Deliverable 5.2: Strategic capacity building and awareness raising at the pan-European level

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About the INTAS project

The aim of the INTAS project is to provide technical and cooperative support, as well as capacity building activities, to Market Surveillance Authorities (MSAs). The need for the INTAS project arises from the difficulty that MSAs and market actors face in establishing and verifying compliance with energy performance requirements for large industrial products subject to requirements of the Ecodesign Directive, specifically transformers and industrial fans. Therefore, the project aims to:

- Support European Member State MSAs deliver compliance for large products (specifically for transformers and large fans);
- Support industry to be sure of what their obligations are under the Ecodesign Directive and to deliver compliance in a manner that will be broadly accepted by MSAs;
- Foster a common European approach to the delivery and verification of compliance for these products.

More details and publicly available reports can be found at: **www.INTAS-testing.eu**

List of project partners:

WIP Renewable Energies	Europe
European Environmental Citizens' Organisation for Standardisation	Europe
European Copper Institute	Europe
Engineering Consulting and Design	Europe
Waide Strategic Efficiency	Europe
Austrian Energy Agency	Austria
Federal Public Service Health, Foodchain, Safety and Environment	Belgium
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Food and Economic Safety Authority	Portugal

1. Introduction

This report examines strategic capacity building and awareness raising at the pan-European level within the context of the INTAS project and specifically Ecodesign market surveillance of large industrial products (notably power transformers and large industrial fans). It addresses the value proposition from effective market surveillance for these products and aims to contextualise it so that resource allocation questions and decisions are better informed. It also considers the cross and inter-ministerial connections that are necessary to support more optimised decision making in this field.

The aim is to develop strategically important and informative communication literature that will help support the dissemination and utilisation of the project findings, and to utilise this literature to underline the importance of adequate funding for market surveillance activities.

Impact of market surveillance and measures to help increase MSA resources

MSAs are currently insufficiently funded to conduct adequate product energy performance market surveillance for many product types and as a result energy is being wasted that might otherwise be saved cost-effectively due to insufficient deterrence. This deliverable compiles evidence and conducts analysis that reveals the scale of the value proposition from greater investment in product energy performance market surveillance and presents the findings in terms that are intended to support decision making for national energy strategies and public budgetary resource allocations.

Specifically, it involves:

- gathering data and conducting analysis to determine the scale of the benefits and costs from greater investment in product energy performance market surveillance
- contextualisation of the information to help place it within European national energy planning and market surveillance frameworks
- the creation of a master document (this report) that outlines EU-level energy and resource losses, whose results can then be easily adapted by national member states to highlight their national situations
- the development of awareness raising materials, within Appendix A, wherein the data that has been gathered and conceptualised is summarised in a short document that clearly outlines the key motivations behind increasing resources for market surveillance.

The work presented in this report builds upon the findings of the preceding INTAS work, and most notably the deliverables:

- D4.3 on Evaluation of costs, benefits and new methods of testing, and common issues found in large product testing
- D4.1 on Final Methodology on market surveillance of large fans
- D4.2 on Final Methodology on market surveillance of transformers, and
- D4.4 on the INTAS policy recommendations.

In addition, it is also directly informed by the deliverables:

- D3.6: Best practice and experiences of both MSAs and industry regarding testing of fans
- D3.7: Best practice and experiences of both MSAs and industry regarding testing of transformers
- D3.8: Screening methodologies to target products for compliance verification.

Structure

The report begins by considering the current scale of non-compliance with Ecodesign requirements in section 2 and how that is likely to change as a function of investment in market surveillance activity. Section 3 considers the cost of non-compliance in terms of lost energy savings, increased greenhouse gas emissions, higher energy bills, lower industry revenues and lower levels of industrial employment. It begins with consideration of Impact Assessment evidence of the expected costs and benefits of Ecodesign regulations for industrial products that fully comply with the regulations and then assesses how these would be expected to vary as a function of four non-compliance scenarios, commensurate with different levels of non-compliance as follows:

A scenario where the non-compliance is such that the energy performance of industrial products is 5% worse than the permitted Ecodesign limits

A scenario where the non-compliance is such that the energy performance of industrial products is 10% worse than the permitted Ecodesign limits

A scenario where the non-compliance is such that the energy performance of industrial products is 15% worse than the permitted Ecodesign limits

A scenario where the non-compliance is such that the energy performance of industrial products is 20% worse than the permitted Ecodesign limits.

This exercise is done for all industrial product groups currently subject to, or expected to be subject to, Ecoesign regulations; and includes: industrial fans, power transformers, electric motors, water pumps and air compressors (with the latter two treated as a single group).

Section 4 considers the expected benefit costs from investment in Ecodesign market surveillance for industrial products. It again shows the impacts expected from sustained market surveillance investment for each of the industrial product groups under the four initial non-compliance scenarios and presents results in terms of market surveillance induced: energy savings, CO_2 savings, energy bill savings, additional industrial jobs and additional industrial employment. It also reports the estimated benefit cost ratios (BCRs) attributable to the outcome of the investment in market surveillance for each product group under each initial non-compliance scenario.

Section 5 examines the reasons why current funding for Ecodesign market surveillance of large industrial products is inadequate and explores options and mechanisms that could be used to improve it. It also reviews the expected impact of the impending Goods Package on market surveillance.

Section 6 provides a brief summary and conclusions.

Appendix A is a short summary document that clearly outlines the key motivations and benefits expected from increasing resources for Ecodesign market surveillance of industrial products and is intended to support MSAs raise awareness of the opportunities that can be realised by strengthening compliance through more effective market surveillance.

Appendix B shows the INTAS compliance methodologies for industrial fans and power transformers.

2. The scale of non-compliance

Estimating the current level of non-compliance is necessary to enable baselines to be established against which the potential benefits of more effective market surveillance actions can be determined. Ironically, the actual level of non-compliance cannot be known until market surveillance verification checks are implemented for a large part of the market, which is not currently the case for large industrial products.

In this section the levels of non-compliance identified in the INTAS project and beyond are reported including both measured results and anecdotal information. To broaden the perspective information on the non-compliance of other product groups with Ecodesign regulations is also reported. This is complemented by the consideration of evidence and analysis about how compliance might be expected to improve as a function of sustained market surveillance. This information is then used to inform the scenario analyses presented in sections 3 and 4.

2.1 How much non-compliance has been identified in INTAS?

Earlier work in the INTAS project has identified that to date very little MSA market surveillance activity has occurred for large industrial products (specifically fans and power transformers) thus far, as the regulatory requirements are relatively new and MSAs have struggled with the technical challenges of how to do market surveillance for these products (which INTAS has made significant progress in addressing) and are mostly yet to allocate significant budgets to this activity. Therefore, there is negligible MSA experience of non-compliance for large industrial products to draw upon outside the INTAS project itself.

2.1.1 Non-compliance identified via verification checks

The INTAS project worked with a selection of cooperative manufacturers of power transformers and fans to examine the compliance of their products with the Ecodesign regulatory requirements. In practice this involved carrying out documentation checks on almost a 100 transformers and verification tests on a smaller proportion. In the case of fans the tests conducted were principally aimed at establishing the viability of scale-model and part-load testing as opposed to compliance with the regulations and far less tests were done. The transformer energy performance verification test results found that on average the product sample examined had energy losses ~6% above the permitted levels, but within this most products complied or were only just non-compliant while a small proportion performed significantly worse. It is difficult and probably unwise to draw many conclusions from this sample as it was a self-selected sample from willing and cooperative suppliers, was relatively modest in size and only covered a very small part of the products on the wider European market. The INTAS consortium has no means of knowing the degree to which products from other suppliers would comply with the requirements; however, from this experience it could be assumed that they are not likely to have a better average level of compliance. It should also be noted that a much higher proportion of regulatory non-compliance was identified for product documentation checks, but these in themselves do not directly increase energy consumption and its associated impacts (bills, emissions etc.), although they can be indicative of the robustness of the conformity assessment process suppliers are using.

2.1.2 Anecdotal evidence

In the course of the project the INTAS consortium would often liaise with industry representatives on a range of topics and information would sometimes be informally offered on the perceived levels of non-compliance with Ecodesign energy performance requirements. There is no systematic means of processing these comments or ascribing validity to them but there seems to be a range of perspectives with figures in the region of an average of 10% above the requirements being common – although higher and lower values have been mentioned.

2.2 Non-compliance for other products

In recent years there have been a number of EU funded projects to address compliance with Ecodesign regulations. These have mostly focused on consumer appliances and products but these of course can still provide insights into the levels of non-compliance that might be expected for other product groups and how markets behave in response to market surveillance actions.

The ATLETE I project[1] (which concluded in 2011) tested 83 models of domestic cold appliances from 49 different brands selected at random across the EU. 50 of the models were from manufacturers that had agreed to cooperate with the project (i.e. were signatory manufacturers) and 23 were from non-signatory manufacturers. The overall results found that 23% of models failed the energy consumption test (i.e. their declared values were outside the independently tested values after taking account of the permitted tolerance) and 21% of models had incorrect energy label classifications. The average energy consumption of non-compliant models was about 14% above the permitted 15% tolerance for initial testing of individual models and 13% above the permitted 10% tolerance when testing 3 identical models.

Interestingly, the share of non-compliant models among signatory manufacturers was 14% for energy consumption and 12% for energy label classification, whereas for non-signatory manufacturers these non-compliant share figures increased to 45% and 45% respectively. Thus, the models tested from non-signatory manufacturers were ~3.5 times more likely not to comply than those from signatory manufacturers.

By contrast, the ATLETE II project, which concluded in 2014 selected 50 washing machine models from 29 manufacturers, present on the European Union market at random and tested them to verify their compliance with EU efficiency labelling and Ecodesign regulations in six European laboratories. The final test results showed that 100% of appliances for which testing was concluded complied with the energy efficiency class declaration and the energy consumption declaration. This excellent result is believed to demonstrate the impact of many years of energy performance market surveillance conducted across many EU Member States and thus to provide an indication of the benefits of comparatively sustained market surveillance activity.

The ATLETE II project and other like it demonstrate, that when market surveillance and testing is done in a systematic, effective and cost-efficient way it helps transform the market and ensures the highest benefit for consumers, manufacturers and the environment. Prior to the instigation of systematic testing and

[1] http://www.atlete.eu/

engagement with the appliance industry the non-compliance levels found among appliances had been much higher, but after a relatively short period of sustained market surveillance activity the results show that compliance levels have improved dramatically.

The EEPLIANT project[2] which finished in 2017 conducted verification checks, including performance testing, on LED lamps, imaging equipment, gas boilers and heat pumps.

Document and information checklists were used for the inspection of packaging, declaration of conformity and technical documents for 141 LED lamps. The main results of these measures are summarised as follows:

- 45% of the LEDs inspected were non-compliant regarding packaging information. The main problems encountered were: no information on equivalence to incandescent lamps, on dimmability, on nominal lamp lifetime and on switching cycles.
- A declaration of conformity was missing for 37% of the products checked. Incorrect information concerning the applicable regulation and standards was seen.
- 54% were non-compliant as a result of their technical documentation. Information regarding the applicable regulation and standards was incomplete, missing altogether or the test report was not supplied.
- 86 models of lamps (25 directional and 61 non-directional) were subject to verification testing. The results showed problems concerning quality and general performance as many products were non-compliant with Ecodesign legislation, which required enforcement measures.

The most frequent issues are related to lamp brightness and lamp lifetime, with a large number of lamp models providing lower brightness or shorter lifetime than declared by manufacturers. Small issues concerning energy efficiency declaration and negligible problems concerning excess energy consumption were detected. Only twelve of the tested models were fully compliant, whilst for the rest the following non-compliance levels were noted:

- 47 lamps were non-compliant with respect to their initial luminous flux (incorrect declaration)
- 16 lamps had an incorrect electric power rating.
- 34 lamps, declared an Energy efficiency index (EEI) which was outside the permitted tolerance. In nine of these cases, the lamps were declared for the wrong efficiency class too.

It should be remembered that the testing focussed upon potentially non-complaint lamps, thus the percentages indicated above do not provide a statistically valid picture of the overall market.

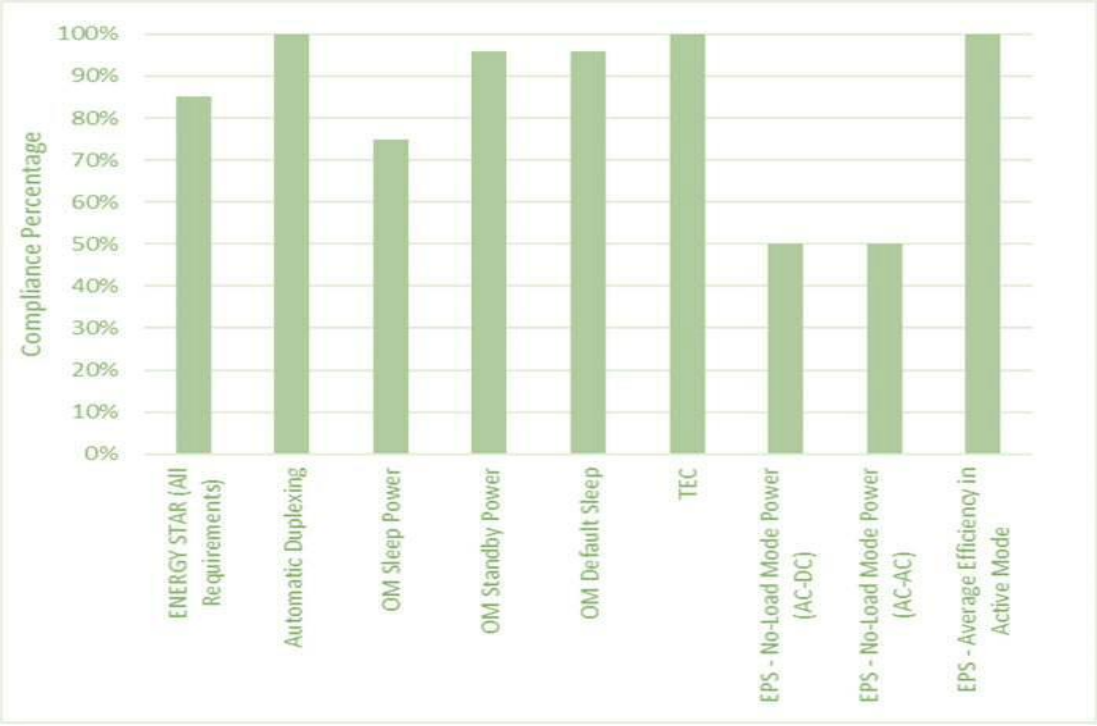
[2] http://eepliant.eu/

In total, 40 imaging equipment (IE) products covering 37 individual models were sent for testing to an accredited laboratory. The following parameters were tested:

- Typical Electricity Consumption (TEC) of laser-based imaging products measured in kWh/week based on the EU ENERGY STAR v2.0 test procedure for imaging products;
- Sleep and Standby/Off Mode power demand of inkjet-based imaging products based on the EU ENERGY STAR v2.0 test procedure for imaging products;
- The availability of duplex printing in laser-based IE;
- Default Delay Time to Sleep of inkjet-based imaging product;
- External Power Supply (EPS) efficiency, for products shipped with those devices, based on the test procedure listed in the EU ENERGY STAR v2.0 specification for imaging equipment.

The results of the verification testing for the imaging equipment is shown Figure 1. An overall pass mark of 85% was observed across all relevant ENERGY STAR tests.

Figure 1. Summary of Imaging Equipment Compliance Rates for each ENERGY STAR Test from the EEPLIANT project



The EEPLIANT project also included testing of 10 “small” gas boilers, i.e. those with a thermal output up to 70 kW. The test results were encouraging as all 10 boilers complied with the Ecodesign minimum

requirements, and the measured space heating energy efficiency matched the declaration on the energy label in all cases.

The project also tested seven heat pumps with a thermal output up to 70 kW. All seven heat pumps met the Ecodesign minimum requirements.

2.3 Evolution of non-compliance as a function of investment in market surveillance and default non-compliance levels

Overall the results from over 15 years of Ecodesign requirements and 25 years of energy labelling requirements are that non-compliance rates tend to start quite high and remain so until systematic efforts are made to conduct sustained market surveillance activities and/or implement other measures which expose false declarations such as 3rd party managed product certification schemes. However, when this is undertaken the compliance rates tend to improve and often attain very high levels. This reflects that market operatives will often need to be proactively engaged to understand what their obligations are with regard to Ecodesign regulatory requirements and equally to ensure that the reward-risk ratio of non-compliance becomes unfavourable once market surveillance is conducted in earnest. To this can be added that for product groups and industry sectors where there is sustained energy performance certification activity, often private sector driven, compliance rates tend to be high. The same tends to be true when there is a globally recognised performance standard and a relatively concentrated set of product suppliers – such as is seen for laptop computers or imaging equipment – as in this case the number of private sector and public actors checking performance is relatively high and the reputational damage from poor compliance is high too. In contrast, when the industry is fragmented, there is less international trade, and there is very little probability of competitor performance checking and “whistle blowing” the risk of non-compliance is higher. This is often the situation which applies to large industrial products for which there is no 3rd party product certification scheme in place, such as for power transformers, industrial fans and electric motors. The characteristics of the latter are likely to be rather different to the former too, because there is more international trade and competition (especially at the smaller size ranges – although that is where there is most international trade for industrial fans and power transformers as well), there is a de-facto global energy performance standard, but there are also many more suppliers (especially at the smaller capacity ranges). The power transformer market is also likely to be unusual too, because the majority of products are sold to utilities and at the larger power ranges factory acceptance witness testing is common. This suggests there is degree of market influence that might limit non-compliance; however, as indicated in section 2.1 this appears to be incomplete. There is little in the way of verification checking (private or public sector) for the industrial fan (except for safety sensitive applications), electric motors (ditto), water pumps or air compressor markets so there is reason to imagine the default level of non-compliance could be higher than for some product groups.

2.4 How much would non-compliance be reduced from greater market surveillance activity?

Market surveillance works both as an enabler of compliance and as a deterrent. It enables compliance by supporting market actors to be aware of the legal obligations applicable to their products and to understand what they need to do in order to make their product offers compliant with the requirements. Equally, market surveillance activities that concern compliance verification checks will serve as a deterrent to non-compliance providing there is follow-up action including legal sanctions if there is sustained non-compliance by any given market actor. There is no way of being certain about how much compliance would be triggered by any specific set of market surveillance actions but there is experience from previous market surveillance activities that can provide a useful indicator of the types of impacts that should be expected from a properly structured and sustained market surveillance effort.

A priori it is possible to anticipate outcomes from imagining how market actors would be likely to respond to market surveillance actions. If a market actor was simply unaware of the obligations their products are subject to, and that cannot be discounted whenever new product regulations are introduced, then if they are law-abiding they could be expected to implement measures to bring their products into line with the requirements once they become aware of the requirements. As markets are in constant flux and the everyday demands of running a business are already quite demanding some suppliers may be aware of a requirement in principle but may not have prioritised bringing their product range into compliance ahead of other concerns that are perceived to be more pressing. This is a balance of risk behaviour, which is not uncommon in all walks of life, where actions are driven by what appears to be most pressing. It is also possible to imagine another category of suppliers that will aim to gain a competitive pricing advantage or enhanced profit margin, by consciously ignoring the requirements in the hope that the risk of being caught is much less than the financial benefits that could be accrued by ignoring the requirements.

Such suppliers will be hoping to create an unequal market position against law abiding suppliers and hoping that customers are unaware or disinterested in having products that satisfy the requirements, but are motivated by price. The responses of these categories of market actors to different levels of market surveillance can be envisaged as set out in Table 1.

Table 1. Behaviour of theoretical market actor types in response to market surveillance

Market actor category	Market surveillance case		
	No market surveillance	**Initial market surveillance**	**Sustained market surveillance**
Aware and law abiding	Products will comply	Products will comply	Products will comply
Unaware and law abiding	Products will not comply	Products will comply	Products will comply
Aware but risk balancing	Products will not comply	Products may comply	Products will comply
Aware but not law abiding	Products will not comply	Products will not comply	Products will comply

From this it is apparent that unaware but law abiding actors will make their products comply as soon as they become aware of the requirements. Aware but risk-balancing market actors will not comply unless they perceive the risk of non-compliance to exceed the inconvenience of bringing their products into compliance. Aware but non-law-abiding market actors will only bring their products into compliance if the deterrence effect of market surveillance are sufficiently strong as to outweigh the financial benefits from non-compliance. Tables 2 to 4 show worked examples of how compliance could be expected to evolve per type of market actor as a function of the number of years since a regulations introduction in response to differing market surveillance scenarios. In the first scenario of no market surveillance (Table 2) there is still a significant degree of compliance because 60% of the market actors are aware of the regulations and are intrinsically law-abiding.

Table 2. Compliance behaviour of theoretical market actor types in response to no market surveillance – worked example

		No market surveillance			
Market actor category	**Share/Year**	**0**	**5**	**10**	**20**
Aware and law abiding	**60%**	100%	100%	100%	100%
Unaware and law abiding	**10%**	0%	0%	0%	0%
Aware but risk balancing	**20%**	0%	0%	0%	0%
Aware but not law abiding	**10%**	0%	0%	0%	0%
Overall compliance		60%	60%	60%	60%

In the case of initial market surveillance activity, launched shortly after a regulation comes into effect, it can be anticipated that the unaware and law-abiding market actors become aware of the regulation and bring their products into line (Table 3). A proportion of the risk balancing market actors bring their products into line but then a proportion of these deprioritise compliance for future products as the observe there is no sustained market surveillance. A similar effect occurs with the non-law-abiding segment but the effect of bringing products into compliance is less pronounced and sustained.

