The rule-of-thumb estimate of the value of the components and materials used in the production of transformers globally is US$20-22 billion per annum

Transformer components and sub-assembly markets

The production of any power or distribution transformers requires the purchase and assembly of many components and materials, some of which are commodity items that are used in a variety of products, and some are tailor-made specifically for the transformer industry. Examples of the former include sheet steel, paint, aluminium and copper section, fixings, etc. and examples of the latter include grain oriented steel, bushings, transformer oil, etc.

We know that the global transformer market has a value in the order of US$40 billion annually. It is therefore computable to estimate the value of the components that are used in the production of those transformers. To save time and computing power, the rule-of-thumb figure is slightly over 50 % or US$20 billion to US$22 billion annually. However, this headline figure offers no insights into the dynamics of the market, which components are still manufactured in house, for what types of transformers are components outsourced and geographically, where the markets are situated.

The principal transformer components and materials are defined as:

- Core steel
- Transformer oil
- Sheet steel
- Steel profile
- Radiators/cooling
- Aluminium wire and sheet
- Copper profile and wire
- Insulation:glass fibre, Kraft paper, presspan, resin, wood, etc.
- Porcelain insulators/bushings
- Miscellanous parts

Table 1. Growth rates over time

Metric	2002 to 2008	2009 to 2017
Global GDP growth	10.62 %	2.94 %
Global transformer market growth	18.37 %	0.39 %
Transformer trade growth	26.66 %	-1.84 %
Global parts trade growth	15.61 %	11.33 %

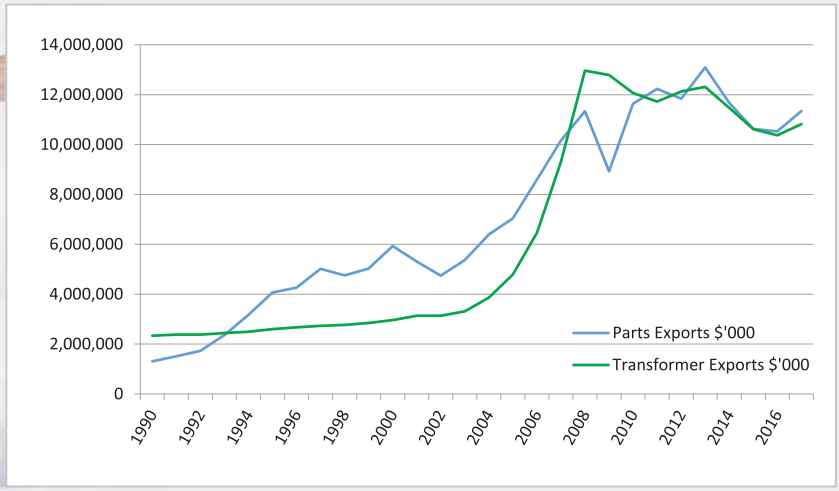


Figure 1. Transformer trade and component trade – 1990 to 2017

The principal subassemblies are:

- Cores: comprising core steel, other core components and assembly costs
- Chassis: tank, cooling equipment and assembly costs
- Tap-changer
- Bushings: HV and LV bushings
- Miscellaneous components and control
- Oil/fluid

When the transformer market is disaggregated into these major components and sub-assemblies, an estimation can be made of the market for each sub-assembly. Some assemblies are easily quantifiable, such as bushings, tap-changers and tanks – all products which are commonly traded. Others, such as complete cores, are traded as finished parts but are also an integral part of the assembly of transformers within an OEM transformer producers' remit. In this article these "sub-assembly" parts have been calculated based on the total transformer market, and the estimates contained herein are therefore the TTM – Total Theoretical Market, rather than the TAM – Total Accessible Market, which may be available to companies supplying pre-wound and assembled windings and cores. The prevalence of buying and selling these sub-assemblies is higher at the lower power end of the market – as commodity items – and becomes increasingly rare at the higher bespoke end of the market.

