Are international product energy-efficiency policies becoming endangered species?

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Abstract

The total primary energy supply curve in OECD-countries has been nearly flat since 2000, thanks to energy-efficiency improvements on several sectors, where international cooperation has resulted in binding legislation among members of the organisation. Earlier, we studied the impacts of free-trade agreements in force among OECD-members to speculate how the prospective EU–U.S. agreement (TTIP) could affect the minimum energy-efficiency performance standards (MEPS) policy. The TTIP wasn't agreed in 2015 as estimated, and it is still being negotiated, but chances are that the political tide is changing due to recent events in Europe and the presidential elections in the USA. Instead of free trade, we could experience countries withdrawing from international cooperation, and perhaps from widely accepted technical legislation (like MEPS) as well. The Brexit has left Britain to decide how they will continue with their product efficiency policy, with several options discussed in this paper. For the case of TTIP failing its target, we will discuss alternatives to harmonized technical legislation, for example, the possible role of IEC-standards defining several levels of efficiency for products on the global marketplace. Moreover, if TTIP results in increased industry self-regulation instead of mandatory requirements, as the latest textual proposals state, certain principles presented here should be followed when deciding the product groups for such treatment. Finally, we consider how to keep MEPS in pace with technological development and even pursue improvements if there is less ambition for international cooperation in 2020s.

Introduction

After the fall of the Roman Empire, common technical standards were lowered considerably for centuries. Roman standards for transport and water supply infrastructure were abandoned, though they were superior in efficiency compared to other contemporary standards. Reasons for this are unclear, but they certainly are connected to lack of centralized organization pushing for higher standards in construction of roads and aqueducts. A more recent example is the dissolution of the Soviet Union in 1991. They had a standardization system called GOST in force on many different fields, including appliances and industrial products. The system proved its worth by living through the regime transition, and it is still in use in Commonwealth of Independent States (CIS) which consists of 11 former Soviet Republics. Surprisingly, these standards did include also energy-efficiency provisions, such that, for example, the measured energy efficiency class of a Mockba-refrigerator from 1970s was nearly EU's Energy Labelling class A (Krivosik 2016). However, Figure 1 partly explains that. The Mockba was copied from 1950s American refrigerators, which were also very efficient, compared to late-1960s or early-1970s units.

Since 2000, the energy-efficiency requirements in European Ecodesign and U.S. Federal and State level regulations, as well as Australian, Japanese, and few others, have developed seemingly independently. However, OECD trade deals with their aim to remove tariffs and barriers to trade, have ensured that economies have to follow each other in standards setting to

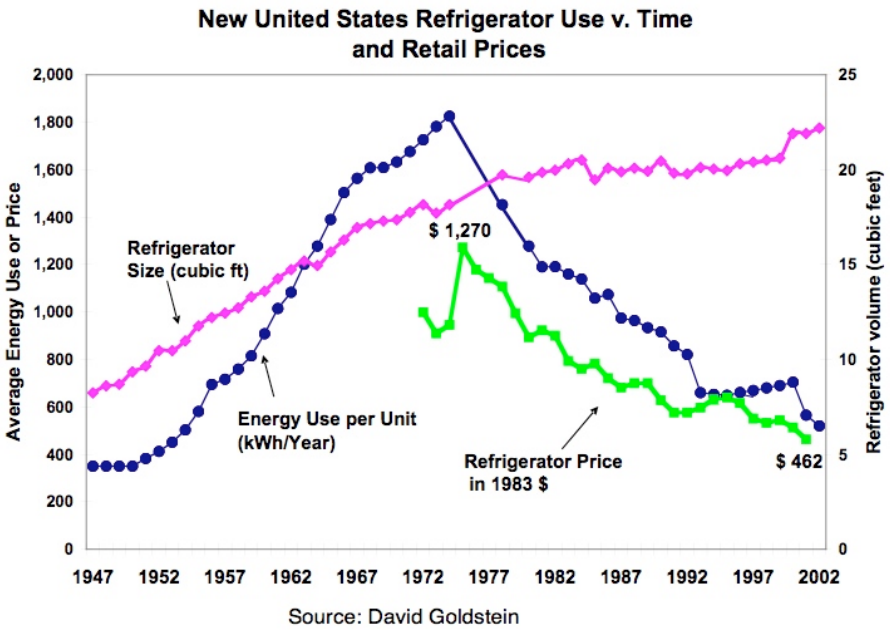

Figure 1. U.S. refrigerator energy use between 1947–2002. Mid-1950s models consumed the same (kWh/year) as an average fridge of mid-2000s. However, average cabinet volume has doubled.

maintain their competitive edge. Thus, the outcome is that the product groups regulated and the actual efficiency provisions are relatively similar everywhere.

