The Setting of Progressive Energy Efficiency Performance Standards for Products through the Ecodesign Directive

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Abstract

The European Union (EU) sets mandatory energy efficiency standards for appliances and other energy-relevant products through the Ecodesign Directive. The standards set so far have improved energy efficiency in a very cost-effective way. The main aim of the Directive is to remove the worst performing products from the market. There is a discussion on the potential to set more progressive legal standards in order to more rapidly improve the energy efficiency of products, or even induce 'technology forcing', which can be defined as standards requiring technology that goes beyond what is currently available on the market. This contribution examines different legal design options to set progressive energy standards and discusses the advantages and drawbacks with applying stricter standard-setting. The European ecodesign standards for vacuum cleaners are analyzed as they provide a recent example of standards with elements of technology forcing.

Keywords: Energy efficiency, eco-design, MEPS, eco-design directive, technology forcing

1. Introduction

A number of policies and regulations have been introduced to deliver energy efficiency and reduced greenhouse gas emissions at the EU and national levels.[1] They include carbon and energy taxes, emission trading, green and white certificates, and energy labeling. One well-tested policy approach is the setting of mandatory standards for the energy efficiency of appliances, such as dishwashers, TVs, and electric motors. Such binding standards can be found in virtually all OECD countries, with the most progressive standards usually set in the United States (US), Japan, or the European Union (EU).[2] These regulations are usually referred to as minimum energy performance standards (hereafter MEPS).[3] Improved energy efficiency brings several benefits, such as industrial productivity, energy security, less air pollution, and reduced greenhouse gas emissions.[4] Several studies have indicated that binding standards for buildings, vehicles and products are the most cost effective policy options for quickly reducing energy use and the release of greenhouse gases;[5] in some cases stan-

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1 National policies are required in order to reach the 20-20-20 targets; for a summary of member state targets see: http://ec.europa.eu/europe2020/pdf/targets_en.pdf [2015-03-20].

2 For an overview see P. Waide, International comparisons of product policy, Report, 2013, Coolproducts: Brussels.

3 MEPS can be defines as "*legally enforced thresholds for an individual product or group of products, set at a level to exclude a proportion of the worst performing products in the marketplace*", see M. Ellis, Experience with energy efficiency regulations for electrical equipment, Report, International Energy Agency, 2007, p. 18.

4 International Energy Agency, Capturing the multiple benefits of energy efficiency, report, 2014.

5 International Energy Agency, Energy technology perspectives, 2010; McKinsey & Company, Pathways to a low-carbon economy, 2009; J.Thema et al., The impact of electricity demand reduction policies on the EU-ETS: modelling electricity and carbon prices and the effect on

dards brings energy savings that are more or less "free" as it costs little for manufacturers to reduce energy consumption of appliances.[6] Pricing policies such as taxes and trading schemes are also important in the long term in order to reach energy and climate targets, but pricing policies will not lead to quick improvements in all sectors as they do not directly address various market barriers,[7] whereas energy efficiency standards quickly reduce energy use.[8] Sachs states that MEPS for products and fuel efficiency standards have been the main drivers for energy efficiency in the US so far: "*Although information disclosure, financial incentives, and other softer alternatives to regulation play a vital role in reducing energy demand, these should be viewed as complements to efficiency regulation, rather than replacements*."[9]

In the EU, binding energy efficiency standards are set through Regulations for specific product groups, which are adopted under the Ecodesign Directive.[10] Recent evaluations indicate that the Directive has reduced electricity use in a very cost effective way.[11] As the main life cycle impacts from most energy related products are related to energy needed during usage[12], setting mandatory energy efficiency standards can lead to significant energy savings (cf. section 2.1.2); according to some estimates the potential for reducing greenhouse gases under the Directive until 2020 is similar in scope to the savings under the EU-ETS.[13]

But MEPS may not greatly reduce the total energy use associated with use of appliances, due to so-called "rebound effects": as appliances become more energy efficient we can afford to use them more, or use the monetary savings to purchase other stuff.[14] Further, both the quantity and variety of products are increasing and the growth of single households increase the number of products per capita. Globally, the use of electricity for information and communications technology (ICT) and consumer electronics (CE) has been growing more than 7% annually since 1990 and many products also grow in size. Even taking into account foreseen significant energy efficiency improvements, electricity consumption by appliances is projected to increase by

industrial competitiveness, Energy Policy 60, 656–66, 2013.

6 B. Boardman, Achieving energy efficiency through product policy: the UK experience. Environmental Science and Policy 7(3), 2004, 165–76. Studies have established that the payback of energy efficiency programs is usually much greater than the investments, cf. Ellis supra note 3, p. 20–22

7 For a discussion on market barriers see C. Stenqvist, Industrial energy efficiency improvement – the role of policy and evaluation. Doctoral Dissertation, Lund University, 2013.

8 Cf. McKinsey & Company, supra n.5; J. Thema et al., supra n.5.

9 N. Sachs, Can We Regulate Our Way to Energy Efficiency? Product Standards as Climate Policy, 65 Vanderbilt Law Review, 2012, 1631–1678, p. 1633.

10 Directive 2009/125/EC of the European Parliament and of the Council 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products, OJ 2009 L 298/10.

11 ECOFYS, Economic benefits of the EU Ecodesign Directive, Report, 2012; CSES/Oxford Research, Evaluation of the Ecodesign Directive, Final Report to the European Commission, 2012.

12 This is because electricity production – especially when based on the burning of fossil fuels – is often associated with substantial environmental impacts, such as air pollution and the release of greenhouse gases.

13 ECOFYS, supra n. 11, p. 5; European Commission, Less CO2: Ecodesign is as important as the Emissions Trading Scheme, available: http://ec.europa.eu/enterprise/magazine/articles/sustainable-industry-innovation/article_11045_en.htm [2015-06-01]. Note that a direct comparison is difficult as the scope of both pieces of law will change. The EU-ETS is currently not delivering to its potential because of several problems, for an overview see e.g. CarbonWatch, What's needed to fix the EU's carbon market?, Policy Brief, July 2014; S. van Renssen, Policy watch: Carbon market rescue, Nature Climate Change 5, 297–299, 2015.

14 It is estimated that rebound effects in the developed world will mean that at least 30 % of energy efficiency gains will be "swallowed" by increasing consumption. For an overview see J. Jenkins et al., Energy emergence: Rebound and backfire as emergent phenomena, Report, The Breakthrough Institute, 2011.

250% by 2030.[15] Since it is not politically acceptable to stop consumers from buying more and larger appliances, nor easy to curb current lifestyle trends, we may need to set even more stringent energy efficiency standards for appliances in order to curb the growing need for electricity. While the level of "progressiveness" of the current standards set vary between product groups, the main focus of standards set under the Ecodesign Directive so far have been to exclude the poorest performers from the market, and implicitly to trigger diffusion of better performing products. Therefore many researchers believe that there are opportunities to set stricter standards without increasing costs for manufacturers or consumers. Stricter standards, together with quicker updating of outdated standards, could lead to more rapid energy savings.[16]

But we face some problematic issues here. The Ecodesign Directive is not necessarily the best instrument to promote progressive standards; instead we could make use of other policies such as energy labeling, consumer subsidies and public procurement in order to promote the best performing products. Secondly, a relevant question is how more stringent can be set in practice. A most fundamental question is whether MEPS should be used to induce so-called 'technology forcing' – which can be defined as a regulatory standard that cannot be met with currently available technology?[17] Technology forcing has sometimes been successfully induced through environmental law,[18] but is quite controversial. Some researchers argue against the use of MEPS standards to induce technology forcing for appliances as they may act as a barrier for innovation.[19] Other studies conclude that technology forcing entail both promises and risks.[20]

The topic of MEPS and progressive standard setting has received very limited attention by legal scholars.[21] This contribution will therefore investigate the case for more progressive standard-setting under the Ecodesign Directive. *The issue is quite topical as recent research in both the EU and the US indicate that MEPS could be more progressive as the cost of energy efficient products decrease more rapidly than estimated;*[22] the costs for the most energy efficient products are reduced quite quickly, which means that more stringent standards would not be costly for consumers. More stringent MEPS can thus make both environmental and economic sense.