One trend which has become very clear from the analysis of transformer parts trade is that transformer manufacturers are increasingly outsourcing the supply of transformer parts and sub assemblies. Part of this is no doubt due to transformer manufacturers rationalising their supply chains, but increasingly, manufacturers are happy to purchase key parts and to concentrate their skill base on design and assembly expertise. The Henry Ford approach to transformer manufacture, where raw materials went into one end of a factory and finished transformers came out of the other end, has long since finished. A tank welding unit and electrostatic paint bay were once considered as much an essential integral part of any transformer plant as a winding shop or testing facility. Finished tanks are now routinely outsourced as are increasingly the windings, complete cores, bushings, tap-changers, etc. Trade in parts grew by a CAGR of 15.61 % from 2002 to 2008, and 11.33 % from 2009 to 2017.

Figure 1 shows the trends in value of global trade since 1990. The dramatic growth in both components and transformers since 2002 is clear and, as mentioned earlier, this is partly due to supply chain rationalisation, but is also largly due to outsourcing – the de-stocking of components following the 2008 recession is evident.

In ball park terms, 45 % (by value) of transformers produced each year can be classified as power transformers and 55 % are distribution transformers

Table 2. The world market for transformer components, by region, 2010-2015 (US$ Million)

Region	2010	2013	2014	2015	CAGR
Western Europe	3,123.2	3,121.9	3,144.5	3,182.4	0.4 %
Eastern Europe	774.4	700.1	710.8	725.1	-1.3 %
Former Soviet Union	777.7	914.3	893.4	901.4	3 %
Africa	430.3	446.0	455.8	469.6	1.8 %
Middle East	642.6	678.1	697.7	717.1	2.2 %
Indian Sub Continent	777.5	753.6	795.5	845.1	1.7 %
Asia	8,819.9	9,371.8	9,877.7	10,404.3	3.4 %
South & Central America	728.2	837.0	842.6	856.2	3.3 %
North America	2,828.5	2,532.3	2,588.5	2,638.1	-1.4 %
Oceania	120.6	108.1	111.1	114.3	-1.1 %
Global total	**19,022.9**	**19,463.1**	**20,117.6**	**20,853.6**	**1.9 %**