Our earlier paper concentrated on free-trade agreements, especially how product policy is considered in different trade deals and what should be taken into account in terms of MEPS-policy when the trans-Atlantic TTIP agreement is negotiated (Hartikainen 2015). But during the last year, political changes have apparently reversed the international order of free trade, open borders, and increasing cooperation among nations. It remains to be seen how Brexit in the UK, the Trump revolution in the USA, French presidential elections, and other events will change that order, but this paper is written for policymakers who are seeking alternative ways to continue the propitious development of increasing energy efficiency in products and services.

There are two ways to achieve an international agreement resulting in common technical parameters for products that in turn set the levels for public safety and/or energy efficiency. One is through binding legislation, prepared and enforced by governmental actors, while the other one is agreements among industries, typically administered through technical standardization organizations (ISO, IEC, and ITU). If governments become reluctant to negotiate wide-ranging international agreements due to political reasons, the role of industrial organizations and NGOs should be strengthened. NGOs (non-governmental organizations, such as environmental or consumer rights watchdogs) have been instrumental in lobbying decision makers to adopt more ambitious targets for efficiency. Here we are making an argument that in the future they should perhaps focus more on the industrial organizations in their efforts.

In this paper, Section I discusses success stories from established fields, like the one-watt initiative, and presents an example of power supply efficiency levels adopted by all major industrial economies. Section II takes us to a tour in history to see how societies cope with sudden or gradual change in centralized governance, in terms of trade policy. Section III proposes solutions for the UK (and maybe others) how they could keep up with product policy of their trading partners, while Section IV concentrates on self-regulation issues and international standardization as an alternative to governmental regulation. Conclusions and future outlook are in Section V.

SECTION I. SUCCESS STORIES OF INTERNATIONAL EFFORTS IN PRODUCT ENERGY EFFICIENCY

Energy efficiency initiatives can succeed even in the face of opposition of major countries. The IEA's one-watt initiative to reduce standby power in appliances is one example. OECD economies with major appliance manufacturing centres initially opposed the initiative, but smaller countries strongly supported it (Meier 1999). During the 2000s, the resistance finally weakened and the initiative became translated into national legislations. In just a few years, standby and off-mode consumption of home appliances has fallen sharply to 1 watt and below. This can be confirmed with market surveillance reports from the Nordic countries, where compliance rates are above 95 % of tested appliances (Huang 2016). Several economies mandate 0.50 W or even 0.30 W as a minimum, depending on product type. Already in 2011, the average passive stand-by power of home appliances in Australia had fallen to 1.1 W, from 3.7 W average in 2005 (Maia 2011). One can assume that such trend has continued since that study, and currently the standby powers are well below 1 watt, possibly below 0.5 W.

The power supply efficiency levels are given by Roman numerals (I–VI) on the nameplate of each external power supply (EPS). While several other markings are different among economies, this one is harmonized everywhere. It all started in 2004, when the California Energy Commission (CEC) implemented the first mandatory efficiency requirements. In the early 1990's, it was estimated that there were more than a bil-

lion EPSs in active use in the USA alone. The efficiency of these power supplies could be as low as 50 %, with remarkable "no-load" consumption. Experts calculated that without efforts to increase efficiencies and reduce "no-load" consumption, these EPSs would account for around 30 % of total electricity consumption in less than 20 years (Schnabel 2012). Today, the USA mandates level VI for new EPSs while in the EU level V is the minimum. The Environmental Protection Agency (EPA) estimates that efficiency regulations for EPSs implemented over the past decade have reduced energy consumption in the USA alone by 32 billion kilowatts, saving $2.5 billion annually and reducing CO_2 emissions by more than 24 million tons per year.

MEPS for electric motors issued by IEC includes a set of predefined energy performance thresholds applicable for most 0.12 kW–1,000 kW electric AC motors (IEC 2014). The IEC standard for electric motors does this by designating four distinct energy efficiency classes: IE1 to IE4; and many regulators (including the EU and USA, Japan, China, Korea and Australia) have made use of these within their regulations, such that currently the IE3 (Premium efficiency) class is the minimum, making it a truly global performance standard for motors.

These examples show that if efficiency thresholds (ladders) are set internationally, they will first gain wide acceptance as a system, and then regulators can choose the levels mandatory in their economies.

One more example is worth presenting here: the Energy Star. The idea of the program is that products carrying an Energy Star mark consume 25 % less energy than required by the U.S. federal MEPS. While in the EU the program covers only office equipment (computers, displays, imaging equipment, UPS, and enterprise servers), in the U.S. it includes also domestic appliances, heating/cooling/ventilation, electronics, and lighting. In addition, the program is adopted by Canada, Australia, New Zealand, Japan, and Taiwan, thus making it an international success story.

