


NRGExpert
Energy Intelligence

Electricity T&D White Paper

2013

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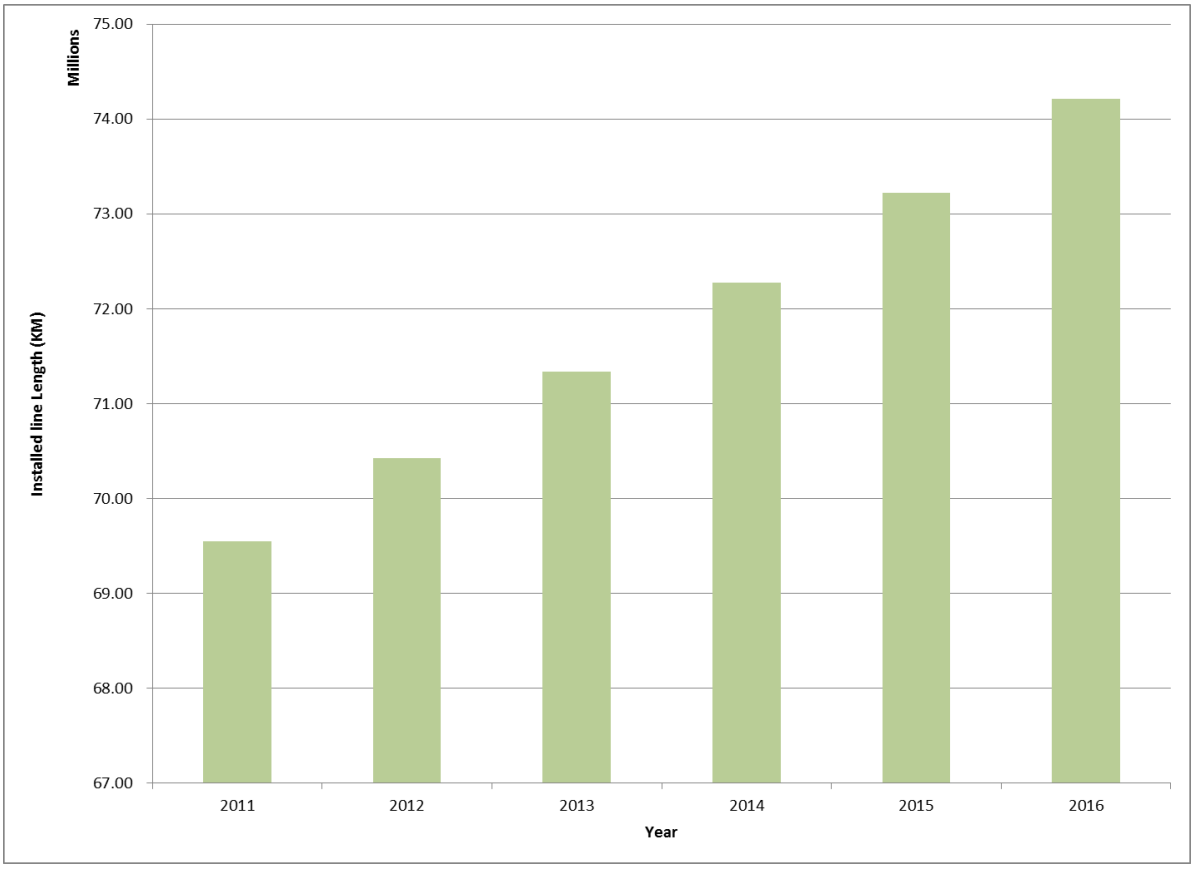
An Introduction to the Transmission and Distribution Industry

Political and technological events have influenced the development of the electricity transmission and distribution networks worldwide in recent years and will likely continue to do so. This white paper provides an overview of some of these developments and insight into the future of this industry.

Network Developments

Grid stability and reliability has driven new investment and overall spending in the transmission and distribution markets with fewer major outages occurring in recent years. Despite a strong focus on grid-infrastructure renewal, especially in Europe, there has also been significant expansion of the grid network. In 2011, the total installed transmission and distribution line length reached 69.5 million kilometers; in 2016, that figure is set to reach 74.2 million kilometers.