The next section outlines the main elements of the Ecodesign Directive, the estimated potentials savings, and the methods applied for standard-setting. This is followed by a discussion on the shortcomings of the directive in setting progressive standards, and potential ways to address these shortcomings. Section three outlines how binding standards could best interact with other instruments for energy efficiency in a policy mix, and provides examples of progressive stan-

[15] OECD/IEA, Energy Use in the New Millennium: Trends in IEA Countries, 2007, Paris; OECD/IEA, Gadgets and Gigawatts: Policies for Energy Efficient Electronics, 2009, Paris.

[16] CLASP, Estimating potential additional energy savings from upcoming revisions to existing regulations under the ecodesign and energy labelling directives: a contribution to the evidence base, Report, 2013; H.-P. Siderius, The role of experience curves for setting MEPS for appliances, Energy Policy 59, 2013, 762–772.

[17] D. Gerard and L. Lave, L., Experiments in technology forcing: comparing the regulatory processes of US automobile safety and emissions regulations, Int. J. Technology, Policy and Management, Vol. 7, 2007, 1–14, p. 1.

[18] Id.

[19] Sachs, supra note 9, p. 1665–1667.

[20] K. Lane, K. et al., The role of technology-forcing standards and innovation to dramatically accelerate product energy efficiency, Proceedings of the ECEEE 2013 Summer Study.

[21] An exemption is Sachs, supra n. 9. Sachs argues against technology forcing MEPS, and therefore does not elaborate on legal options for setting more stringent standards.

[22] Siderius 2013, supra n. 16; Van Buskirk, R. D. et al., A retrospective investigation of energy efficiency standards: policies may have accelerated long term declines in appliance costs, Env Research Letters 9(11), 2014.

dards and technology forcing in environmental product law. This is followed by a discussion on options for setting more progressive standards. The current media backlash against some MEPS is also discussed. Section four analyses the recently adopted ecodesign standards for vacuum cleaners to provide an example of how the issue of progressive standard-setting has been dealt with for a specific product group. The paper ends with some concluding remarks.

2. The Ecodesign Directive

2.1 Key elements of the directive

The Ecodesign Directive provides a framework for setting ecodesign requirements for energy-related products. Its initial scope included "energy-using" products, but this scope was extended to include all "energy-related" products in 2009. This means that not only energy-using products (TVs, dishwashers, boilers etc.) are within the scope of the Directive but also products such as windows, insulation material and water-using appliances. Vehicles are however excluded.[23] The Directive can in principle be used to regulate a vast number of life cycle aspects, but energy efficiency is the key focus. The directive was considered a necessary piece of regulation as other policy approaches (e.g. energy labels, eco-labels and consumer information) were not enough to encourage cost-efficient design solutions among producers.[24]

The main objective of the Directive is to ensure free movement on the Internal Market (i.e. within the EU) of products in compliance with the MEPS, and simultaneously contribute to energy security and climate mitigation.[25] The Directive is a so-called framework directive. It does not create binding requirements for products by itself but provides a framework, which allows for setting compulsory ecodesign requirements – so-called implementing measures (IMs) – for various product groups through Commission regulations (comitology). All manufacturers and importers that import or sell their products in the EU must comply with the rules. The actual requirements include the MEPS, but also include functional requirements, to ensure that all products are of sufficient quality. Voluntary undertakings (self-regulation) by industry are considered to be a valid alternative to mandatory MEPS under certain conditions.[26]

There are two types of mandatory product requirements, often referred to as "implementing measures" (IMs) (see Annexes I-II in the Directive):

> 1) *Specific requirements* set limit values for products, such as maximum energy consumption or water consumption during use. These are rather straightforward, although the process of measuring e.g. energy use may in practice be quite complicated;
>
> 2) *Generic requirements* do not set specific limit values. One example concerns mandatory information to consumers about how to use a product in an energy efficient way.

There are criteria for the development of implementing measures under the Directive (see Art. 15(5)). Set requirements should have no significant negative impacts on the functionality of the product and no adverse effects on health, safety and environment. Further, there should be no negative impact on users regarding the affordability of the product and its cost during its life cycle; no negative impact on competitiveness;

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23 Art. 1(3).
24 Cf. Boardman supra note 6.
25 The Directive is adopted under Art. 95 of the Treaty establishing the European Community [now Art. 114 in the TFEU]. Art. 6 of the Directive contains a free movement clause.
26 Annex VIII.

no imposition of proprietary technology and no excessive administrative burden. While these criteria could in principle be very constraining for the possibility to set strict MEPS, it has been possible in practice to set MEPS for a wide array of product groups, and there have been no major legal battles over this issue.

Often requirements are set *in two tiers*: this means that a certain improvement of product performance must be in place by a certain date in the near future whereas a more stringent standard comes into force at a later date. This means that manufacturers have to improve product design in the short run, but have reasonable time to adjust to more stringent criteria. This is because manufacturers will need some time to undertake research and design, and adjust production; it is often costly to make design and production changes abruptly, whereas medium and long term changes can be aligned with product design cycles and investment decisions.

Standards are set through a complex legislative process.[27] A preparatory study with legislative proposals for each product group is performed by consultants, and discussed by various stakeholders. Legal proposals are usually changed several times before final MEPS are adopted.

2.1.1 Setting MEPS: MEErP and LLCC

When conducting preparatory studies consultants make use of the *Methodology for Ecodesign of Energy-related Products* (MEErP), a common methodology developed for performing life cycle assessments in the context of the Directive.[28] This involves a technical, environmental and economic analysis,[29] including: The selection a number of representative variants of the product; analyzing technical options for improving the environmental performance (conditions: economic viability, no significant loss of performance or usefulness for consumers); identify the best-performing products and technology available on the market. The consultants should also consider the performance of products available on international markets and benchmarks set in other countries' legislation. An impact assessment is always undertaken, with relevant calculations on issues such as energy saving potential and costs for industry.

Concerning energy consumption in use, the level of energy efficiency guiding MEPS is *the life-cycle cost minimum to end-users*, or 'least life cycle costs' (LLCC) for representative products; as stated in Art. 15 and the Annexes of the Directive. In Annex II it reads: "*Concerning energy consumption in use, the level of energy efficiency or consumption must be set aiming at the life cycle cost minimum to end-users for representative product models, taking into account the consequences on other environmental aspects.*" While life cycle costs may include disposal costs and other costs, in reality it is the 1) product purchase price and 2) the running electricity costs that are the main elements in the calculation, while other parameters may

[27] For more details about the process see C. Dalhammar, Promoting energy and resource efficiency though the Ecodesign Directive, Scandinavian Studies in Law Vol. 59, 147–179, p. 159–162.

[28] R. Kemna et al., MEErP 2011 Methodology Report: Methodology for Ecodesign of Energy-related Products: Final report prepared for the European Commission, 2011. The Directive also has rules on the methodology in Art. 15 and the annexes. The MEErP contains an EcoReport, a simplified MS Excel life cycle assessment (LCA) tool. It calculates impacts caused by a product during different phases of its life-cycle, i.e. production, use, and end-of-life. The required inputs for the EcoReport are a Bill of Material (BOM), energy consumption data, and economic data. The EcoReport delivers environmental impact indicators and Life-Cycle Cost (LCC) as outputs.