SECTION II. HISTORY OF EVENTS SHAPING THE TRADE CULTURE

The Roman Empire was, among other attributes, an economic free trade area. Goods and services spread by utilizing those well-built roads, and merchants were able to travel long distances safely and relatively quickly to the far corners of the Empire, by sea or land routes. The Romans imported a great variety of raw materials: iron, lead, leather, marble, olive oil, perfumes, purple dye, silk, silver, spices, timber, tin and wine. Their main partners for trading were Spain, France, the Middle East and North Africa. Manufacturing of products took place in Rome, the largest city in the world with over a million inhabitants around 100 AD.

The Byzantine Empire, successor of Rome until 1453, had a similar trade history. Both traded also with China and Persia through the Silk Road. That trade was so important for the Chinese that they extended the Great Wall of China, especially during the Ming Dynasty, to protect traders from attacks of nomadic groups from the north. Trade flourished, and it was also encouraged by the governments, as growth in the economy meant more taxable revenue. Many goods carried a mark of origin or were stamped to guarantee purity, weight or authenticity. (Cartwright 2013)

The *Provincia Britannia* exported mainly lead, tin and wool products. Imports from Rome were wine, olive oil, pottery and papyrus. British traders relied on the Roman legions to provide security services within the Empire. When that collapsed and Europe was overrun by Barbarians in the 5th century, there was no guarantee for traders that their products would get through. Thus the trade ended, and the economy was localized in all of Western Europe. The need for marking of products and other standardized procedures came to an end.

Between the 14th and 17th centuries, a trade group called Hanseatic League operated from the coast of the North Sea to the coastal areas of the Baltic Sea, thus extending from London to present-day St. Petersburg, with Lübeck as the capital city,

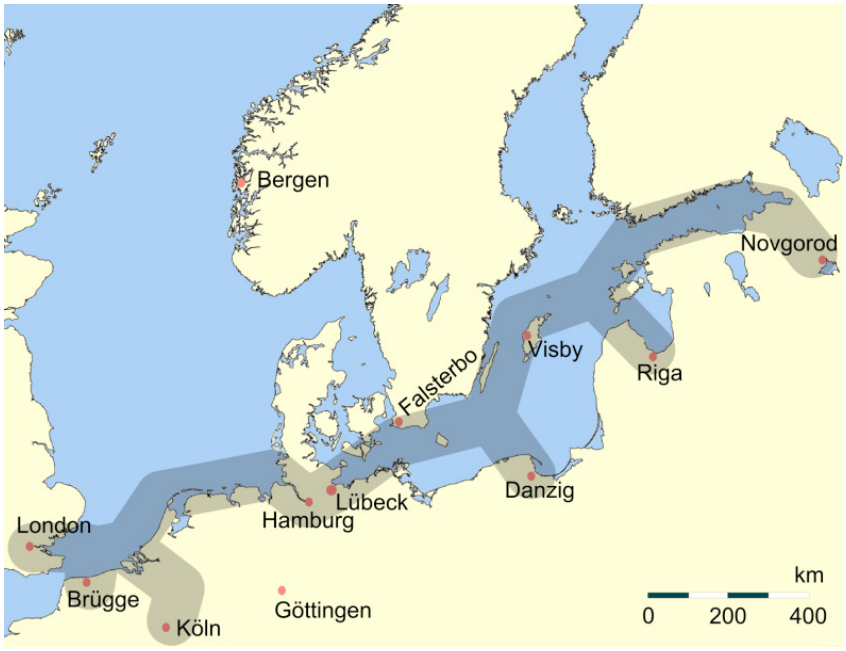

Figure 2. Main trading routes of the Hanseatic League.

shown in Figure 2. It is widely considered as a forerunner for the European Union, not only as a free trade zone, but also as a balancer between greater political interests and identities of individual member states/regions.

The North Sea and the Baltic Sea became safe for sailing after the Vikings gave up piracy and raids in the 11th century. The League primarily traded timber, furs, tar, copper and iron ore, wheat and rye, and manufactured goods. However, during the 17th century, one by one the trading posts along the route, or *Hansa-kontors* as they were called, were closed due to increased national interests and rising tensions between member countries. Thereafter Dutch and English merchants took over the European trade. In fact, the whole World trade was controlled first by the Dutch in the 17th century, and shortly afterwards by the English until the end of the 19th century. As a legacy, the standardization of sea trade and of trade regulations derives from the practices of this League (Porten 1994).

