PlasticsEurope
Association of Plastics Manufacturers

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Plastics Europe – Fluoropolymer Group

Socio-economic Analysis of the European Fluoropolymer Industry – Executive Summary

Executive Summary

Purpose of the report

This is an executive summary of an independent report, commissioned by the Fluoropolymers Group (FPG) of Plastics Europe. It identifies the contribution to European society and economy of a group of plastics known collectively as fluoropolymers. These include the well-known PTFE and many other polymers; they are not to be confused with fluorotelomers, which are out of the study scope. Further information is contained in the full report.

The study – the first such study carried out by the Fluoropolymer industry in Europe – evaluates the contribution made by the manufacture of fluoropolymers in terms of revenue, investment and employment. But much more significant benefits are generated along the value chain via the use of fluoropolymers in various critical applications which we use every day. In these, even though the fluoropolymer content may be tiny, they offer key attributes: non-wetting, high dielectric, non-stick, fire resistant, temperature resistant, weather resistant and with near universal resistance to chemicals. It is their ***specific combinations of properties*** that are not matched by any of the alternatives and which thus make them so valuable.

This socio-economic analysis (SEA) draws on publicly available data, alongside a survey undertaken with members of the Fluoropolymers Group and interviews with a selection of downstream users. Key messages from the analysis are below – also presented graphically.

The fluoropolymer value chain – sectors dependent on fluoropolymers

Fluoropolymers provide vital performance characteristics to products or production processes. Collectively this creates socio-economic value far beyond the direct impact created by the industry itself. Whilst not all of these benefits can be quantified, the report analysed these in eight strategically important sectors:

- **Transport:** By providing durable and effective protection against heat, aggressive fluids and fuels, humidity, vibrations and compression, Fluoropolymers prolong the useful life of various components critical for performance, emission control and safety in both the automotive and aerospace industries.

  Looking specifically at cars, fluoropolymers contribute to safety, engine efficiency, weight reductions and emission control, thereby improving fuel efficiency and reducing leaks and fugitive emissions. Modern road transport emission standards could not have been achieved without these materials. Specifically, fluoropolymer use in fuel hoses alone enables fuel savings worth some €40m per year and lower emissions prevents health damage valued at a further €100m in Europe. Over the vehicle lifetime, this equates to fuel savings in Europe of some €200m.

- **Chemical and power:** Fluoropolymers enable a high level of efficiency and environmental safety in the chemical and power sectors, helping them remain internationally competitive. Uses include piping, vessels, fluid-handling components, filters, vents and cable coatings.

  Fluoropolymer coatings, linings and components prevent corrosion in demanding environments. Each percent reduction in corrosion is estimated to deliver savings of some €150m per year across Europe. Amongst other benefits, they support savings in maintenance through increased component lifetime. Consultation suggested their use effectively doubled the lifetime of equipment, potentially yielding savings in the order of €100m annually. Furthermore, they provide important contributions to applications that prevent or remove pollution; in Combined Heat and Power (CHP)[1] installations alone, fluoropolymer heat exchanger technology contributes to energy savings worth up to €8bn and CO_2 emission reductions worth around €0.5-3bn, across Europe, per year.

- **Cookware:** Fluoropolymer-coated cookware provides easy-clean, non-stick properties, saving time, water and energy. This facilitates cooking with less added fat contributing to a healthy diet.

[1] A highly efficient process that captures and utilises the heat that is a by-product of the electricity generation process.

- **Electronics:** Fluoropolymers are critical to the semiconductor manufacturing process. Here various fluoropolymer components can stand up to the aggressive etching chemicals and provide the necessary purity required in the production of microchips and other electronics, where even trace contaminants can severely affect production yield. Annual benefits of fluoropolymers in semiconductor manufacturing are substantial - estimated in a 2006 study at some €10bn, per year. Semiconductors, in turn, are found in millions of products which are becoming ever more powerful, but compact.

  More generally, fluoropolymers enable improved fire safety, reliability and performance of cables, notably data transmission cables enabling a wide range of ICT[2], industrial, automotive, medical imaging and analysis and a huge range of other applications. A combination of high dielectric properties, high heat resistance and fire resistance is necessary to produce acceptable products.

- **Food and pharmaceuticals:** Fluoropolymers enable durable processing equipment, ensuring high purity of food and pharmaceuticals as well as a high level of efficiency by preventing corrosion and facilitating cleaning. In the European biopharmaceutical manufacturing sector alone, €270m was saved in 2012 compared to 2008 from reductions in contamination and material failure. Such improvements can be attributed to a range of factors, but fluoropolymers play an important role in these efficiency gains.

