PVC Cables Competitiveness:
A Total Cost of Ownership Approach

Introduction

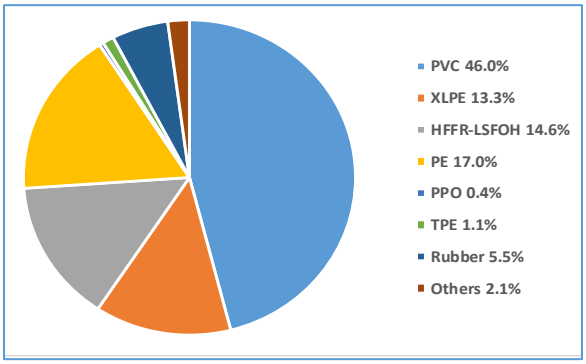
The adoption of PVC in several applications has been growing in the last years, along with the perception of its advantages compared to other materials (technical performance, competitive price, flexibility in application and design, recyclability). The competitiveness of PVC was confirmed by the studies conducted by Althesys in 2010[i] and in 2018[ii]. These studies, basing on Total Cost of Ownership approach (TCO), compared the economic performance of PVC products and the main competing materials for three key applications: windows, pipes, floor coverings. TCO is a "customer centric" methodology aimed to account for the difference between the purchase price of a good and its cost in the long term.

The purpose of this new study is to develop a similar research assessing the economics resulting from the use of cables containing PVC instead of the main alternatives along its entire lifetime used in: residential buildings, industrial buildings and telecommunication networks. The countries investigated are: Italy, France and Germany.

Use of PVC in European cable industry

PVC is an attractive material for the cable industry. It is used for the production of any type of electric and data transmission cables and as insulation and/or sheathing in various fields: classic electric cables for power transmission at low voltage for homes and offices; telephone cables; coaxial cable TV/computer/hi-fi; cables for cars; battery cables and robotics; data transmission cables, LAN and IT.
Accounting for 46% of the cables market in Europe (2016), PVC is the most used polymer for electric and telecommunication cables, thanks to its advantages in terms cost/performance ratio, high sustainability and recyclability. PVC maintains its historical dominance in the low-voltage cables sector with a market share of around 70%.

Wires and cables represent today the largest application for flexible PVC in Europe, absorbing around 7% of the PVC resins manufactured[iii]. Italy, Germany and France are the main European markets for the use of polymeric materials in cables industry (almost 50% of European sales).

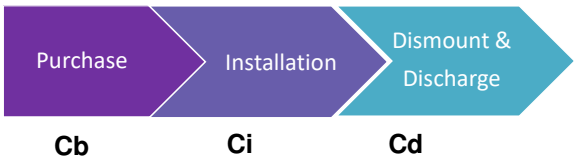


PVC cable sustainability

PVC cables are recyclable. Recycling diverts wastes from landfill and contributes to the preservation of natural resources. The use of recycled PVC reduces energy consumption and greenhouse gas emissions. PVC resin recycled from cables is used for a wide range of applications such as garden and air hoses, geo-membranes, foils (roofing, flooring, waterproofing membranes, pool and pond foils), mats, speed bump and other road safety products, shoe soles and boots[iv].

The TCO Methodology

The quantitative cost model developed for cables is basically the same used for the past Althesys studies on PVC products. However, for cables the costs for use and maintenance are not relevant and so not considered. Cables, if correctly projected, sized and posed, don't need ordinary maintenance and the extraordinary one is in general not required since the total substitution of cables is cheaper. Moreover, the costs for use due to energy consumption (thermal heating of cables) are not significant.



$$TCO = T_{Cb} + T_{Ci} + T_{Cd}$$

Purchase and installation cover the first year of the asset (year 0), while dismantling (the model considers that the cables will have to be substituted at the end of the service life) covers the year n. A present value of the costs for each stage is computed by summing the future costs adjusted for inflation and discounted at an annual rate with a nominal discount rate. The TCO of the cables is then obtained by summing the present value of the costs for each lifecycle stage.

Initial investment is 100% equity for residential buildings without actualization and 50% equity, 50 % debt for industrial building and TLC with financing period of 10 years. The application of VAT (10% in Italy, 20% in France and 19% in Germany) is only for residential buildings. Cable prices and installation costs refer to the final users of investment: house owners for residential buildings and industrial companies for industrial building and telecommunication.

Discounts on price lists have been considered for the TCO calculation. However, discounts vary considerably in relation to the different commercial policies, the specific context and over time.

Installation costs consider the different labor costs in the three countries[v]. These costs also include labour insurance, third party risk insurance and consumables (spray, glands, etc.).

The technical life considered for all cables is 30 years. The real life for cables can clearly go beyond depending on the conditions for laying the cable. In general, electric cables are replaced in buildings for other purpose, independently by technical life of cables (e.g. refurbishment of buildings, installation of new equipment).

Dismantling costs have been considered at the end of life of the cables. These costs have been estimated in relation to dismounting and transfer of cables to landfill (net of copper recovery). The benefits of PVC cables recycling are not included in the calculations.