[29] For details about the process see P.J.S. Siderius and H. Nakagami, A MEPS is a MEPS is a MEPS: comparing Ecodesign and Top Runner schemes for setting product efficiency standards, Energy Efficiency 6:1–19, 2013.

be neglected.[30] Typically, in most cases, the most energy efficient products are more expensive to purchase than the less energy efficiency (average) products, but have smaller operating expenses during their lifetime. By combining these two costs, we get the LLCC for a given product.

Several jurisdictions around the world set MEPS for products, including the US, Australia and Japan. Siderius and Nakagami recommend that the EU applies one important element of the Japanese Top Runner scheme: that the actual best-performing product on the market serves as benchmark for standard-setting, rather than the application of LLCC. This would allow for the introduction of stringent standards at an earlier date.[31] There are significant differences in different jurisdictions when it comes to the methods for setting requirements, and the stringency of product standards. Waide recommends that the EU should more consistently monitor the requirements applied in other markets.[32]

2.1.2 Estimated energy savings from MEPS set under the Directive

Estimated savings from the 12 first regulations are provided in the table below. These savings are calculated up until 2020. Savings accumulate over the years as old products are substituted for new, more efficient ones.[33]

Adopted regulations	**Estimated savings (yearly by 2020)**
Standby and off mode losses, electric & electronic equipment	35 TWh
Simple set top boxes	9 TWh
Domestic lighting	39 TWh
Tertiary sector lighting (office and street)	38 TWh
External power supplies	9 TWh
Televisions	43 TWh
Electric motors	135 TWh
Circulators	23 TWh
Domestic refrigeration	8 TWh
Domestic dishwashers	2 TWh
Domestic washing machines	1.5 TWh
Fans	34 TWh
= 376 TWh = 14% of the electricity consumption of the EU in 2009	

Table 1. Expected savings under the first 12 implementing measures adopted under the Ecodesign Directive in combination with energy labelling.[34]

Electric motors stand out as the product group with the highest savings; it is expected that regulations can save about 5 % of the current EU electricity use. Significant savings are also expected from MEPS entering into force in the near future. Especially important are regulations for heating systems, which can save more electricity than electric motors, and regulations for ventilation.

We may conclude that the potential of eco-design standards to reduce energy use and CO2 emissions is significant. Even if there will be some rebound effects (see section 1), eco-design

30 This is discussed in Siderius supra note 16; Kemna et al. supra note 28.

31 Cf. Siderius and Nakagami, supra note 29, p. 15–16.

32 Waide, supra note 2, p. 3, 8.

33 There is an ongoing project that aims to provide detailed data on savings from eco-design and labeling, see R. Kemna, Ecodesign impact accounting: Part 1 – Status Nov. 2013, Report to the European Commission, May 2014.

34 These are estimates made by the European Commission, mainly based on: P. Bertoldi and B. Atanasiu, Electricity consumption and efficiency trends in European Union Report, Joint Research Centre, 2009.

standards can help stabilize energy use, or even decrease energy use in developed countries.[35] It is crucial that we set standards as quickly as possible, and make them stringent, in order to stabilize energy use; if standards are delayed, consumers will keep on purchasing inefficient appliances until regulations enter into force, wasting energy.

2.2 The stringency of standards: main shortcomings of the Directive and possible improvements

The savings projected from the MEPS substantial but still they constitute only the "low-hanging fruits". Standards could most likely be more stringent without additional costs for consumers.[36] While the use of the LLCC methodology should ensure the best life cycle costs for consumers in theory, this is only correct under certain assumptions. A risk is that the LLCC is used in a rather "static" way, and there are several issues connected to the use of the LLCC. First of all, the price premium for the best products may not be related only to energy efficiency. Producers can often charge a premium for top performing products, and make a premium profit on the top segment of the market, but this is not primarily due to the fact that the product is energy efficient.[37] Instead, it tends to be other functions that consumers are willing to pay extra for. This means that that the purchase cost for consumers is not necessarily a good benchmark for setting standards in all cases. Further, we may find that the most energy efficient products cost more than less energy efficient models, but we also know that the consumer price for energy efficient equipment decreases rapidly over time when the numbers of units increase, as the costs of manufacturing of new product models goes down quickly. Thus, by using so-called "learning curves", which makes use of estimations for how quickly the costs on new product models will go down, we can set stricter standards without risking that the consumer prices will be very high. Therefore, Siderius argue that applying "learning curves" – showing how quickly the costs for top performing products decrease over time – should be used in the setting of standards: if we can assume that the costs for top performing products will decrease rapidly in the near future, it is possible to set stricter standards. He shows that at least twice the energy savings for driers and refrigerator-freezers could be gained, compared to the current approach, by applying learning curves in calculations. He also argues that in some cases product price calculations may have to be complemented by other methods. This goes for products under rapid technological change where the price has little correlation with the energy efficiency, such as TVs where LED technology has recently been introduced. Then it may make sense to enter into agreements with producers on a reasonable legal standard.[38]

Thus the price difference between the average product and the top performers tend to be treated as "static", whereas in reality the price for top performers tend to decrease every year due to learning effects. This typically means that we should be able to set stricter standards than we do because the least life cycle costs for top performers will be lower every year.

A second problem is that the LLCC calculations may mean that we set strict standards too

[35] There are some signs that electricity use may decrease in OECD countries, cf. E. Toulouse et al., Energy consumption of household appliance and electronics by 2030: a modelling and forecasting exercise for France, paper, proceedings from the ECEEE2015 Summer Study. In developing countries the electricity use is expected to rise.

[36] Cf. Siderius 2013, supra note 16, and van Buskirk et al., supra note 22.

[37] Siderius, supra note 16, p. 763.

[38] Siderius, supra note 16, p. 771.

far into the future, i.e. the manufacturers have several years before they must comply with standards. In the Japanese Top Runner scheme, it is possible to set stricter requirements earlier.[39] Siderius and Nakagami therefore recommend that the EU applies one important element of the Japanese Top Runner scheme: that the actual best-performing products on the market serve as benchmark for standard-setting, rather than the application of LLCC as the method.[40]

But the lack of stringency for some EU eco-design standards can be attributed to other factors as well. One is the lengthy legal procedures which make the process for standard-setting – and updating of existing standards – cumbersome. The time between the start of the preparatory study and the coming into force of the legal requirements is quite long:[41] For the first 12 regulations adopted, the time span varied between 3.5 and 6.7 years, with an average of almost 5 years. The reasons for the long processes include extensive stakeholder consultations, understaffing in the Commission, and limited funding provided to make preparatory studies compared to the US and Japan;[42] if there are deficiencies in the studies, the process will be delayed. The problem with the long process is that standards may not be able to keep up with technological developments, but also that it is cumbersome to update them when technological progress makes this possible and relevant. It also makes is harder to account for upcoming technologies. The preparatory study on TVs suffered from this problem:[43] it was not possible to take into account new emergent technologies, such as TV's based on LED technology which improves energy efficiency, when standards were set. This also means that the standards are sometimes "outdated" already when they enter into force, and manufacturers can too easily comply with them.

Another crucial weakness in the EU scheme is that the monitoring is an issue for the Member States[44], and the practices vary a lot throughout the EU.[45] Some member States have poor market surveillance and therefore there are a high number of non-compliant products on the Internal Market.

Thus, current standards could be more stringent, and they hardly act as drivers of innovation among the progressive manufacturers in most cases. We should acknowledge that the Directive is not explicitly intended to trigger eco-innovation, but rather to remove the worst product from the market. But even so, the standards could often be set tighter – and remove more products from the market – without the risk of significantly higher consumer prices, or the risk that some manufacturers would be forced out of the market.