At the end of the First World War in 1919, the United States defined the values and norms of the international system in the context of the peace agreement. But only after the Second World War, General Agreement on Tariffs and Trade (GATT) was negotiated, and it became a multilateral agreement regulating international trade. According to its preamble, its purpose was the "substantial reduction of tariffs and other trade barriers and the elimination of preferences, on a reciprocal and mutually advantageous basis." It was negotiated during the United Nations Conference on Trade and Employment in 1947. The collapse of communist regime in Eastern Europe and the rising influence of developing countries increased the need for new rules, and thus GATT was replaced by World Trade Organization (WTO) in 1994. WTO has aimed towards global trade agreement, but since its Doha development round negotiations collapsed in 2008, regional trade agreements have been on the rise, until recently (WTO 2017).

Recent Development in the United States

The Trump Administration in the USA favours bilateral trade agreements and withdrawing from wider trade pacts, like the Trans-Pacific Partnership (TPP) and Trans-Atlantic Trade and Investment Partnership (TTIP). The administration also wants to, at a minimum, renegotiate the North American Free Trade Agreement (NAFTA). (Trump 2017). Together, these actions will create a whole new landscape for world trade. International energy efficiency policies cannot be promulgated through trade agreements so alternative mechanisms will be needed.

In the USA, clashes between federal and state level energy policies have happened in the past. In the 1970s, the state of California created the first energy efficiency regulations in the face of federal attempts to pre-empt them as illegal barriers to interstate commerce. Later, during the Reagan administration (in the 1980s), the federal government strongly opposed energy efficiency regulations, even though they were mandated by US Congress. The Administration sought to create a "no-standard standard" to both eliminate the standard and pre-empt California from creating its own. The courts eventually ruled against the federal government in this case, but the Trump administration could conceivably try a similar tactic.

Individual states have now been pre-empted by the federal government in setting efficiency standards if the federal government already has a standard in place. Thus, if the federal government weakens a standard, California (or another state) could not enact a stronger version. There are two possible exceptions. First, a state may regulate emissions (rather energy use). However, it must first demonstrate a unique need, such as excessive air pollution caused by that appliance. California used this strategy to cut emissions and increase the fuel economy of road vehicles. Second, a state could regulate the *system* efficiency of a package of inter-operating products, such as HVAC components (Heating, Ventilation, Air Conditioning). In this way, the state avoids dictating efficiency of a single product, but compliance is possible only by exceeding federal efficiencies. This approach has not yet been tested.

The Trump Administration's plans regarding MEPS and voluntary specifications have not yet been articulated. MEPS represent the kind of regulations that the Trump administration aims to eliminate. These regulations will require some time to unwind and bi-partisan opposition to removing them could still emerge. Government support of test methods will most likely be reduced at the same time because they are funded through the same budget items. Enforcement and compliance activities will almost surely be reduced.

A recent Executive Order (Trump 2017/2) requires that two regulations must be eliminated for every new regulation issued. The Order states, "For fiscal year 2017, which is in progress, the heads of all agencies are directed that the total incremental cost of all new regulations, including repealed regulations, to be finalized this year shall be no greater than zero, unless otherwise required by law or consistent with advice provided in writing by the Director of the Office of Management and Budget". Depending on the exact mechanism for its implementation, this Executive Order could potentially stop all new MEPS and their updates.

At the time of this writing, a Secretary of Energy has been nominated but not yet confirmed. The Department of Energy has been operating on "continuing resolution", that is, at the same funding level as the previous year. The disagreements are so severe that the continuing resolution may extend into the 2018 fiscal year.

For decades, the US MEPS policies have operated largely independently of international trade agreements. This independence is likely to grow as its own programs diminish or are eliminated and trade frameworks are removed. The US will probably be less internationally active promoting its own levels of efficiency and more restrictive in accepting international levels and technical standards. The exception may be Energy Star, which has a tradition of obtaining an international consensus on many of its voluntary specifications. Some American appliance manufacturers have benefitted from MEPS or have undertaken major investments to comply. To protect these investments in the event that MEPS are eliminated, the manufacturers are increasing support for Energy Star's voluntary programs.

SECTION III. SOLUTIONS FOR BREXIT(EERS)

The United Kingdom decided on June 23, 2016, to leave the European Union for good. While it is still unclear whether it's going to be a "soft Brexit" or "hard Brexit", the landscape of European product policy will definitely change, and new trade rules are needed. The new rules should be considered also because it may be that other countries are joining the "Exit"-movement in the near-to-middle term.

One often mentioned option for the UK is the so-called Norway-model, meaning membership in the European Free Trade Association (EFTA) that together with the EU form the European Economic Area (EEA). As our earlier paper states, the EFTA members are practically just adopting the EU regulations without much power to influence them. For the UK, that would translate as "soft Brexit".

Another option is the Swiss-model, a bilateral agreement with the EU, which allows the Swiss to either follow the EU regulations or amend them to suit their interests. In terms of products policy, that would be a "semi-soft Brexit".

