



A FOCUS ON PVC CABLES

INNOVATION, AND FAKES

4TH ANNUAL PVC COMPOUNDING & PRODUCTION CYCLE FORUM
*ADVANCING THE INDUSTRY THROUGH PRODUCT & PROCESS
INNOVATION, INCREASED SUSTAINABILITY, AND THE DRIVE FOR A
CIRCULAR ECONOMY*
19-20TH JAN 2023
ROME





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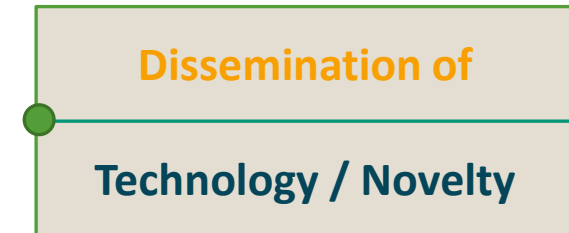
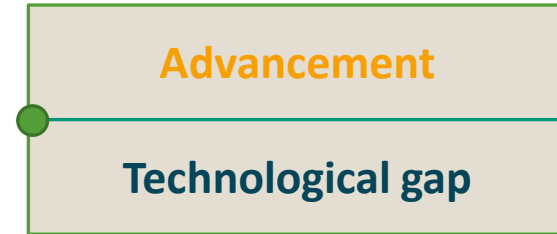
1 The flow of the information

1 The flow of the information

“Innovation is the multi-stage process transforming ideas into new and enhanced products, services or processes, to **compete, advance, and differentiate themselves** successfully in their marketplace”¹

An innovative product to win in the market should be well explained and its uniqueness or advantages **disseminated.**

When this happens, you have the opportunity “to ride the wind of change, ” which makes the difference between survival and winning.



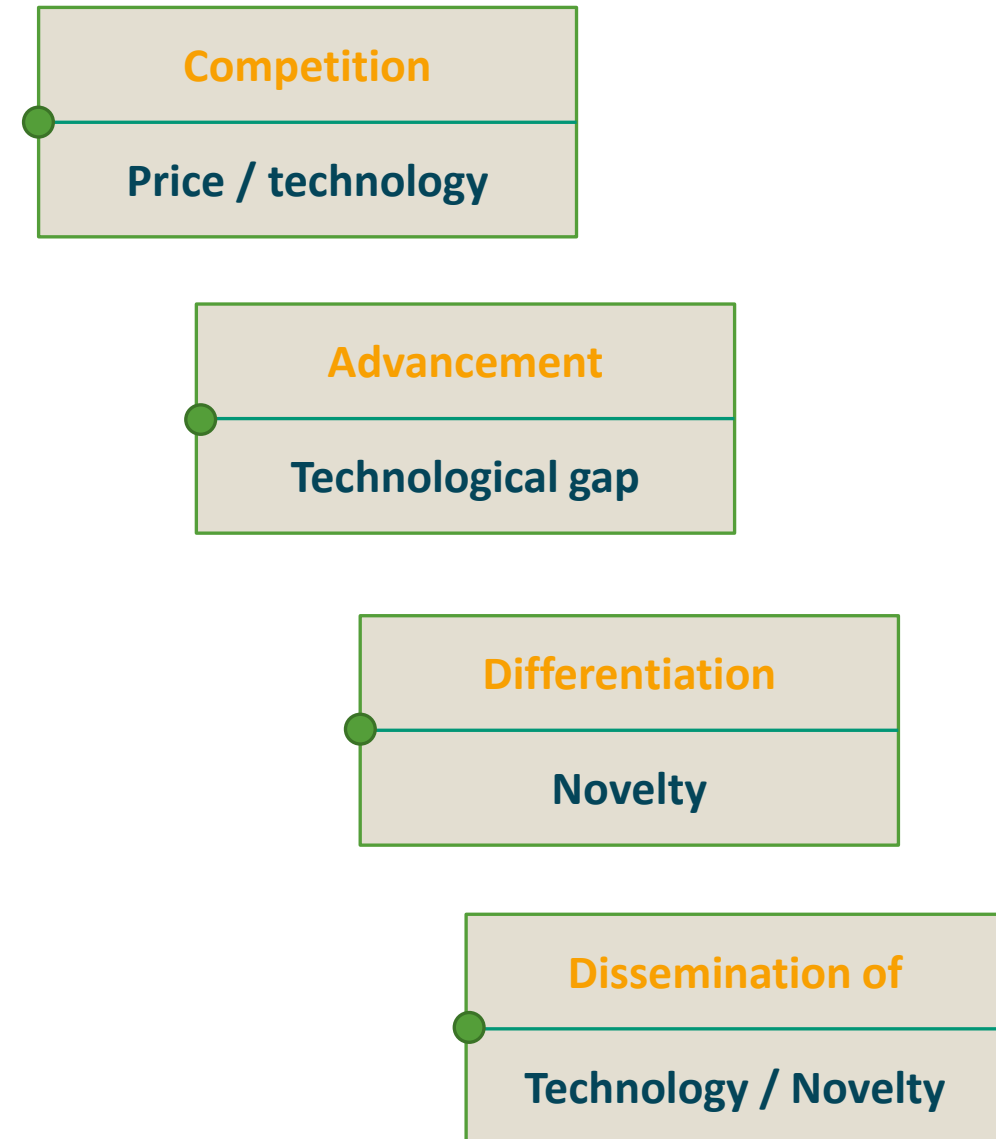
[1] Baregheh, Anahita; Rowley, Jennifer; Sambrook, Sally (4 September 2009). "Towards a multidisciplinary definition of innovation". *Management Decision*. **47** (8): 1323–1339. doi:10.1108/00251740910984578. ISSN 0025-1747.

1 The flow of the information

In this, R&D in PVC compounds for cables plays a strategic role in all levels of our value chain. New stabilizers, plasticizers, lubricants, processing aids, and acid scavengers are fundamental to developing items capable of **competing**, **advancing**, and **differentiating** with halogen-free alternatives.

R&D in PVC compounds for cables alone does not bring any “success” in the market. We must **disseminate** our innovation in brochures, conferences, webinars, academia, websites, and socials.

And the dissemination must be “up” to technical committees, national authorities, and the European Commission and “down” to public opinion.