Installed Transmission + Distribution Line Length 2011-2015



Source; FERC

Overhead vs. Underground

Electrical energy worldwide is mainly transmitted with High Voltage Alternating Current (HVAC), overhead line technology. 96% of the onshore Transmission network in Europe is overhead HVAC line and the remaining consists of underground cable. Underground cables are mainly used over short distances, in areas where overhead lines are inappropriate or impossible to use and for specific technical applications. Underground cabling is becoming increasingly attractive for use, mainly for environmental and aesthetic reasons. Undergrounding is not a new trend, as underground cables have been used for low and medium voltage lines in urban areas for a long time. In countries such as the Netherlands (high population density/easily penetrable surface) it is often cost neutral to cable underground for cables up to 150kV. Several countries use underground LV distribution cables in almost their entire network, with a target of 100%, such as the Netherlands, Singapore and Denmark. Use in HV applications is still limited owing to their high cost and the cost of maintenance and repair in case of an outage. The Dutch/German TSO TenneT has estimated that underground lines can take anywhere from 48 to 480 hours to repair should an outage occur, versus 8 to 48 hours for an overhead line.

Looking Towards Renewables

The Fukushima nuclear crisis has not only affected power generation systems and public opinion towards nuclear energy – it has also placed a strain on transmission and distribution grids worldwide as countries have (temporarily) scaled down nuclear production. Decreased production has led to rolling blackouts and other preservation measures to be taken in Japan. Countries heavily reliant on Nuclear Energy such as Germany, France and the USA have also seen an increased strain placed on their grids with some stations being shut down for inspections or safety evaluations outside of scheduled practice. There is a renewed resurgence of renewable energy, which in turn also places a strain on the reliability of networks.

Many renewable sources of energy are not considered to be on demand and are incapable of forming a reliable peak load source of energy. With the growing number of renewable generation power plants, the grid must adapt and become intelligent to be able to take on this strain. With the renewed call for more renewable power the level of investment in smart-grid technology is set to rise.

Grid Interconnections

With increasing smart grid technology and new investment as well as added generation capacity, grids that were once standalone are becoming increasingly interconnected to one another. There are many technological hurdles to overcome and with rising energy prices fuelling interest, more projects are coming online.

The development of cross-borders lines started earlier than many people think. In Europe it started by 1920, mainly to take advantage of Swiss hydropower. In most of continental Europe, cross-border interconnections took place before the creation of national networks. The process of national interconnection slowed down and was restricted to the radial operation of power plants from one country to another.

Europe

For obvious geographical reasons, the Northern part of Europe started the process of integrating their national systems later but the most significant model was Nordel, combining international exchange in a free international market. In this relatively small region there is a huge diversity of power sources. In the early 1990s Norway was and still is almost 100% reliant on hydro power, while its neighbor Sweden used hydro power for approximately half of its generation, the rest being split between thermal and nuclear power. Finland's generation was 60% thermal, with the rest split about evenly between hydro and nuclear

power, while Denmark relied on thermal power for 90% of its electricity. In the hydro dependent countries, when water levels were low it made sense for Norway and Sweden to be able to draw on cheap thermal power from Denmark and Finland, and when water levels were high it was equally sensible to sell cheap hydropower to Denmark and Finland. And so Nordel was born, to facilitate the exchange of cheap power across national borders. It involved a change in mindset, from perceiving electricity as a closely guarded strategic national resource, to an international commodity to be bought and sold in the market place. Nordel, in 2009, became part of the wider European Entso-E.

The demise of the Soviet Union, together with European liberalization of electricity markets has prompted expansion of the co-operation between the networks of different regions and the development of new interconnecting trans-national networks in Europe, giving an impetus to the growth of cross border interconnections and regionalization of markets. In the last few years international power exchanges have been established to service these networks, in addition to the national exchanges which have been set up to service national deregulated markets.

