12.82 %
Asia	48.45 %	36.65 %	49.89 %	44.58 %	48.76 %	51.99 %
South & Central America	4.22 %	3.56 %	3.06 %	4.62 %	4.92 %	5.73 %
North America	15.05 %	14.04 %	13.14 %	11.97 %	10.04 %	8.42 %
Total	100 %	100 %	100 %	100 %	100 %	100 %

remains high at a little under 150,000 MVA from 2020 through to 2030, it nevertheless declines in global share over that period to end at a just over 8 % of global demand by 2030.

Many of the global manufacturers have concentrated production of power transformers in Asia and this process has continued since the end of the last century; siting production near to demand has many advantages given the cost of transporting such large items of capital plant across the globe (Brown Boveri were implementing that strategy in the early 20th century by winning power development projects in a country and then constructing production facilities close to the project site). Over and above that Table 6 seems to vindicate the decisions of many of those players to increase production in India and in Russia. What seems less certain is the future of investment in Latin America or for that matter North America. The USA is currently investing heavily in T&D development and large power transformer manufacture has again returned to the USA. The scale of investment necessary to establish

Apart from determining the correct manufacturing capacity, there also remains the question of establishing the correct type of production

production facilities is high and the return benefits take years to realise, therefore careful consideration is necessary and above all timing. The investment in the USA by EFACEC was soundly based, but ultimately was too much and above all the whole industry has a history of establishing overcapacity at the tail end of a boom period. There also remains the

question of establishing the correct type of production; 30 years ago large 300 MVA GSU transformers for large centralised generating facilities were the norm, but this must now be contrasted with the myriad of GSUs less than 5 MVA that are needed for wind farm development; however, that is probably the subject of another separate article.

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