Study Scope

The analysis of cables shows some differences from other applications of PVC: each kind of cable is made by multiple materials (PVC, rubber, copper, etc.) and so the comparison is not among cables in PVC and those without it, but among cables with different quantity of PVC. The cables for each sector are detailed in the table below. The functional unit is a 100 meters long cable. The comparison among cables for each sector concerns a general application which is not subjected to a specific safety qualification.

Key Results

For **residential building** the TCO analysis considers two kinds of cable: FG16OR16 that has sheath in PVC and FG16OM16 where sheath is in LSOH thermoplastic and none part of the cable contains PVC. The best TCO performer is the FG16OR16 that has sheath in PVC. FG16OM16 (without PVC) is 12.1% more expensive in Italy, 10.1% in France and 9.8% in Germany.

In **industrial buildings** the cable FS18OR18 (with sheath and insulation in PVC) has in all countries the minimum TCO. The FG16OR16 (only sheath in PVC) is 0.8 % more expensive than FS18OR18 in Italy, 1.4% in France and 1.6% in Germany.

	Electric cables			Data cables	
	FG16OM16	FG16OR16	FS18OR18	UTP5ELSZH	UTP5EPVC
Conductor	copper	copper	copper	copper	copper
Insulation	rubber	rubber	PVC	PE	PE
Filler	thermoplastic LS0H	thermoplastic	thermoplastic		
Sheath	thermoplastic LS0H	PVC	PVC	LSZH	PVC

	FG16OR16 - 3 G 2,5 [PVC]	FG16OM16 - 3 G 2,5
	€ 276.4 minimum TCO	€ 309.8 12.1%
	€ 338.4 minimum TCO	€ 371.6 9.8%
	€ 357.1 minimum TCO	€ 393.3 10.1%

The cable FG16OM16 (that doesn't contain PVC) is the most expensive solution (+13.2% in France, +13.3% in Italy and +13.5% in Germany).

	FS18OR18 – 5 G 2,5 [PVCx2]	FG16OR16 - 3 G 2,5 [PVC]	FG16OM16 - 3 G 2,5
	€ 232.7 minimum TCO	€ 234.5 0.8%	€ 263.7 13.3%
	€ 255.3 minimum TCO	€ 259.4 1.6%	€ 289.8 13.5%
	€ 255.0 minimum TCO	€ 258.6 1.4%	€ 288.8 13.2%

In **telecommunication data** the cable UPT5E PVC (with sheath in PVC) shows the best TCO. UPT5-ELSZH (without PVC) is 10.5% higher than UPT5-EPVC in Italy, 8% in Germany, 7.9% in France.

	UTP 5 E PVC	UTP 5 E LSZH
	€ 87.9 minimum TCO	€ 97.1 10.5%
	€ 104.2 minimum TCO	€ 112.5 8.0%
	€ 108.0 minimum TCO	€ 116.6 7.9%

Takeaways

The higher is the proportion of PVC contained in the cable the lower is the TCO. In all applications (residential building, industrial and telecommunications data) and in all countries investigated (Italy, Germany, France) cables made with multiple PVC parts is the best TCO performer. In the next years the opportunity of recycling could further improve the performance of PVC.

About the Author

Alessandro Marangoni is an economist specialized in the energy industry, utilities, waste management and recycling. Graduated with honors from Bocconi University (Milan, Italy), he started his career as researcher at Space Bocconi, a joint venture with the Northeastern University (Boston, USA). He is currently CEO of the consultancy Althesys and Professor in Economy and Management of the Public Utility at Bocconi University. He also teaches in various academic and master classes. With a wide experience in strategic management, he has been one of the first in Italy to deal with accountancy and environmental reports, sustainability and cost-benefit analysis, becoming one of the main experts in business and financial issues on environment. He is the author of several publications, on environment, energy, public utilities and infrastructures.

Disclaimer

Althesys does not take charge of any responsibilities for a possible improper use of the information and data included in this document. The survey has been conducted on data coming from open sources, information provided by players and associations of the industry and also on subjective opinions that could be more or less accurate. Although Althesys has paid attention and taken care of the elaboration of this document, it does not take charge of any responsibility and does not offer any guarantee about the precision and/or completeness of the information and evaluation herein contained.

Acknowledgements

The author would like to thank Arjen Sevenster, Vincent Stone and Zdenek Hruska from the European Council of Vinyl Manufacturers, Carlo Ciotti and Marco Piana from PVC Forum Italia, for their cooperation. The author would also like to thank all the companies and associations interviewed for their contribution and information provided for the study.

References

[i] A. Marangoni, PVC Product Competitiveness: A Total Cost of Ownership Study, 2011, http://www.pvc.org/upload/documents/TCO_ppt_ProfMarangoni.pdf

[ii] A. Marangoni, PVC Product Competitiveness: A Total Cost of Ownership Study, 2018.

[iii] AMI Consulting, "Polymeric materials in the European cable industry" Bristol, 2017.

[iv] VinylPlus Progress 2018. Bruxelles, 2018.

[v] Eurostat database labour cost http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lc_lci_lev&lang=en