Table 3. Compliance behaviour of theoretical market actor types in response to initial market surveillance – worked example

Market actor category		Initial market surveillance			
	Share/Year	0	5	10	20
Aware and law abiding	60%	100%	100%	100%	100%
Unaware and law abiding	10%	0%	100%	100%	100%
Aware but risk balancing	20%	0%	50%	25%	0%
Aware but not law abiding	10%	0%	25%	5%	0%
Overall compliance		60%	83%	76%	70%

In the case of sustained market surveillance activity, launched shortly after a regulation comes into effect, it can be anticipated all but the most risk taking non-law-abiding segment of the market will move to bring their products into compliance with the requirements, and that the effect will be sustained as market actors observe the continued market surveillance activity (Table 4).

Depending on the scenario in question overall market compliance either remains around 60% or rises up to almost 100% in response to the vigour of market surveillance applied.

It is worth noting that while the above analysis is theoretical and hypothetical it does seem to be in line with observed data on compliance trends with Ecodesign regulations (not withstanding that there may be specific factors which apply to specific product group sectors that could make their industry/suppliers more or less likely to respond in this manner).

In particular, consumer products that have been subject to Ecodesign regulation for some time and for which there have been sustained market surveillance efforts are reporting quite high compliance rates, which was not the case earlier in the regulatory process.

Table 4. Compliance behaviour of theoretical market actor types in response to sustained market surveillance – worked example

Market actor category		Sustained market surveillance			
	Share/Year	**0**	**5**	**10**	**20**
Aware and law abiding	**60%**	100%	100%	100%	100%
Unaware and law abiding	**10%**	0%	100%	100%	100%
Aware but risk balancing	**20%**	0%	50%	100%	100%
Aware but not law abiding	**10%**	0%	25%	75%	85%
Overall compliance		60%	83%	98%	99%

3. Estimation of the cost of non-compliance

This section begins (in section 3.1) by presenting the impacts of Ecodesign regulations for industrial products that were anticipated in the regulatory impact assessments and then evaluates the cost of non-compliance against the four non-compliance scenarios considered in this assessment (in section 3.2). In each case it presents the anticipated impacts in terms of energy consumption, CO_2 emissions, energy bills, industrial revenues and industrial employment.

3.1 The benefits of Ecodesign measures: evidence from impact assessments predicated on full compliance

In this section the expected impacts of Ecodesign regulations for industrial products as estimated within the EU's various impact assessments are reported. Importantly, these assessments assume there is full compliance with the requirements, which means that the savings they estimate are the upper boundary of what could be expected for any given level of actual compliance.

3.1.1 Fans

3.1.1.1 Sources

The sources used are the original Ecodesign impact assessment from the 2009 regulation [3] and the consolidated Ecodesign impact assessment from 2017 [4]. These include all reported impacts and also centrally agreed assumptions about energy prices and CO_2 emission factors. As the 2017 study is more recent and consolidated it takes precedent over the original product group impact assessment.

3.1.1.1.1 Double counting of components and products

The 2017 consolidated Ecodesign impact assessment notes that several products, among them electric motors and industrial fans, may be embedded in other products which are regulated under the Ecodesign Directive. This means that Ecodesign impacts, such as energy savings, could be attributed to the efficiency gains in the component product or to the final product they are embedded in. From an impact accounting perspective, it is important that there is no double counting of the impacts of regulations and therefore current practice is to ascribe the savings to the regulation which applies to the final product, and not to those further up the supply chain. As an illustration of the issue, a part of the industrial motors is included in industrial fans and a part of industrial fans is included in non-residential mechanical ventilation units (e.g. centrifugal fans), air conditioning/heat pump/refrigeration products (e.g. axial convection fans), very large boilers (typically centrifugal combustion fans), etc. In such an instance, regulation potentially takes place at 3 levels and, by and large, the energy figures presented in the 3 underlying impact assessment studies relate to these 3 levels separately. Summing the energy data from these three studies could result in a considerable overestimation of the energy consumption and savings. To avoid this a double counting correction factor ('db') was introduced in the overarching 2017 Ecodesign impacts accounting study.

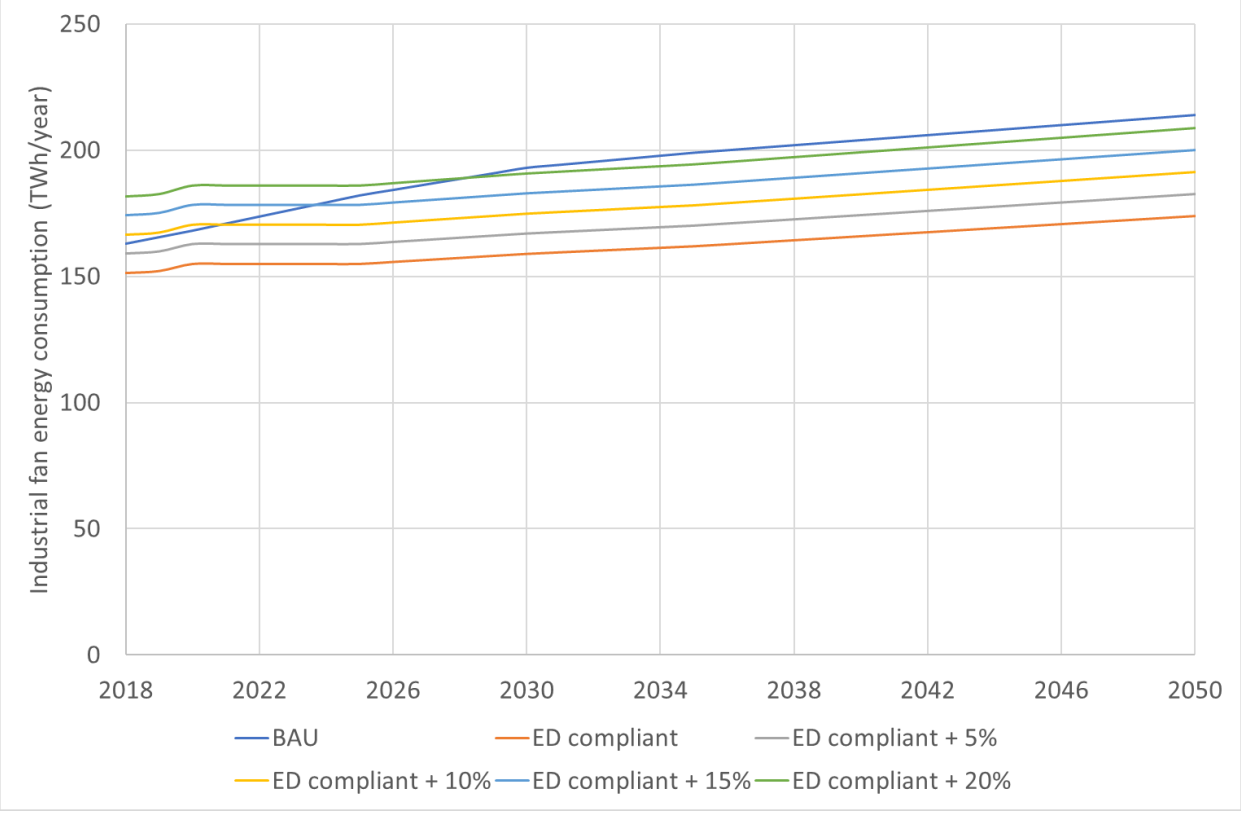
[3] https://www.vhk.nl/downloads/IA/IA_report-sec_2011_0384_en.pdf
[4] https://ec.europa.eu/energy/sites/ener/files/documents/eia_ii_-_status_report_2016_rev20170314.pdf

The db correction is applicable to motors (db=0.5) and fans (db=0.5) among other product groups. The reporting here abides by this correction, thus the impacts reported for both motors and fans could be doubled should they wish to be viewed in isolation of the impacts of the regulations applicable to products which use these as components. In part, this approach is applied here as it is a rather crude means of attempting to separate large industrial products (the principal focus of the INTAS study) from smaller industrial products which are more likely to be used as components in OEM equipment subject to other Ecodesign regulation.

3.1.1.2 Energy impacts

The expected evolution in the energy (final electricity) consumption of industrial fans across the EU is shown in Figure 2 for the Business as Usual (BAU – no Ecodesign regulation case) and also for the Ecodesign regulation case with full compliance (ED Compliant). Also shown are how the consumption could vary under the Ecodesign regulatory scenario if the actual energy fan energy efficiency is below the declared values by 5%, 10%, 15% and 20% respectively (the ED compliant + 5%, ED compliant + 10%, ED compliant +15% and ED compliant +20% cases). From this is apparent that if the actual efficiency is 20% worse than the declared value then most of the energy savings anticipated under the regulations would be lost and that if the efficiency is 10% worse than declared almost half the savings would be lost.

Figure 2. Projected evolution in industrial fan energy consumption across the EU



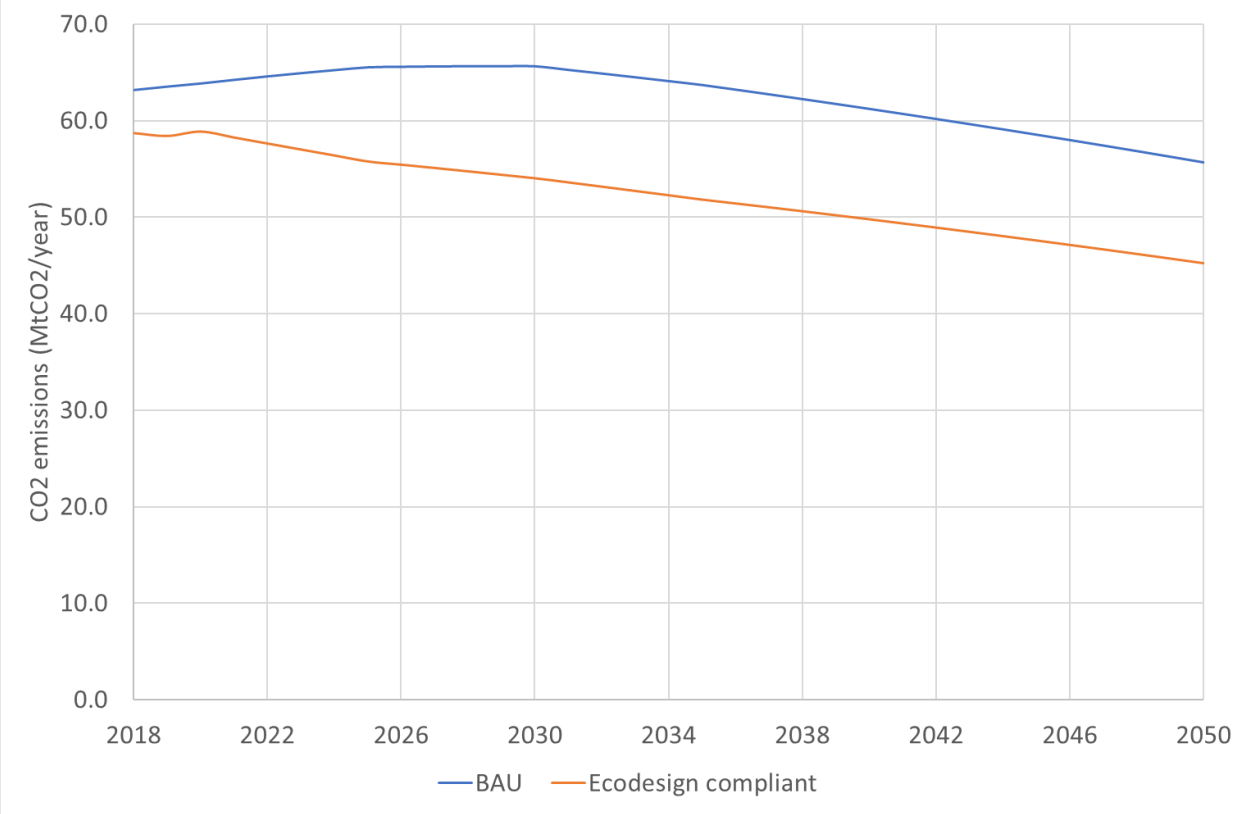
Under the fully compliant Ecodesign scenario some 13 TWh of electricity would be saved in 2020, 34 TWh in 2030, 38 TWh in 2040 and 40 TWh in 2050.

3.1.1.3 CO_2 impacts

The expected evolution in the energy-related CO_2 emissions due to the electricity consumption of industrial fans across the EU is shown in Figure 3 for the Business as Usual (BAU – no Ecodesign regulation case) and also for the Ecodesign regulation case with full compliance (ED Compliant).

Under the fully compliant Ecodesign scenario some 5 Mt of CO_2 emissions would be saved in 2020, 12 Mt in 2030, 11 Mt in 2040 and 10 Mt in 2050.

Figure 3. Projected evolution in industrial fan energy-related greenhouse emissions across the EU

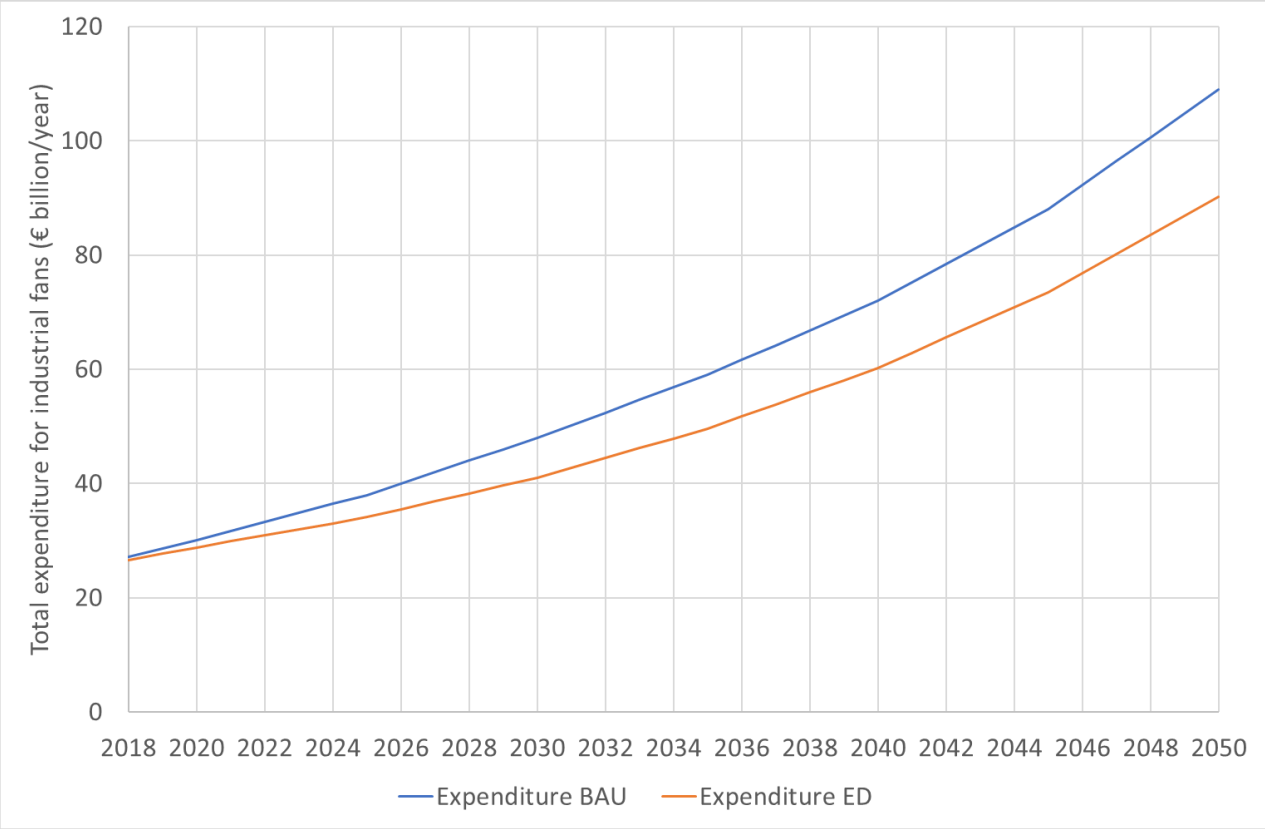


3.1.1.4 Economic impacts

The expected savings in total expenditure due to the Ecodesign regulations for industrial fans are reported in Figure 4. The total expenditure is the sum of the following expenditures: product acquisition costs, installation costs, maintenance costs and energy bills.

Under the fully compliant Ecodesign scenario total expenditure worth €1 billion would be saved in 2020, €7 billion in 2030, €12 billion in 2040 and €19 billion in 2050. The expenditure savings are due to lower energy bills which are partially offset by an increase in product price (caused by requiring more efficient equipment) and the associated mark-ups in the supply chain.

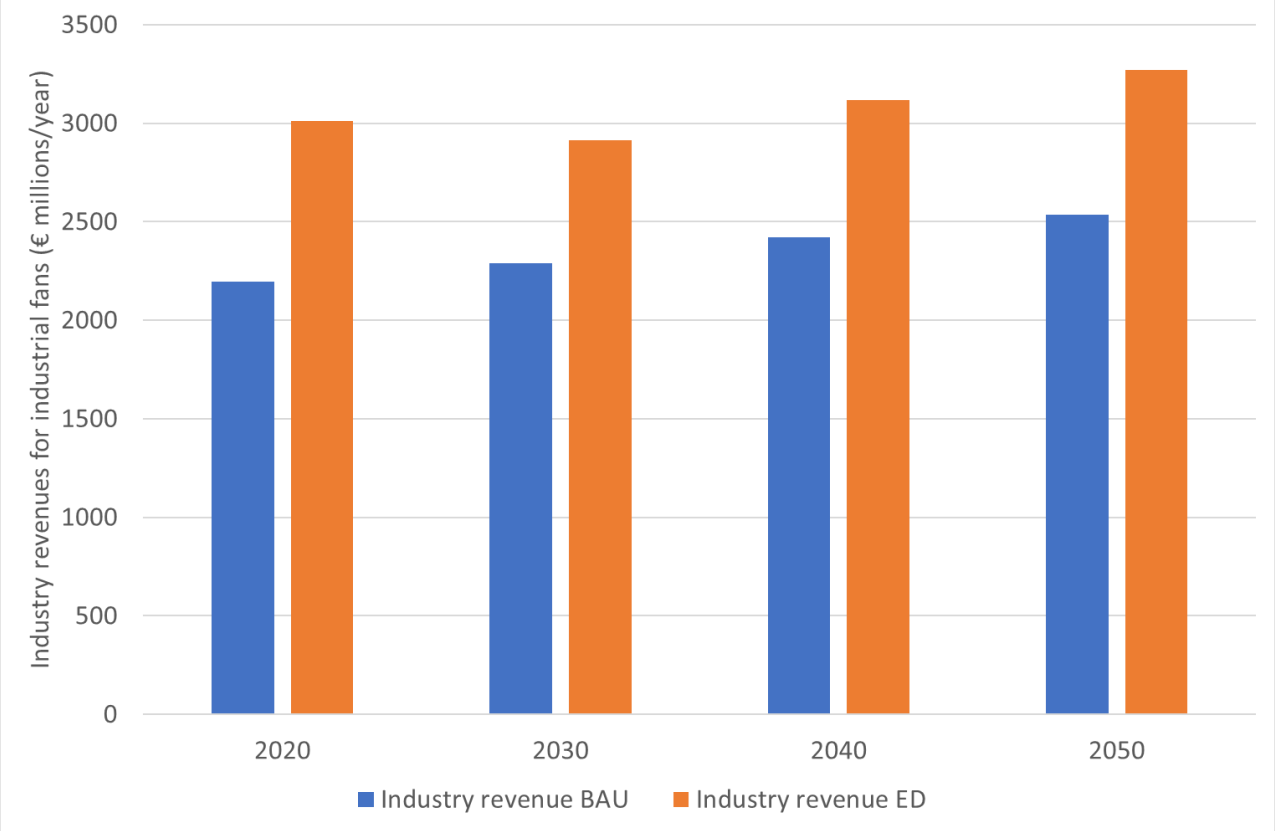
Figure 4. Estimated expenditure savings for industrial fans if there is full compliance with the Ecodesign requirements



3.1.1.5 Industry and employment impacts

Requiring higher efficiency fans drives up industry revenues as projected in Figure 5. Under the fully compliant Ecodesign scenario fan industry revenues increase by €814 million in 2020, €624 million in 2030, €697 million in 2040 and €734 million in 2050, compared with the business as usual (no Ecodesign) scenario. This in turn increases employment by 16 thousand jobs in 2020, 12 thousand jobs in 2030, 13 thousand jobs in 2040 and 14 thousand jobs in 2050, compared with the business as usual (no Ecodesign) scenario.

Figure 5. Estimated extra industry revenues for industrial fans if there is full compliance with the Ecodesign requirements



3.1.2 Power transformers

3.1.2.1 Sources

The sources used are the original Ecodesign impact assessment from the 2009 regulation [5] and the consolidated Ecodesign impact assessment from 2017 [6]. These include all reported impacts and also centrally agreed assumptions about energy prices and CO_2 emission factors. As the 2017 study is more recent and consolidated it takes precedent over the original product group impact assessment.

3.1.2.2 Energy impacts

The expected evolution in the energy (final electricity) losses of power transformers across the EU is shown in Figure 6 for the Business as Usual (BAU – no Ecodesign regulation case) and also for the Ecodesign regulation case with full compliance (ED Compliant). Also shown are how the losses could vary under the Ecodesign regulatory scenario if the actual energy losses are above the declared values by 5%, 10%, 15%

[5] https://www.vhk.nl/downloads/IA/IA_report-sec_2011_0384_en.pdf
[6] https://ec.europa.eu/energy/sites/ener/files/documents/eia_ii_-_status_report_2016_rev20170314.pdf

and 20% respectively (the ED compliant + 5%, ED compliant + 10%, ED compliant +15% and ED compliant +20% cases).