For "hard Brexit", a new trade agreement is needed between the UK, and the EEA. It should be based on WTO rules, such that the UK retain their current energy-efficiency regulations, but leaves room for national development of them and somehow attaches the UK experts into development of new EU regulations that the UK could then adopt through their own process.

Whatever the model adopted by the UK it is likely to have a significant impact on the speed and nature of product energy efficiency policies adopted in the UK, the EU and the rest of the world. The UK is currently the 5th largest economy in the world and a major importer of products. Depending of the type of product concerned, manufacturers aim to ensure that their products comply with the legal requirements in place in all the major economies to maximise their market access. Thus, regulatory fragmentation among the major economies could create a dynamic where there are more potential sources of regulations, and hence more prospects for one of these economies opting to raise the bar and set more stringent requirements than has hitherto been the case. While this notion may be expected to be true in general, it is germane to consider the specifics of the UK's involvement in the EU process, the drivers of UK policy, and the positions which could be expected in the future.

The UK is more of a consumer of products than a producer and hence does not always have a domestic manufacturing industry who's interests it is seeking to protect. It was a strong supporter of the energy labelling and Ecodesign Directives when they were first adopted, and has been one of the most proactive EU Member States in arguing for and implementing product energy efficiency policy since. The precise focus of UK energy policy fluctuates depending on which political party is in power and their main concerns; however, the fundamentals have remained relatively constant in recent years across successive Labour, Conservative-Liberal Democrat and purely Conservative led administrations. All three of these parties backed and still support the UK Climate Change Act of 2008 which locks into place legally binding reductions in CO_2 emissions compared to 1990 levels. The Act makes it the duty of the Secretary of State responsible for Energy and Climate Change to ensure that the net UK carbon account for all six Kyoto greenhouse gases for the year 2050 is at least 80 % lower than the 1990 baseline. Under the terms of the Act carbon reduction budgets towards the 2050 target are set every 5 years. Progress in meeting the targets is assessed by the responsible line ministry, but is also scrutinised by an independent Committee on Climate Change. Both the line ministry and the Committee regularly produce analyses to demonstrate, or consider how likely it is, that the current basket of energy policy measures will lead to the reduction targets being met and this remains a major driver of UK energy policy development. In addition, UK energy policy is strongly influenced by the need to maintain energy security, provide value for money and minimise energy poverty for disadvantaged households. This is unlikely to change with the UK's departure from the EU unless currently marginal political parties with little interest in addressing climate change assume power and repeal the Climate Change Act.

With this policy background and the traditions already established of the UK being one of the most vocal advocates for ambition in product energy efficiency measures, it is quite possible that the UK will seek to be more ambitious than the EU with respect to its product policy settings. This is most likely to manifest itself for product types where the UK's usage is higher than the EU average – such as for clothes dryers – and hence where the level of efficiency corresponding to the point of least life-cycle cost for the end-user is higher than in the EU average. It could also be the case that UK product efficiency regulations move more rapidly than the EU's for products where resistance by powerful manufacturing lobbies has led to a cautious policy progression in the EU.

On the other hand, the UK regulatory process is likely to remain strongly linked to the EU process for some time to come – even if a hard Brexit pathway is followed. At present the EFTA are passive takers of EU regulations including Ecodesign regulations. In the event of a soft Brexit, the UK would continue to be obliged to adopt EU product policy rules if it follows the Norwegian model but surrender its voting rights to influence their nature. Like Norway today, the UK would be given observer status during EU regulatory processes, be able to submit information into the regulatory deliberations, and be able to comment on the draft regulations, but would have no voting power and hence would have a greatly-reduced impact on the development of EU regulations compared to remaining an EU member (the UK currently has the same voting power as Germany, France and Italy). The Swiss model is a variant on this. Switzerland has no voting power in the derivation of EU product policy regulations, is required to align their policy with the EU's, but is allowed to set more stringent requirements than the EU does. As a result, Swiss product policy for energy labelling and Ecodesign is generally aligned with the EU's but for some products – such as clothes dryers – it has set more stringent energy efficiency requirements.

Under a hard Brexit scenario the UK would not be bound to align its product policy with the EU's at all; however, as the EU's product policy objectives generally align with the UK's, and the regulatory effort and cost of developing such regulations is very significant, the UK is more likely to remain a taker and/or adapter of EU regulations than it is to establish a fully resourced process to create wholly distinct regulations of its own – at least within the initial years following the leaving of the EU.