There are several potential remedies to the problems identified above. Some actors stress the need to change the "least life cycle cost" methodology in order to allow the setting of stricter standards.[46] This would however require a change in the text of the Directive. The proposed use of 'learning curves' – i.e. making assumption that

[39] Id., p. 770.
[40] Cf. Siderius and Nakagami, supra note 39, p. 15–16.
[41] H.-P. Siderius, The ecodesign and energy labeling process – challenges and solutions, Paper, EuP Network, 2012. Another reason for delays can be that the consultancy reports are not of sufficient quality.
[42] Siderius, supra note 41; Waide, supra note 2.
[43] R.D. Huulgaard and A. Remmen, Eco-design Requirements for Televisions: How ambitious is the Implementation of the Energy-using Product Directive? Report, Danish Ministry of the Environment, 2012.
[44] See Art. 3 and 7 of the Ecodesign Directive. Art. 12 obliges Member States to cooperate, but this cooperation do not seem to be very advanced as yet.
[45] J. Krivošík and S. Attali, Market surveillance of energy labelling and eco-design product requirements, Report, ECEEE, 2014.
[46] D. Jepsen et al., Product-related top runner approach at EU level, Federal Environment Agency Umweltbundesamt, Dessau-Rosslau, 2011, p. 9–14; Cf. Siderius and Nakagami, supra note 29, p. 15–16.

the price of the best-performing products will quickly go down, which allows for stricter standard setting[47] – will probably not require any change of the legal text however. This is because the least life cycle cost (LLCC) concept stipulated in the Ecodesign Directive does not seem to set any impediments for assumptions used in calculations. When setting the LLCC standards, learning curves could be taken into account.

Siderius proposes several changes in the legislative process that could speed up the setting of standards, such as the use of stricter deadlines.[48] He also points out that the consultants contracted by the Commission to do the preparatory study must have right qualifications, otherwise the studies will be insufficient and this will delay the later steps in the legislative process.

3. Progressive standard setting and technology forcing

3.1 The importance of a policy mix

Before discussing the nature of technology forcing in product policy, it is important to point out that MEPS are not the only policy that can promote more efficient technologies. There are several other instruments that can be used to stimulate the development of new technologies, and/or promote market uptake of new technologies. The policy mix for product energy efficiency includes several policy instruments, most notably:

1) *Energy labeling*, which include:
   a. Mandatory regulation, where producers must label some product groups according to their environmental performance. EU demands this for a growing number of product groups including fridges and freezers and vacuum cleaners;[49]
   b. Voluntary labeling programs, such as the Energy Star[50] label.

2) *Eco-labeling*, which are voluntary, as manufactures choose if they want to apply for them or not. They include the EU eco-label as well as regional (the Nordic Swan) and national (e.g. Germany's Blue Angel) schemes. Eco-labels focus on several environmental aspects of a given product group, and energy efficiency is one criteria applied for eco-labeling of appliances.

3) *Public procurement*, which may promote more energy efficient appliances through technical descriptions and award criteria. Procurers can also apply life cycle costing (LCC) when deciding the most economically beneficial tender: by basing calculations on both purchasing and running costs (e.g. costs of electricity and maintenance), as opposed to only the price, more expensive products with lower running costs can be promoted.[51]

4) *Technology procurement and public procurement for innovation (PPI)*, which governments can make use of to trigger the development of new, more energy efficient products on the market. Typically, man-

47 Cf. Siderius, supra note 16.

48 Siderius, supra note 41, p. 8–12.

49 Standards are set through regulations adopted under the Energy Labeling Directive; Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products, OJ 2010 L 153/1.

50 For more information see http://www.eu-energystar.org/ [2015-03-20].

51 The new EU procurement directive has an article devoted to LCC; see Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC, OJ 2014 L 94/65, Art. 68.

ufacturers can hesitate to develop better products if they are uncertain about the demand, and governments can make use of various tools (e.g. competitions with prizes, and/or a guarantee that a certain amount of new products will be sold through agreements with municipalities) to encourage the development of new products. For instance, the US and Sweden has successfully used procurement to induce the design of more energy efficient appliances such as fridges and freezers.[52]

5) *Subsidies for consumers and industries*, which is used to increase the market uptake of energy-efficient products, which lead to larger market shares and – over time – lower prices for energy efficient products, due to economies of scale and learning effects. Subsidies have been applied for many product groups including heat pumps, windows and energy-efficient appliances.

6) *Taxes and charges for energy and electricity* may influence some consumers and businesses to invest in energy efficient products – in combination with labeling which help the consumer to identify such products – but generally have limited influence.

7) *R&D and demonstration projects* are used to trigger fundamental research into new solutions, but generally it takes several years until the solutions reach markets.

These policies are often applied simultaneously in a policy mix. The various policies can then interact and support each other in various ways, cf. figure 1.[53]

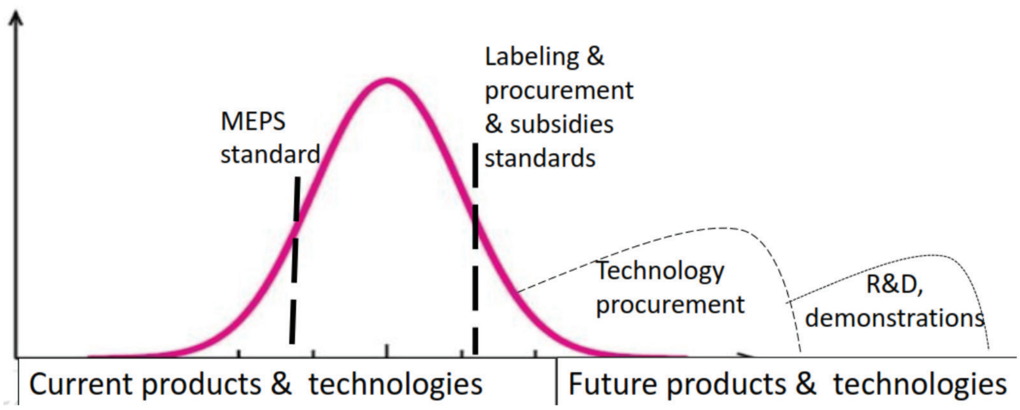

Figure 1. Interactions of policies for product energy efficiency

[52] For an overview of practices see C. Dalhammar and C. Leire, Miljöanpassad upphandling och innovationsupphandling som styrmedel, Rapport till Upphandlingsutredningen, chapter 5.

[53] See e.g. S. Birner and E. Martinot, Promoting energy-efficient products: GEF experience and lessons for market transformation in developing countries, Energy policy 33:14, 2005,1765–1779; Sachs, supra note 9; Boardman, supra note 6.

In the figure, the normal variation curve depicts an 'ideal' product group ('current products and technologies'): the worst performers (i.e. the least energy efficient products) are found at the left side, and the best performers to the right. If a mix of policies is enacted, MEPS will remove the worst-performing products from the market (the products left of the dotted line on the left side are no longer allowed in the EU), whereas eco-labeling, energy labeling and public procurement criteria can be set so only the best performers can comply (those to the right of the dotted line to the right). Over time, MEPS and labeling/criteria are strengthened, pushing all manufacturers to develop products with better environmental performance, pushing everyone to the right. This obviously works best if criteria in MEPS and labeling/procurement are coordinated, and in the best case updated simultaneously. Thus, *the main role of the mandatory standards set under the Ecodesign Directive is to make sure the worst-performing products are removed from the market. They currently provide limited incentives for the manufacturers with the best-performing products in most cases. This means that other instruments are required to stimulate eco-innovation among the front-runners*.