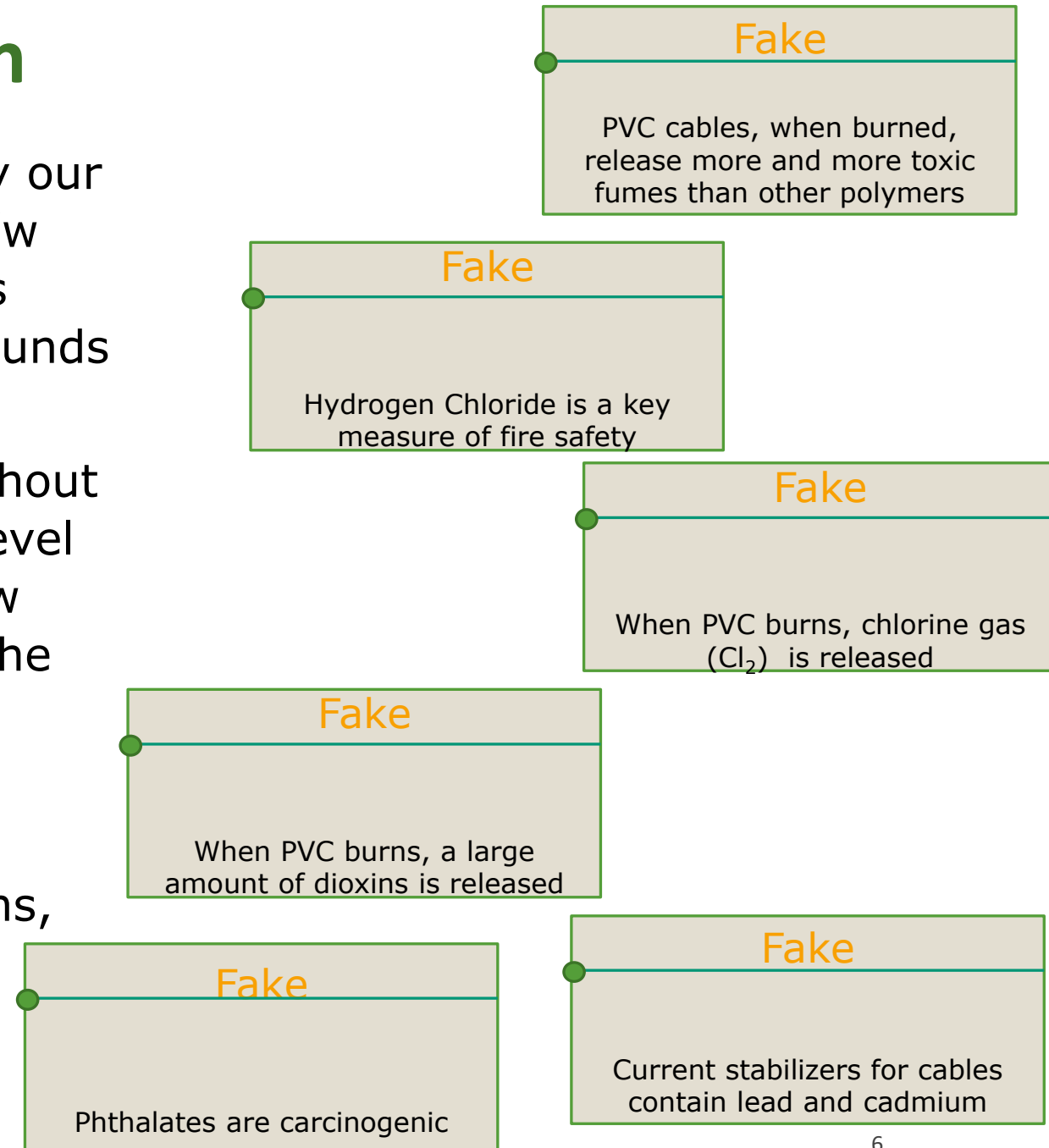


1 The flow of the information

For example, the strong R&D made by our competitor plastics on halogen-free cables b/w seventies and the nineties produced products mimicking the main properties of PVC compounds for lines, including fire performances.

This R&D would have been ineffective without a capillary diffusion of information at every level promoting the claimed advantages of the new “halogen-free compounds” and highlighting the negative aspects of PVC compounds.

Concepts like this: “PVC compounds release more and more toxic smoke, are less sustainable are non-recyclable, release dioxins, contain dangerous additives, etc.,” became dominant in the flow of information.



1 The flow of the information

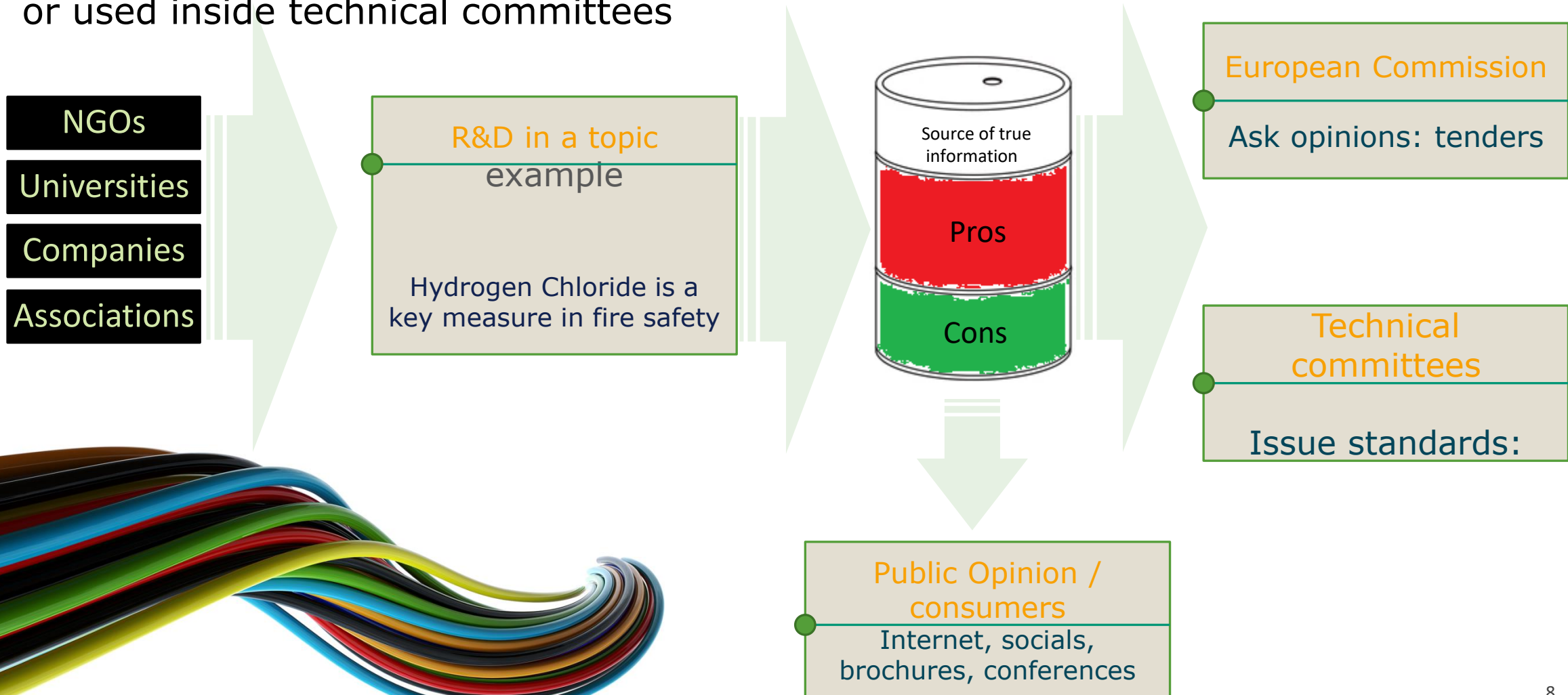
The R&D in halogen-free cables became a market innovation when all these concepts were well disseminated, and the European Commission, National Authorities, or Technical Committees took specific actions.