But what impact will the UK's exit have on the EU's own product policy process? As mentioned above the UK has been a strong supporter of proactive product energy efficiency and environmental policies and has also provided a substantial part of the EU's budget. If a hard Brexit involving full withdrawal from the Singe Market and Custom's Union take's place, other EU member states would need to increase their budgetary con-

tributions to cover the shortfall, or reduce the scale of EU activity. Even if UK maintains full access to the Single Market via a soft Brexit pathway involving ongoing contributions to the EU's budget, the loss of the UK voting block may result in a slowing of the ambition of product policy development, as one of the more proactive players withdraws. Thus under a Norwegian-model soft Brexit scenario, the UK would be bound to adopt EU product policy regulations, but their voice would no longer count during their development, and a proactive voice in favour of more progressive regulation would be lost from the EU policy deliberations. This could see a slower rate of progress in EU policy development, and no freedom for the UK to set its own requirements thereby reducing the pace of product energy efficiency improvement in both economies – albeit that the EU process would continue to benefit from UK budgetary contributions.

Under a hard Brexit scenario, the UK would have freedom to set whatever product policy regulations it saw fit, and in some cases this may lead to more stringent requirements than is currently the case in the EU. However, the UK most probably would remain a taker and adapter of EU product policies, and, as it would no longer be contributing to their formation through its voting power or budget, these may end up being less ambitious than under the other scenarios. Furthermore, while the UK generally supports progressive product energy efficiency policy settings, there is a countervailing effect from a broad-based desire to reduce the total number of regulations that businesses are subject to. Under the current administration, there is a general objective to cut regulations for every new regulation introduced. Under a hard Brexit scenario this might result in the UK either jettisoning EU product energy efficiency regulations which have the least impact, or in repackaging the requirements into a reduced number of individual regulations. If the former is the case then some energy savings would be lost.

Under a Swiss style semi-soft Brexit model, the UK would remain a taker of EU product policy regulations, would continue to make some budgetary contributions, but would have the right to adopt more stringent requirements should it choose to. Its voting influence in EU policy deliberations would be lost and hence it is quite likely that EU product policy would advance less quickly than hitherto; however, the stringency of the UK's product energy efficiency policies would be as least as stringent as the EU's and possibly higher. The UK might even make common cause with Switzerland in setting such requirements.

Given the argument expostulated above, Brexit scenarios can be imagined where the UK's product policy requirements will remain the same as the EU's or be somewhat more ambitious over a period of time; however, EU product policy settings could simultaneously be liable to become less ambitious than had the UK stayed in the EU. Of course, this is conjecture based on past policy behaviours, and the remaining EU Member States have ample resources to continue a product policy dynamic that is every bit as ambitious as today, should they choose to do so, but this simple thought exercise indicates that the EU product policy process will need to make adjustments following Brexit almost as much as the UK's will. While the potential exists for the UK to become a kind of "California of Europe" in product policy process by setting requirements that are sometimes higher than the EU's – this will not drive global product energy efficiency any faster than is presently the case, unless the EU maintains an equivalent level of progress to what it would have done had the UK not been leaving.

At the time of writing, January 2017, the UK prime minister had just signalled that the UK government was aiming to push for some kind of hard Brexit; however, it remains likely that parliament will have to approve any proposed deal and also likely that they will have to approve triggering Article 50 which initiates the UK departure from the EU. In addition, it is not clear how much of the proposed stance is a negotiation tactic rather than a final position and there is even a possibility the UK public will be invited to vote on a proposed deal in a second referendum. For these reasons at present all options remain on the table.

Impact on test procedures

The above discussion focused on the potential impact of Brexit on the pace and ambition of product policy, but it is also pertinent to consider the impact of Brexit on the technical underpinnings of product energy efficiency policy, and especially on energy performance test procedures. Currently, like other EU Member States, the UK is a member of the European standardization bodies, CEN and CENELEC, which are responsible for developing harmonised energy performance testing standards that are used to determine product energy performance in EU Ecodesign and energy labelling regulations. The UK contributes to this collective standards development effort through its national standardisation body, the British Standardisation Institute (BSI). Funding to develop and maintain these standards comes from the sale of standards by standardization bodies such as the BSI, through pro-bono contributions of experts by industry, commerce and NGO's, and through directly funded mandates from the European Commission. The UK is one of the more proactive partners in this process, and it is unclear how this will function under the various Brexit scenarios. Given the large effort involved in developing such standards, the UK is unlikely to develop their own, even under a hard Brexit scenario, unless there are deemed to be good reasons to do so; however, it is quite imaginable that the UK might adapt or tweak such standards in response to its own perceived needs. Most probably some formulae will be found wherein the UK continues to contribute to and to use such standards, but under a hard Brexit scenario there is clearly a risk of greater fragmentation in standardization, while under a soft Brexit scenario there is a risk of weaker UK engagement in the European standardization process than is currently the case.