In order for this interaction to be optimal, the requirements of MEPS should be coordinated with those in labeling and procurement. Otherwise, we may run into problems. For instance, if requirements in energy labeling are not updated often enough, a product may get a high ranking though it does not comply with MEPS (if the MEPS are recently adopted) and is banned from the EU market. This would lead to confusion and undermine consumer confidence in the policies. For this reason, the Commission has started to coordinate the process of setting requirements in the Ecodesign and Energy labeling directives. But there is less coordination of MEPS and eco-labeling and procurement criteria.[54] A challenge is that some policies, such as MEPS, are mainly pursued at the EU level, whereas procurement and labeling schemes are mainly applied at the national level. This provides a challenge to proper coordination of policies.

If governments know that better performing products can be designed with current technologies, they can use technology procurement (cf. above) as a tool to encourage manufacturers to develop new products (and move towards 'Future products and technologies', cf. figure 1). In cases where there is need for more radical innovations, governments can support R&D (research and development), and demonstration projects to test new technology.

As stated above, there are several policies that can drive innovation. This seems to imply that mandatory standards set under the Ecodesign Directive do not have to be very progressive, as their main function is to get the worst performers off the market. Other policies could drive innovation. While this seems plausible in theory, there are some implications in practice. First of all, instruments like energy labeling and eco-labeling tend to work best for certain types of products, such as white goods. Other products, such as TVs, PCs, servers, and standby equipment, do not have the characteristics where consumers would typically care much about energy efficiency, nor be very influenced by labeling in their purchasing decisions.

Also in industry, there is often limited information and knowledge, leading to suboptimal choices of technology, such as the choice of pumps, motors and boilers. The success of energy efficiency programs in industry is a sign that there are various market barriers for uptake

[54] C. Dalhammar et al., Addressing resource efficiency through the Ecodesign Directive: A review of opportunities and barriers, report, Nordic Council of Ministers, 2014, p. 122.

of technologies, not least imperfect information among decision-makers.[55] Otherwise, some cost effective measures would probably be undertaken without policy interventions. This implies that we should consider strengthening these standards when possible. There is also a competition argument: some industries want more stringent standards, as they are afraid that Chinese and US companies may have an advantage if their domestic standards are more stringent.[56] The fact that some industries lobbied for stricter MEPS for electric motors during the EU legislative process is a clear indication that some standards should be more progressive.[57]

Another concern is that eco-labeling is much more successful in some countries than in others. Likewise, there are great variations in the use of public procurement and subsidies throughout the EU. Also, even in cases where labels and procurement can provide incentives for eco-design, they do little to trigger innovation among the worst performers, and stricter MEPS can lead to innovative activities to all firms exporting to the EU market.

Finally, it may be considered necessary to set much more stringent standards in the future, if such will be needed to contribute to the 2-degree climate target. *For these reasons, we should explore how to set more progressive MEPS, even if the importance of other policies should not be forgotten*. In some cases it may be more relevant to improve the use of other policies than to strengthen the MEPS, but this will probably depend quite a bit on the product group at hand. Ultimately, it may be necessary to induce innovative activities by setting more progressive standards in both mandatory and voluntary instruments.

3.2 Examples of progressive standard setting and technology forcing in product oriented environmental law

There is some common understanding regarding the design of environmental law and policy instruments, which can be discerned in academic literature.[58] First of all, legal standards should be so demanding that they require serious effort among producers to reach set targets. Further, industry should be granted reasonable phase-in periods. Set targets should also be technology neutral and expressed e.g. in terms such as emissions or energy efficiency standards, or recycling levels, but not promote any specific type of technology. Standards should also be transparent, and not provide benefits to incumbents on the market e.g. by introducing market barriers for new firms; they should not be designed so they benefit domestic firms either. Further, governments may involve industry in the policy process, e.g. in the purpose of finding cost-effective policies, but be careful so that industries does not have too much influence over the target setting, or manages to lobby for policies that favor certain industry groups.

'Technology forcing' can be defined as a regulatory standard that cannot be met with currently available technology.[59] Technology forcing has been applied in several areas of environmental law, such as air emissions, vehicle standards,

55 Cf. Stenqvist, supra note 7.

56 Speech by A. Chambris, head of EU Public affairs, DANFOSS, at the workshop "Ecodesign – are we done yet?", ECEEE Summer Study, 4 June 2015.

57 E.g. Grundfos, Enormous Energy Savings to be lost if the EU does not take action: Efficiency legislation for industrial electrical motors, Position paper, July 2008.

58 Cf. e.g. M. Porter and C. van der Linde, Toward a New Conception of the Environment-Competitiveness Relationship, The Journal of Economic Perspectives, Vol. 9(4), 97–118; A. Gouldson and J. Murphy, Regulatory realities, Routledge, 1998; N.A. Ashford, Government and Environmental Innovation in Europe and North America, in: K. Weber et al. (eds.), Towards Environmental Innovation Systems, Springer: Heidelberg, 2005, p. 159–174.

59 Gerard and Lave, supra note 17, p. 1.

renewables obligations, chemical phase-out, the Montreal Protocol, cap and trade, and building regulations.[60] Some main conclusions from the studies are that: 1) the regulations must be flexible, which means that standards are set so industry does not focus solely on short term technology, and they should specify the goals but not the solution; 2) the regulation must be properly backed up by scientific arguments and strong government programs; 3) government agencies need to obtain information from industries on new and emerging technologies; this often requires fora for information exchange. Typically, setting technology forcing standards will be risky unless at least one technological trajectory is known by the policymaker.[61]

There are few clear-cut examples of technology forcing standards for product energy efficiency, where the regulator has been uncertain about whether industry can comply. We can however find several other examples in product related laws. One example concerns the Zero Emission Vehicle Mandate that was introduced in California in 1990. The aim was to stimulate environmental innovation in the motor industry by requiring that a certain percentage of the cars sold each year must be zero emission vehicles. The percentage was set to be at least 2% in 1998, 5% in 2000 and 10% in 2003. However, the Mandate was later revised and the required percentages were dropped, because the manufacturers could not deliver the required solutions. This does not mean that the policy was a failure, as it led to heavy investment in research and development for less polluting cars, which benefited the development of new technologies.[62] This example shows the difficulties in evaluating whether these kinds of laws are successes or not. The example also show the risk the legislator takes when setting technology forcing standards: *No legislator wants to back down from set policies as this would undermine the credibility of future efforts*.

In chemical policy we find examples of technology-forcing when chemicals are banned for certain uses. However, the legislator typically knows that existing substitutes exist, though the costs are not always certain. This was the case for ozone-depleting substances. Industry generally tends to underestimate the cost of compliance and costs of substitutes, and overestimate the costs for new alternatives, strengthening the case for bans.[63] But uncertainties on whether industry can find substitutes can lead to policymakers being reluctant to set stringent policies or apply bans. One way to solve this problem is to *provide exemptions*. For instance, in the case of the RoHS Directive, which bans the use of a number of heavy metals and flame retardants in electrical and electronic products, exemptions have been provided for certain components and materials, often with a set time limit.[64] An important principle is that exemptions should be limited in scope and duration, in order to achieve a gradual phase-out of hazardous substances as new innovations come about.[65] If the industry knows

60 For an overview see e.g. K. Lane et al., The role of technology forcing standards and innovation to dramatically accelerate product energy efficiency, ECEEE 2013 Summer Study Proceedings, 2017-227; D. Gerard and L. Lester, Experiments in technology forcing: comparing the regulatory processes of US automobile safety and emissions regulation, Int Journal of Technology, Policy and Management Vol. 7(1), 2007, 1–14.

61 K. Lane et al., supra note 60, p. 224.

62 R. Kemp, Zero Emission Vehicle Mandate in California: misguided policy or example of enlightened leadership?, in: C. Sartorius and S. Zundel, Time strategies, innovation and environmental policy, Edvar Elgar: Cheltenham 2005.