Figure 6. Projected evolution in power transformer losses across the EU

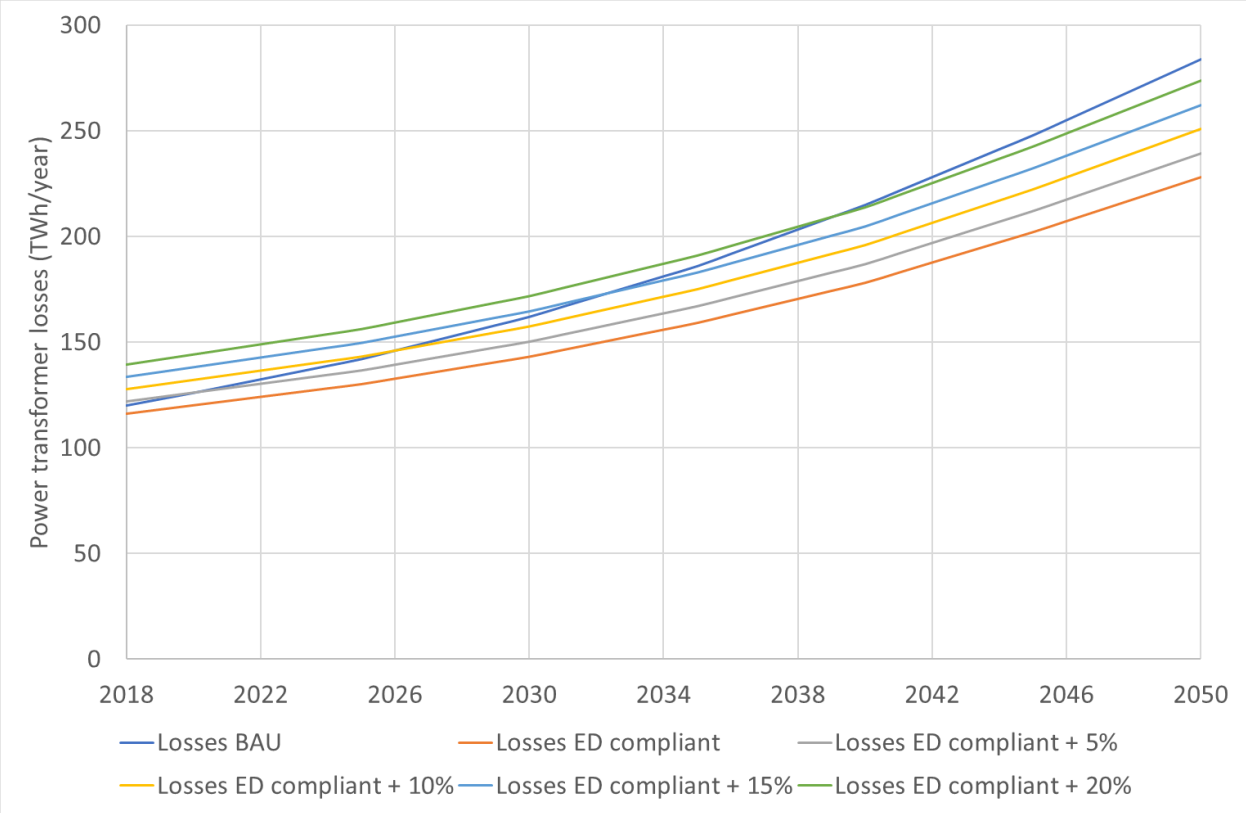
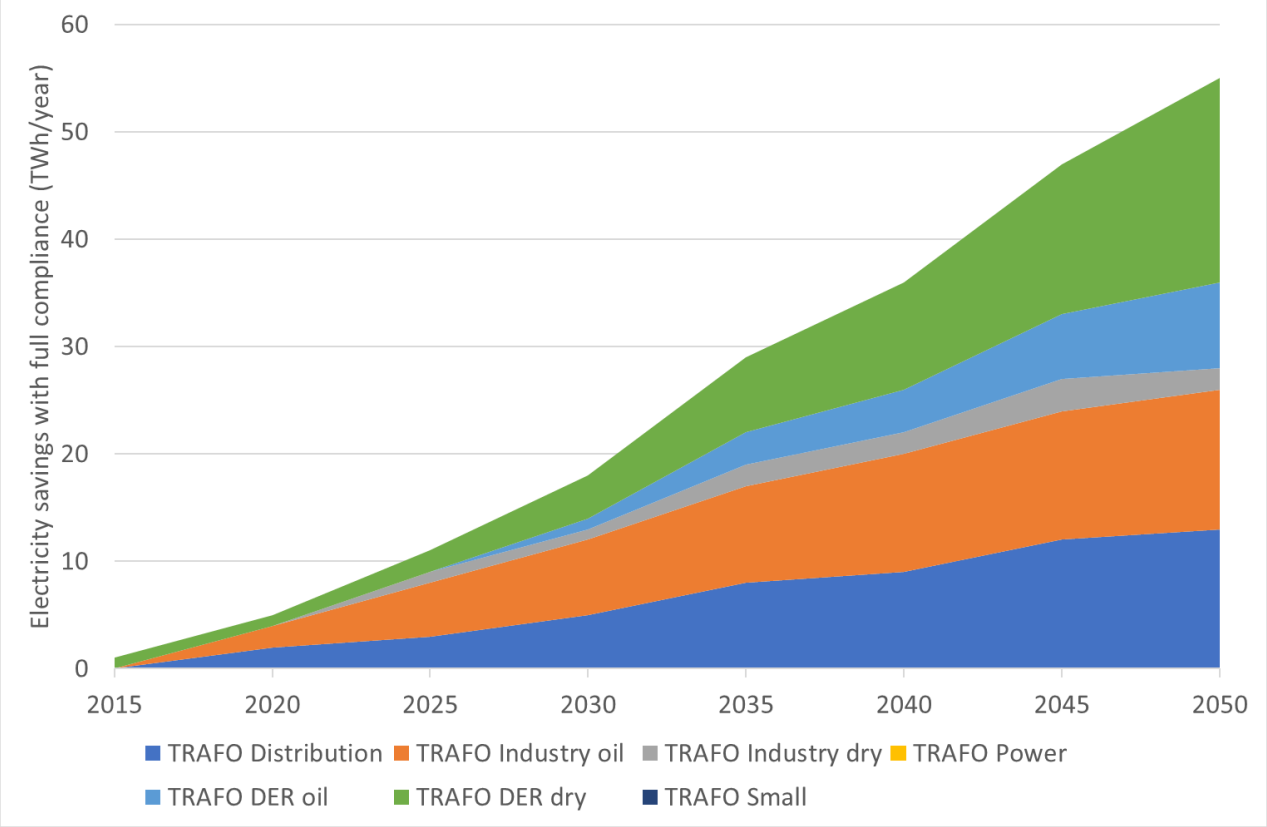


Figure 7 shows how the energy savings in power transformer losses are projected to evolve by transformer type in response to the Ecodesign regulation assuming there is 100% compliance with the requirements.

Under the fully compliant Ecodesign scenario some 6 TWh of electricity would be saved in 2020, 19 TWh in 2030, 37 TWh in 2040 and 56 TWh in 2050.

Figure 7. Estimated electricity savings for power transformers if there is full compliance with the Ecodesign requirements



3.1.2.3 CO_2 impacts

The expected evolution in the energy-related CO_2 emissions due to the losses of electricity consumed in power transformers across the EU is shown in Figure 8 for the Business as Usual (BAU – no Ecodesign regulation case) and also for the Ecodesign regulation case with full compliance (ED Compliant).

Figure 9 indicates how the Ecodesign regulations are projected to lead to savings in CO_2 emissions assuming 100% compliance with the regulations (results are reported by transformer type).

Under the fully compliant Ecodesign scenario some 2 Mt of CO_2 emissions would be saved in 2020, 6 Mt in 2030, 11 Mt in 2040 and 15 Mt in 2050.

Figure 8. Projected evolution in power transformer energy-related greenhouse gas emissions across the EU

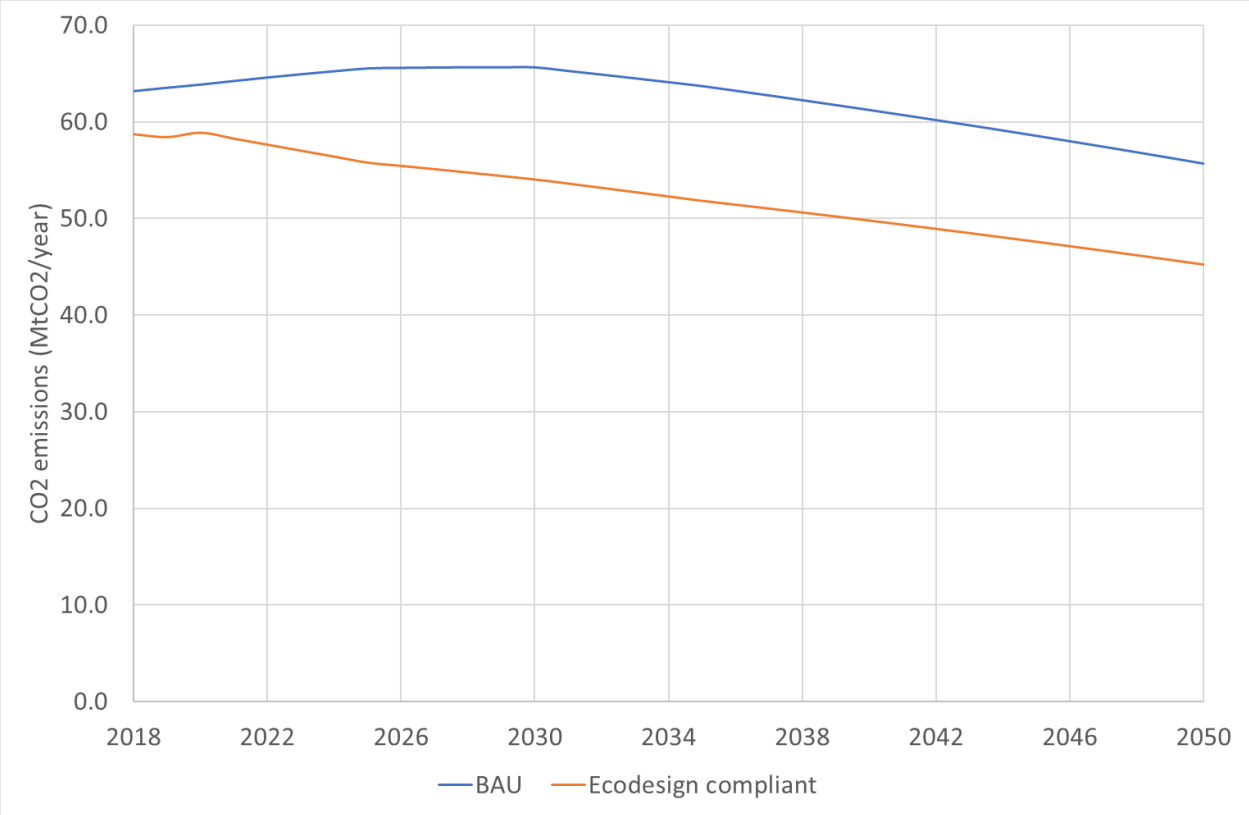
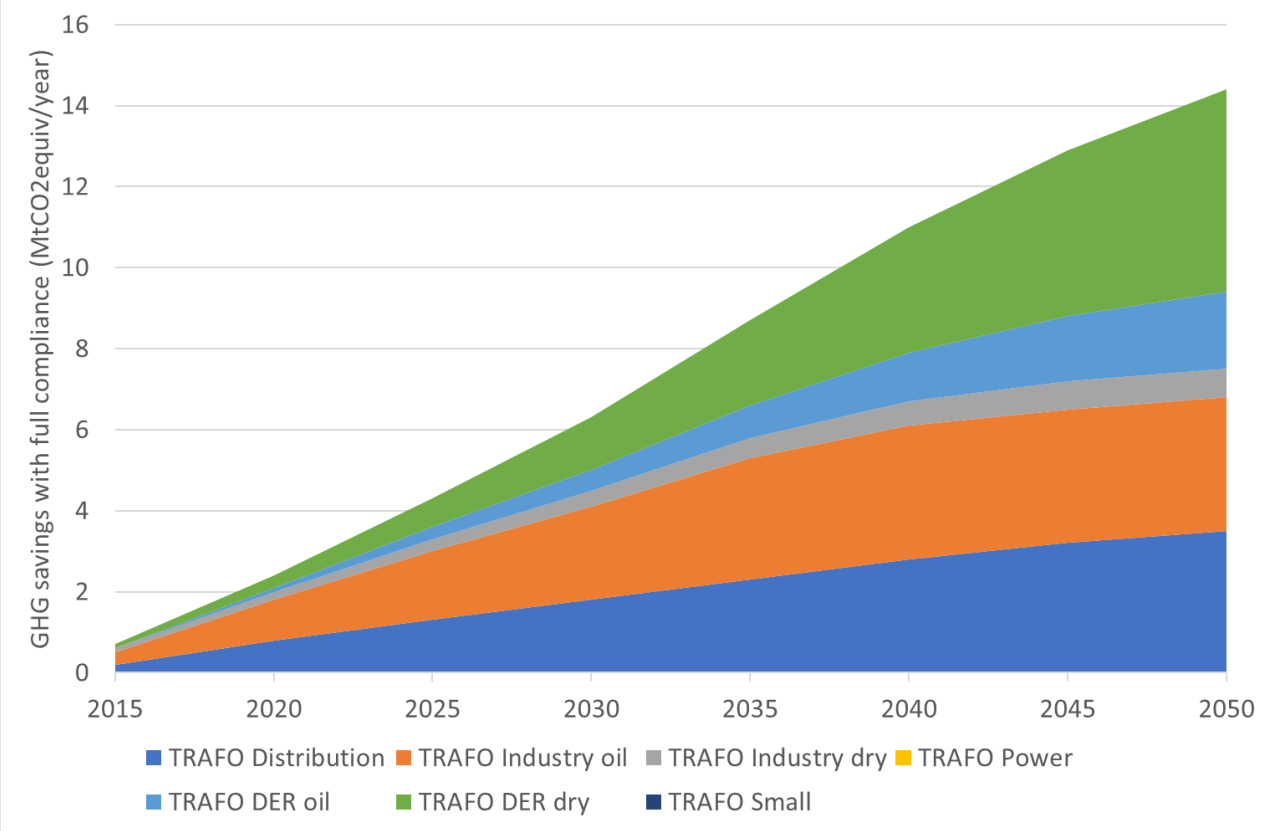


Figure 9. Estimated greenhouse gas emissions savings for power transformers if there is full compliance with the Ecodesign requirements

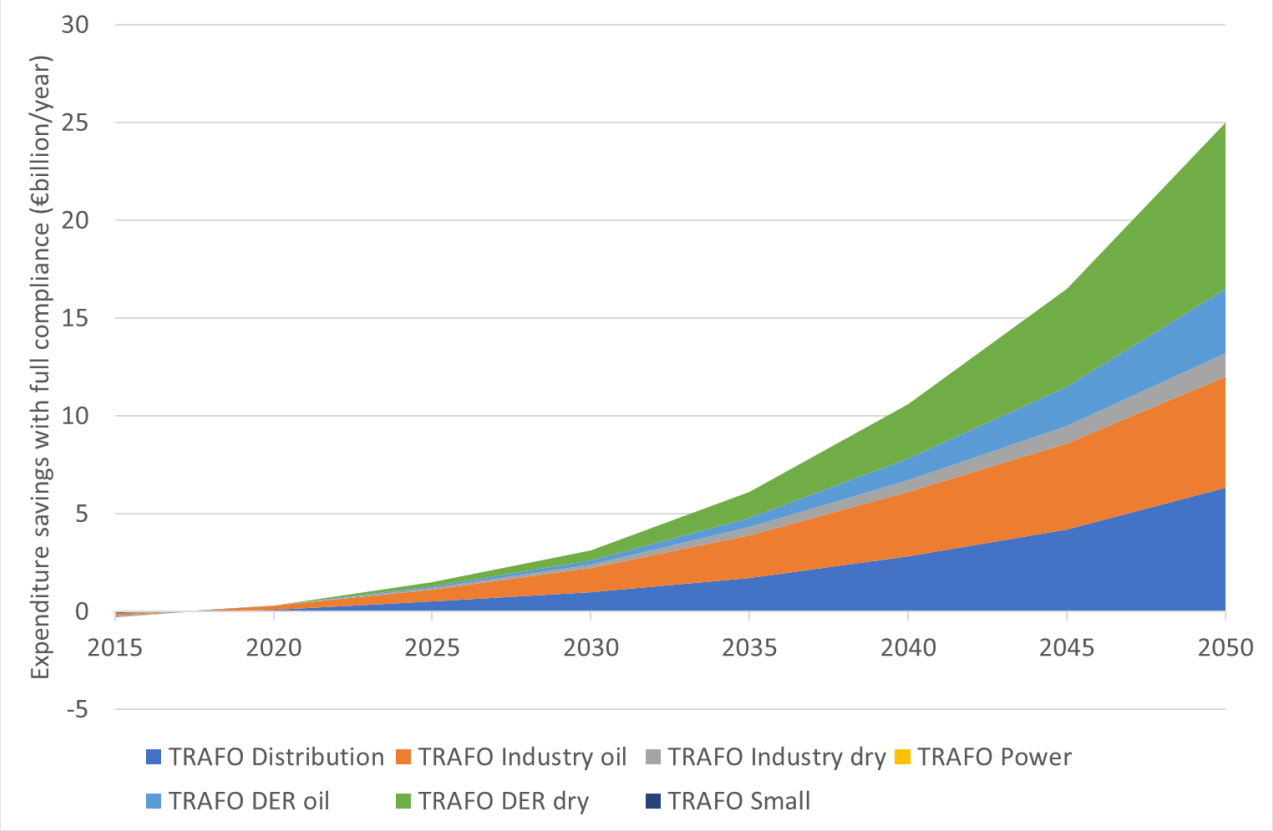


3.1.2.4 Economic impacts

The expected savings in total expenditure due to the Ecodesign regulations for power transformers are reported in Figure 10. The total expenditure is the sum of the following expenditures: product acquisition costs, installation costs, maintenance costs and energy bills.

Under the fully compliant Ecodesign scenario total expenditure worth €0 billion would be saved in 2020, €3.4 billion in 2030, €10.5 billion in 2040 and €24.9 billion in 2050. The expenditure savings are due to lower energy bills which are partially offset by an increase in product price (caused by requiring more efficient equipment) and the associated mark-ups in the supply chain.

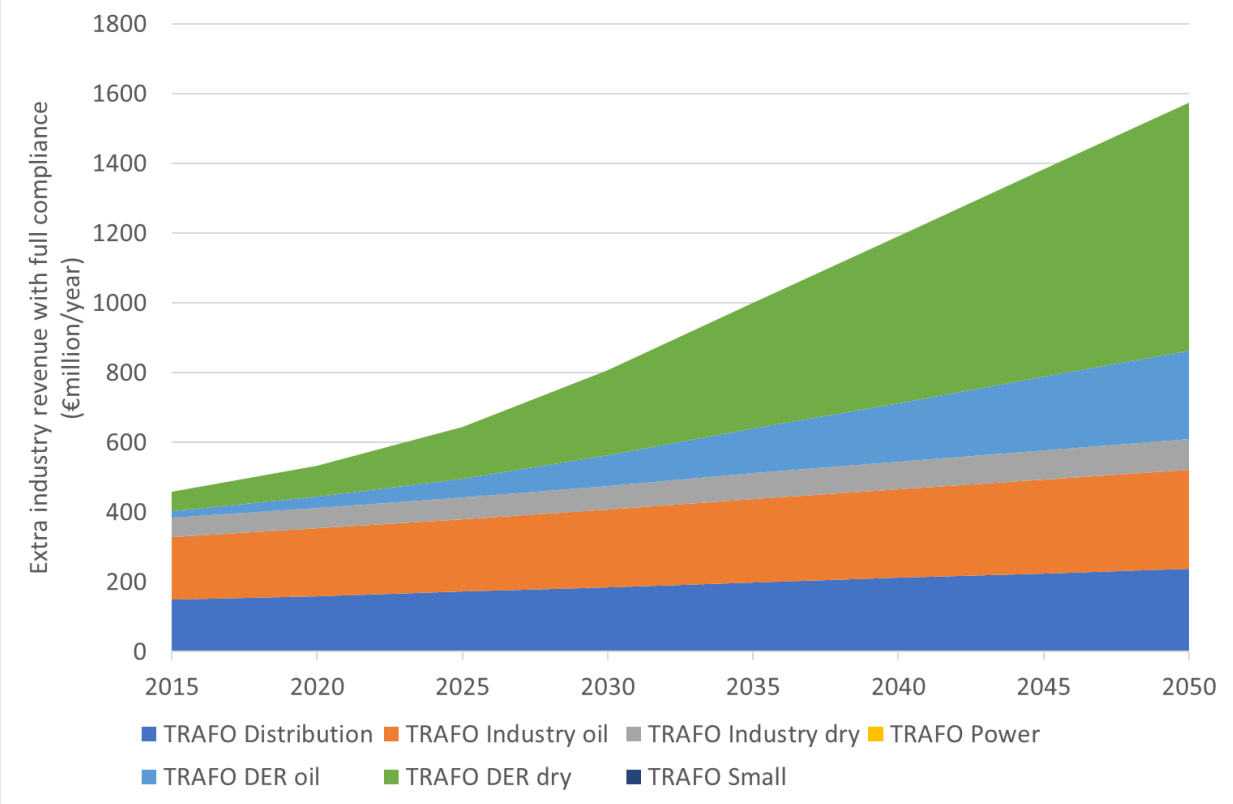
Figure 10. Estimated expenditure savings for power transformers if there is full compliance with the Ecodesign requirements



3.1.2.5 Industry and employment impacts

Reducing transformer losses drives up industry revenues as projected in Figure 11. Under the fully compliant Ecodesign scenario transformer industry revenues increase by €535 million in 2020, €807 million in 2030, €1572 million in 2040 and €2379 million in 2050, compared with the business as usual (no Ecodesign) scenario. This in turn increases employment by 11 thousand jobs in 2020, 16 thousand jobs in 2030, 31 thousand jobs in 2040 and 47 thousand jobs in 2050, compared with the business as usual (no Ecodesign) scenario.