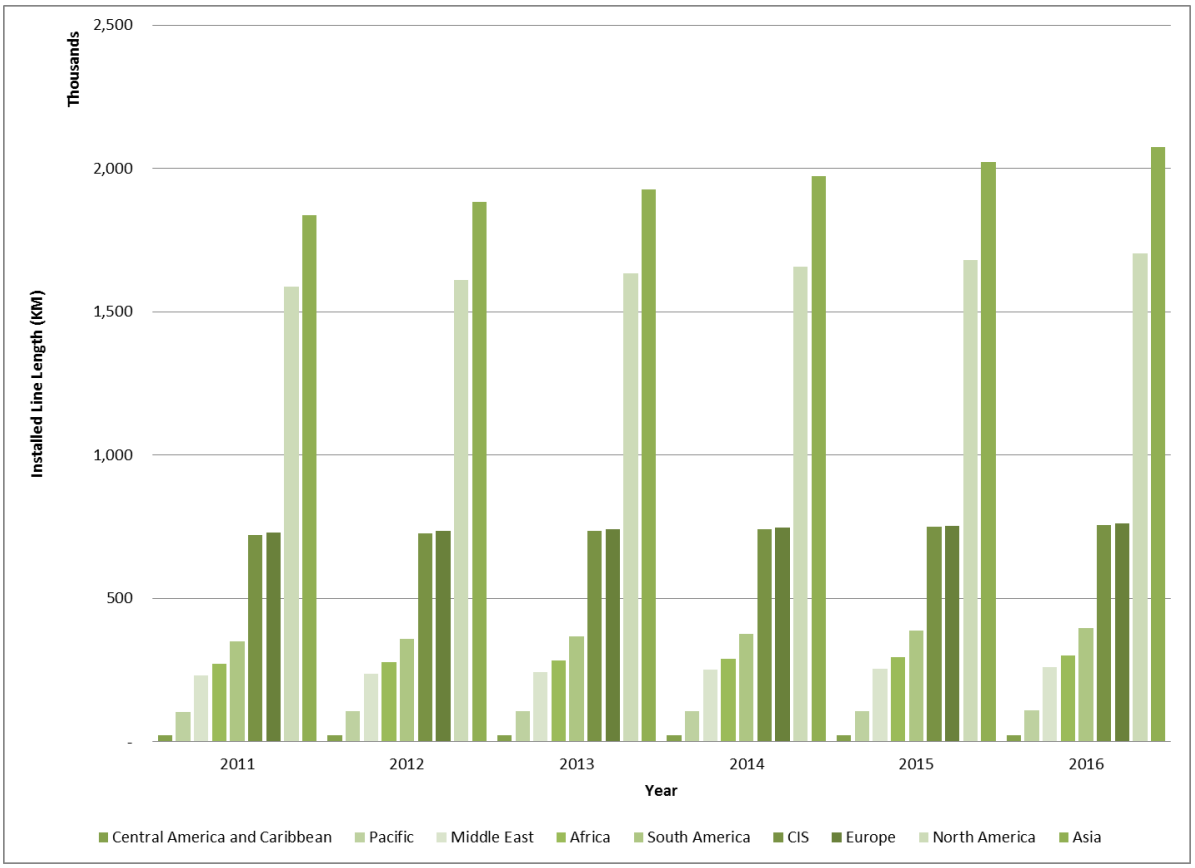
A major priority of the EU is to encourage the expansion of cross border transmission capacity and interconnections.

Outlook

With the current economic uncertainty in some countries, notably in Europe, broader considerations may impact on the T&D sector. With too many variables and uncertainties, it is difficult to predict what will happen in countries like Greece, Ireland, Portugal, Spain, Italy, and Belgium if sovereign debt defaults take place. To combat this, many countries have targeted transmission and to a lesser extent distribution for support with fiscal stimulus measures. Many transmission systems are in serious need of upgrading after years of neglect and under-investment. Their inefficiency costs money with outages causing lost production and disruption. This is not simply a matter of refurbishing and retrofitting but of upgrading to a new generation of technology.

Globally between 2011 and 2016 the transmission and distribution network line lengths will increase 6.7% compared to their 2011 bases. Transmission networks will increase 9% with double digit growth forecast for Asia (12.9%), Africa (10.7%), South America (13.8%) and the Middle East (12.6%).

Figure 1 Installed Transmission Line-Length by Region 2011-2016



Source, NRG Expert T&D Database

Distribution networks are set to rise by 6.5% globally, with the strongest growth seen in the Middle East (16.9%) and Africa (11.5%) between 2011 and 2016.

Capital Expenditure

In 2011, Capital Expenditure (CapEx) in Transmission and distribution rose to US$190,215.2 million and is forecast to rise to US$231,830.8 million by 2016. As has been seen in previous years with the replacement of existing technology with higher-end smart technologies, there is an ever-increasing capital spend, though NRG Expert expects the increased spend to start leveling out after 2015 as the effects of the global economy wear on and replacement projects slow down. Below are charts showing the levels of capital expenditure worldwide and by region.