63 See e.g. European Environment Agency, Late lessons from early warnings: science, precaution, innovation, Report 2013/1; ChemSek, Cry Wolf, Report, 2015.

64 Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, OJ 2011 L 174/88, Annex III and IV.

65 Id., Recital 19.

exemptions are time limited they have incentives to do R&D to find substitutes.

When it comes to stringent requirements that certain percentages of products should be recycled, there has often been uncertainty on how much this would cost or whether this will have impacts on innovation. For instance, when the EU's end-of-life vehicle (ELV) Directive[66] was introduced, which introduced mandatory percentages for materials and energy recycling from cars and other vehicles, some industries claimed that the requirements for recycling were too stringent. They also claimed that there was a risk that manufacturers would use new materials and make the cars heavier in order to comply with recycling standards, which would lead to reduced fuel efficiency. This never happened, however, as it was actually possible to make cars recyclable without making them heavier. This shows how most potential conflicts are often technically solvable, as new technological solutions can solve the problems. The policymaker however needs to consult industries to ensure that such options exist, and whether industry can resolve conflicts within a reasonable timescale.

3.3 Arguments against technology forcing under the Ecodesign Directive

Sachs argues that MEPS should not be used for "technology forcing", as this would entail many risks.[67] He states that policymakers can know for certain that some innovation will take place, but not how much, and argues (p. 1666):

> "The approach taken in the United States and the EU of close consultation with industry to negotiate incremental improvements in the existing energy performance of products is quite sensible. If product standards were to become technology forcing, imposing requirements that no actor in the industry can currently meet, government runs the risk of blundering into costly and anticompetitive standards. Moreover, the implementation of product standards depends on manufacturer cooperation, and promoting incremental improvement helps to ensure that cooperation over the long term."

Sachs also provides an example of how regulation could hinder desired innovation: if stringent regulations on cell phones would have been introduced in 1999, it may have inhibited the rapid development of smart phones, as they tend to require more energy.[68] Legal standards set so far have not been a main barrier for innovation, but radical standards may actually pose a barrier to desirable innovation as manufacturers may choose not to pursue the development certain "risky" technologies which may entail long run benefits.

Sachs no doubt has a point. We could for instance imagine a situation where 3D printers were regulated now, and this would hamper future innovation. Still, we find few examples, if any, in practice were stringent legal standards seems to have hindered technological innovations. Further, it must also be a matter of how we regulate: if the law stipulates a stringent energy efficiency standard, or the phase-out of a chemical, and gives industry significant amount of time to adhere to the standards, such standards should be quite reasonable in most cases. Especially in cases where independent experts have been involved to provide input on expected future developments and the scope for technological innovations.

[66] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles, OJ 2000 L 269/34.

[67] See Sachs, above n. 9, p. 1661–1664.

[68] Id., p. 1661.

3.3.1 The anti-regulation backlash in the US and the EU

One concern with stringent standards is that they may strengthen the media backlash against MEPS that we are currently experiencing in the US and the EU. While eco-design standards for energy efficiency have worked well for several decades in the US with little critique, this has recently changed.[69] A main driver for the critique against MEPS is the increasing calls for a 'hands-off' approach by government; urging governments to stay away from market intervention. *The ban against traditional light bulbs seems to have been a triggering factor for this critique*. While there are technically and economically viable alternatives to traditional light bulbs, they do not always satisfy consumers' preferences for lighting aesthetics, as they do not replicate the light consumers are used to. While this will no doubt change – new lighting products that better fulfil consumer preferences are rapidly entering the market, and the prices go down quite quickly – the ban of traditional light bulbs have been a more 'visible' government intervention than the regulations of e.g. TVs, dishwashers, and electric motors. Government regulations are seen as imposing on consumer sovereignty, disregarding the fact that new research discredits the idea that consumer choice influences the market offers; in reality, producers, governments and other actors exercise significant influences and strongly affect consumer preferences. Nevertheless, recent critique may lead to a 'spillover' effect, where more and more MEPS are questioned in the future.[70]

Also in the EU, MEPS have recently been questioned. This seems to coincide a lot with proposed standards for everyday products like hair dryers, vacuum cleaners and coffee machines. The British media – most notably newspapers that are critical of UK's EU membership – have been especially critical, claiming that the EU standards impose on consumer sovereignty. There are even 'scare' stories hinting that some types of products may be banned although it seems highly unlikely.[71] This has caused some caution among politicians, who wishes to take public and media concerns into account.[72] EU politicians have however criticized this media coverage as being 'populist'; former Commissioner Janez Potočnik has made a strong defense of the MEPS set under the Ecodesign Directive,[73] as have current commissioner Günther Oettinger.[74]

One concern with the potential introduction of more stringent MEPS is that more manufacturers will complain about the rules, possibly leading to increased criticism over MEPS, and increased media coverage. This could undermine the Ecodesign Directive's credibility.

3.4 Options for technology forcing under the Ecodesign Directive

In section 2.2 some methods for strengthening standards were outlined. They included: the use of 'learning curves' would allow for setting stricter standards for some product groups; using a Top Runner concept instead of the least life cycle cost (LLCC) approach would allow for an earlier introduction of more stringent standards, and; by reducing the long legislative process standards would not risk becoming obsolete

69 Id., p. 1670 et seq.
70 Id., p. 1675.

71 E.g. The Telegraph, EU to ban high-energy hair dryers, smartphones and kettles, available: http://www.telegraph.co.uk/news/worldnews/europe/eu/11061538/EU-to-ban-high-energy-hair-dryers-smartphones-and-kettles.html [2014-10-25]
72 ENDS Europe, Better public relations urged for under-fire ecodesign, ENDS Europe 7 November 2014.
73 ENDS Europe, Potočnik slams 'lazy populism' over ecodesign, ENDS Europe, 6 June 2014
74 Euractiv, Oettinger lashes out at 'anti-European' ecodesign campaigns, Euractiv 13 June 2014.

once they enter into force. All these measures could help setting more progressive standards, but probably have limited effect on triggering research into new technologies and induce technology forcing.

Below we outline some potential ways forward for setting even more stringent standards and induce innovation.

3.4.1 Several tiers further into the future

As was previously discussed, policymakers would like to set standards that are so strict that new technological innovations may be required, and where manufacturers would feel pressed to engage in research, but still do not want to be in a position where they may have to cancel legislation if it turns out that manufacturers can not comply. One method that could potentially remediate this problem, proposed by some stakeholders, would be to set requirements in more than two tiers, with checkpoints along the way.[75] This also means that industries are well "prepared" for future requirements. Currently, standards are typically set so that the first MEP standard, which is usually not very demanding, enters into force 1–2 years after the regulation is adopted (e.g. in 2015 for a regulation that is adopted 2014). Usually, 4–6 years after the adoption of a regulation a more demanding MEP standard comes into force (e.g. 2018 for a regulation enacted in 2014); this provides manufacturers with some time to comply with the standards and coordinate with their product development process and design cycles. An example for how this staged introduction of MEPS is done is given in section 4, for vacuum cleaners. This staged implementation of MEPS, with two tiers, provides manufacturers with a direct incentive to reach the short term MEP and more time to comply with the stringent standard. The stringent standard is however seldom very progressive: there are typically some products – though sometimes quite few – already on the market that complies. This means that it is almost certain that most – or all – manufacturers will be able to comply with the more stringent standard.