In the past our PVC value chain was not able to confute misconceptions evolved in WRONG information from our competitors, nor communicate efficiently the innovation, moreover in cables' segment.



1 The flow of the information

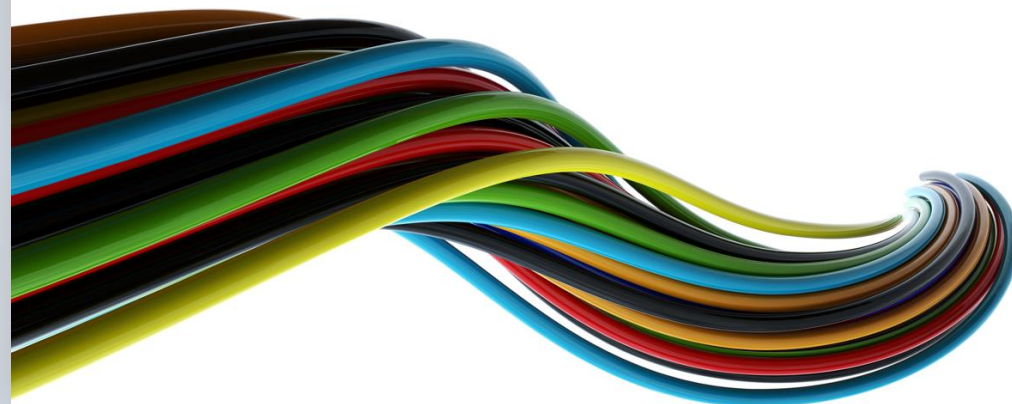
Authoritative information plays a critical role in this flow, because it is considered the true information and it is screened in case of actions of the European Commission or used inside technical committees





2

The Impacts



2

The impacts

Additional classification for acidity: 2006 - 2017

Most “fire scientists” consider **smoke acidity an ancillary fire safety measure**. Several articles clearly show that tenability is driven mainly by narcoleptic substances like CO or HCN rather than HCl²⁻⁴. CO and HCN reach the concentration impeding people from exiting unharmed from the fire scenario before HCl or other irritant gases. That is because PVC articles burn later, and in a real fire scenario, HCl decays quickly, is absorbed by surrounding materials, is washed away by water, or is trapped by fillers in the PVC compound⁵⁻⁹.

Despite all these considerations, in the European Union (EU), according to Regulation (EU) N°305/2011 (Construction Product Regulation, or CPR), cables permanently installed in buildings must also be classified for the acidity of the gases released during their combustion.

Cables are the only building and construction products with the additional acidity classification.

1990 - 2006

Hydrogen Chloride is a key measure in fire safety



2006 - 2017

Introduction of additional classification for acidity

[2] Obloj-Muzaj, M. Fire performance of PVC. *Int. Polym. Sci. Technol.* **2001**, *28*, 98–100. [[Google Scholar](#)] [[CrossRef](#)]

[3] Hirschler, M. Fire safety, smoke toxicity, and acidity. In Proceedings of the Flame Retardants 2006, London, UK, 14–15 February 2006. [[Google Scholar](#)]

[4] ISO/TR 20118:2019; Plastics—Guidance on Fire Characteristics and Fire Performance of PVC Materials Used in Building Applications 2019. ISO: Geneva, Switzerland. Available online: <https://www.iso.org/standard/67071.html> (accessed on 16 August 2022).

[5] Babrauskas, V.; Gann, R.G.; Levin, B.C.; Paabo, M.; Harris, R.H.; Peacock, R.D.; Yusa, S. A methodology for obtaining and using toxic potency data for fire hazard analysis. *Fire Saf. J.* **1998**, *31*, 345–358. [[Google Scholar](#)] [[CrossRef](#)]

[6] Guillaume, E.; Didieux, F.; Thiry, A.; Bellivier, A. Real-scale fire tests of one-bedroom apartments with regard to tenability assessment. *Fire Saf. J.* **2014**, *70*, 81–97. [[Google Scholar](#)] [[CrossRef](#)]

[7] Beitel, J.J.; Bertelo, C.A.; Carroll, W.F.; Gardner, R.O.; Grand, A.F.; Hirschler, M.M.; Smith, G.F. Hydrogen chloride transport and decay in a large apparatus I. Decomposition of poly(vinyl chloride) wire insulation in a plenum by current overload. *J. Fire Sci.* **1986**, *4*, 15–41. [[Google Scholar](#)] [[CrossRef](#)]

[8] Babrauskas, V.; Peacock, R.D. Heat release rate: The single most important variable in fire hazard. *Fire Saf. J.* **1992**, *18*, 255–272. [[Google Scholar](#)] [[CrossRef](#)]

[9] Babrauskas, V.; Harris Jr, R.H.; Gann, R.G.; Levin, B.C.; Lee, B.T.; Peacock, R.D.; Paabo, M.; Twilley, W.; Yoklavich, M.F.; Clark, H.M. Fire hazard comparison of fire-retarded and non-fire-retarded products (NBS SP 749). In *Special Publication (NIST SP)*; National Institute of Standards and Technology: Gaithersburg, MD, USA, 1988. [[Google Scholar](#)] [[CrossRef](#)]

2

The impacts

Additional classification for toxicity: 2017

In the EU in 2017, there were some attempts to introduce an additional classification for toxicity for all building and construction products. The European Commission asked for a study assessing the need to introduce the additional classification for toxicity in building and construction products. Ecorys, BRE, and Vito, issued a report. ¹⁰

“Study to evaluate the need to regulate within the Framework of Regulation (EU) 305/2011 on the toxicity of smoke produced by construction products in fires”

The conclusions were “partially positive for us”: no action were taken by the commission, more over because data in the report shows “*the number of deaths per million people reduced over the last 30 years without a specific regulations to smoke toxicity*”. Partially positive because the conclusions actually do not close the game.

“*However, if the case for regulation were proven, then an agreed European system for testing and classification, with regulations and requirements at national level is favoured*”.

2017

Study to evaluate the need to regulate within the Framework of Regulation (EU) 305/2011 on the toxicity of smoke produced by construction products in fires



2017

NO Actions by EC

[10] European Commission, Directorate-General for Internal Market, Industry,. 2017. Study to evaluate the need to regulate within the Framework of Regulation (EU) 305/2011 on the toxicity of smoke produced by construction products in fires. <https://ec.europa.eu/docsroom/documents/27346>