This is against a general background of greater international harmonisation in product energy performance test procedures – and one where the EU's efforts have been a major driver of global standards. The study on the Impacts of the EU's Ecodesign and Energy/Tyre labelling legislation on third jurisdictions (Ecofys 2014) found that the same test procedures used in the EU, are widely used in many other economies around the world (see Figure 3), and while these are often due to both the EU and other economies adopting international test procedures issued through the IEC and ISO, the EU standardisation process has a very significant impact on the development of these international test procedures. It is not uncommon for test procedures

that have been developed via the European standardisation process to be adopted directly by the international standards bodies under the terms of the Vienna and Dresden agreements. As the UK is a major participant in international standardisation, it is likely that a post-Brexit solution will be sought that aims to maximise its future engagement in both European and International Standardisation efforts. But there are clearly greater prospects for fragmentation and disengagement than would have been the case had the UK remained an EU member. From both a trade facilitation and technology transfer perspective, harmonisation in performance metrics and testing is generally of a greater importance than harmonisation in regulatory performance levels and hence this issue will be one of the most critical product policy issues that needs to be addressed as the UK leaves the EU.

The Brexit and the Trump Administration's desire to sever international agreements may create a leadership vacuum in the international standards bodies. China will most likely fill this vacuum and possibly play dominant roles in many technical committees. Japan, Korea, and possibly India will also play larger roles. This means that Europe will increasingly be a receiver of test methods rather than a developer. However, the energy implications of this (admittedly speculative) shift are not clear.

SECTION IV. ALTERNATIVES FOR GOVERNMENTAL REGULATION

In this section, we propose two alternatives for legally binding international regulations. Namely, they are self-regulation within the industries, and international standardization by IEC as MEPS-setter. Both are already applied in many economies, but with a new approach, they can be used as a tool to keep energy-efficiency limits developing even if governments cannot agree on common targets.

Self-regulation

The European Ecodesign-Directive states that "Self-regulation, including voluntary agreements offered as unilateral commitments by industry, can enable quick progress due to rapid and cost-effective implementation, and allows for flexible and appropriate adaptations to technological options and market sensitivities." (EU-Commission 2009). Industry and their associations taking part in a self-regulatory action must represent a large majority of the relevant economic sector, with as few exceptions as possible. Care must be taken to ensure respect for competition rules. A "large majority" is represented by at least 80 % of the total sales, in units sold, of the products covered by the scope of the measure placed on the EU market. (EU-Commission 2010) The voluntary measure should be drafted in the form of a regulation, with mechanisms for compliance verification and monitoring. Voluntary agreements are in place for complex set-top boxes, imaging equipment, and game consoles.

In Europe, voluntary programmes for the ICT sector called Codes of Conduct (CoC) have been introduced at the beginning of 2000. CoCs are in place for Digital TV Systems, Broadband Equipment, and UPS. All these Codes of Conduct impose energy consumption limits or minimum efficiency levels for specific products in specific working modes. Participation by equipment manufacturers is on a voluntary basis, but when they join any of the CoCs they have to meet the performance level and report once a year on the energy consumption of the products they place on the market (Bertoldi 2015).

This example from European approach shows that the self-regulation can be expanded to cover several economies, as it is industry-driven, and most industries dealing with energy-efficiency of their products are operating on an international scale. However, it is doubtful whether the industries would