The idea with more tiers would be to *set a requirement even further into the future* (e.g. for 2022 for a MEP set in 2014), and thus *have a third requirement set*. By introducing 'checkpoints' along the way, the legislative process can be made more flexible: if it shows over time that the mandatory standard for 2022 is likely to be too demanding as technical innovation did not happen as expected, it can be made less stringent; if technological developments have meant that the standards are too easy to fulfil for manufacturers they can be strengthened. This would allow for more radical standard-setting that could provide impetus for companies to engage in innovation, but if it turns out those standards are too demanding or too lax they can be altered. This would require that 'checkpoints' are established at certain periods.

A benefit with this approach is that, currently, introduction and updating of standards is very cumbersome. This solution would provide some flexibility. The downside is that some industries would probably lobby against such measures as much power is provided to the body that is reviewing the standards. There would probably also be complaints that industry would not be able to foresee the long term requirements, reducing the certainty regarding future requirements. The counter-argument would be that industry gets more certainty as they know the long term benchmark and thus have a target that could guide innovative activities. One problematic issue concerns how the use of a third tier with a long term target would work under the LLCC methodology (cf. section 2.1.1). In principle, certain assumptions can be made that a long term target is consistent with the LLCC

[75] This solution has been proposed by interviewees in C. Dalhammar et al., supra note 54, chapter 9.

for the consumer, but there would probably be counter-arguments, with industries claiming that an ambitious target can increase the costs of appliances in the future. The estimated price of future energy/electricity would probably be very important in such a calculation.

3.4.2 *Aspirational targets*

A somewhat softer approach is the use of 'aspirational targets'.[76] An 'aspirational target' is a target for a future standard expressed in the law, which states that product manufacturers should strive for compliance with a proposed future standard. *While the target is not legally binding, it could encourage manufacturers to engage in research for new technology if certain incentives are in place*. For instance, the target may be applied to government procurement policies, so manufacturers whose products comply can have better chances to win future procurement contracts. Thus, the success of aspirational targets is strongly linked to the coordinated use of other instruments. In fact, if the coordinated use of various instruments is performed in good way, we could question if there is a need for aspirational targets. It may still make sense to list the aspirational target in law in some cases however, as: 1) the law will provide a clear benchmark for firms regarding which standards to aim for, especially if criteria applied in eco-labelling and procurement varies among countries and regions, and; 2) legal targets can have strong influence of industry work in e.g. standardisation.

3.4.3 *Towards 'sufficiency' standards: Examples from the Energy Star criteria for TVs*

Due to several factors – the increasing number of appliances being used, a growing world population, more single households, and larger appliances being designed – MEPS can probably only reduce the growth in energy consumption rather than reduce it, at least in developing countries. More radical approaches would be needed to remediate this situation. One such approach could be sufficiency: It has been proposed that we should apply a sufficiency approach in appliance policy. It would *imply that an absolute power consumption limit is set: appliances cannot use any more power regardless of product size or functionality being offered*. In principle, this means that larger appliances or appliances with more functions may not use more energy beyond a set limit. Looking at TVs, it is quite likely that a TV could cover a whole wall in a house in the near future if we extrapolate current trends.[77] A sufficiency approach would mean that large TVs must make use of new technologies, if they are to be allowed. The typical way to regulate TVs in various jurisdictions is that TVs are allowed to use more energy when they are larger in size, though there are limits for energy use within the size categories.[78] This 'linear' approach has usually been allowed also in eco-labeling and energy labeling. But in the latest standards for TVs found in the Energy Star (version 5.0), there are some differences. A linear approach is applied for smaller models but when TVs reach a certain size (Area>1 068.0 square inches), the energy requirement is virtually flat.[79] This means that screens above a certain size cannot use more energy than smaller TVs, requiring manufacturers to develop the technology. This also means that there is an upper energy limit for TVs; future TVs cannot use more energy even if they get bigger, if they want to apply the Energy Star.

[76] Cf. Lane et al., above n. 20, p. 225 et seq.

[77] See C. Calwell, Is efficient sufficient? The case for shifting our emphasis in energy specifications to progressive efficiency and sufficiency, Report: European Council for an Energy Efficient Economy (ECEEE), 2010, p. 20.

[78] Id., p. 22.

[79] Id. p. 20–25; "ENERGY STAR® Program Requirements Product Specification for Televisions. Eligibility Criteria. Version 5.3".

However, the Energy Star is a voluntary instrument. More demanding standards can be set in voluntary instruments than in binding regulations, because appliances that cannot comply with eco-labeling criteria will not be excluded from the market. Therefore sufficiency criteria may be difficult to apply in MEPS. However, *while a sufficiency approach may be considered extreme at the moment, it may be the only way to stem appliance energy use in the future*. This is due to the rebound effects discussed previously, coupled with a growing global population. Further, it has been claimed that for product groups like TVs the large models are usually bought by well-off consumers, which can probably pay for the expensive technology applied to make the large TV energy efficient even if it increases the price significantly.[80]

3.4.4 The future: Neutral or Plus products?

In the future, it may be possible to change the whole paradigm of MEPS, and demand products that are neutral or even PlusEnergy (i.e. products that generate more energy than they use). Due to the shrinking costs of solar technology and various technological breakthroughs, such developments are not unlikely for some products, like small consumer electronics. For instance, a product can be neutral or PlusEnergy if it can charge itself with solar power.

3.4.5 Concluding remarks

There is a lot we can do to set more progressive standards for product energy efficiency, and there are some options that are likely in the short term to induce research into new solutions. The use of several tiers with flexibility embedded in the process could be one way to trigger manufacturers to engage in new research. Other approaches, such as the enactment of sufficiency standards are probably not realistic in the short term, but may become viable in the long term if required to stem the rising use of energy associated with appliances.

Clearly, if we ambitiously make use of the voluntary instruments, the need for technology forcing legal standards is reduced. The new EU Procurement Directive encourages a more ambitious approach when it comes to sustainability criteria, and encourages life cycle thinking. It may form the basis for more ambitious procurement programs

4. The case of ecodesign standards for vacuum cleaners

Here, a short account of the recently adopted eco-design rules on vacuum cleaners will be provided, in order to supply an example of the issues explored in this contribution. There are many types of vacuum cleaners; here we will mainly focus on the so-called 'general purpose vacuum cleaners' which is the type of vacuum cleaner used in most households.

The Commission ordered a study on vacuum cleaners in 2007. The final report of the consultants was delivered in February 2009.[81] In the report, it was concluded that there were good reasons to regulate vacuum cleaners at the EU level: vacuum cleaners have – unlike many other product groups – become more energy-demanding (i.e. less energy efficient) over time. Many manufacturers use high energy use as a sales argument, as consumers often believe that high energy use equals good vacuuming function. But there is relatively little correlation between effect and vacuuming function and small energy-efficient vacuums may in some cases per-

[80] C. Calwell, Speech at the Workshop "Is efficient sufficient?", 18 may 2010, Brussels (arranged by the ECEEE).

[81] AEA Energy & Environment, Work on preparatory studies for eco-design requirements of EuPs (II) Lot 17 Vacuum cleaners, Final report, February 2009.

form better cleaning than large, high-voltage machines.[82] The consultants identified a number of potential technical improvements to improve the energy efficiency, including changes to designs and construction of fans, motors, and nozzles.[83] The consultants proposed two tiers of requirements, for 2011 and 2014 respectively.

The Commission made a proposal in 2011 with a proposed text for a Directive.[84] It included functional requirements (e.g. on vacuuming function and dust re-emissions) and requirements on annual energy consumption of vacuums in two tiers. The member states and other stakeholders however had several lines of critique: they wanted rules on noise levels, more stringent requirements on input power, and higher standards for dust re-emissions.