2

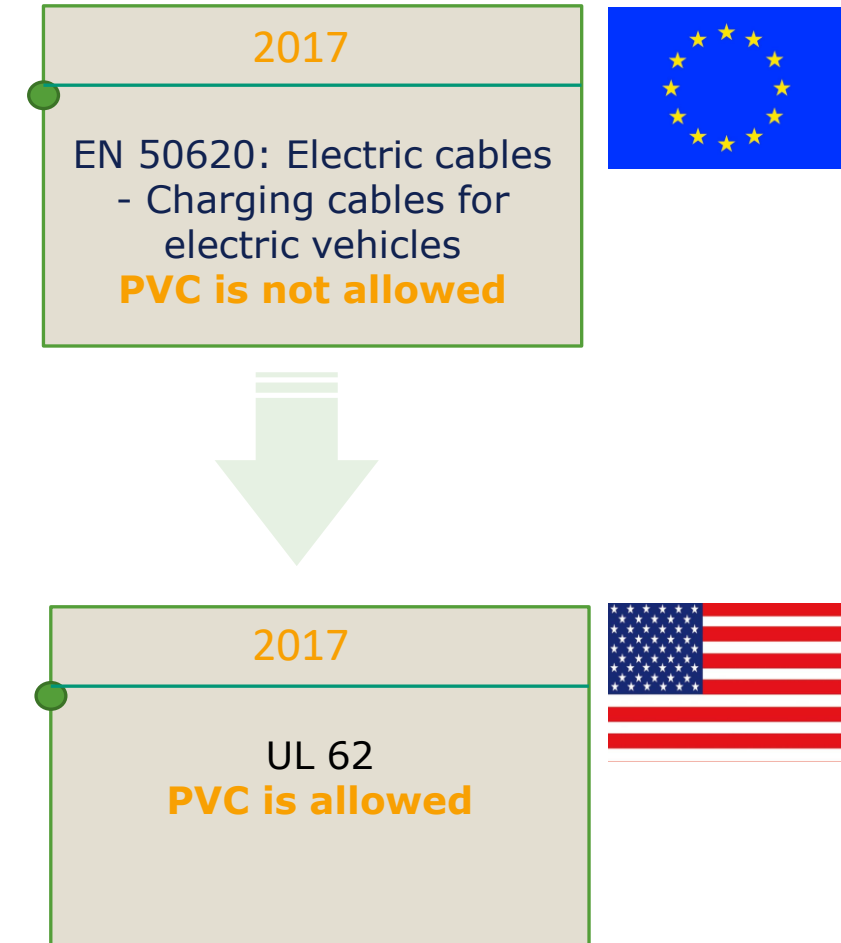
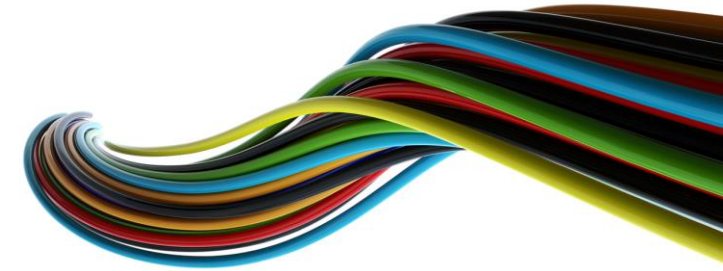
The impacts

A priory exclusion of PVC in technical committees

EN 50620 is the European standard for charging cables.

It requires only halogen-free compounds. PVC has been excluded as a priory for no reason. Renewable energy will be one of the drivers of the cable market growth in the following years, but in the EU, charger cables cannot be made up of PVC.

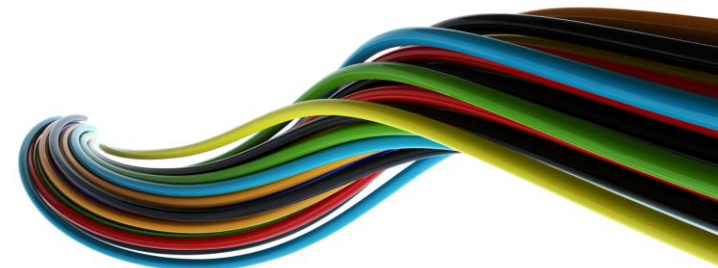
UL 62 can be used in the US, and that standard does not exclude PVC, being safe, durable, and cheaper; therefore, we should wonder why this exclusion is in the EU.



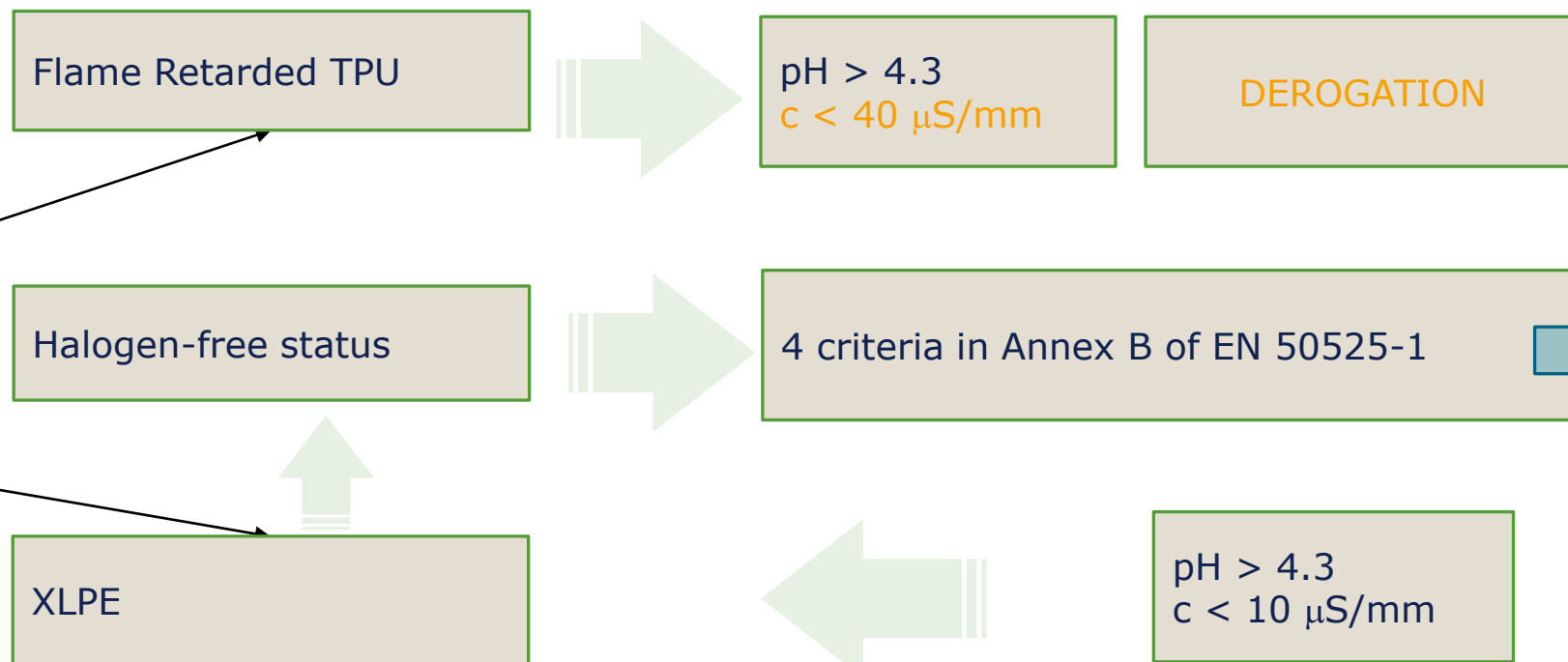
2

The impacts

A priory exclusion of PVC in technical committees



Furthermore, TPU jackets, the most used in charging cables, have a derogation in conductivity ($< 40 \text{ m}\mu\text{S}/\text{mm}$, while halogen-free status requires $< 10 \text{ }\mu\text{S}/\text{mm}$). They cannot reach this value due to the composition of the used flame retardants.