Figure 2 Global T&D Capital Expenditure 2011-2016 (million US$)

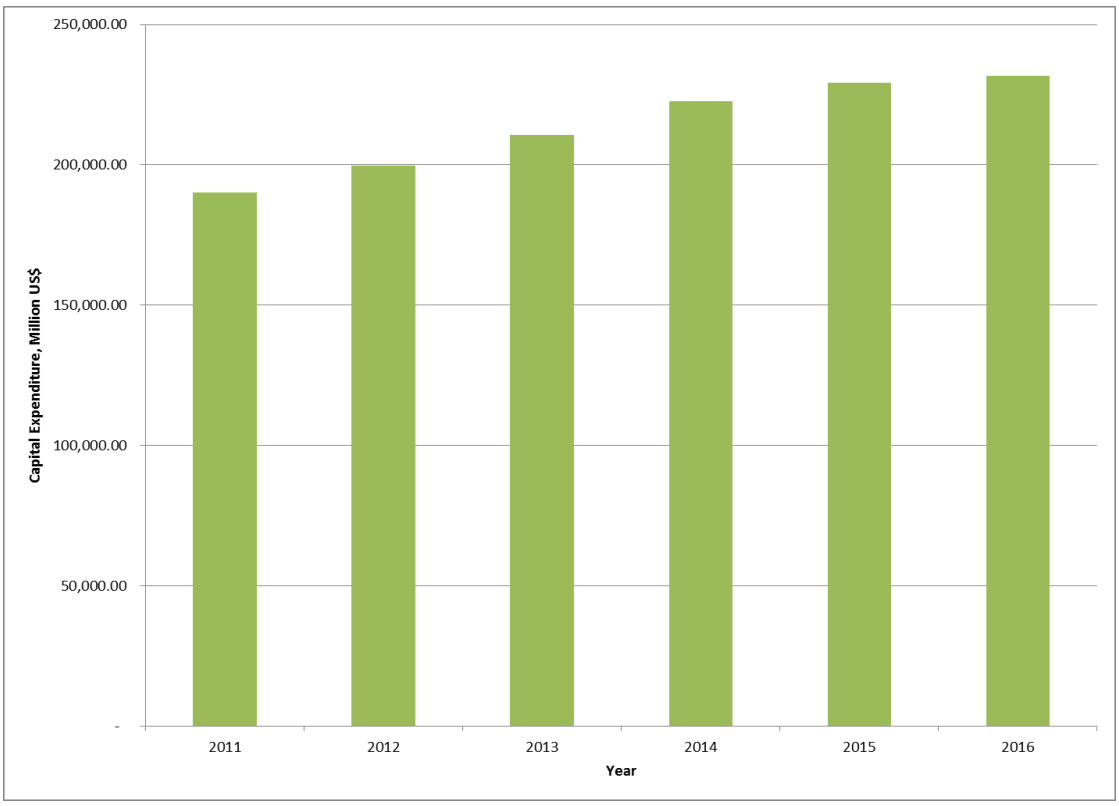
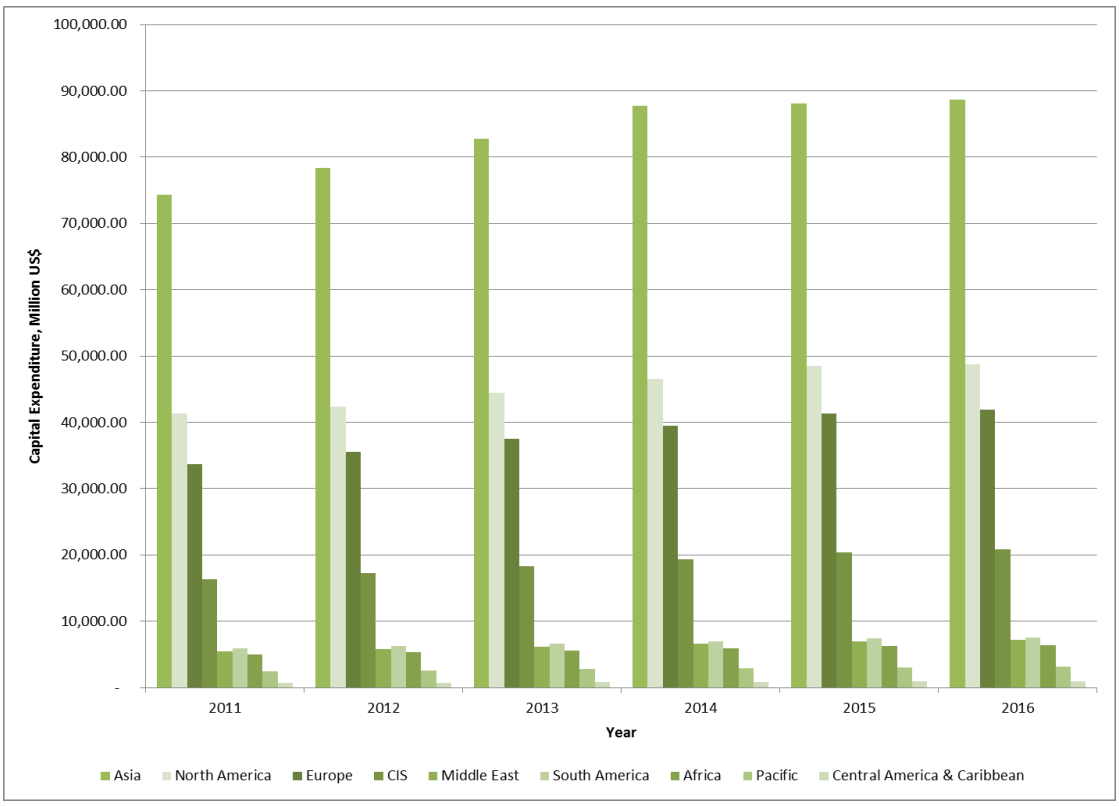