Source: Goulden Reports

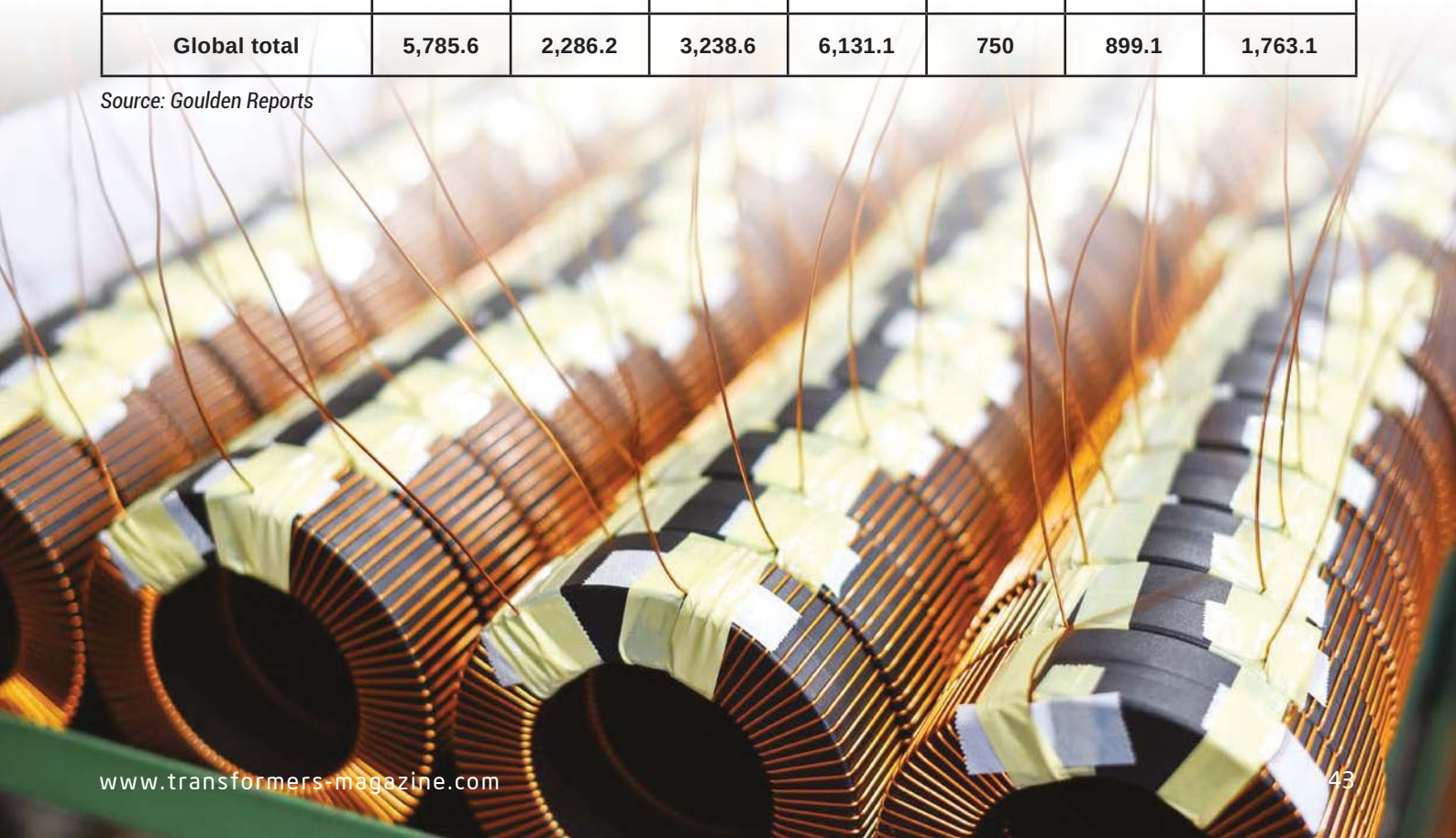
This value is the TTM (Total Theoretical Market), some of which is satisfied by in-house supply and some is a part of that TAM (Total Accessible Market) open to independent specialist suppliers. On the same basis, this market can be expressed by major component part, as shown in Table 3, thus providing a breakdown by component part.

One trend which has become very clear from the analysis of transformer parts trade is that transformer manufacturers are increasingly outsourcing the supply of transformer parts and sub-assemblies

Table 3. The world market for transformer components by type, by region, 2015 (US$ Million)

Region	Core steel	Oil	Structural steel & cooling	Conductor	Insulation	Bushings & insulators	Other components
Western Europe	850.7	339.2	517.2	939.6	122.5	141.7	271.5
Eastern Europe	199.2	79.2	113.7	213.5	26.5	31.6	61.5
Former Soviet Union	243.7	97.5	144	268.2	31.6	39.6	76.8
Africa	139.5	53.9	66.3	135	16.6	19.7	38.8
Middle East	223.8	85	93.6	201	26.4	29.1	58.1
Indian Sub Continent	223.3	90.7	138.7	253.8	29	37	72.6
Asia	2,804.3	1,115.1	1,678.5	3,092.3	372.1	453.5	888.5
South & Central America	269.6	103.2	109.1	240.1	30.6	34.4	69.2
North America	795	307.8	363.9	755.8	90.6	107.9	217
Oceania	36.4	14.7	13.6	31.8	4.1	4.6	9.2
Global total	**5,785.6**	**2,286.2**	**3,238.6**	**6,131.1**	**750**	**899.1**	**1,763.1**

Source: Goulden Reports



The Henry Ford approach to transformer manufacture, where raw materials went into one end of a factory and finished transformers came out of the other end, has long since finished

Another way in which this market can be expressed is by the value of the various sub-assembly elements that comprise the transformer market. The analysis produces a breakdown that is shown in Table 4. This table shows the most common sub-assemblies that transformer manufacturers will buy in from external suppliers, and for these suppliers the values must represent their TAM. Part of this will never be bought in, especially at the higher power end of the market, but a percentage of each of the totals will be accessible to the independent suppliers.