Figure 11. Estimated extra industry revenues for power transformers if there is full compliance with the Ecodesign requirements



3.1.3 Other industrial products

3.1.3.1 Sources

The sources used are the original Ecodesign impact assessment from the 2009 regulation for electric motors[7], the 2012 impact assessment for water pumps[8], and the consolidated Ecodesign impact assessment from 2017[9]. Note the air compressors impact assessment is only in draft form and is not yet in public domain but its main findings are reported in the consolidated impact assessment from 2017. These include all reported impacts and also centrally agreed assumptions about energy prices and CO_2 emission factors. As the 2017 study is more recent and consolidated it takes precedent over the original product group impact assessment.

3.1.3.1.1 Double counting of components and products

The same remark on double counting that was expressed in section 3.1.1.1 for fans also applies to motors. In consequence a double counting correction factor (db) is applicable to motors (db=0.5) and fans (db=0.5)

[7] https://www.vhk.nl/downloads/IA/IA_report-sec_2009_1013_en_Motors.pdf
[8] https://ec.europa.eu/energy/sites/ener/files/documents/swd_2012_178_impact_assesment.pdf
[9] https://ec.europa.eu/energy/sites/ener/files/documents/eia_ii_-_status_report_2016_rev20170314.pdf

among other product groups. The reporting here abides by this correction, thus the impacts reported for both motors could be doubled should it be desired to view them in isolation of the impacts of the regulations applicable to products which use these as components. In part, this approach is applied here as it is a rather crude means of attempting to separate large industrial products (the principal focus of the INTAS study) from smaller industrial products which are more likely to be used as components in OEM equipment subject to other Ecodesign regulation.

3.1.3.2 Energy impacts

The expected evolution in the energy (final electricity) consumption of industrial electric motors across the EU is shown in Figure 12 for the Business as Usual (BAU – no Ecodesign regulation case) and also for the Ecodesign regulation case with full compliance (ED Compliant). Also shown are how the consumption could vary under the Ecodesign regulatory scenario if the actual energy consumption is above the declared values by 5%, 10%, 15% and 20% respectively (the ED compliant + 5%, ED compliant + 10%, ED compliant +15% and ED compliant +20% cases). Under the fully compliant Ecodesign scenario some 52 TWh (50% = 26 TWh) of electricity would be saved in 2020, 207 TWh (50%=103 TWH) in 2030, 203 TWh (50%=101 TWh) in 2040 and 187 TWh (50%=93 TWH) in 2050. Note, if extra losses due to non-compliance exceed 15% then there would be no net savings from the Ecodesign measures.

Figure 12. Projected evolution in industrial electric motor energy consumption across the EU

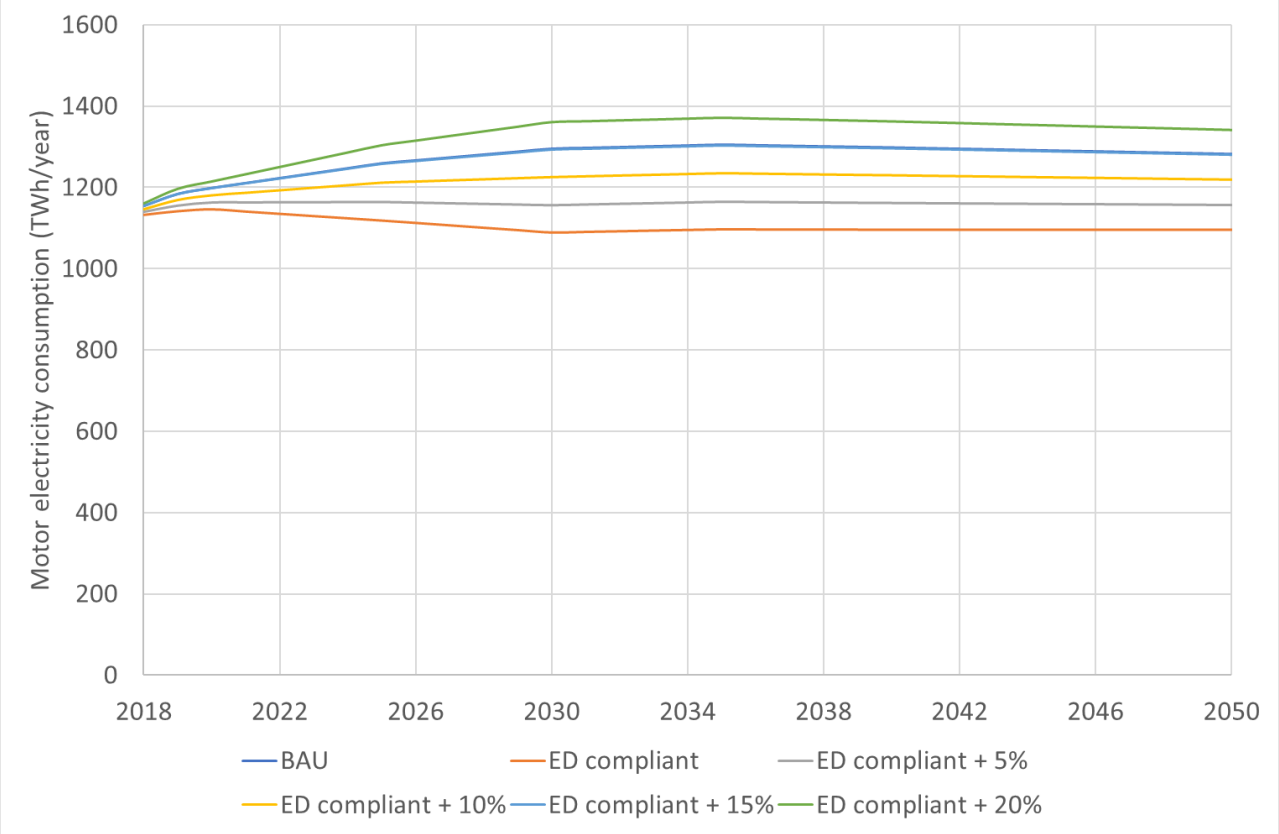
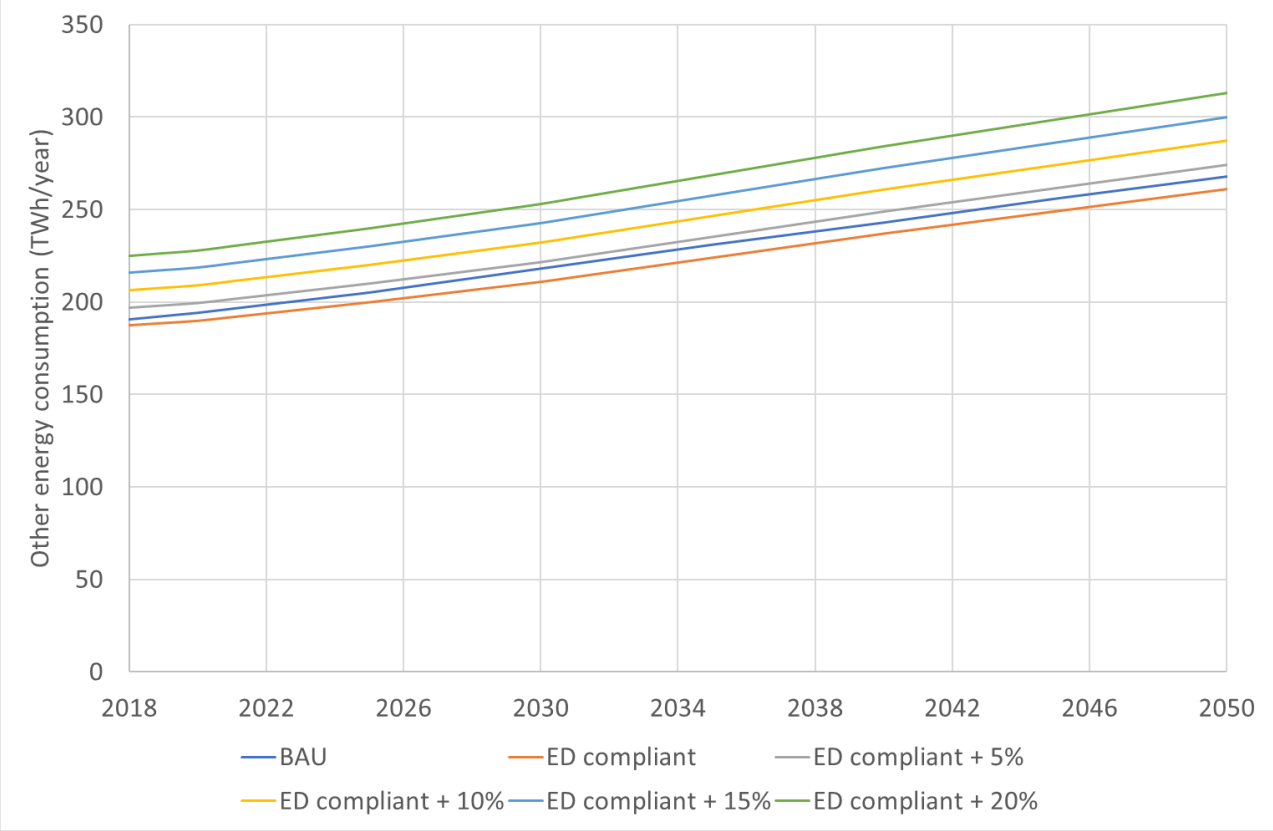


Figure 13 shows the equivalent values for water pumps and compressors (i.e. other). Under the fully compliant Ecodesign scenario some 4 TWh of electricity would be saved in 2020, 7 TWh in 2030, 6 TWh in 2040 and 7 TWh in 2050. Note, even if extra losses due to non-compliance attain 5% then there would be no net savings from the Ecodesign measures.

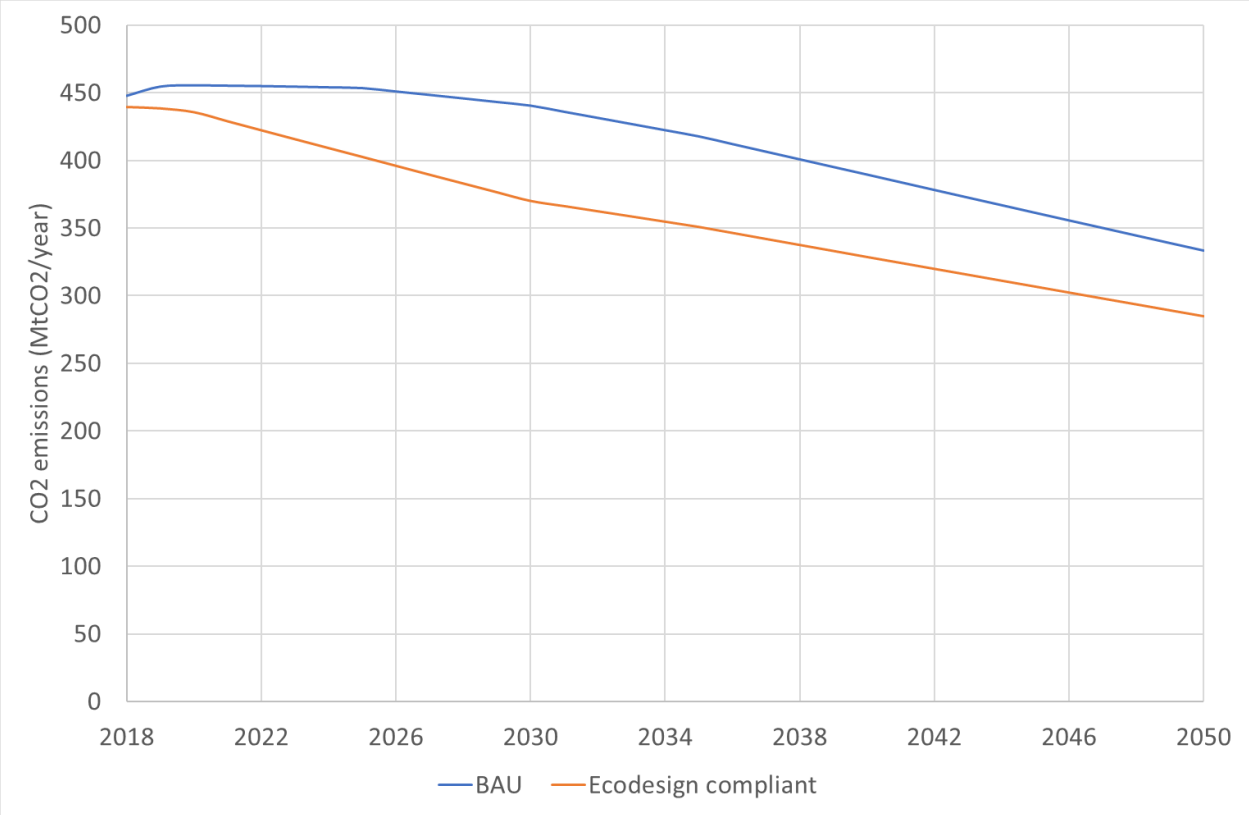
Figure 13. Projected evolution in water pump and air compressor energy consumption across the EU



3.1.3.3 CO_2 impacts

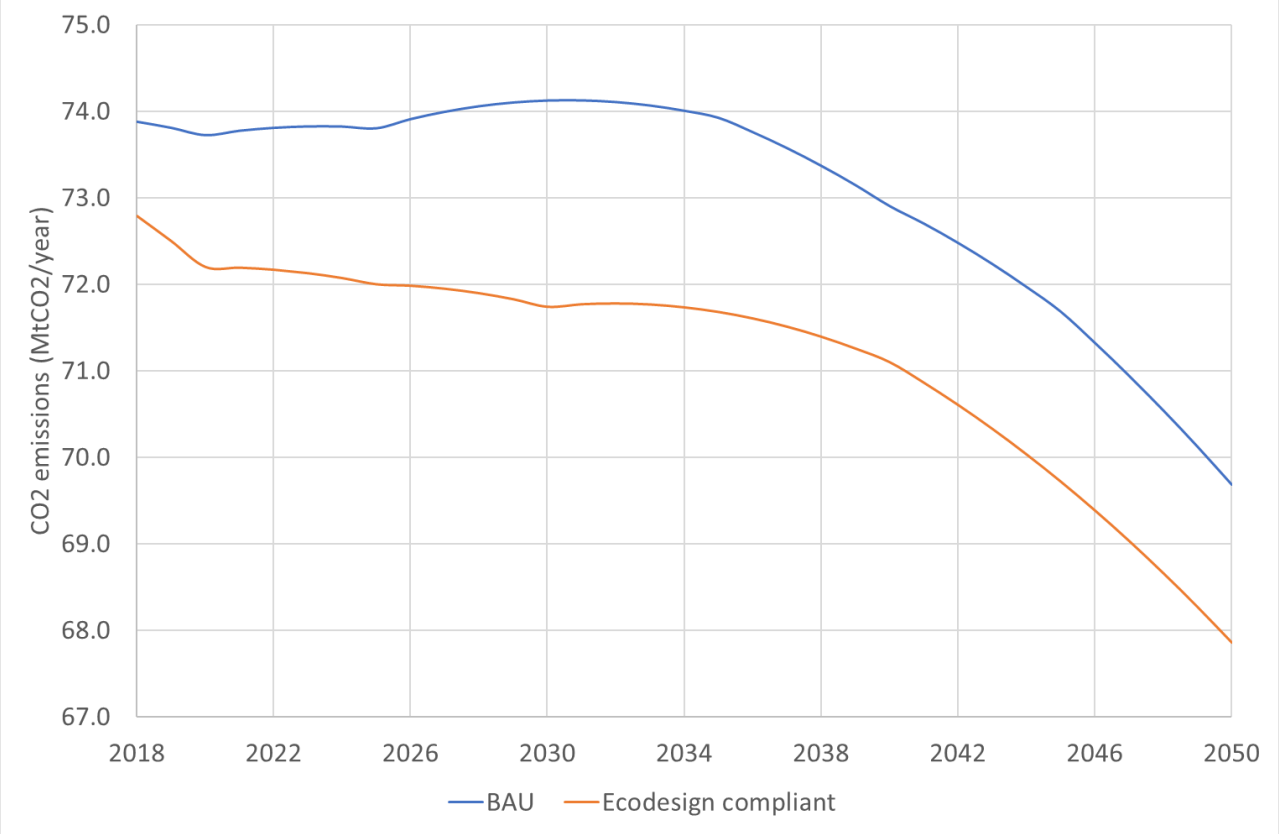
The expected evolution in the energy-related CO_2 emissions due to electricity consumed in electric motors across the EU is shown in Figure 14 for the Business as Usual (BAU – no Ecodesign regulation case) and also for the Ecodesign regulation case with full compliance (ED Compliant). Under the fully compliant Ecodesign scenario some 20 Mt of CO_2 emissions would be saved in 2020, 70 Mt in 2030, 61 Mt in 2040 and 49 Mt in 2050. These figures can be halved when the impact accounting reduces the motor Ecodesign regulations by 50% to take account of motors sold for use in products covered by other Ecodesign regulations.

Figure 14. Projected evolution in electric motor energy-related greenhouse gas emissions across the EU



The expected evolution in the energy-related CO_2 emissions due to the electricity consumed in water pumps and air compressors across the EU is shown in Figure 15 for the Business as Usual (BAU – no Ecodesign regulation case) and also for the Ecodesign regulation case with full compliance (ED Compliant). Under the fully compliant Ecodesign scenario some 2 Mt of CO_2 emissions would be saved in 2020, 2 Mt in 2030, 2 Mt in 2040 and 2 Mt in 2050.

Figure 15. Projected evolution in water pump and air compressor energy-related greenhouse gas emissions across the EU



3.1.3.4 Economic impacts

The expected savings in total expenditure due to the Ecodesign regulations for electric motors are reported in Figure 16. The total expenditure is the sum of the following expenditures: product acquisition costs, installation costs, maintenance costs and energy bills. Under the fully compliant Ecodesign scenario total expenditure worth €4 billion would be saved in 2020, €13 billion in 2030, €15 billion in 2040 and €12 billion in 2050. The expenditure savings are due to lower energy bills which are partially offset by an increase in product price (caused by requiring more efficient equipment) and the associated mark-ups in the supply chain.

Figure 17 reports the total expenditure savings for water pumps and air compressors. Under the fully compliant Ecodesign scenario total expenditure worth €0.6 billion would be saved in 2020, €1.3 billion in 2030, €2.0 billion in 2040 and €3.2 billion in 2050.