2

The impacts

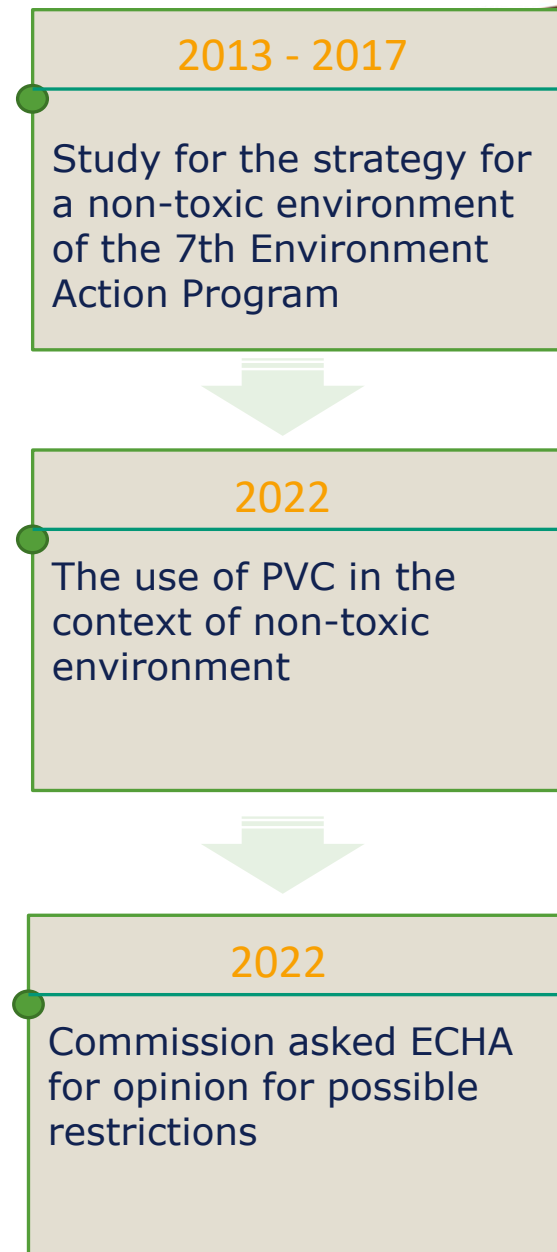
The use of PVC in the context of non-toxic environment

In 2019 the European Commission issued a tender for studying the use of PVC in the context of a non-toxic environment. In Feb 2022, Ramboll issued a report focusing on PVC, its additives, their impact on health and the environment from the cradle to the grave, the possible substitutions for additives, and PVC, the socio-economic impacts of the substitution¹¹.

Despite the report being full of misconceptions, cliché, and outdated information, it has been used by Commission to justify the request to ECHA verify the possibility of restrictions on PVC and its additives.

ECHA will issue a report by May 2023, analyzing a priority list of 63 additives for 31 applications, where they should evaluate a vast quantity of data quickly.

PVC value chain associations are in contact with ECHA to move the discussion to the “scientific level,” denying and confusing the false and outdated information and misconceptions about PVC.



[11] European Commission, Directorate-General for Environment, *The use of PVC (poly vinyl chloride) in the context of a non-toxic environment : final report*, Publications Office of the European Union, 2022, <https://data.europa.eu/doi/10.2779/375357>



3 The risks, defense and opportunities

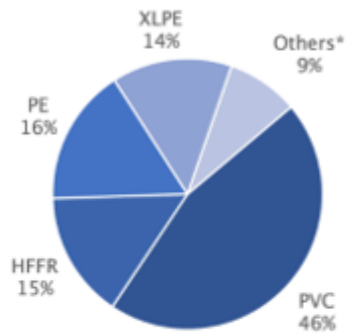
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Risks, defense, and opportunities

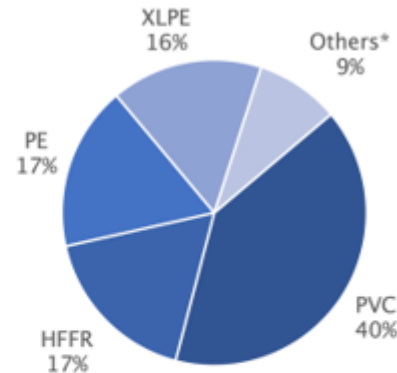
the risks

The effect of this witch hunt in the EU is that PVC articles suffered the competition of other “plastics 12.”

Demand breakdown by polymer - 2017

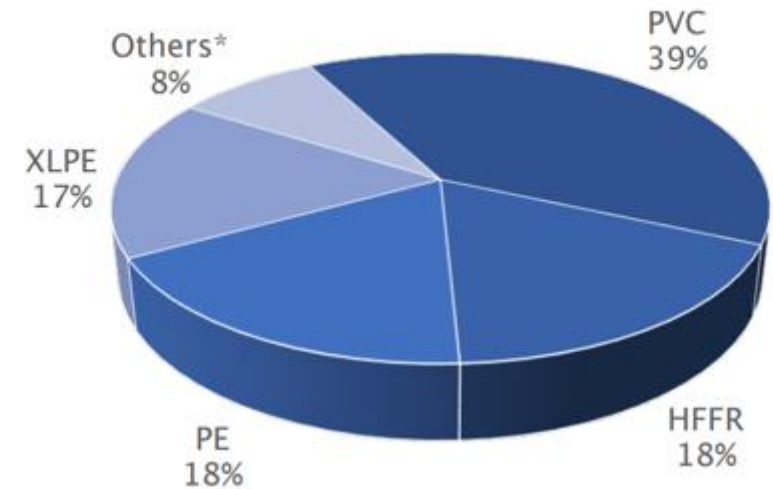


Demand breakdown by polymer - 2021



* = TPE + PP + PU, rubber, etc.

Demand breakdown by polymer - forecast 2024



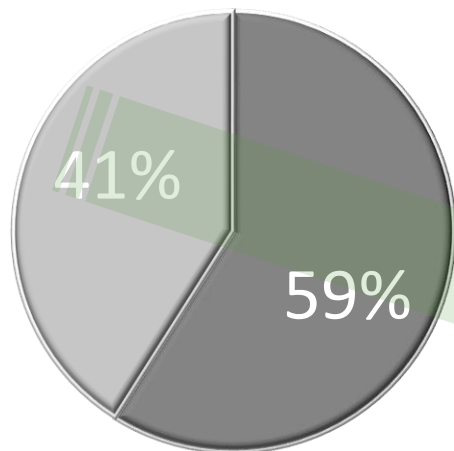
[12] P. Arcelli. European cable market: data and trends, 3rd in PVC4cables conference proceedings, Bologna 05 Oct 2022