The Commission came up with a new legislative proposal in August 2012, with more elaborate criteria on e.g. noise and energy efficiency.[85] It also introduced clear targets on input power for vacuums. There it was stated that: From 1 January 2014 rated input power of vacuum cleaners should be less than 1 600W; from 1 January 2016 less than 1 200W. These numbers were less stringent than proposed by some EU member states and stakeholders. For instance, Germany had proposed that the requirements would be 1 400W in the first stage and requirements that are "significantly more ambitions than 1 000W" in the second stage.[86]

The regulations for eco-design requirements[87] and labeling[88] were introduced simultaneously in 2013. In the final adopted eco-design regulation it was stated that:[89]

- From 1 September 2014 rated input power shall be less than 1 600W, and
- From 1 September 2017 rated input power shall be less than 900W.

The Directive also contains rules related to functions such as noise, dust pick up capacity, motor operational lifetime (to avoid vacuums that break down early), and the durability of the hose.[90] The following discussion will focus on the target for input power discussed above.

In the end, the Regulation seems to have followed the industry's line on the short term target for 2014, which is not very stringent. The target for 2017 is definitely more stringent compared to vacuum cleaners on the market today. One reason for the strengthening of standards seems to be that *manufacturers did react to proposed legislation and started to make energy efficiency improvements, which means that more stringent requirements were considered feasible during the legislative process*. This effect – that producers react already when there are signals that legislation is forthcoming – is a quite common phenomenon in environmental policy.

So, how stringent is the actual requirements adopted? In a test by the German testers Stiftung

[82] Id., p. 3.

[83] Id., chapter 7.

[84] European Commission, Working Document on a possible Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to Ecodesign requirements for vacuum cleaners, Brussels 2011.

[85] European Commission, Working document on Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to Ecodesign requirements for vacuum cleaners, 27 Aug 2012.

[86] Federal Environment Agency, Comments on the second working document on possible eco-design requirements and on the labelling document for vacuum cleaners, 7 Oct, 2011, p. 3.

[87] Commission Regulation (EU) No 666/2013 of 8 July 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners, OJ 2013 L192/24.

[88] Commission delegated Regulation (EU) No 665/2013 of 3 May 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of vacuum cleaners, OJ 2013 L192/1.

[89] Commission Regulation (EU) No 666/2013, Annex I.

[90] Id., Annex I.

Warentest of vacuums currently on the market, only three tested models using less than 900W cleaned well.[91] But since models that can pass the 2017 energy target are already on the market and performs well, the MEPS for 2017 is clearly achievable. This implies that the standards are somewhat challenging but can probably be reached by most manufacturers. Experts also believe that there is substantial improvement potential for vacuum cleaners,[92] and that a requirement in the range 700W-800W should be feasible.[93] In other words, the set MEPS are not really technology-forcing, though it will most likely provide quite a lot of impetus to manufacturers for research and development, which will possibly lead to new solutions.

The adopted requirements are a bit challenging but could have been a bit more stringent. The technical potential seems to be there to set more stringent standards, and induce more innovation, and it is unlikely that such requirements would raise the costs of vacuum cleaners to any significant extent in the future. A possible option could have been be to apply the additional, third tier further into the future as discussed previously (cf. section 3.4), and e.g. set a target for input power at 400W from 2020 onwards, to trigger more research. However, the need for stringent requirements is somewhat reduced due to the mandatory labeling requirements implemented at the same time as the eco-design requirements, which require manufacturers to include information about the vacuum cleaner's energy efficiency, cleaning performance, sound level, and dust re-emissions.[94] But it is uncertain to what extent consumers will actually read and act upon this information.

However, the timing to introduce more stringent requirements was not perfect in the case of vacuum cleaners, because the media backlash (cf. section 3.3.1) was especially strong in the case of vacuum cleaners. In a phenomenon dubbed 'Hoovergate', several news sources, have published several pieces criticizing the phasing out of vacuum cleaners with elevated power usage.[95] The criticism seems to be largely based on a false association of power usage with performance. British media has been especially critical, not least the part of media that are skeptical of EU membership.[96] The idea that bigger vacuum cleaners are better at cleaning seems to be the reigning one, although this myth was rejected in the preparatory study. The Commission has tried to set the record straight both through its own blog[97] and through commentaries in newspapers, and point out the benefits often neglected in the media debate: energy efficiency makes EU less dependent on energy import, and EU manufacturers can often benefit from the eco-design rules as they are good at quickly adopt measures to comply with high standards.

The vacuum cleaner example shows the complicated turns in trying to set a reasonable future standard to push manufacturers forward, but not set too high requirements. A third tier of requirements longer into the future could have

91 See https://www.test.de/Staubsauger-im-Test-1838262-0/ [2015-04-10]; BBC, Vacuum cleaner debate hots up, BBC web 2 Sep 2014.

92 BBC, above n. 91.

93 Cf. Federal Environment Agency, above n. 86, p. 3

94 These are found in Commission delegated Regulation (EU) No 665/2013, above n. 88.

95 Cf. J. Hunter, Consumers sucked into media vortex again, CoolProducts blog, available: http://www.coolproducts.eu/blog/media-vortex [2015-04-13]

96 Examples of critical news stories include: Mail Online, Now Europe wants to make it harder to clean your carpets with new rules BANNING powerful vacuum cleaners, November 3, 2013; Sunday Express, EU ban on vacuum cleaners is a blow to our freedoms, August 23, 2014; The Independent, This new EU law sucks more than my Hoover, August 24, 2014.

97 See "Consumers will get better vacuums than ever before", available: https://blogs.ec.europa.eu/rebuttal/consumer-will-get-better-vacuum-cleaners-ever [2014-09-30]

provided impetus to technology forcing, but since there was significant backlash in media against the vacuum regulations, it may not have been the best time to try such an approach.

5. Concluding remarks

In this contribution we have discussed MEPS set under the Ecodesign Directive, and how they could be made more stringent and even induce technology forcing among industries. MEPS can provide a very cost-effective way to quickly cut energy use and greenhouse gas emissions. The media backlash experienced under the last couple of years however indicate that the EU should progress slowly and make some efforts to explain why implemented regulations are necessary to combat climate change, improve energy security, and save money for EU consumers.

There are several options for setting more stringent standards. More progressive legal standards are especially important if other instruments, such as eco-labeling and public procurement, do not provide enough incentives for innovation among manufacturers. If voluntary approaches work well, there is less need for progressive mandatory standard-setting.

What is most important is that we make use of new research on 'learning curves' and similar approaches to set more progressive standards. The evidence indicates that we can do so without increasing costs for consumers in most product groups. Such standards may not necessarily be technology-forcing, but will induce manufacturers to more quickly speed up the energy efficiency of their products. In the future, it may be necessary to set even more stringent standards, such as 'sufficiency' standards, to induce more radical innovations and induce technology-forcing. This is especially relevant if other energy and climate policies underperform.

Traditionally, the Nordic countries have lobbied for stringent MEPS. Generally speaking, Nordic manufacturers are hardly disadvantaged by strong requirements – if they are well thought through – as they tend to serve the top end of the market.[98] There are several ways in which Nordic countries can lobby for stricter MEPS. One strategy is to lobby for the use of 'learning curves' and the application for a third tier of requirements in regulations, as well as other ways to strengthen requirements. We can also push the market forward by using green procurement and technology procurement, when applicable, as this is an area where several Nordic countries have a strong performance. Better coordination among Nordic countries could be advantage. Pushing for higher standards in procurement and labeling will aid the market transformation, and will allow also for the application of stricter MEPS over time.

Another area where Nordic countries could improve concerns the coordination of EU Ecodesign requirements and energy criteria in the Nordic Swan label. The reviews and updating of the Swan criteria seems to have been lagging behind in some cases.[99]

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98 See e.g. Dalhammar et al., above n. 54, chapters 7 and 9. There is not much research on these issues, however.
99 Id., chapter 5.