Figure 16. Estimated expenditure savings for electric motors if there is full compliance with the Ecodesign requirements

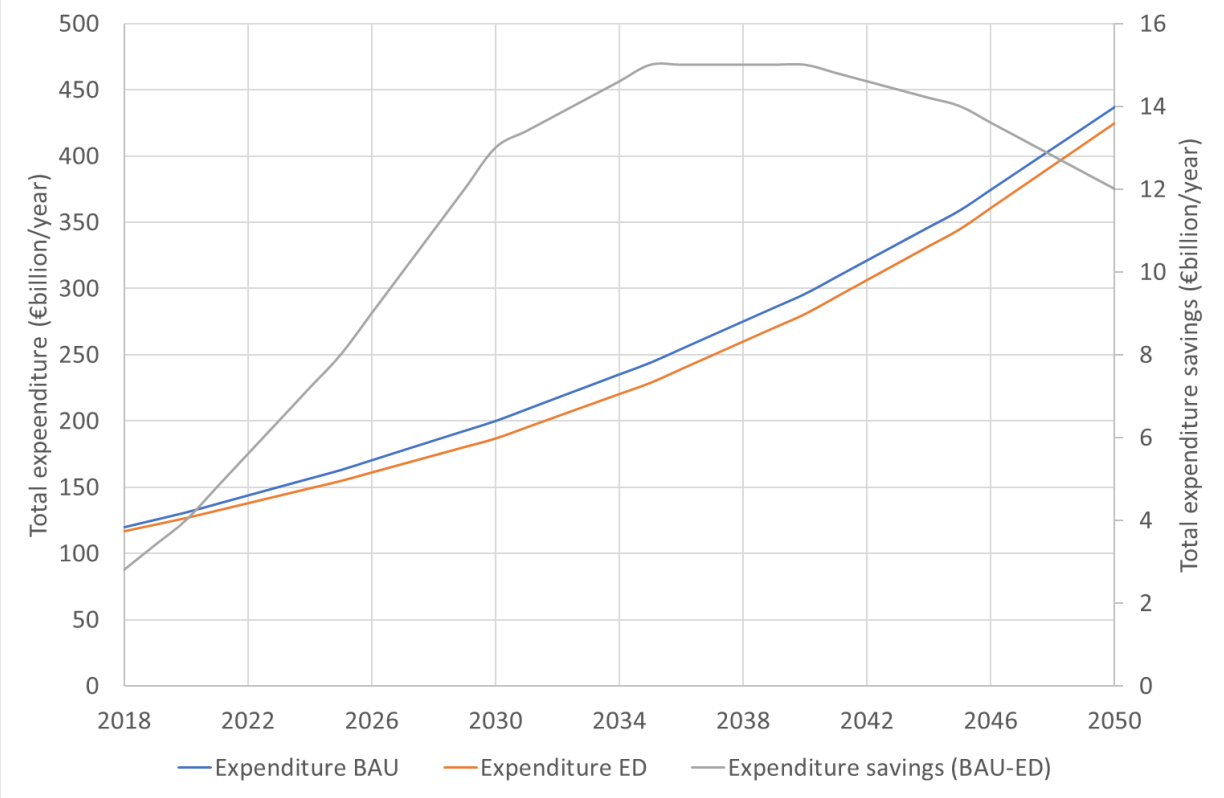
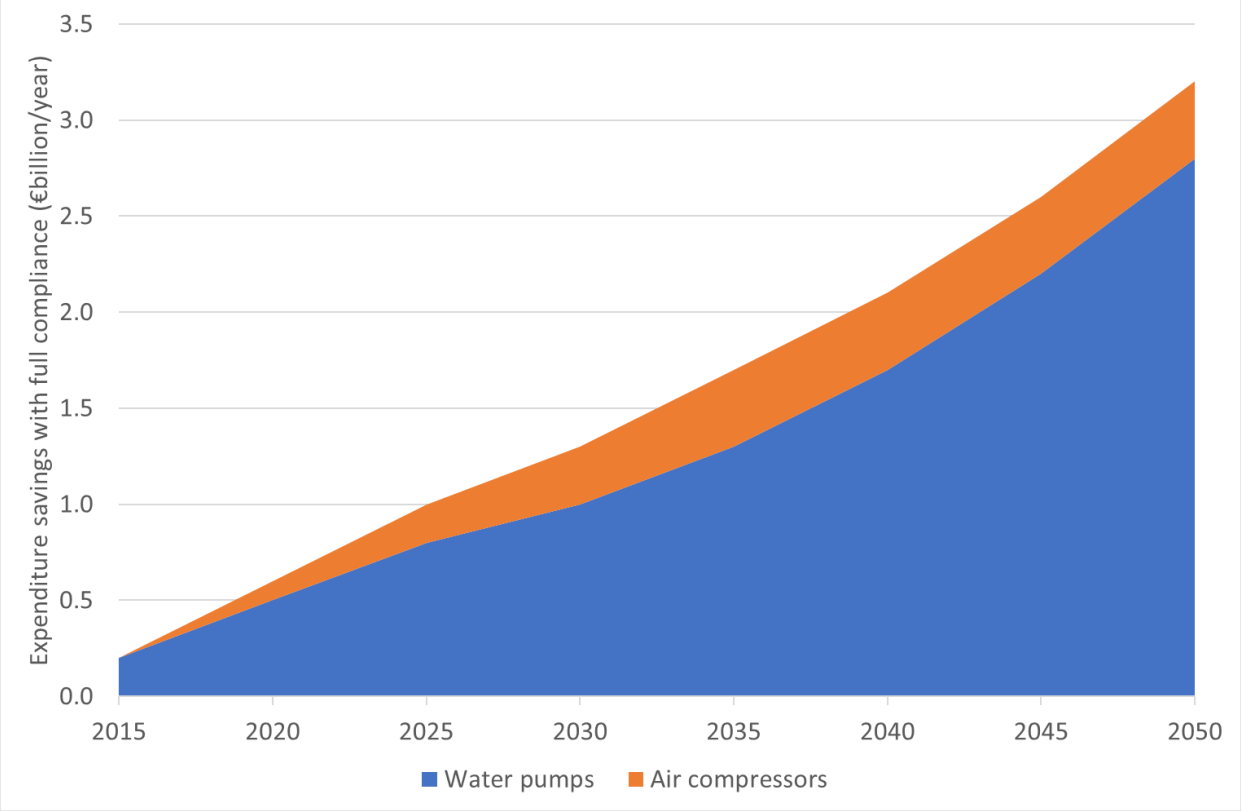


Figure 17. Estimated expenditure savings for other industrial products if there is full compliance with the Ecodesign requirements



3.1.3.5 Industry and employment impacts

Reducing electric motor losses drives up industry revenues. Under the fully compliant Ecodesign scenario electric motor industry revenues increase by €190 million in 2020, €230 million in 2030, €176 million in 2040 and €93 million in 2050, compared with the business as usual (no Ecodesign) scenario. This in turn increases employment by 11 thousand jobs in 2020, 14 thousand jobs in 2030, 11 thousand jobs in 2040 and 6 thousand jobs in 2050, compared with the business as usual (no Ecodesign) scenario.

Improving efficiency in water pumps and air compressors also drives up industry revenues. Under the fully compliant Ecodesign scenario industry revenues increase by €66 million in 2020, €59 million in 2030, €51 million in 2040 and €59 million in 2050, compared with the business as usual (no Ecodesign) scenario. This in turn increases employment by 2 thousand jobs in 2020, 1 thousand jobs in 2030, 1 thousand jobs in 2040 and 1 thousand jobs in 2050, compared with the business as usual (no Ecodesign) scenario.

3.2 Estimation of the impact of non-compliance

In this section the estimated impacts of Ecodesign non-compliance for industrial products as a whole are reported as a function of the 4 non-compliance scenarios considered in the analysis, i.e. if the actual energy performance poorer than the declared values by 5%, 10%, 15% and 20% respectively (the ED compliant +5%, ED compliant +10%, ED compliant +15% and ED compliant +20% cases).

3.2.1.1 Energy impacts

Figure 18 shows how the impact of varying levels of non-compliance with the Ecodesign regulations would be expected to increase electricity consumption in the EU, under the four non-compliance scenarios used throughout this report. Figure 19 shows this per main product group for the central non-compliance case of an average 10% increase in losses against the Ecodesign requirements. Note, in both cases only 50% of the motor and fan Ecodesign impacts are reported to avoid double-counting with the impacts of other Ecodesign regulations. Under the 10% non-compliant scenario some 27 TWh of electricity would be lost in 2020, 115 TWh in 2030, 125 TWh in 2040 and 128 TWh in 2050.

Figure 18. Estimated additional industrial product electricity consumption due to non-compliance with Ecodesign requirements

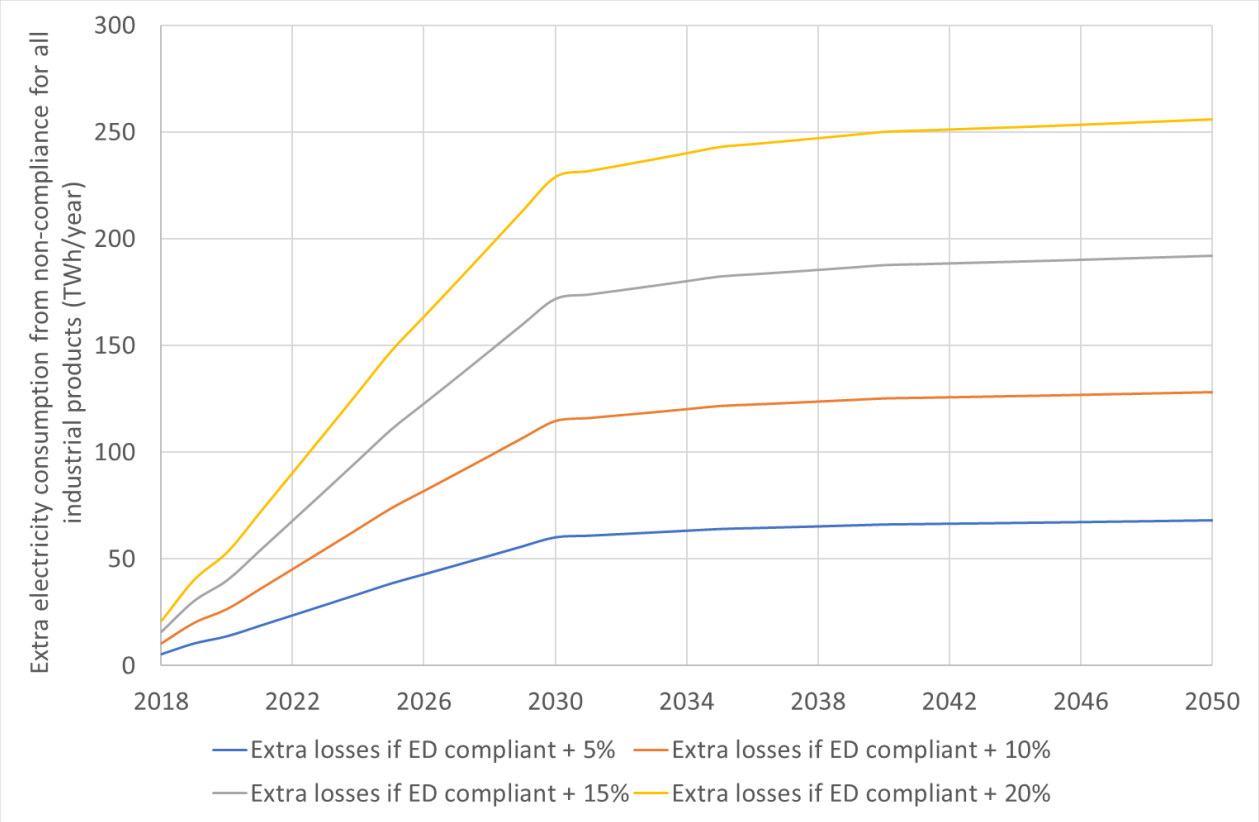


Figure 19. Estimated additional industrial product electricity consumption due to non-compliance with Ecodesign requirements for the case where Ecodesign requirements are exceeded by 10% on average

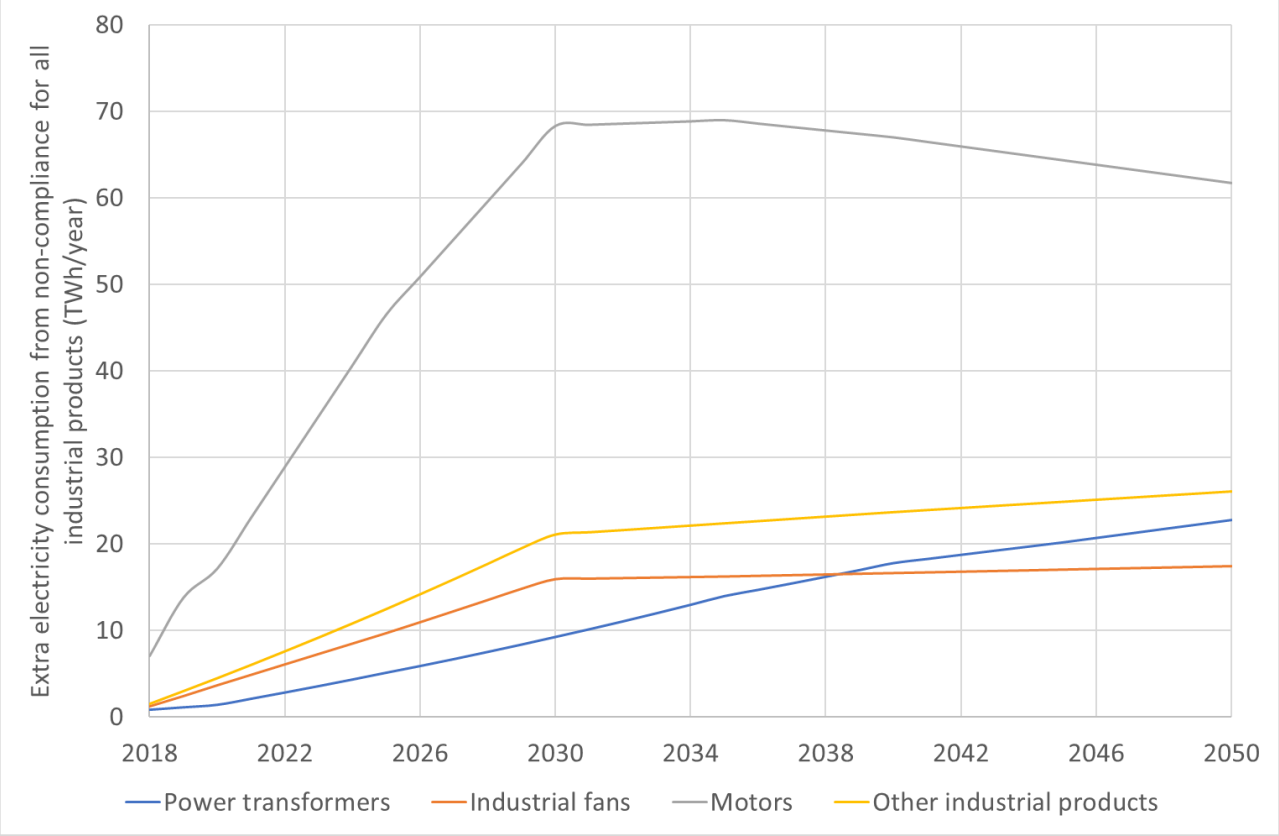


Table 5 shows the estimated energy losses due to non-compliance for each product group and collectively for the four non-compliance scenarios.

Table 5. Additional energy losses due to non-compliance as a function of product group and average level of non-compliance

	Increased losses per year (TWh)			
	2020	**2030**	**2040**	**2050**
Additional energy losses for the case where average energy performance is 5% lower due to non-compliance (ED+5%)				
Power transformers	0.8	5.2	10	12.8
Industrial fans	2.0	8.9	9	9.7
Motors	8.6	34.2	33	30.9
Other industrial products	2.5	11.8	13	14.6
All	13.9	60.0	66.0	68.0

Additional energy losses for the case where average energy performance is 10% lower due to non-compliance (ED+10%)				
Power transformers	1.4	9.2	18	22.8
Industrial fans	3.6	15.9	17	17.4
Motors	17.2	68.3	67	61.7
Other industrial products	4.4	21.1	24	26.1
All	26.6	114.5	125.1	128.0
Additional energy losses for the case where average energy performance is 15% lower due to non-compliance (ED+15%)				
Power transformers	2.1	13.9	27	34.2
Industrial fans	5.4	23.9	25	26.1
Motors	25.7	102.5	100	92.6
Other industrial products	6.7	31.7	36	39.2
All	39.9	171.8	187.6	192.0
Additional energy losses for the case where average energy performance is 20% lower due to non-compliance (ED+20%)				
Power transformers	2.7	18.5	36	45.6
Industrial fans	7.2	31.8	33	34.8
Motors	34.3	136.6	134	123.4
Other industrial products	8.9	42.2	47	52.2
All	53.2	229.1	250.2	256.0

3.2.1.2 CO_2 impacts

Figure 20 shows how the impact of varying levels of non-compliance with the Ecodesign regulations would be expected to increase CO_2 emissions across the EU. Figure 21 shows the expected share of this increase for a central non-compliance case of an average 10% increase in losses against the Ecodesign requirements. In both cases the electric motor and industrial fan-related emissions are reduced by 50% to avoid double counting impacts with other Ecodesign regulation impact assessments.

Table 6 shows the estimated additional CO_2 emissions due to non-compliance for each product group and collectively for the four non-compliance scenarios (again the fan and motor values are 50% of what would be accounted for were the impacts of regulations for products that include these as components not accounted for separately in other Ecodesign impact assessments).

Under the central 10% non-compliance scenario Ecodesign scenario CO_2 emissions due to non-compliance increase by 10 Mt in 2020, 39 Mt in 2030, 38 Mt in 2040 and 33 Mt in 2050, compared with the fully compliant Ecodesign scenario.

Figure 20. Estimated additional industrial product greenhouse gas emissions due to non-compliance with Ecodesign requirements

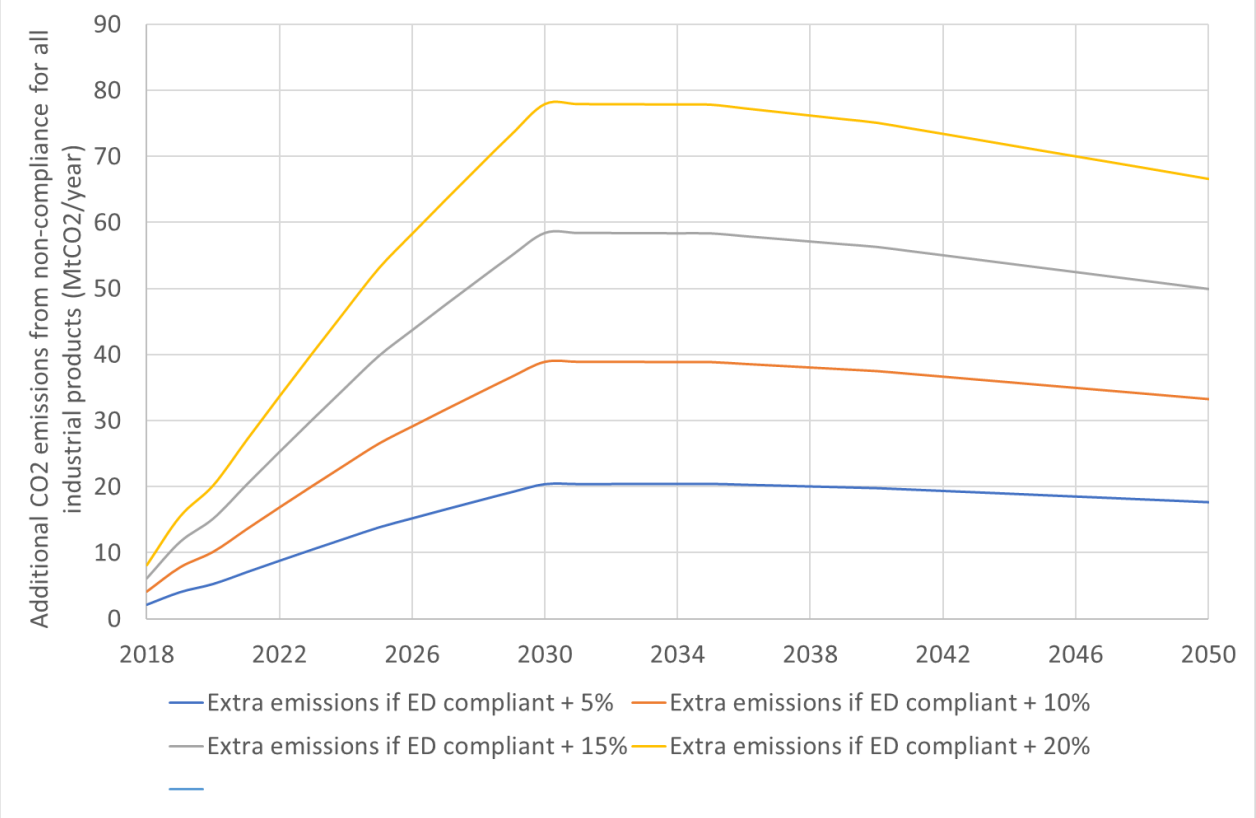


Figure 21. Estimated additional industrial product greenhouse gas emissions due to non-compliance with Ecodesign requirements under the average 10% non-compliance scenario

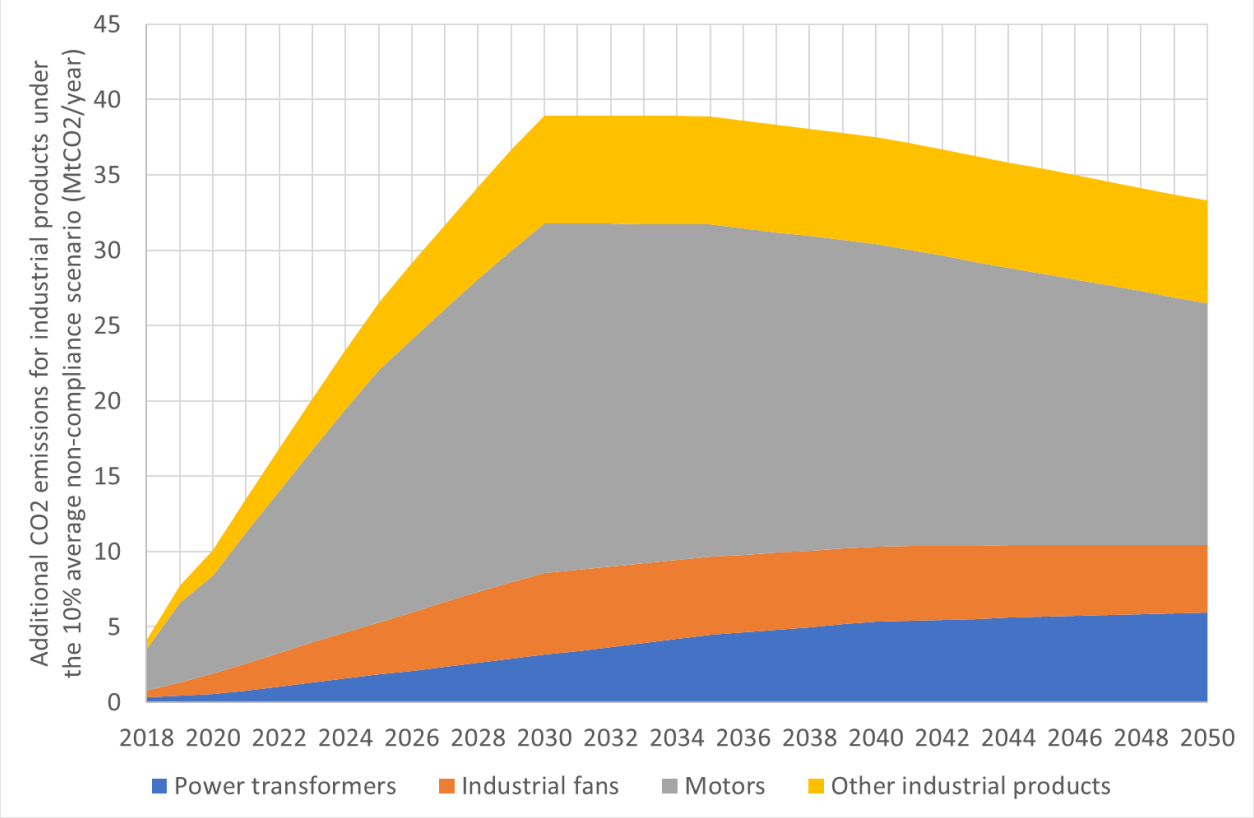


Table 6. Additional greenhouse gas emissions due to non-compliance as a function of product group and average level of non-compliance

	Increased emission per year ($MtCO_{2equivalent}$)			
	2020	**2030**	**2040**	**2050**
Additional emissions for the case where average energy performance is 5% lower due to non-compliance (ED+5%)				
Power transformers	0.3	1.8	3	3.3
Industrial fans	0.8	3.0	3	2.5
Motors	3.3	11.6	10	8.0
Other industrial products	0.9	4.0	4	3.8
All	5.3	20.4	19.8	17.7

Additional emissions for the case where average energy performance is 10% lower due to non-compliance (ED+10%)				
Power transformers	0.5	3.1	5	5.9
Industrial fans	1.4	5.4	5	4.5
Motors	6.5	23.2	20	16.0
Other industrial products	1.7	7.2	7	6.8
All	10.1	38.9	37.5	33.3
Additional emissions for the case where average energy performance is 15% lower due to non-compliance (ED+15%)				
Power transformers	0.8	4.7	8	8.9
Industrial fans	2.1	8.1	7	6.8
Motors	9.8	34.8	30	24.1
Other industrial products	2.5	10.8	11	10.2
All	15.2	58.4	56.3	49.9
Additional emissions for the case where average energy performance is 20% lower due to non-compliance (ED+20%)				
Power transformers	1.0	6.3	11	11.9
Industrial fans	2.8	10.8	10	9.0
Motors	13.0	46.5	40	32.1
Other industrial products	3.4	14.3	14	13.6
All	20.2	77.9	75.1	66.6

3.2.1.3 Economic impacts

Figure 22 shows how the impact of varying levels of non-compliance with the Ecodesign regulations would be expected to increase energy bills across the EU. While Table 7 shows how these would be expected to increase as a function of non-compliance per non-compliance scenario and product group.