PVC Compounding & Production Cycle Forum, Rome 19th - 20th 2023

Risks, defense and opportunities

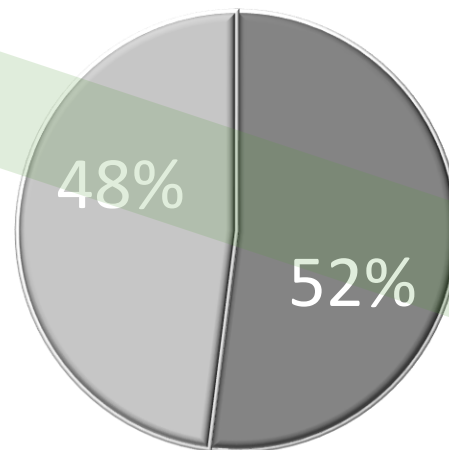
the risks

Market share PVC cable compound
worldwide: 2013



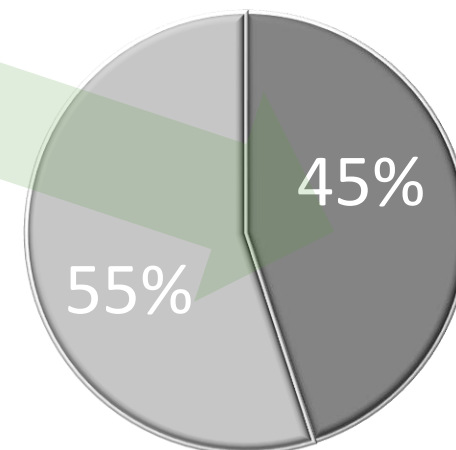
■ PVC ■ Others

Market share PVC cable compound
worldwide: 2019



■ PVC ■ Others

Market share PVC cable compound
worldwide: forecast 2023



■ PVC ■ Others

Worldwide the situation is similar, with a gap of 10 years. Without actions, the risks will cause the decline of PVC in cables ¹³

[13] Aupetit, A. Overview of the global cable industry—markets and materials. In *The Global Cable Industry: Materials, Markets*, 1st ed.; Beyer, G., Ed.; John Wiley & Sons Ltd: Chichester, UK, 2021; pp. 1–20. [\[Google Scholar\]](#) [\[CrossRef\]](#)



DEFENSE

Antenna up inside technical committees


Scientific lobbying in the EC

Publish more articles and disseminating data and ideas in critical fields

Critical fields: smoke toxicity

Fakes and misconceptions

When PVC compounds burn, they emit more smoke and more toxic smoke than other polymers



PVC4cables funded an R&D in novel low smoke and smoke acidity cables, and the emerging data are the following.:

Low smoke acidity cables have smoke production comparable with Halogen-Free cables¹⁴.

Standard PVC cables like FG16OR16 cables are in class s_2 ¹⁴

[14] C. Cardelli. Comparative testing of PVC cables and halogen-free cables regarding gas emission, 3rd in PVC4cables conference proceedings, Bologna 05 Oct 2022



OPPORTUNITIES

**DEVELOP NEW, MORE
SUSTAINABLE PVC ITEMS**

**ENTER IN APPLICATIONS AND
FIELD WHERE PVC IS ABSENT**

**ADVOCACY ACTIONS FOR
CHANGING EN 60754-2**

3

Risks, defense and opportunities

the opportunities

Critical fields: smoke acidity

Fakes and misconceptions

Acidity is considered a fire risk measure in the EU as important as smoke and heat release

PVC4cables is funding a strong R&D in low smoke acidity compounds disseminating data through articles' journals, conferences, and webinars.

Sarti, G., Piana, M. (2022). PVC in cables for building and construction. Can the “European approach” be considered a good example for other countries? Academia Letters, Article 5453. <https://doi.org/10.20935/AL5453>

Sarti, Gianluca. 2022. "A New Perspective on Hydrogen Chloride Scavenging at High Temperatures for Reducing the Smoke Acidity of PVC Cables in Fires. I: An Overview of the Theory, Test Methods, and the European Union Regulatory Status" *Fire* 5, no. 5: 127. <https://doi.org/10.3390/fire5050127>

Sarti, Gianluca. 2022. "A New Perspective on Hydrogen Chloride Scavenging at High Temperatures for Reducing the Smoke Acidity of PVC Cables in Fires. II: Some Examples of Acid Scavengers at High Temperatures in the Condensed Phase" *Fire* 5, no. 5: 142. <https://doi.org/10.3390/fire5050142>