In ball park terms, 45 % (by value) of transformers produced each year can be classified as power transformers and 55 % are distribution transformers. The prevalence of transformer manufacturers buying in core assemblies is almost entirely restricted to the latter, which implies that the TAM for core manufacturers must be a maximum of

Table 4. The world market for transformer sub-assemblies by type, by region, 2015 (US$ Million)

Region	Core assembly	Tank/chassis	Tap-changer	Bushings	Total
Western Europe	2,452.2	1,106.0	133.3	141.7	3,833.1
Eastern Europe	560.6	246.3	30.2	31.6	868.6
Former Soviet Union	686.3	306.7	37.2	39.1	1,069.3
Africa	366.6	148.9	19	19.7	554.2
Middle East	563	215.9	28.5	29.1	836.5
Indian Sub Continent	650.6	296.4	35.6	37	1,019.7
Asia	8,030.7	3,601.90	436.2	453.5	12,522.3
South & Central America	663.9	250.9	33.5	34	982.2
North America	2,062.0	823.9	106.5	107.9	3,100.4
Oceania	89.7	32.6	4.5	4.6	131.4
Global total	**16,125.6**	**7,029.4**	**864.6**	**898.1**	**24,917.8**

Source: Goulden Reports

US$8.8 billion. Sub-contract tank and chassis manufacture will be more than 55 % of the US$7 billion shown above; therefore the TAM will be upwards of US$ 4.0 billion (on the basis that it is possible to buy in steel fabrications, although at the very large end of the market there will be logistical limitations). In the tap-changer segment, the large end of the market has for many years been largely sub-contracted to specialist producers, and at the lower end of the market manual tap-changers are a commodity product or totally manufactured in house. It is therefore complicated to estimate the TAM for these products, but it must approach three quarters of the above US$865 million. The bushings segment displays the same characteristics as that for tap-changers, whether these are simple porcelain insulators or complex condenser types, and the TAM will approach 75 % of the US$898 million shown in Table 4.

These are ball park estimates, and it would require a great deal of specialist research to further hone these into working assessments with a greater degree of accuracy; but these will serve as a reasonable starting point until more accurate figures become available.

A market growth of 3.8 % CAGR over the 2010-2025 timeframe appears to be a sound bet for the future, growing from US$20 billion to US$30 billion in current US$ values, and providing some good opportunities

Future markets

It is fair to assume that the TTM for transformer components and sub-assemblies will grow in line with the overall transformer market. On this basis, the TTM for those products will be as shown in Table 5.

A market growth of 3.8 % CAGR over that timeframe appears to be a sound bet for the future, growing from US$20 billion to US$30 billion in current US$ values, providing some good opportunities. Factor into this the fact that these are TTM values, and within this is the actual TAM which has been growing at an even more aggressive rate, and the future looks refreshingly buoyant for this market segment.

Author

Steve Aubertin is the Managing Director of Goulden Reports and following a first career in electrical engineering has spent the last 30 years researching and reporting on the global market for electrical products in both published and in the form of tailored research for specific clients.

Table 5. The world market for transformer components, by region, 2010-2025 (US$ Million)

Region	2010	2015	2020	2025	CAGR 15 to 25
Western Europe	3,123.2	3,182.4	3,288.3	3,675.6	1.5 %
Eastern Europe	774.4	725.1	797.7	917.5	2.4 %
Former Soviet Union	777.7	901.4	962.3	1,059.8	1.6 %
Africa	430.3	469.6	534.6	628.4	3 %
Middle East	642.6	717.1	782.5	904.2	2.3 %
Indian Sub Continent	777.5	845.1	1,136.5	1,507.8	6 %
Asia	8,819.9	10,404.3	13,201.8	16,986.9	5 %
South & Central America	728.2	856.2	954.3	1,123.0	2.8 %
North America	2,828.5	2,638.1	2,865.8	3,216.7	2 %
Oceania	120.6	114.3	127.4	149.9	2.7 %
Global total	**19,022.9**	**20,853.6**	**24,651.3**	**30,169.8**	**3.8 %**

Source: Goulden Reports