Figure 3 Regional Breakdown of Capital Expenditure 2011-2016 (million US$)

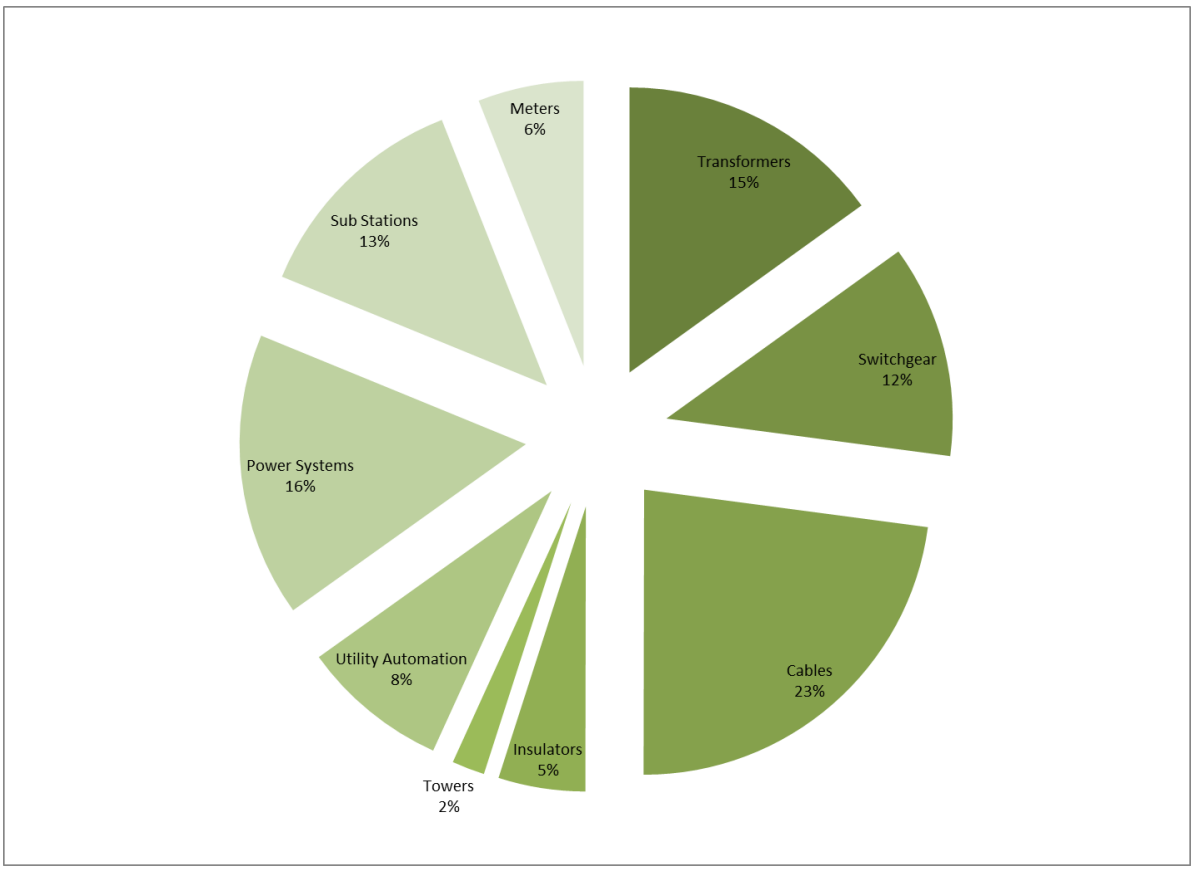


Source: NRG Expert T&D Database

Annual Demand

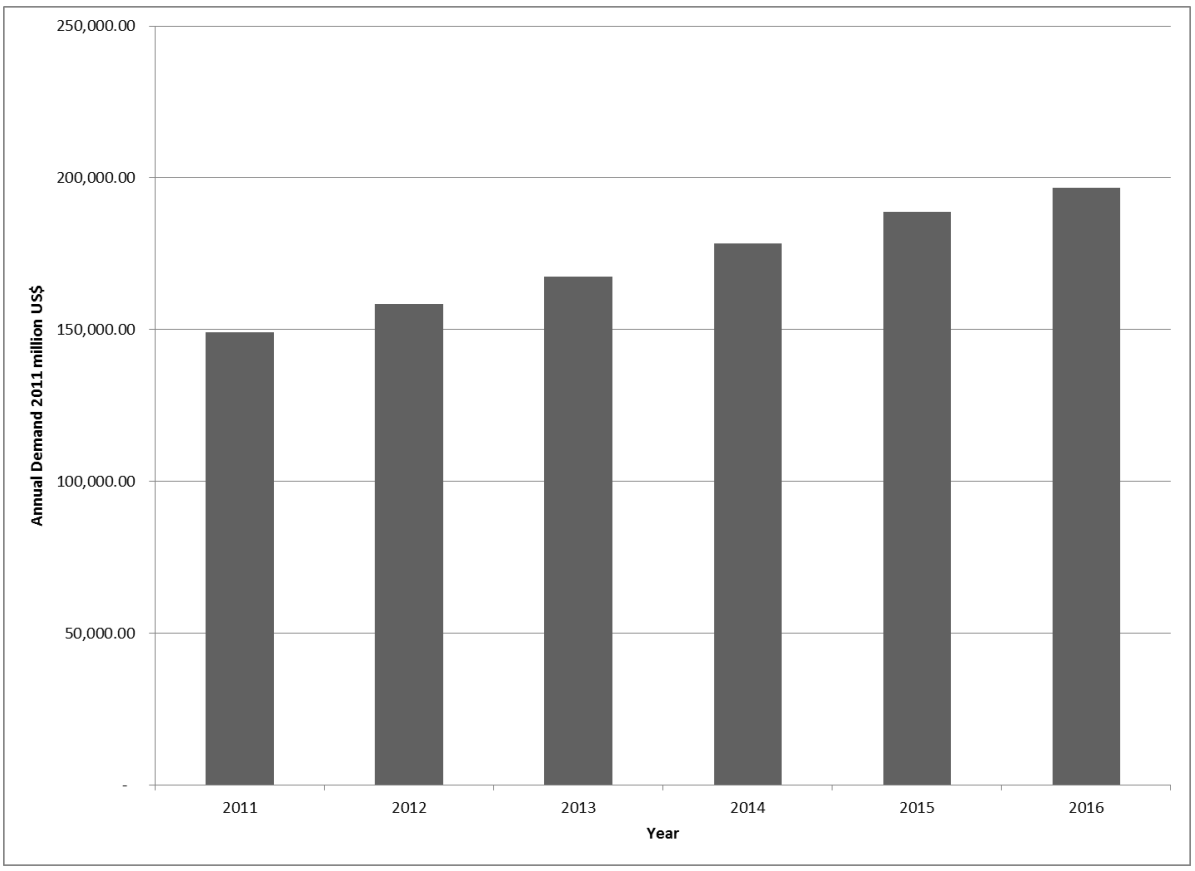
Global Annual Demand for T&D Equipment in the 9 sectors defined by NRG Expert reached US$149,235.4 Million in 2011 forecasted to reach 196,669.3 million by 2016. The following chart shows the breakdown of the total figure into the 9 sectors showing Cables as one of the largest sectors explaining why companies producing only cables are able to obtain a large market share.

Figure 4 2011 Annual Demand breakdown by Sector



Source: NRG Expert T&D Database.

Figure 5 Total Annual T&D Demand 2011-2016 (million US$)



Source: NRG Expert T&D Database.

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