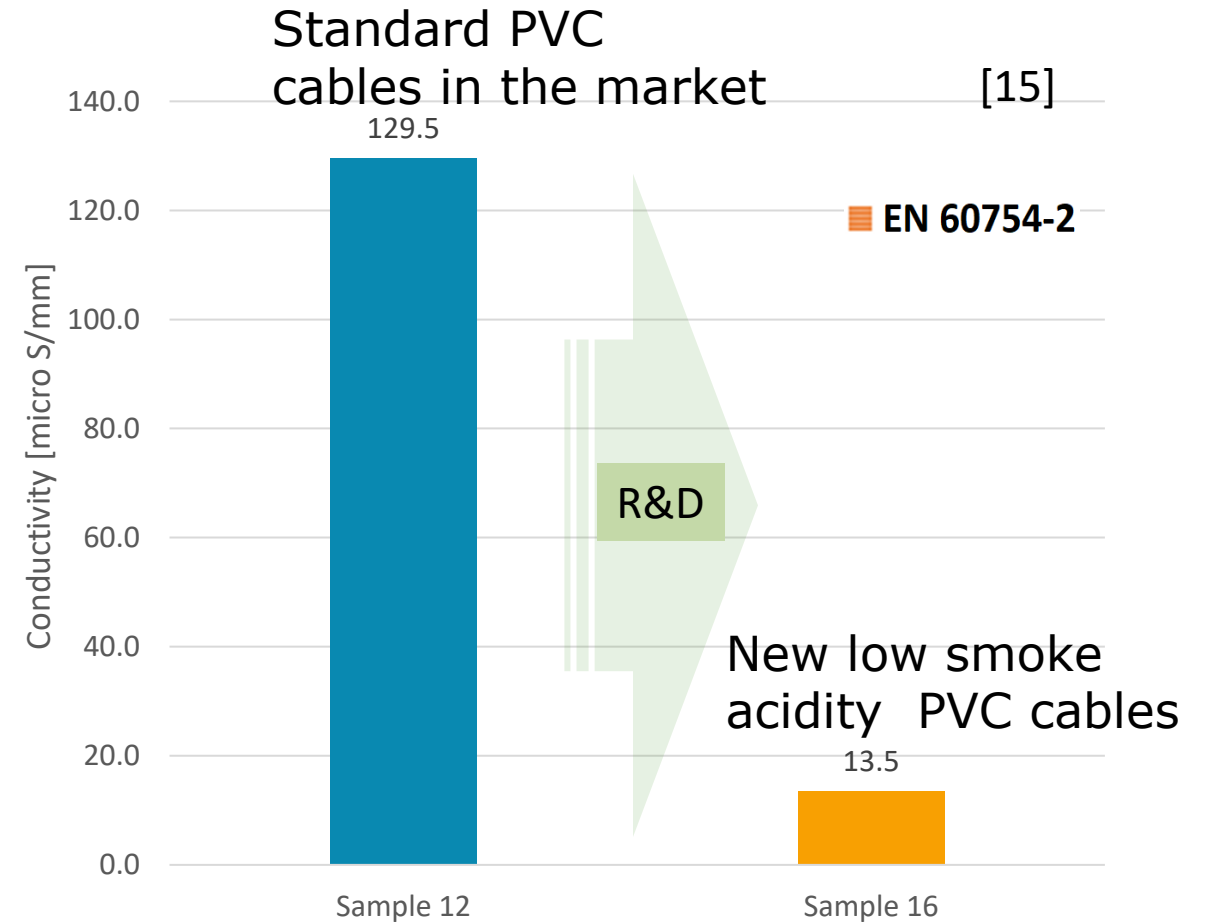
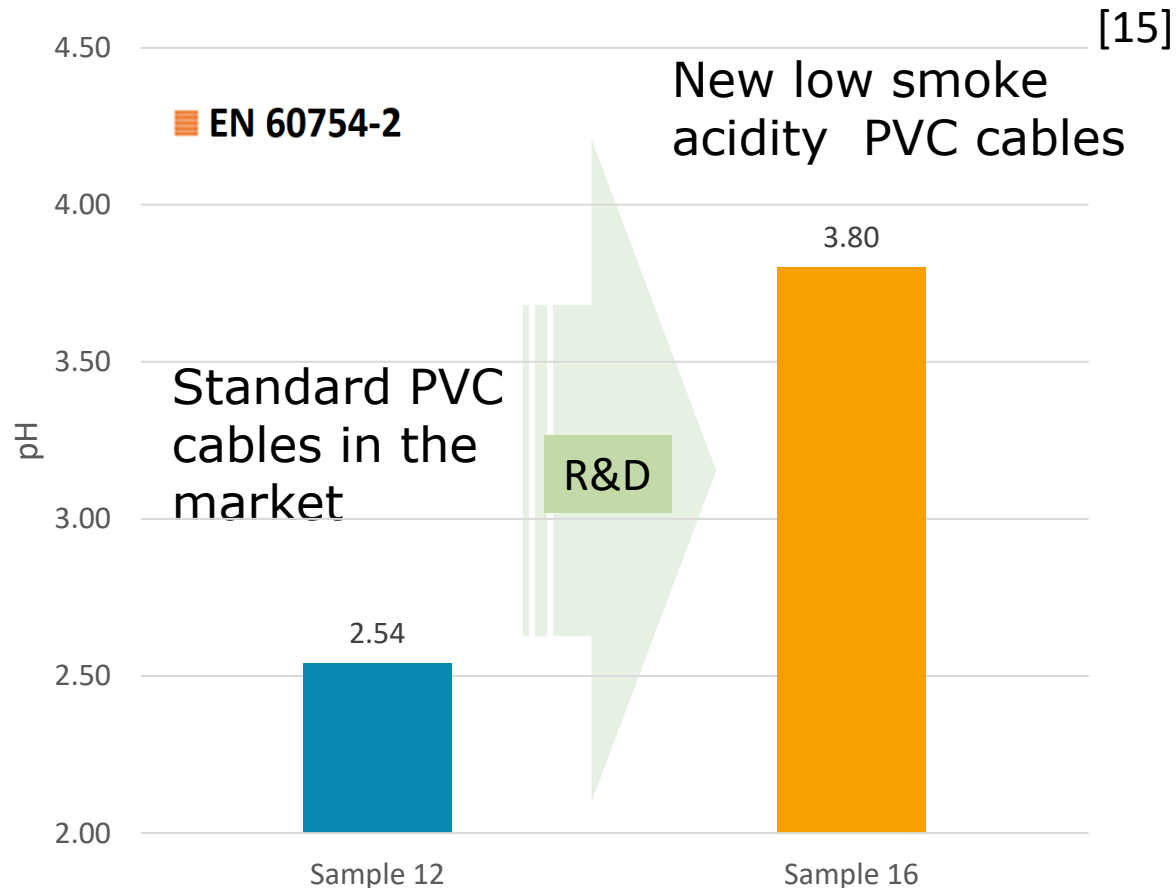
Bassi, I. Characterization of PVC Compounds and Evaluation of Their Fire Performance, Focusing on the Comparison between EN 60754-1 and EN 60754-2 in the Assessment of the Smoke Acidity. Master's Thesis, University of Bologna, Bologna, Italy, October 2021. Available online: https://www.pvc4cables.org/images/assessment_of_the_smoke_acidity.pdf

Sarti, G., Piana, M. (2017 – 2022) Several conferences, TBM 2020, 2022, available at [PVC4cables.org](https://www.pvc4cables.org)

Sarti, G., Piana, M. (2017 – 2022) Several conferences, Avlante 2020, 2022 [PVC4cables.org](https://www.pvc4cables.org)

Sarti, G., Piana, M. (2017 – 2022) Several conferences, AMI Cables 2022, 2020, 2019 [PVC4cables.org](https://www.pvc4cables.org)

R&D in low smoke acidity cables. New low-smoke acidity compounds



[15] Istituto Giordano. Unpublished report commissioned by PVC Forum Italia, 2019

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Risks, defense and opportunities