- **Textiles and architecture:** In clothing and footwear fluoropolymers increase performance and comfort through combining waterproofing and breathability, in low weight but durable materials. They provide durable, fire-safe, easy-to-clean, building materials which can both reduce building cooling costs and energy use, whilst enabling novel "landmark" architectural designs not feasible with other materials. These include the O_2 Dome (London), the Sony Centre (Berlin), Wimbledon Centre Court, the Allianz Arena (Munich), San Mamés stadium (Bilbao) and the Eden Project in Cornwall, UK, all of which use fluoropolymers in the designs, for example woven PTFE fabric, fluoropolymer-coated glass fabric or extruded ETFE film.

- **Medical applications:** Fluoropolymers enable excellent performance and long lifetimes in medical equipment such as surgically-implantable medical devices, catheters, guide wires, filters and pumps. This reduces the risks of failure, replacements, cross-infections and clogging of medical equipment, contributing to the reduction/avoidance of medical complications and the associated pain and public cost.

- **Renewable energy:** Fluoropolymers exhibit a unique combination of properties within various components in renewable energy installations. We estimate that production efficiency increases of certain fluoropolymer-grade modules relative to glass provides a potential yearly saving – depending on uptake – in the order of €40m for European PV[3] module manufacturers, or approximately €90m for PV module customers in the EU. Installed capacity of both PV and wind energy is increasing quickly; a pre-requisite is unit cost reductions driven by efficiency gains. They are also used in energy storage systems such as PEM fuel cells and lithium-ion batteries.

The fluoropolymer industry – direct effects

The starting point of the value chain – sales of fluoropolymers in their basic form – is relatively small in comparison to the wider socio-economic benefits created by downstream fluoropolymer applications, described above.

However, even the production and sale of fluoropolymers themselves creates significant direct socio-economic effects in the EU. In 2015, around 52,000 tonnes of fluoropolymers worth around €780m were sold. By tonnage, the EU is a net importer of fluoropolymers, but the sales values of exports (€380m) are around 18% higher than the sales value of imports (€310m).

EU fluoropolymer manufacturing is a highly innovative sector, with an estimated €43m invested in research and development (R&D) in 2015. This equates to 5.5% of turnover; around triple the EU average.

[2] Information Communication Technology
[3] Photovoltaics

The location of the fluoropolymer industry in Europe plays an important role in allowing EU-based customers to meet lead times for the various end user sectors. This is necessary in maintaining innovation and R&D, as companies are continually customising products for their local customers.

Alternatives?

A high level analysis of alternatives has been carried out for all of the above sectors. Overall, whilst some alternatives might have a similar performance to fluoropolymers for a particular parameter or property, it is the combinations or ranges of properties required for the applications that sets fluoropolymers apart from the alternatives. In summary, whilst the implications of substituting fluoropolymers differ across specific applications, they include:

- **Technical implications** include lower performance, increased weight (with associated effects on fuel consumption and fuel efficiency), and reduced durability. This results in increased challenges (less compatibility and versatility) associated with component design/redesign and operating condition requirements.
- **Economic implications** include regression of advanced technologies and the reduced ability of Europe to compete and attract high and medium technology manufacturing investment (if it is not possible to prototype and produce competitive products), efficiency losses, higher initial (investment) costs and higher maintenance costs. The diversity of specific applications would pose major product qualification issues alongside design implications.
- **Environmental / health implications** include the potential for higher risk of exposure of staff to hazardous substances, higher safety risks (vehicle or aircraft failure) and increases in emissions arising from technical regression (in transport, for example this includes inferior car emission sensors, inferior internal seals, increased fugitive emissions or weight increases). This could put at risk Europe's ability to meets its climate and energy goals.

Socio-economic benefit of fluoropolymer applications

Fluoropolymer sales to key sectors in the EU (2015)			Example application and benefit of fluoropolymers	Statistics on sectors where fluoropolymers are used
Transport	18,500 Tonnes	300 € m	Fluoropolymer fuel hoses enable fuel savings and reduce damage from emissions, worth ~ €140m per year in EU	> 13 million employed
Chemicals & power	16,500 Tonnes	220 € m	Corrosion prevention saving hundreds of millions of € each year in the EU	Nearly 3 miliion employed
Cookware	3,500 Tonnes	60 € m	Easy clean non-stick properties, allows cooking with less fat	Production value in the order of €2 billion
Electronics	3,500 Tonnes	50 € m	Critical in semiconductor manufacturing, enabling progress in IT that has generated trillions of € globally in the last 20 years	EU semiconductor market worth circa €25 billion
Food & pharma	3,000 Tonnes	40 € m	Safer and cheaper food and pharma by preventing contamination and material failure	Nearly 5 million employed
Textiles & architecture	3,000 Tonnes	40 € m	Enabling novel and unique 'landmark' architectural designs	> 2 million employed
Medical applications	1,500 Tonnes	20 € m	Reduces the risks of failure, cross-infections and clogging of medical equipment	Europe accounts for 41% of global medical device patents
Renewable energy	500 Tonnes	<5 € m	PV module production efficiency increases which save €40m – €90m each year in the EU	Europe leading the global market in installed capacity
Other	2,000 Tonnes	30 € m	–	–
Total	**52,000** Tonnes	**780** € m		