Under the central 10% non-compliance scenario Ecodesign scenario energy bills due to non-compliance increase by €4billion in 2020, €25billion in 2030, €41 billion in 2040 and €62 billion in 2050, compared with the fully compliant Ecodesign scenario.

Figure 22. Estimated additional industrial product energy bills due to non-compliance with Ecodesign requirements

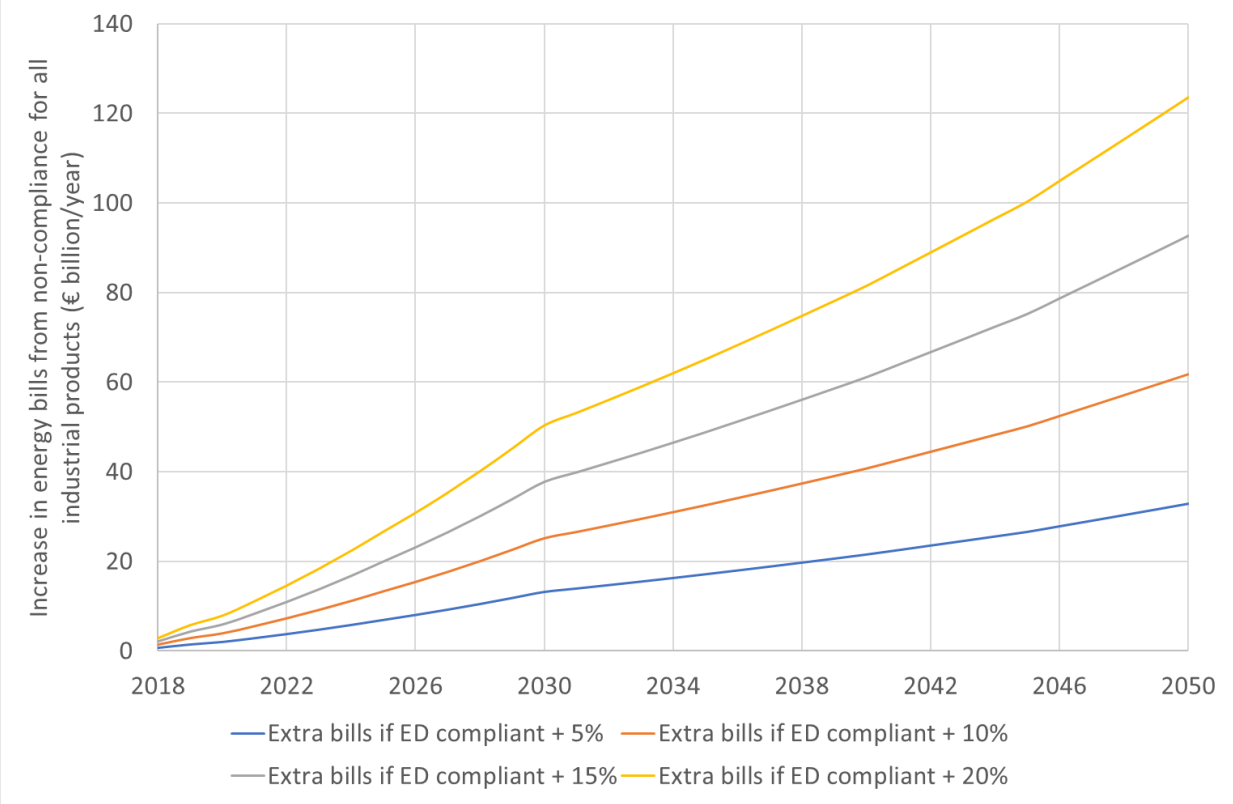


Table 7. Increase in energy bills due to non-compliance as a function of product group and average level of non-compliance

	Increased in energy bills per year (€ billion)			
	2020	**2030**	**2040**	**2050**
Additional energy bills for the case where average energy performance is 5% lower due to non-compliance (ED+5%)				
Power transformers	0.1	1.1	3	6.2
Industrial fans	0.3	2.0	3	4.7
Motors	1.3	7.5	11	14.9
Other industrial products	0.4	2.6	4	7.1
All	2.1	13.2	21.5	32.8

Additional energy bills for the case where average energy performance is 10% lower due to non-compliance (ED+10%)				
Power transformers	0.2	2.0	6	11.0
Industrial fans	0.5	3.5	5	8.4
Motors	2.6	15.0	22	29.8
Other industrial products	0.7	4.6	8	12.6
All	4.0	25.2	40.8	61.8
Additional energy bills for the case where average energy performance is 15% lower due to non-compliance (ED+15%)				
Power transformers	0.3	3.0	9	16.5
Industrial fans	0.8	5.2	8	12.6
Motors	3.8	22.5	33	44.7
Other industrial products	1.0	7.0	12	18.9
All	5.9	37.8	61.2	92.7
Additional energy bills for the case where average energy performance is 20% lower due to non-compliance (ED+20%)				
Power transformers	0.4	4.1	12	22.0
Industrial fans	1.1	7.0	11	16.8
Motors	5.1	30.1	44	59.6
Other industrial products	1.3	9.3	15	25.2
All	7.9	50.4	81.6	123.7

3.2.1.4 Industry and employment impacts

Table 8 shows how the impact of varying levels of non-compliance with the Ecodesign regulations would be expected to reduce industry revenue across the EU per non-compliance scenario and product group.

Under the central 10% non-compliance scenario Ecodesign scenario industry revenue due to non-compliance falls by €485 million in 2020, €938 million in 2030, €1335 million in 2040 and €1576 million in 2050, compared with the fully compliant Ecodesign scenario.

Table 8. Loss of industry revenue due to non-compliance as a function of product group and average level of non-compliance

	Loss of industry revenue per year (€ million)			
	2020	**2030**	**2040**	**2050**
Reduction in revenues for the case where average energy performance is 5% lower due to non-compliance (ED+5%)				
Power transformers	68.3	219.8	423	542.3
Industrial fans	127.0	163.4	171	178.8
Motors	31.4	38.0	37	34.3
Other industrial products	41.0	99.6	112	123.2
All	267.7	520.7	743.1	878.6
Reduction in revenues for the case where average energy performance is 10% lower due to non-compliance (ED+10%)				
Power transformers	122.0	392.4	756	968.4
Industrial fans	226.8	291.8	305	319.3
Motors	62.7	75.9	74	68.6
Other industrial products	73.3	177.8	200	220.0
All	484.8	938.0	1334.9	1576.3
Reduction in revenues for the case where average energy performance is 15% lower due to non-compliance (ED+15%)				
Power transformers	183.0	588.7	1134	1452.6
Industrial fans	340.2	437.7	457	479.0
Motors	94.0	113.9	112	102.9
Other industrial products	109.9	266.8	300	330.0
All	727.2	1407.0	2002.3	2364.4
Reduction in revenues for the case where average energy performance is 20% lower due to non-compliance (ED+20%)				
Power transformers	244.1	784.9	1512	1936.8
Industrial fans	453.6	583.6	609	638.7
Motors	125.4	151.8	149	137.1
Other industrial products	146.5	355.7	400	440.0
All	969.6	1876.0	2669.8	3152.6

Table 9 shows how the impact of varying levels of non-compliance with the Ecodesign regulations would be expected to result in lower industrial employment across the EU per non-compliance scenario and product group.

Under the central 10% non-compliance scenario Ecodesign scenario industrial employment is 13 thousand less in 2020, 21 thousand less in 2030, 29 thousand less in 2040 and 33 thousand less in 2050, compared with the fully compliant Ecodesign scenario.

Table 9. Lost growth in industrial jobs due to non-compliance as a function of product group and average level of non-compliance

	Number of jobs not created (1000s)			
	2020	**2030**	**2040**	**2050**
Jobs not created for the case where average energy performance is 5% lower due to non-compliance (ED+5%)				
Power transformers	1.4	4.4	8	10.8
Industrial fans	2.5	3.1	3	3.4
Motors	1.8	2.3	2	2.1
Other industrial products	1.2	1.7	2	2.1
All	7.0	11.5	15.8	18.4
Jobs not created for the case where average energy performance is 10% lower due to non-compliance (ED+10%)				
Power transformers	2.5	7.8	15	19.2
Industrial fans	4.5	5.6	6	6.1
Motors	3.6	4.6	5	4.2
Other industrial products	2.2	3.0	3	3.7
All	12.8	21.0	28.8	33.2
Jobs not created for the case where average energy performance is 15% lower due to non-compliance (ED+15%)				
Power transformers	3.8	11.7	22	28.8
Industrial fans	6.7	8.4	9	9.2
Motors	5.4	6.9	7	6.3
Other industrial products	3.3	4.5	5	5.6
All	19.2	31.5	43.1	49.9
Jobs not created for the case where average energy performance is 20% lower due to non-compliance (ED+20%)				
Power transformers	5.0	15.6	30	38.4
Industrial fans	8.9	11.2	12	12.3
Motors	7.3	9.2	9	8.3
Other industrial products	4.4	6.0	7	7.5
All	25.6	42.1	57.5	66.5

4. Benefits and costs from investment in market surveillance

This section examines the benefits and costs that are could be expected from greater investment in Ecodesign market surveillance for industrial products. It begins by considering the level of investment that might be needed to substantially improve compliance and then analyses the impacts that would be expected were this to happen as a function of the average initial level of non-compliance.

4.1 What level of investment is needed to ensure compliance?

It is of course difficult to be sure how much market surveillance activity is needed to ensure that the large majority of products will comply with the requirements. Budgetary estimates can be derived bottom-up by considering the type and cost of actions that an MSA would undertake to deliver improve compliance with the regulations. The types of general market surveillance actions are summarised in section 4.1.1 while typical costs of verification checking actions are summarised in section 4.1.2. The impact that this might have on the market for a given level of investment is considered in section 4.1.3.

4.1.1 General market surveillance and preparatory actions

The following general market surveillance and preparatory actions are recommended:

1. Identify market actors (manufacturers, final clients and EPCs)

2. Develop MSA technical competence with regard to the industrial product group in question – including identifying supporting contractors with the appropriate technical skills and market knowledge to be able to support market surveillance and conformity verification activities. Note, these are likely to include 3rd party testing facilities if such facilities exist with close enough proximity to the economy.

3. Create awareness of the requirements with both local industrial product producers, and local procurers of industrial products (be they final clients, OEMs or EPCs).

4. Encourage market actors (e.g. manufacturers and procurers) to minimise project risk by informing MSAs when their activities will result in a product being placed on the market and thereby mitigate the risk of disruptive conformity verification actions occurring later in the product supply chain, when the costs and inconvenience would be greater.

5. Consider encouraging local industry to undergo a conformity assessment quality assurance review wherein a review is undertaken of the practices the company is applying to ensure their products comply with the Ecodesign regulation. Cooperation could be encouraged by: a) assuring the company that the review will respect their confidentiality and taking appropriate actions to ensure it

does, b) informing companies that in the event that they undertake such a review and no conformity assessment issues are identified or all that are identified are addressed that that they will be permitted to inform their clientele that this is the situation thereby creating a positive incentive to participate because it provides a degree of assurance to their clients that their products will carry less non-conformity risk), c) in the event any company is reticent to permit such a review inform them that failure to do so increases the likelihood that their products will be selected for conformity verification assessments even if this may disrupt the installation of the product.

6. Take measures to increase the likelihood of being informed when products are being placed on the market, including:

   - Establishing links with customs so that the MSA is informed whenever industrial products are being imported and establishing data exchange mechanisms to facilitate this.

   - Consider requesting that local procurers of industrial products should notify the MSA whenever they are placing an order for a product to facilitate the option of the MSA being able to conduct conformity verification actions should they chose to. Cooperative procurers should be identified who are willing to engage in this process, perhaps beginning with those that are procuring industrial products for use in public sector projects. A mechanism should be established for them to inform the MSA whenever an order for a large industrial product is placed, the address and contact details of the supplier, and the expected (and subsequently actual) shipping date in time for the MSA to be able to conduct a conformity verification assessment should they chose to.

The rationale behind the actions descried above is to:

a) Ensure market actors are aware of their obligations with respect to Commission Regulation (EU) No 327/2011

b) To maximise the probability that local industry have put in place adequate conformity assessment practices

c) To maximise the prospects of the MSA being informed of a product being placed on the market in time to be able to conduct conformity verification actions that have the minimum disruption for market actors

d) To ensure that imported products are not favoured over locally made ones with respect to enforcement of the regulations i.e. that there is a level playing field.

4.1.2 Typical costs of verification checking actions

INTAS deliverable 4.3 presents the following summaries of the typical costs of verification checking actions for power transformers and industrial fans respectively (Tables 10 and 11). Flow charts showing INTAS's recommended market surveillance actions for power transformers and industrial fans are shown in Appendix B and give an indication of the type and sequence of market surveillance activities that would be expected.

Table 10. Summary of indicative costs for MSAs per conformity verification method for power transformers (costs expressed per unit tested)

Method	Indicative verification costs per unit		Indicative verification costs per unit relative to testing in a 3rd party laboratory	
	Average unit	40 MVA unit	Average unit cost	40 MVA unit cost
1. Documentation inspection	€ 239	€ 239	6%	2%
2. Physical inspections	€ 106	€ 106	3%	1%
3. 3rd party testing	€ 3,688	€ 13,258	100%	100%
4. Verification testing in situ - at final site	€ 3,166	€ 8,284	86%	62%
5. Verification testing in situ - at manufacturer's premises	€ 2,264	€ 4,489	61%	34%
6. Witness testing at manufacturer's premises	€ 2,549	€ 3,584	69%	27%
Risk assessment methods				
7. Detailed simulation modelling	€ 614	€ 3,730	17%	28%
8. Simplified plausibility simulation modelling	€ 459	€ 2,130	12%	16%
9. Checking consistency of manufacturer's simulation modelling with declared results	€ 117	€ 2,330	3%	18%

Table 11. Summary of indicative costs for MSAs per conformity verification method for industrial fans (costs expressed per unit tested)

Method	Indicative verification costs per unit		Indicative verification costs per unit relative to testing in a 3rd party laboratory	
	Average unit	45 kW unit	Average unit cost	45 kW unit cost
1. Documentation inspection	€ 239	€ 239	4%	3%
2. Physical inspections	€ 106	€ 106	2%	1%
3. 3rd party testing	€ 6,139	€ 8,973	100%	100%
4. Verification testing in situ - at final site	NA	NA	NA	NA
5. Verification testing in situ - at manufacturer's premises	€ 6,404	€ 9,238	104%	103%
6. Witness testing at manufacturer's premises	€ 508	€ 723	8%	8%
Risk assessment methods				
7. Detailed simulation modelling	€ 2,477	€ 2,530	40%	28%
8. Simplified plausibility simulation modelling	€ 2,077	€ 2,130	34%	24%
9. Checking consistency of manufacturer's simulation modelling with declared results	€ 155	€ 2,330	3%	26%
10. Scale model testing or part-load for fans (only applicable to very large fans)		€ 8,973	NA	100%

From these figures were one to imagine a typical MSA annual budget allocation of €100k to conduct Ecodesign market surveillance activities for a targeted product group, it could be imagined that roughly €60k would be set aside for verification checking activities and €40k for other actions. With a budget of €60k it would be possible to do roughly (for example):

- 150 documentation checks
- 75 physical inspection checks

- and about 6 verification tests (either 3rd party or witness testing) – note, it is likely that rather more electric motors and water pumps could be tested as their unit testing costs can be lower.

With this level of annual coverage and typical industrial product market where there might be from 10 to 50 suppliers (perhaps more for motors) but with the majority of the market volume concentrated into a smaller share it would be possible to cover most suppliers within the first two years and thus to alert all market actors to the reality of market surveillance occurring for their products. Using the risk profiling approach for product compliance screening set out in INTAS deliverable D3.8 the resources can be optimised to preferentially target the suppliers and product types presenting the highest risk of non-compliance (while also always ensuring the whole market is subject to some level of compliance checking) and thus to maximise the incentive for non-compliant suppliers to become compliant.

The remainder of the budget (i.e. the €40k imagined above) could be used to support the general market surveillance actions discussed in section 4.1.1 that are aimed at identifying what products are being placed on the market, in a timely manner, informing market actors of their obligations and conformity assessment pathways, and working with local industry to help them meet the requirements. Some budget would also be required for legal enforcement actions when non-compliance is determined, although how significant this would be is likely to depend on the severity and persistence of non-compliance identified via the verification checks. As most MSAs will avoid formal legal action with the first instances of non-compliance identified for a given supplier and will often give the supplier the opportunity to remedy the non-compliance, a significant budget for legal enforcement actions is only likely to be required after a few years of conducting market surveillance to address legal actions against persistent and severe offenders. Ordinarily, this would coincide with the compliance of the market as a whole improving and hence with a reduced budgetary need for verification checks and thus in these later years there could be slight shift in focus while maintaining a similar budgetary envelope.

4.1.3 The impact that could be expected for a given level of investment

For the reasons set out above it is likely that a typical MSA budget of about €100k per annum per industrial product group would quickly provide a high coverage of the suppliers present on the market and would therefore alert them to their obligations, the conformity assessment options available, and alert them to the risk of having non-compliant products being identified. The figure of a €100k per annum is loosely assumed for an MSA covering an average EU country in terms of GDP/capita, population and economic structure and thus could be foreseen for a jurisdiction of ~10-15 million people. There is no certainty about the level of compliance such an expenditure would produce but based on the partially data driven and partially anecdotal experience for other product groups with longer regulatory histories it seems likely that a sustained level of market surveillance at this approximate level of effort would induce compliance for the majority of products on the market within a decade of its implementation

4.2 Estimated impacts of investment in market surveillance

In this section results of scenarios are presented where it is assumed that at least €16 million is invested annually across the EU in market surveillance of industrial products[10] per year and that this amounts to €4 million per major industrial product group (motors, industrial fans, power transformers, and the aggregated group of water pumps and air compressors). This figure is derived from the assumption that an average MSA representing a community of about 12 million people could choose to allocate ~ €100k in annual funding to do market surveillance for industrial products including verification checks. It is informed by typical expenditures that MSAs have committed for other types of product market surveillance when they have chosen to focus on a particular product group. It is also informed by the cost of market surveillance actions summarised in INTAS project deliverable D4.3 on *Evaluation of costs, benefits and new methods of testing, and common issues found in large product testing*.

With this level of hypothecated funding it would be possible for an MSA to:

- contact market actors and inform them of their obligations under the regulations
- conduct site inspections of local producers
- liaise with those that have knowledge of the movement of products in the supply chain, including border agencies and customs.
- conduct verification checks comprising documentation checks, visual checks and verification tests (either 3rd party or Witnessing of Factory Acceptance Tests)
- pursue legal actions against non-compliant products and suppliers.

The exact blend of appropriate actions would be likely to vary year by year with initially there being a greater focus on ensuring market actors are aware of the obligations and the steps required for their products to conform with the Ecodesign requirements. There may also be an initial focus on working with local industry to facilitate their compliance. Once MSAs are confident that market actors have enough knowledge and reasonable time to have brought their products into compliance they are likely to pursue more proactive verification checks to ensure there is a level playing field in the market.