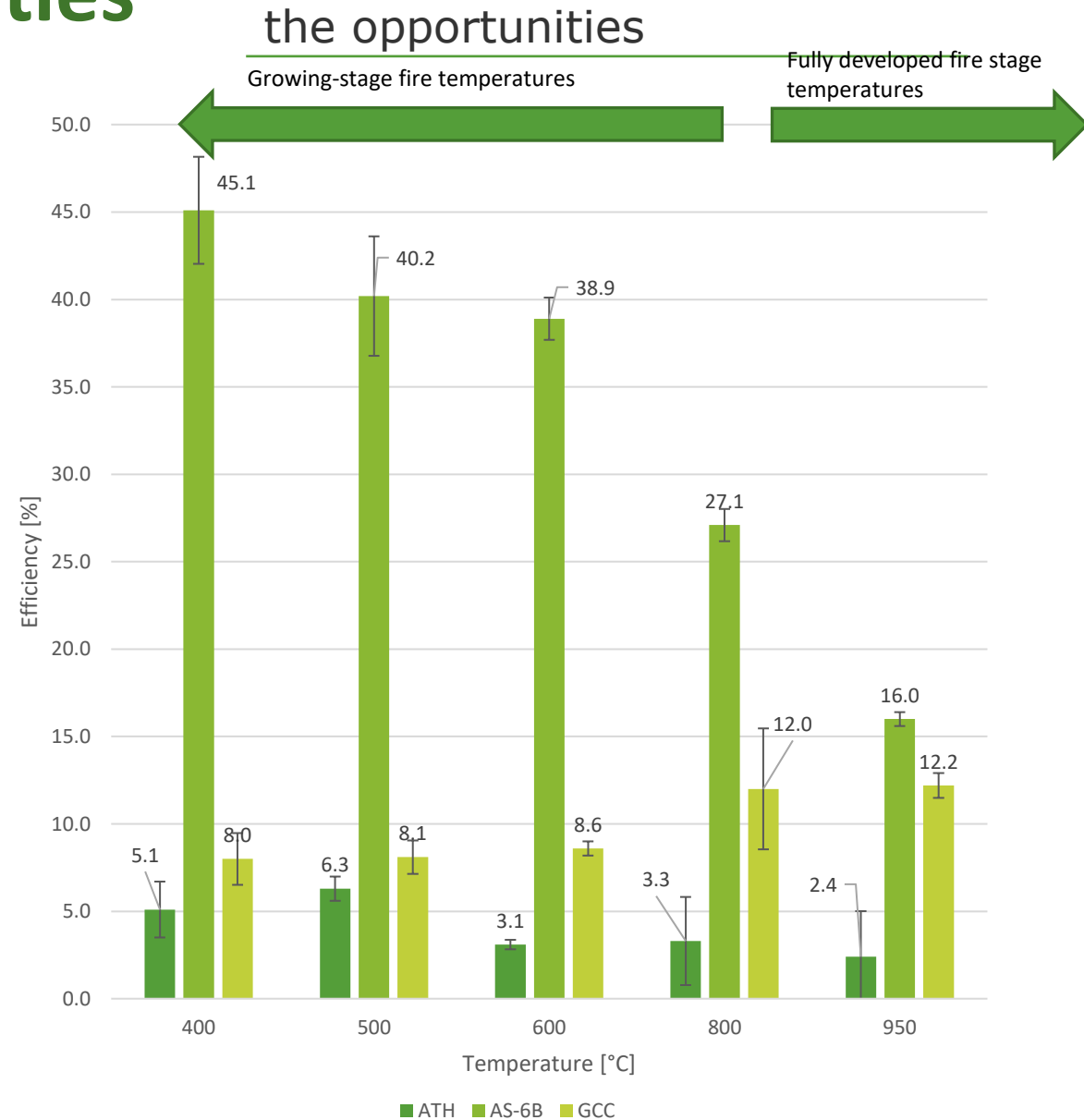
R&D in low smoke acidity cables

Different heating regimes and final temperatures give different acidity results ¹⁶.

The higher the temperature, the higher the acidity.

Acid scavengers commonly used in PVC for trapping HCl fail their action at temperatures over 900 °C

CPR test for assessing the additional classification for acidity is carried out between 935 °C and 965 °C



[16] Sarti, G. 2022. "A New Perspective on Hydrogen Chloride Scavenging at High Temperatures for Reducing the Smoke Acidity of PVC Cables in Fires. II: Some Examples of Acid Scavengers at High Temperatures in the Condensed Phase" *Fire* 5, no. 5: 142. <https://doi.org/10.3390/fire5050142>

R&D in low smoke acidity cables. New generation of low smoke acidity cables

The introduction of the heating regime of EN 60754-1 (40 minutes at 800°C and 20 minutes at 800°C) in EN 60754-2 gives PVC cables the possibility of reaching the classification a₂ or even a₁ and therefore, their use in locations where today are excluded.

Advocacy action is need for changing the standard.

Low acidity PVC cables



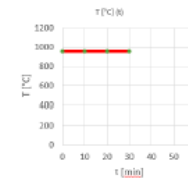
Picture 6: FG16OR16 5 X 1,5, cable manufactured according to CEI UNEL 35318 in 2019.

EN 60754-2: WV	Value	Class	Req. a2	Req. a1
pH	3,77	a ₃	> 4,3	> 4,3
Conductivity [μS/mm]	16,3	a ₃	< 10	< 2,5

EN 60754-1: WV	Value	Class	Req. a2	Req. a1
pH	4,36	a ₂	> 4,3	> 4,3
Conductivity [μS/mm]	7,4	a ₂	< 10	< 2,5

EN 60754-2

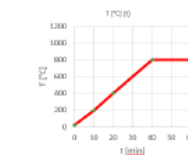
C_{car} s_{1r} d_{0r} a₃



B_{2ca} s₁ d₀ a₃

EN 60754-1

C_{car} s_{1r} d_{0r} a₂



B_{2ca} s₁ d₀ a₂



Picture 7: FG16OR16 5 X 1,5, cable manufactured according to CEI UNEL 35318 in 2021.

EN 60754-2: WV	Value	Class	Req. a2	Req. a1
pH	3,80	a ₃	> 4,3	> 4,3
Conductivity [μS/mm]	13,6	a ₃	< 10	< 2,5

EN 60754-1: WV	Value	Class	Req. a2	Req. a1
pH	4,44	a ₂	> 4,3	> 4,3
Conductivity [μS/mm]	2,8	a ₂	< 10	< 2,5

Table 4 a, b, c, d: measurements according to EN 60754-2 and EN 60754-1: pH and conductivity differ depending on the thermal profile.

14 | TITLE: Smoke Acidity Tests and Results. 3rd PVC4cables conference. 05/10/2022

Sustainability: R&D and dissemination

Fakes and misconceptions

“PVC compounds for cables are not sustainable.”



PVC compounds for cables are sustainable, using recyclates and renewable additives. R&D and innovation in this field are essential.

Environmental product declaration and VinylPlus labels are opportunities. They measure the sustainability of your products.

We can compete with other materials in a specific field where labels are required. We avoid the risk of a priori exclusion of PVC items because they are considered “non-sustainable.”

Furthermore, we need to show the sustainability of PVC items to public opinion and consumers.



4 Conclusions & Proposals



- The flow of information is critical and can bring misconceptions and fakes about PVC, which makes it difficult to be eradicated
- If mistakes and errors on PVC are present in the authoritative information, this can amplify the fakes down
- PVC4cables is funding a vital R&D supporting PVC compounds for cables in reaching their objectives
- The aim is to recover the market share we are losing and inverting the tendency of the last decades
- The support and the suggestion by cable manufacturers will help PVC4Cables to achieve objectives shortly
- CPR is under review, as are the industry standards, which are reviewed every five years, and the review of product and classification standards will begin shortly.
- In this phase, it will be the responsibility of the associations representing the world of PVC cables to be present and operate correctly, respecting the reality of the fire scenarios proposing to take into account the test and classification methods in line with the pre-established premises

5. About us



The PVC Forum Italia (www.pvcforum.it) is an Italian association that combines primary PVC production, compounding, processing companies, additives manufacturers, and processing machines. Based in Milan, the PVC Forum is part of the European network of PVC forums linked to ECVM (European Council of Vinyl Manufacturers), the European association of PVC producers, which is a division of the association of European plastics producers (Plastics-Europe).

www.pvcforum.it



VinylPlus® is the Voluntary Commitment to the sustainable development of the European PVC industry. The program has been developed through an open dialogue with stakeholders, involving industry, NGOs, regulators, civil society representatives, and PVC end-users.

VinylPlus® operates in the EU27 plus Norway, Switzerland, and the UK. VinylPlus® is registered as a SMART partnership on the UN Partnerships for the SDGs platform.

[Vinyl plus.eu](http://vinylplus.eu)



PVC4Cables is the ECVM platform dedicated to the PVC cable supply chain. It brings together PVC resin producers, stabilizers, plasticizers, and PVC compounders. It gathers PVC cable producers, recyclers, and supply chain associations. PVC4Cables intends to be a driver for environmentally compatible innovations in the PVC cable sector and act as a point of reference for dialogue and communication with all stakeholders: cable manufacturers, legislators, designers, installers, electricians, media, and public opinion.

www.pvc4cables.org



Thank you for your attention



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