The fluoropolymer industry - direct effects

Produced in the EU

Tonnes of fluoropolymers (2015): 51,000

Annual sales /turnover: € 840m

Trade

€ 380m Exports

€ 310m Imports

Employment

2,200 Direct

Research and development (R&D) investment by fluoropolymer manufacturers in the EU

€ 43m = 5.5% of revenue

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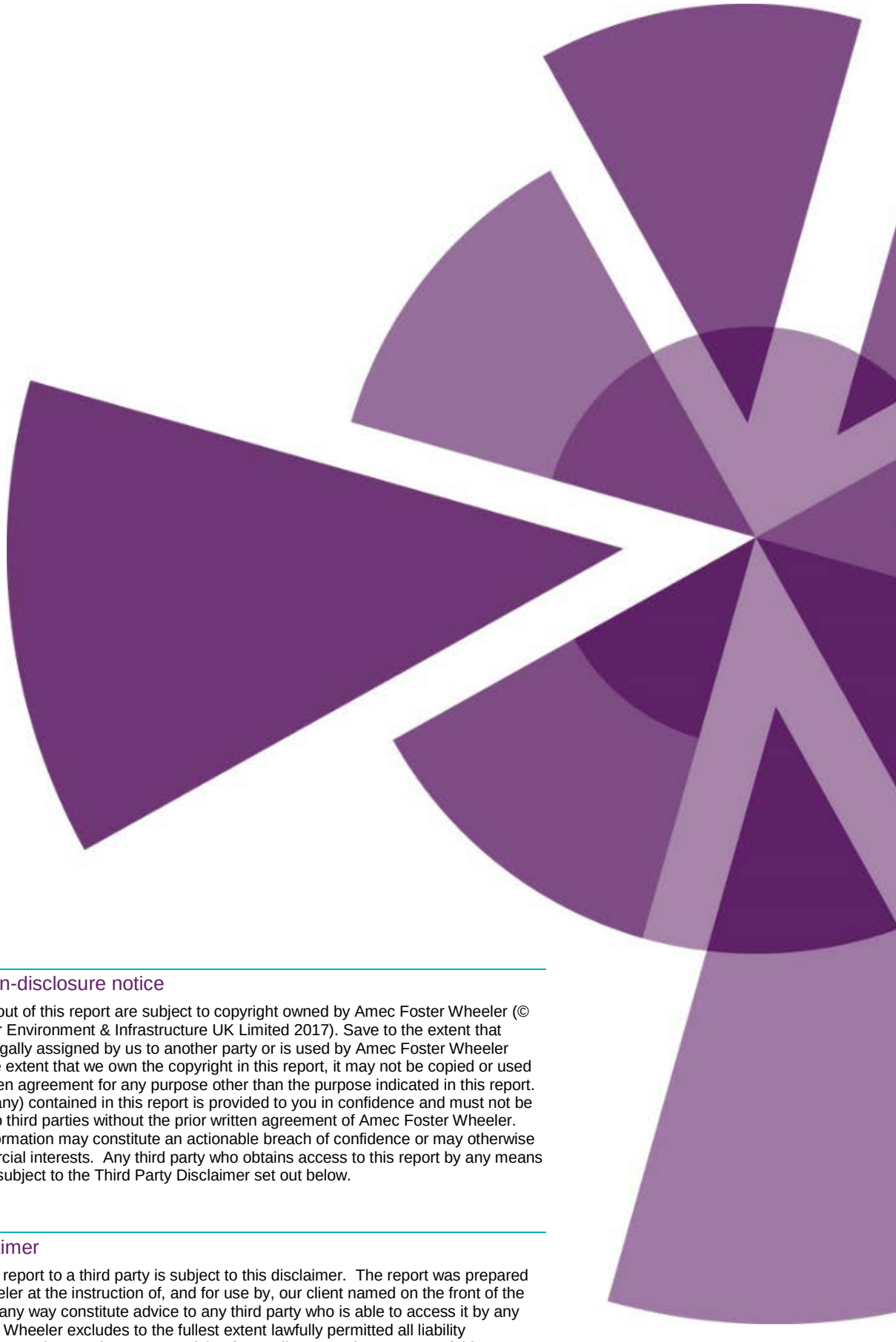
Note all sales values are rounded to the nearest €10 million; all tonnage data are rounded to the nearest 500 tonnes



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