The impacts in terms of energy savings, greenhouse gas emission savings, energy bill savings, additional revenue earned by industry and additional industrial sector employment attributable to the extra compliance this level of market surveillance activity is estimated to induce are set out in the following sub sections. In each the impacts are reported as a function of the presumed level on non-compliance without the market surveillance activity being implemented for the following cases:

- an average energy performance of 5% worse than the Ecodesign regulatory limit

[10] Taken to be: electric motors, power transformers, industrial fans, water pumps and air compressors

- an average energy performance of 10% worse than the Ecodesign regulatory limit
- an average energy performance of 15% worse than the Ecodesign regulatory limit
- an average energy performance of 20% worse than the Ecodesign regulatory limit

Based on the existing limited evidence the 10% worse than the Ecodesign regulatory limit is the INTAS project's best guess of current non-compliance for the products it investigated (power transformers and industrial fans); however, there is considerable uncertainty about actual non-compliance levels and the true state of affairs will only be determined once significant market surveillance verification check data is gathered and analysed. It should be noted that these scenarios do not necessarily imply the energy consumption of the average product in question is the stated percentage higher than the Ecodesign limit. Rather, the average non-compliance assumed per product group for each initial non-compliance scenario are as follows:

- industrial fans - average efficiency is the stated percentage less than the permitted regulatory limit
- power transformers – average losses are the stated percentage higher than the permitted regulatory limits
- electric motors – average losses are the stated percentage higher than the permitted regulatory limits
- water pumps – average efficiency is the stated percentage less than the permitted regulatory limit
- air compressors – average efficiency is the stated percentage less than the permitted regulatory limit

4.2.1.1 Energy savings impacts

The estimated final electricity savings across the EU induced by the sustained market surveillance action described in the beginning of section 4.2 for each initial level of average non-compliance are shown per product group in Table 12. In the central 10% initial average non-compliance case the total electricity savings attain 96 TWh in 2030 and 108 TWh in 2050.

Table 12. Energy savings from a €4m annual investment in market surveillance as a function of product group and initial average level of non-compliance

	Energy savings (TWh/year)			
	2020	**2030**	**2040**	**2050**
Saved electricity under scenario where initially ED compliant +5% and €4m spend				
Power transformers	0.3	4.3	8	10.7
Industrial fans	0.7	7.5	8	8.2
Motors	3.0	28.7	28	25.9
Other industrial products	0.9	9.9	11	12.3
All	4.9	50.4	55.5	57.1
Saved electricity under scenario where initially ED compliant +10% and €4m spend				
Power transformers	0.5	7.8	15	19.2
Industrial fans	1.3	13.4	14	14.6
Motors	6.0	57.4	56	51.8
Other industrial products	1.6	17.7	20	21.9
All	9.3	96.2	105.1	107.5
Saved electricity under scenario where initially ED compliant +15% and €4m spend				
Power transformers	0.7	11.6	22	28.7
Industrial fans	1.9	20.0	21	21.9
Motors	9.0	86.1	84	77.8
Other industrial products	2.3	26.6	30	32.9
All	14.0	144.3	157.6	161.3
Saved electricity under scenario where initially ED compliant +20% and €4m spend				
Power transformers	1.0	15.5	30	38.3
Industrial fans	2.5	26.7	28	29.2
Motors	12.0	114.8	113	103.7
Other industrial products	3.1	35.4	40	43.8
All	18.6	192.4	210.2	215.1

4.2.1.2 CO_2 impacts

The estimated final electricity savings across the EU induced by the sustained market surveillance action described in the beginning of section 4.2 for each initial level of average non-compliance are shown per product group in Table 13. In the central 10% initial average non-compliance case the total greenhouse gas emissions savings attain 32.7 Mt of CO_2 in 2030 and 28.0 Mt of CO_2 in 2050.

Table 13. Greenhouse gas emissions savings from a €4m annual investment in market surveillance as a function of product group and initial average level of non-compliance

	Emissions savings ($MtCO_2$/year)			
	2020	**2030**	**2040**	**2050**
Saved emissions under scenario where initially ED compliant +5% and €4m spend				
Power transformers	0.1	1.5	3	2.8
Industrial fans	0.3	2.5	2	2.1
Motors	1.1	9.8	8	6.7
Other industrial products	0.3	3.4	3	3.2
All	1.8	17.2	16.6	14.8
Saved emissions under scenario where initially ED compliant +10% and €4m spend				
Power transformers	0.2	2.6	4	5.0
Industrial fans	0.5	4.5	4	3.8
Motors	2.3	19.5	17	13.5
Other industrial products	0.6	6.0	6	5.7
All	3.5	32.7	31.5	28.0
Saved emissions under scenario where initially ED compliant +15% and €4m spend				
Power transformers	0.3	4.0	7	7.5
Industrial fans	0.7	6.8	6	5.7
Motors	3.4	29.3	25	20.2
Other industrial products	0.9	9.0	9	8.6
All	5.3	49.1	47.3	41.9
Saved emissions under scenario where initially ED compliant +20% and €4m spend				
Power transformers	0.4	5.3	9	10.0
Industrial fans	1.0	9.1	8	7.6
Motors	4.6	39.0	34	27.0

Other industrial products	1.2	12.1	12	11.4
All	7.1	65.4	63.0	55.9

4.2.1.3 Energy bill impacts

The estimated final electricity bills across the EU induced by the sustained market surveillance action described in the beginning of section 4.2 for each initial level of average non-compliance are shown per product group in Table 14. In the central 10% initial average non-compliance case the total electricity bill savings attain €21 billion in 2030 and €52 billion in 2050.

Table 14. Energy bill savings from a €4m annual investment in market surveillance as a function of product group and initial average level of non-compliance

	Energy bill savings (€billion /year)			
	2020	**2030**	**2040**	**2050**
Saved energy bills under scenario where initially ED compliant +5% and €4m spend				
Power transformers	0.0	1.0	3	5.2
Industrial fans	0.1	1.6	3	4.0
Motors	0.4	6.3	9	12.5
Other industrial products	0.1	2.2	4	5.9
All	0.7	11.1	18.1	27.6
Saved energy bills under scenario where initially ED compliant +10% and €4m spend				
Power transformers	0.1	1.7	5	9.3
Industrial fans	0.2	2.9	5	7.1
Motors	0.9	12.6	18	25.0
Other industrial products	0.2	3.9	6	10.6
All	1.4	21.2	34.3	51.9
Saved energy bills under scenario where initially ED compliant +15% and €4m spend				
Power transformers	0.1	2.6	7	13.9
Industrial fans	0.3	4.4	7	10.6
Motors	1.3	18.9	28	37.6
Other industrial products	0.3	5.8	10	15.9
All	2.1	31.8	51.4	77.9
Saved energy bills under scenario where initially ED compliant +20% and €4m spend				

Power transformers	0.1	3.4	10	18.5
Industrial fans	0.4	5.9	9	14.1
Motors	1.8	25.2	37	50.1
Other industrial products	0.5	7.8	13	21.2
All	2.8	42.3	68.5	103.9

4.2.1.4 Industrial and employment impacts

The estimated additional industrial revenue across the EU induced by the sustained market surveillance action described in the beginning of section 4.2 for each initial level of average non-compliance are shown per product group in Table 15. In the central 10% initial average non-compliance case the total additional industry revenue attains €788 million in 2030 and €1324 million in 2050.

Table 15. Additional industry revenue from a €4m annual investment in market surveillance as a function of product group and average level of initial non-compliance

	Additional revenue (€millions/year)			
	2020	**2030**	**2040**	**2050**
Additional revenue from market surveillance if initially ED compliant +5% and €4m spend				
Power transformers	23.9	184.6	356	455.5
Industrial fans	44.5	137.3	143	150.2
Motors	11.0	31.9	31	28.8
Other industrial products	14.4	83.7	94	103.5
All	93.7	437.4	624.2	738.0
Additional revenue from market surveillance if initially ED compliant +10% and €4m spend				
Power transformers	42.7	329.7	635	813.5
Industrial fans	79.4	245.1	256	268.2
Motors	21.9	63.8	63	57.6
Other industrial products	25.6	149.4	168	184.8
All	169.7	787.9	1121.3	1324.1
Additional revenue from market surveillance if initially ED compliant +15% and €4m spend				
Power transformers	64.1	494.5	953	1220.2
Industrial fans	119.1	367.7	384	402.4
Motors	32.9	95.6	94	86.4

Other industrial products	38.5	224.1	252	277.2
All	254.5	1181.9	1681.9	1986.1
Additional revenue from market surveillance if initially ED compliant +20% and €4m spend				
Power transformers	85.4	659.3	1270	1626.9
Industrial fans	158.8	490.2	512	536.5
Motors	43.9	127.5	125	115.2
Other industrial products	51.3	298.8	336	369.6
All	339.3	1575.8	2242.6	2648.2

The estimated additional industrial employment (jobs) across the EU induced by the sustained market surveillance action described in the beginning of section 4.2 for each initial level of average non-compliance are shown per product group in Table 16. In the central 10% initial average non-compliance case the total additional employment attains 17.7 thousand jobs in 2030 and 27.9 thousand jobs in 2050.

Table 16. Additional industry jobs from a €4m annual investment in market surveillance as a function of product group and average level of initial non-compliance

	Number of jobs created (1000s)			
	2020	**2030**	**2040**	**2050**
Additional jobs from market surveillance if initially ED compliant +5% and €4m spend				
Power transformers	0.5	3.7	7	9.0
Industrial fans	0.9	2.6	3	2.9
Motors	0.6	1.9	2	1.8
Other industrial products	0.4	1.4	2	1.8
All	2.4	9.7	13.3	15.4
Additional jobs from market surveillance if initially ED compliant +10% and €4m spend				
Power transformers	0.9	6.5	13	16.1
Industrial fans	1.6	4.7	5	5.2
Motors	1.3	3.9	4	3.5
Other industrial products	0.8	2.5	3	3.1
All	4.5	17.7	24.2	27.9
Additional jobs from market surveillance if initially ED compliant +15% and €4m spend				
Power transformers	1.3	9.8	19	24.2

Industrial fans	2.3	7.1	7	7.7
Motors	1.9	5.8	6	5.3
Other industrial products	1.2	3.8	4	4.7
All	6.7	26.5	36.2	41.9
Additional jobs from market surveillance if initially ED compliant +20% and €4m spend				
Power transformers	1.8	13.1	25	32.3
Industrial fans	3.1	9.4	10	10.3
Motors	2.5	7.8	8	7.0
Other industrial products	1.6	5.1	6	6.3
All	9.0	35.3	48.3	55.8

4.3 Estimated range of benefit-cost ratios

The societal benefit to cost ratio (BCR) of a policy is a key metric of its value to society as a whole and hence an important factor to consider when reflecting on the merits of a policy. In the case of Ecodesign regulatory measures the benefits include the value of energy savings and the value of greenhouse gas emissions savings. The former can be expressed directly in terms of the value of avoided energy bills but the latter requires a shadow carbon price to be used to be put into monetary terms. For this reason the BCRs are presented below both with and without taking the value of CO_2 savings into account. The costs associated with the Ecodesign regulations are the extra equipment acquisitions cost due to the increased cost of production of more energy-efficient and environmentally friendly equipment. There are also benefits due to extra employment (due to the higher value of the equipment) and potentially reductions in other environmental impacts; however, as industrial product Ecodesign lifecycle assessments (LCAs) are dominated by savings from the energy in use the analysis presented below makes no attempt to include valorisations of other environmental benefits.

4.3.1 BCRs when only valuing equipment and energy costs

The estimated benefit cost ratios across the EU attributable to the sustained market surveillance action described in the beginning of section 4.2 for each initial level of average non-compliance are shown per product group in Table 17. In the central 10% initial average non-compliance case the BCR for all industrial equipment attains 1274 in 2030 and 3163 in 2050. These BCR calculations exclude the value of CO_2 emissions abatement.

Table 17. Estimated benefit cost ratios from a €4m annual investment in market surveillance as a function of product group and average level of initial non-compliance

	BCR			
	2020	**2030**	**2040**	**2050**
Benefit cost ratios from market surveillance if initially ED compliant +5% and €4m spend				
Power transformers	4	193	593	1181
Industrial fans	15	377	601	951
Motors	109	1570	2285	3122
Other industrial products	29	525	885	1457
All	39	666	1091	1678
Benefit cost ratios from market surveillance if initially ED compliant +10% and €4m spend				
Power transformers	7	344	1060	2109
Industrial fans	27	673	1072	1698
Motors	218	3140	4571	6245
Other industrial products	51	937	1581	2601
All	76	1274	2071	3163
Benefit cost ratios from market surveillance if initially ED compliant +15% and €4m spend				
Power transformers	11	517	1590	3164
Industrial fans	41	1010	1609	2547
Motors	327	4710	6856	9367
Other industrial products	77	1406	2371	3902
All	114	1911	3106	4745
Benefit cost ratios from market surveillance if initially ED compliant +20% and €4m spend				
Power transformers	14	689	2120	4218
Industrial fans	55	1347	2145	3396
Motors	436	6280	9141	12490
Other industrial products	103	1875	3161	5202
All	152	2548	4142	6327

4.3.2 BCRs when including the value of CO_2 abatement

The estimated benefit cost ratios across the EU attributable to the sustained market surveillance action described in the beginning of section 4.2 for each initial level of average non-compliance are shown per

product group in Table 18. In the central 10% initial average non-compliance case the BCR for all industrial equipment attains 1324 in 2030 and 3626 in 2050. These BCR calculations include the value of CO_2 emissions abatement where the assumed carbon prices are derived from mean of the prices presented in the EU Roadmap to 2050[11].

If the resulting values are compared to then BCRs when the value of greenhouse gas emissions is not taken into account (per Table 17) it can be seen that they are only ~2% higher in 2020, rising to ~4% higher in 2030, ~8% higher in 2040 and ~ 15% higher in 2050. This reflects the near exponential increase in the carbon price projected in the *Roadmap to 2050* analysis.

Table 18. Estimated benefit cost ratios including a market valorisation of CO_2 from a €4m annual investment in market surveillance as a function of product group and average level of initial non-compliance

	BCR			
	2020	**2030**	**2040**	**2050**
Benefit cost ratios from market surveillance if initially ED compliant +5% and €4m spend				
Power transformers	4	202	645	1374
Industrial fans	16	393	649	1098
Motors	111	1630	2459	3588
Other industrial products	29	546	954	1677
All	40	693	1177	1934
Benefit cost ratios from market surveillance if initially ED compliant +10% and €4m spend				
Power transformers	7	361	1152	2453
Industrial fans	28	701	1159	1960
Motors	222	3260	4918	7176
Other industrial products	53	974	1703	2995
All	78	1324	2233	3646
Benefit cost ratios from market surveillance if initially ED compliant +15% and €4m spend				
Power transformers	11	541	1728	3680
Industrial fans	42	1052	1738	2940
Motors	334	4889	7377	10764
Other industrial products	79	1462	2555	4492

[11] ROADMAP 2050 - A PRACTICAL GUIDE TO A PROSPEROUS, LOW-CARBON EUROPE - https://www.roadmap2050.eu/

All	117	1986	3349	5469
Benefit cost ratios from market surveillance if initially ED compliant +20% and €4m spend				
Power transformers	15	721	2304	4906
Industrial fans	57	1402	2317	3921
Motors	445	6519	9836	14352
Other industrial products	105	1949	3407	5990
All	155	2648	4466	7292

Not only do the benefit cost analyses presented above show that Ecodesign market surveillance for industrial products presents extraordinarily high BCR values (i.e. with the value of societal benefits exceeding societal costs by between 28 and 2354 for the central 10% average non-compliance case even when excluding carbon valorisation). These BCRs are in line with those reported for market surveillance for other Ecodesign regulations, where figures of around 1000 have been estimated.

5. Increasing funding for Ecodesign market surveillance of large industrial products

5.1 Why funding is currently inadequate

It is the responsibility of EU Member States to conduct market surveillance for Ecodesign and energy labelling of products yet the funding for this activity has to this point been far below that which is economically rational given the value of the energy savings that greater market surveillance would be likely to attain. This is the case despite that fact that several Member States have increase resource allocations for this activity in recent years (although some others have decreased it). The current funding situation is believed to be highly heterogeneous with some Member States providing relatively generous funding but many others providing very little if any. A key question is why this should be the case? To understand this it is important to reflect on how Member States tend to establish resource allocations for agencies operating within the governmental framework. Generally, the treasury or finance ministry will set an envelope for all government funding in a given period. Each ministry will then make a case for their funding needs and will be in competition with other ministries for funding within a fixed (or near fixed) allocation. Market surveillance will ordinarily be a very small part of a line ministries expenditure and hence is unlikely to feature as a specific line item (or at least a noticeable one) within a ministries overall funding request. This means there will often not a benefits-cost discussion between the line ministry and the treasury/finance ministry concerning market surveillance as a specific item, but rather if such a discussion occurs it will be bundled with those of much large activities that will render the value proposition of the market surveillance component almost invisible.

Rather, a more common scenario will be for the line ministry to be allocated their overall budget based on the broad aggregate needs-benefits analysis with the treasury/finance ministry and then only afterwards would there be discussion within each line ministry about how they will allocate resources for each specific activity they have responsibility for, including market surveillance. By this time the ministerial budget ceiling is set and the factors which will often drive these internal resource allocation discussions are not simply economic benefit cost exercises, but more pressingly those concerned with statutory obligations to provide certain services. Often there will be pressure for ministerial resource allocations to be even handed across the main sectors they have responsibility for, and this is often against a context where ministries are under resourced and hence are struggling to resource their main activities as well as they would like to. By this stage of the decisions making process, the finance ministry/treasury are no longer engaged and hence the agency with most interest and awareness in national economic efficiency is no-longer party to the discussions. Meeting statutory obligations is often the driving concern and particularly those that are most visible in the public discourse. In the case of market surveillance for products conformity with energy performance is not visible unless a market surveillance agency explicitly goes looking for it, and even if non-conformity is suspected as the negative impacts are essentially perceived to be economic rather than a matter of public safety then they are not such a high priority.

In principle, were it the case that the treasury or finance ministry were directly responsible for assessing the specific budgetary needs for Ecodesign market surveillance of products and were they conscious of the extremely favourable benefit-cost ratios from market surveillance actions designed to ensure compliance with energy performance limits then they might be inclined to increase resource allocations to the level that produced energy savings at an equal cost of energy supply (i.e. where the cost of conserved energy were at or near to the cost of an equivalent unit of energy). Yet, the decision about resource allocations for the energy sector is usually managed wholly independently of Ecodesign market resource allocations and is usually the purview of the Ministry with responsibility for Energy who is invariably not the line ministry responsible for Ecodesign market surveillance. Thus, the two ministries (Finance and Energy) who should have a direct interest in optimising resource allocations to deliver (in this case energy-related) services to provide maximum value are very unlikely to be directly involved in the funding allocation decision for Ecodesign market surveillance. This presents a major set of split incentives that act to prevent optimal resource allocation. The situation is usually compounded by the case where the Ecodesign market surveillance budget is typically in direct competition with the budget allocated to product safety and security. As ensuring public safety is a statutory obligation and is highly visible this increases the likelihood that Ecodesign market surveillance will do relatively poorly in terms of resource allocations. It should be noted that there can be exceptions to the situation described above, but these are believed to be relatively rare.

5.2 Potential sources of future funding

Considering the extremely favourable benefit-cost ratios from increased Ecodesign market surveillance and then very low current allocations to market surveillance for industrial products in particular, it is both necessary and appropriate to consider how funding could be increased in the future. Essentially, agencies with responsibility for Ecodesign market surveillance can continue to present a case for their activities in the traditional manner but could do so armed with the emerging information on the very high value proposition of Ecodesign market surveillance set out in this, and similar studies. Appendix A includes a simple two-pager summary of this value proposition for the specific case of industrial products and is presented to aid such discussions. The information it contains is normalised across the EU per 1 million population to facilitate ready comparison but the information it contains could be further adapted to respond to the precise circumstances of each Member State and their responsible market surveillance agencies.

Nonetheless, due to the split incentives and broader budgetary constraints alluded to in section 5.1, it is still likely that Ecodesign market surveillance will be underfunded in relation to the value of the opportunity it presents. Thus, fresh perspectives on funding levels and sources are likely to be required. The sections below consider the potential impact that the EU's pending Goods Package and alternative sources of funding could have to improve the situation.

5.2.1 The Goods Package

There is rising awareness of the need for the EU and its Member States to improve conformity with the requirements of the Single Market to better protect consumers, businesses and the environment, to support economic efficiency and ensure a level playing field. Against this context the Commission and Member States have been developing the Goods Package which includes many elements intended to bolster the ability of market surveillance agencies to ensure conformity with Single Market rules.

The Goods Package[12] was first put forward in December 2017 and is still under discussion with decisions expected in April 2019. It includes a proposal with regard to Mutual Recognition of market surveillance rulings that would increase the ability of market surveillance authorities to recognise the rulings of other EEA market surveillance authorities, including those not within the same national or sub-national jurisdiction, and hence will strengthen the ability of market surveillance authorities to remove from their market or otherwise sanction the suppliers of products that are found to be not in conformity with Single Market rules in another EEA jurisdiction. This measure should increase the cross-community impact of market surveillance actions and critically enable market surveillance authorities to coordinate market surveillance actions in the knowledge that if any one of them identifies and non-conforming product all of them can take legal action against the supplier. This is a very important measure that has the potential to greatly amplify the benefit to cost ratio of market surveillance.

The second major component is a proposed Regulation on Compliance and Market Surveillance. This has two major parts, comprising:

- Compliance and Market Surveillance, which covers all harmonised non-food products (legislation in the accompanying annex)
- Controls at the external borders, which covers all products, unless there are more specific provisions in other Union legislation.

The regulation is intended to replace Articles 15 to 29 of Regulation (EC) No 765/2008. The objectives of the regulation are to improve compliance, strengthen market surveillance, organise controls at external borders and update the framework to cover modern supply chains and online sales (throughout the Regulation).

With regard to improving compliance the draft regulation includes provisions concerning the following:

- providing information to businesses, including establishing Product Contact Points and a Single Digital Gateway)
- establishing agreements on joint activities between market surveillance authorities, other authorities and business and consumer organisations; and enabling results to be used for investigations
- distance sales: products deemed to be made available when offer is targeted at end-users in the EU

In addition, for some products it is intended that they can only be placed on the market when a business in the EU is able to supply declaration of conformity and technical documentation.

With regard to strengthening market surveillance the draft regulation includes provisions concerning:

- the organisation, activities, powers and obligations of market surveillance authorities

[12] https://ec.europa.eu/info/law/better-regulation/initiatives/com-2017-795_en

- establishment of a 'Single Liaison Office' for market surveillance per Member State to represent the coordinated position of Member States
- establishment of peer reviews of market surveillance authorities
- a requirement to issue National Market Surveillance Strategies every 4 years
- Union testing facilities to enhance laboratory capacity for market surveillance authorities
- establishment of mutual assistance mechanisms between market surveillance authorities to support requests for information and requests for enforcement measures
- the establishment of an EU Product Compliance Network that includes representatives from Member States, Single Liaison Offices, ADCOs and the Commission and which will address general horizontal issues of market surveillance
- the establishment of Administrative Coordination Groups (ADCOs) for Directives and regulations that do not yet have such groups (Ecodesign and energy labelling already do)

With regard to establishing controls at external borders the draft regulation includes provisions concerning:

- non-compliance risk analysis and information sharing
- enabling customs authorities to suspend 'release for free circulation' when they suspect noncompliance
- under this event ensuring market surveillance authorities have 4 working days to react
- when non-compliance is found, the destruction of products is to be allowed; and if not destroyed non-compliant products would always be labelled as non-compliant to prevent their entering the EU via other border crossing points
- facilitating international cooperation.

At the time of writing it was expected that formal adoption of the text by the European Parliament and Council will occur in April to May 2019. If this happens as expected, then the application of the EU Product Compliance Network and Financing would occur on 1 January 2021 and the application of the other provisions would occur in the summer of 2021. Among these is an initiative with important implication for financing, known as the Single Market Programme[13].

The proposal for the Single Market Programme envisages setting a budget of ~ €4 billion to support a range wide ranging set of measures including: those aimed at ensuring the competitiveness of businesses, notably SMEs, but also supporting the enforcement of consumer protection and safety rules and by raising the awareness of businesses and individuals by providing them with the right tools, knowledge and competence

[13] https://ec.europa.eu/commission/publications/single-market-programme-legal-texts-and-factsheets_en

to make informed decisions and strengthen their participation in Union's policy-making. Furthermore, the Programme should aim to enhance regulatory and administrative cooperation, notably through exchange of best practices, building of knowledge and competence bases, including the use of strategic public procurement. The Programme should also aim to support the development of high-quality international standards that underpin the implementation of Union legislation. While the proposed budget is very significant it does not look as if any of it could be directly used to conduct Ecodesign market surveillance by member states, but in providing greater budget for product safety related market surveillance it could be used as a rationale to reallocate a greater share of existing budgets to Ecodesign work.

While the measures envisaged in the Goods Package are very welcome and helpful it is important to recognise, however, that they covers the ensemble of market surveillance actions for products and are not targeted at addressing the specific funding disadvantages that Ecodesign market surveillance suffers from. Thus, while the Goods Package measures should improve the general situation for the market surveillance of goods across the EU it is unlikely this will be sufficient, by itself, to unlock the funding levels that would deliver economically cost-optimised Ecodesign market surveillance. Possibly the most useful aspects are those that will allow mutual recognition of market surveillance verification actions across the EU and hence will enable market surveillance agencies to cooperate much more effectively than has hitherto been the case. It is also possible that future developments could support greater focus on Ecodesign market surveillance given its high value and specific characteristics.

5.2.2 Other funding routes - e.g. EED Article 7

The principal split incentive with Ecodesign market surveillance funding is a result of the fact that the main beneficiary from better compliance are those who pay the energy bills of energy-using equipment, such as the industrial products subject to Ecodesign regulations, yet the funding for market surveillance is completely detached from the energy market or energy sector governance. Thus, the natural stakeholders for energy sector planning, investment and operation are not connected to the process of ensuring compliance with the Ecodesign requirements. In principle, under an efficient energy market all cost-effective options, regardless of whether they concern the delivery of energy supplies or the provision of energy savings through efficiency (such as Ecodesign regulations promote) would be adopted in order of cost-effectiveness to deliver a gieven level of energy services. However, as actions to ensure compliance are disconnected from the normal market drivers this does not happen resulting in a huge disparity in the cost effectiveness of savings from compliance measures compared with the cost of energy supply.

As it happens, there is already an EU policy mechanism that could be used to redress this balance. Article of the Energy Efficiency Directive[14] requirements member states to set national energy saving targets and to either implement obligations on energy suppliers to meet these energy saving targets or for Member State government to implement equivalent energy savings actions at the Member State level. A narrow majority of Member States have opted to impose energy savings obligations on energy suppliers and have established schemes by which energy saving measures delivered by energy suppliers can be accounted for and credited. Some include the use of tradable certificates and others simply apply an accounting system for which each supplier has to show they have met their specific targets. The rules that Member States set for

[14] https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive

these schemes affect what energy savings measures are deemed eligible; however, in principle there is nothing which would prevent Member States from establishing rules wherein energy suppliers could receive energy saving credits from funding Ecodesign market surveillance actions. This approach would have the considerable benefit of correcting the major market failure of the disconnect between the beneficiaries of the market surveillance driven improvement in Ecodesign compliance i.e. energy bill payers and the funding of the market surveillance activity. As ultimately energy suppliers pass the costs of their energy saving measures on to their customers via increments in the tariffs the bill payers, who are the beneficiaries, would fund investment in the energy savings delivered. The sums involved would be tiny by comparison with the benefits they would induce and overall energy bills would be lower. Such an approach also has the advantage that it breaks the split-incentive in government funding processes previously alluded to and removes the resource allocation decisions from the constraints of general taxation. Even, for Member States that don't set energy efficiency obligations on energy suppliers but rather choose to apply alternative equivalent measures, it could make sense to link funding for Ecodesign market surveillance directly to fulfilment of the EED Article 7 provisions. This is because it would directly connect the outcome of the market surveillance (greater energy savings) to the delivery of the national energy savings target and hence would ensure that government funding motivations were properly aligned. It is worth mentioning that there are precedents for this type of approach. For example, the state of California has used energy sector funding to support energy efficiency related market surveillance for many years.

There is also a potential role for the European Commission and its agencies in exploring the development of such a funding mechanism as they could support technical development work to establish how best to implement such a mechanism to ensure that the impact of market surveillance induced savings are correctly attributed and apportioned.

6. Summary and conclusions

This report has analysed the anticipated impacts of the Ecodesign regulations for industrial products (industrial fans, power transformers, electric motors, water pumps and air compressors), presented scenarios of how the beneficial impacts might be diminished as a function on the average level of non-compliance in the absence of sustained market surveillance; and has estimated the costs and benefits that would be expected from sustaining market surveillance with a cost of ~€4 million per year per industrial product group across the EU as a whole. The results have shown that without investment in effective market surveillance it can be anticipated that a majority of the Ecodesign regulatory benefits estimated in the EU's regulatory impact assessments would not be achieved. However, with a very modest investment in sustained market surveillance it is estimated that most of the expected benefits would be delivered.

Under a central non-compliance scenario where it is assumed due to inadequate market surveillance that average product energy performance is 10% below the Ecodesign regulatory limits for industrial products some 27 TWh of electricity savings would be lost by 2020, 115 by 2030 and 128 by 2050. These have an estimated value of €4 billion in 2020, €25 bn in 2030 and €62 billion in 2050. In addition, due to a non-level playing field industry would invest less in making their products Ecodesign compliant which would lower expected industry revenues by €485 million in 2020, €938 million in 2030 and €1576 million in 2050. This would also result in lower levels of industrial employment (the large majority of which would have been in the EU) by an estimated 13 thousand jobs in 2020, 21 thousand in 2030 and 33 thousand in 2050.

Table 19. Estimated (negative) impacts from non-compliance with Ecodesign regulations for industrial products under a central 10% non-compliance scenario

	Energy losses	Extra Emissions	Extra energy bills	Lost industry revenue	Jobs not created
Product group	**TWh**	**$MtCO_2$**	**€bn**	**€mn**	**Thousands**
Power transformers	9.2	3.1	2.0	392	7.8
Industrial fans	15.9	5.4	3.5	292	5.6
Motors	68.3	23.2	15.0	76	4.6
Other industrial products	21.1	7.2	4.6	178	3.0
All	**114.5**	**38.9**	**25.2**	**938**	**21.0**
All (per 10 million people)	2.22	0.76	0.49	18.2	0.41

By contrast, it is estimated were an EU-wide annual investment of ~ €4 million to be made in Ecodesign market surveillance per major industrial product group it would deliver between 45 and 84% of these otherwise lost benefits depending on the time horizon (see Table 20 for estimated impacts in 2030). The estimated societal benefit cost ratios rise from ~50 to ~2600 per year over the time horizon of the analysis, making this action one of the most efficient means of delivering value to society from government policy measures and programmes. The analysis also shows how split incentives in government budgetary resource allocation processes currently hinders and disadvantages effective Ecodesign market surveillance and puts forward some suggestions on how this could be remedied.

Table 20. Estimated benefits in 2030 from a €4m per product group annual investment in market surveillance for industrial products

	Energy savings	Avoided Emissions	Energy bill savings	Extra industry revenue	Jobs created
Product group	**TWh**	**$MtCO_2$**	**€bn**	**€mn**	**Thousands**
Power transformers	7.8	2.6	1.7	330	6.5
Industrial fans	13.4	4.5	2.9	245	4.7
Motors	57.4	19.5	12.6	64	3.9
Other industrial products	17.7	6.0	3.9	149	2.5
All	**96.2**	**32.7**	**21.2**	**788**	**17.7**
All (per 10 million people)	1.87	0.64	0.41	15.3	0.34

Appendix A - awareness raising materials

2 page document setting out value proposition

The INTAS (INDUSTRIAL AND TERTIARY PRODUCT TESTING AND APPLICATION OF STANDARDS) is an H2020 project financed by the European Commission. It investigated the situation across the EU with regard to market surveillance to encourage compliance with the requirements of the Ecodesign Directive for large industrial energy-using products, most notably power transformers and industrial fans. The regulations issued under the Ecodesign Directive set minimum energy performnace requirements for these products which are estimated to save very significant amounts of energy, energy bills and greenhouse gas emissions while also stimulating extra industry revenues and employment for European manufacturers. However, this will only occur providing that there is effective market surveillance to ensure a level playing field in the market. The INTAS project has identified that only very modest investment is needed to deliver the required level of market surveillance but this investment is not currently occuring due to split incentives in government budgetary allocation processes and competing demands having a higher visibility.

What is at stake?

The actual level of non-compliance with Ecodesign requirements for industrial products is not yet known but central estimates would project average products to have energy performance levels between 5 and 15% worse than required to comply with the regulations. Across the EU this translates to lost annual benefits in 2030 for the five major industrial product groups of electrical motors, industrial fans, power transformers, water pumps and air compressors of:

- 115 TWh of electricity savings
- €25 billion of power bills
- 39 Million tonnes of CO_2 emissions
- and would also result in 782 million lower revenues and 21 thousand less jobs for European industry.

What can investment in Ecodesign market surveillance deliver?

INTAS estimates that under a central scenario investment across the EU of just €16 million annually would substantially increase compliance with the requirements and save ~84% of the threatened benefits by 2030.

- 96 TWh of electricity savings
- €20 billion in net costs
- €21 billion of power bills
- 33 million tonnes of CO_2 emissions
- €790 million of extra industrial revenues
- and increase industrial employment by 18 thousand.

At over 1000, the benefit-cost ratio of this investment is remarkably favourable.

What would be the cost- benefits for an average European economy of 10 million people

Its estimated that an annual investment of €300 thousand would lead to the following benefits annually by 2030:

- 1.8 TWh of electricity savings
- €390 million in net costs
- €408 million of power bills
- 640 thousand tonnes of CO_2 emissions
- €15 million of extra industrial revenues
- and increase industrial employment by 350.

Why is there a funding deficit?

Lack of broader awareness of the benefits of Ecodesign Market Surveillance, bundling of funding decisions with other concerns and low visibility of the impacts of non-compliance are the main reasons historically Ecodesign market surveillance has been under resourced; however, when it has been resourced, e.g. for consumer products compliance levels have risen considerably.

Where might funding come from?

In principle linking Ecodesign market surveillance with national energy sector investment frameworks and related instruments such as the Energy Efficiency Directive's Article 7 requirements that set national energy savings targets and obligations on energy suppliers could provide a greater and more coherent source of funding than allocations through normal safety-related market surveillance. The provisions under the pending Goods Package could also be a stimulus to increased resource allocations.

Appendix B – Market surveillance methodology flow charts

Final flowchart

The final flowchart setting out the INTAS market surveillance methodology for industrial fans under current circumstances is show in Figure A1.

The final flowchart setting out the INTAS market surveillance methodology for large power transformers under current circumstances is show in Figure A2.

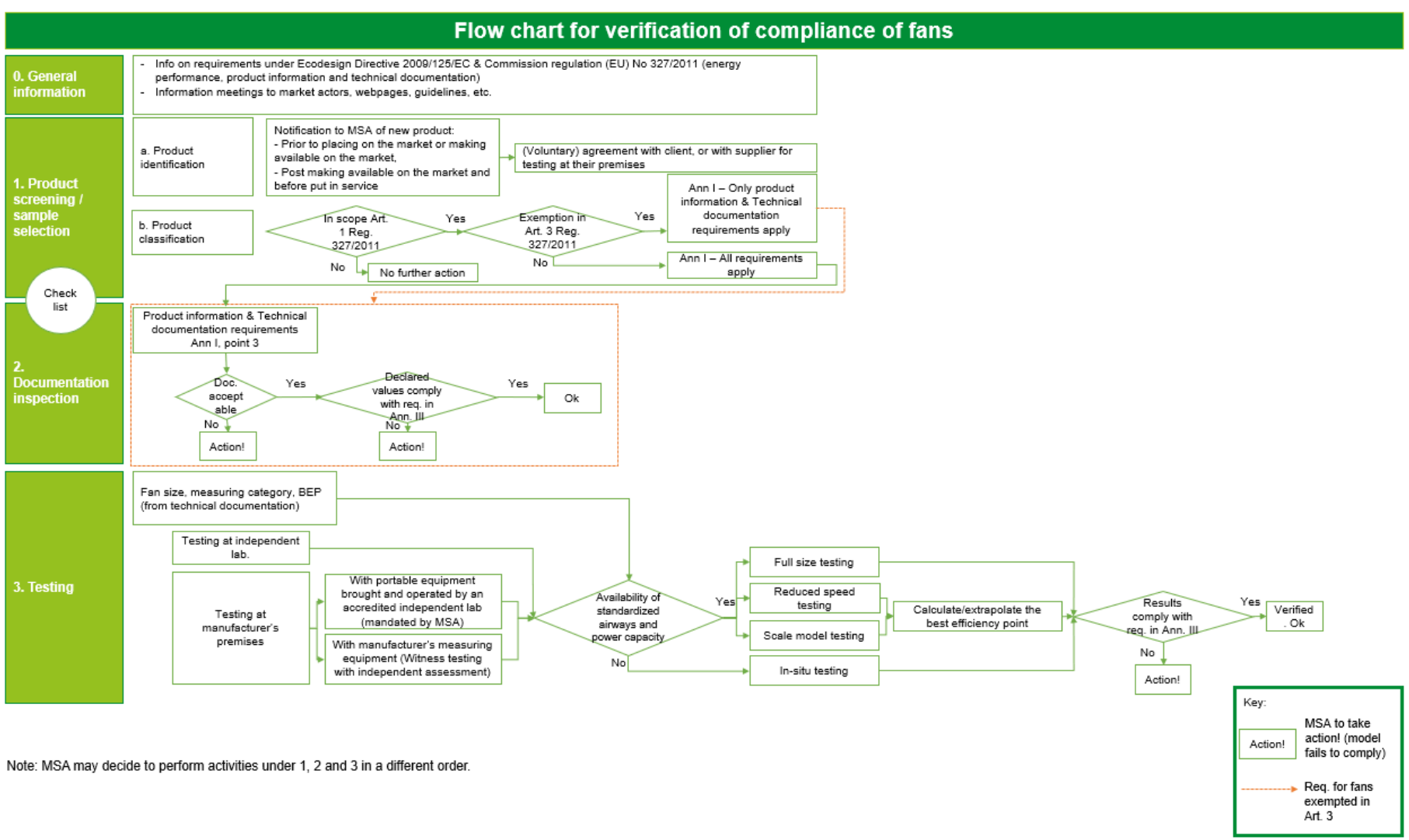
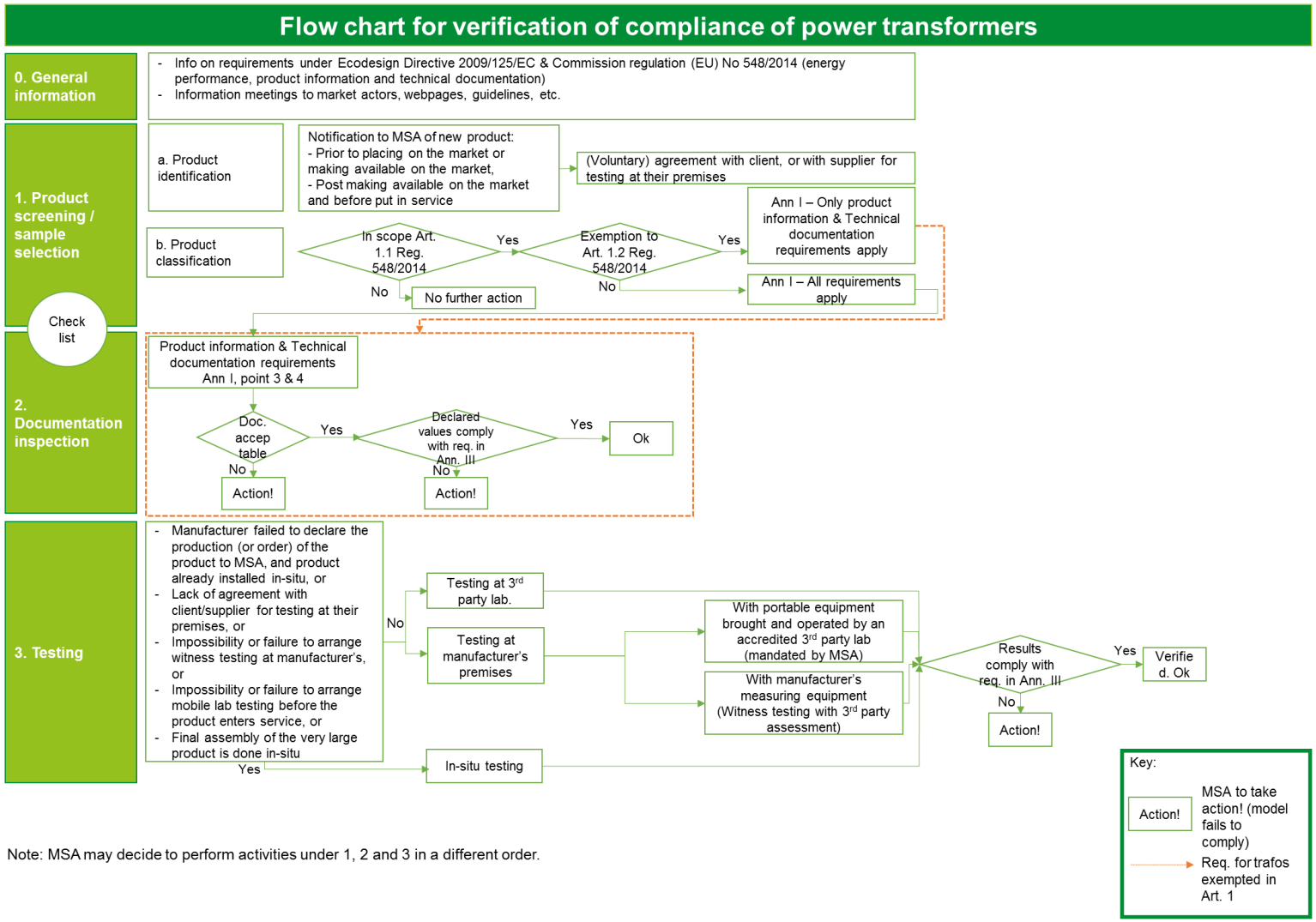


Figure A1. Final flowchart of the INTAS methodology for large industrial fans

Co-funded by the Horizon 2020 programme of the European Union



Note: MSA may decide to perform activities under 1, 2 and 3 in a different order.

Figure A2 Final flowchart of the INTAS methodology for large power transformers

Co-funded by the Horizon 2020 programme of the European Union

Abbreviation list

BCR	-	Benefit cost ratio
EC	-	European Community
ED	-	Ecodesign
EEA	-	European Economic Area
EPC	-	Engineering, Procurement and Construction
EU	-	European Union
FAT	-	Factory Acceptance Test
kVA	-	kilo-volt amps
kW	-	kilo watts
MSA	-	Market Surveillance Authority

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More information
about the INTAS project activities
and all of its results
are published on:

www.INTAS-testing.eu

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