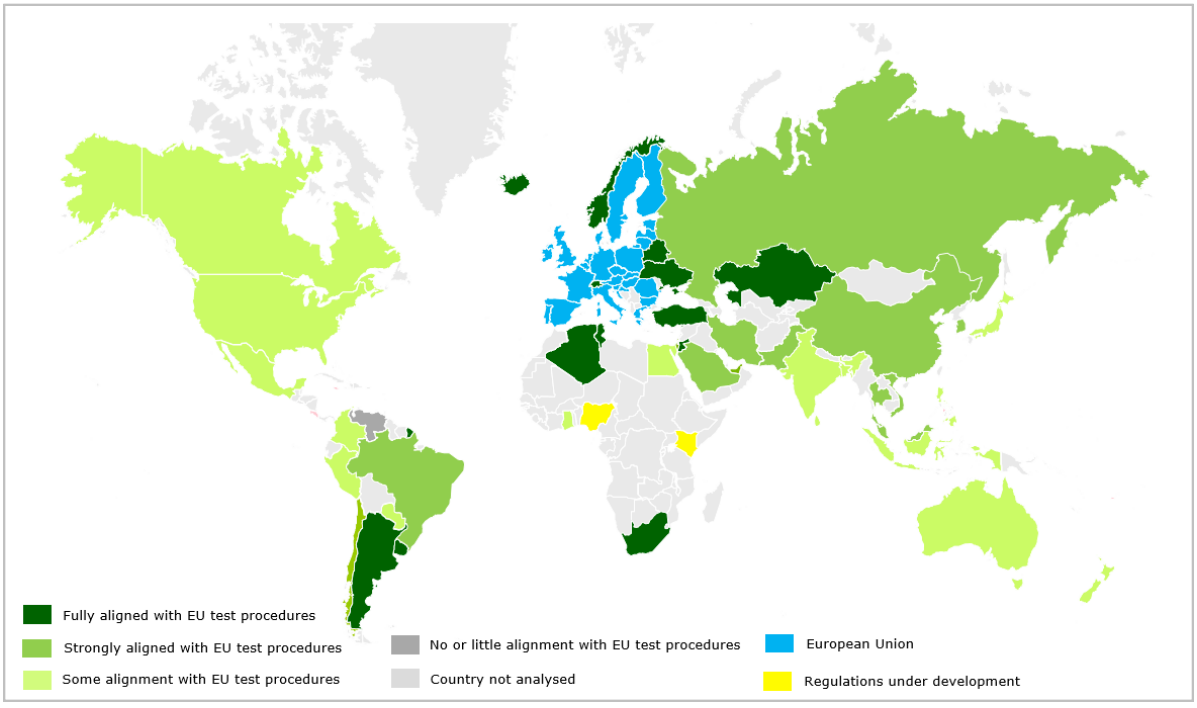

Figure 3. Degree of product energy performance similarities with EU test procedures (Ecofys 2014).

voluntarily begin to regulate itself, as they usually support de-regulation and free markets, unless self-regulation is an alternative to actual regulation.

The EU's textual proposal for the Chapter in Energy and Raw Materials in TTIP calls for harmonization of energy efficiency standards and test procedures, and states: "The Parties shall foster the voluntary adoption by industry of energy efficiency standards for goods when it is likely to deliver the policy objectives faster or in a less costly manner than mandatory requirements." (DG Trade 2016). The first (leaked) version of this had the words 'self-regulation' in place of 'voluntary adoption', but that raised opposition and was thus changed for the final proposal. What exactly is meant by 'fostering' remains to be seen.

International standardization

The IEC is a non-profit, non-governmental international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology". IEC standards cover a vast range of technologies from power generation, transmission and distribution to home appliances and office equipment, batteries, solar and marine energy as well as many others.

The IEC also manages three global conformity assessment systems that certify whether equipment, system or components conform to its International Standards. IEC standards are also being adopted as harmonized standards by other certifying bodies such as BSI (United Kingdom), CSA (Canada), UL & ANSI/INCITS (United States), SABS (South Africa), SAI (Australia), SPC/GB (China) and DIN (Germany). Figure 4 shows how truly international the IEC is (IEC 2017).

At the moment, the IEC standards include only test procedures for MEPS and tolerances for measurement accuracy. However, there is no reason why energy performance thresholds couldn't be included in the standards, in a similar manner as the electrical safety standards state that, for example, the air gap between live parts has a minimum distance in millimetres. If a majority of the members in a Technical Committee voted for inclusion of efficiency limits in certain product-specific standard, they would be included. In fact, such procedure is already under consideration by the IEC (IEC 2016) and has already been adopted in the case of electrical motors, where efficiency thresholds are included in the IEC standards. However, it should be noted that currently the regulatory framework of each economy has to approve the standards within legal regulations before they will become binding.

This seems to be the most promising route for international energy efficiency policies to gain nearly worldwide acceptance and adoption. As presently the environmental organizations and other NGOs are lobbying governments for higher ambition in energy-efficiency requirements, maybe in the future they should concentrate more on industry-dominated IEC Technical Committees who are doing to the groundwork for efficiency standards development, to ensure they include appropriate sets of energy performance thresholds within the standards.

SECTION V. CONCLUSIONS AND FUTURE OUTLOOK

An era of multilateral free trade agreements may be coming to an end, and new approaches are needed to keep product energy efficiency developing in economies. In the coming years, we may see fragmentation in regulatory processes rather than just ever deeper alignment. Historical examples tell us, that such has happened several times in the past. Optimally, the technical underpinnings could be harmonized, meaning the efficiency metrics, energy performance test procedures, and ideally the sets of energy efficiency thresholds (ladders) used internationally. The aim of that would be maximizing technology transfer and minimizing trade costs. The best pathway to be expected is standardized efficiency levels for products, similarly as with electric motors, leaving it to individual governments to select the level it prefers. But each government will also need to make decisions about innovative, non-conforming products, waivers, and other legal aspects. The increasing role of China in standardization bodies is noteworthy, while implications are still unknown.

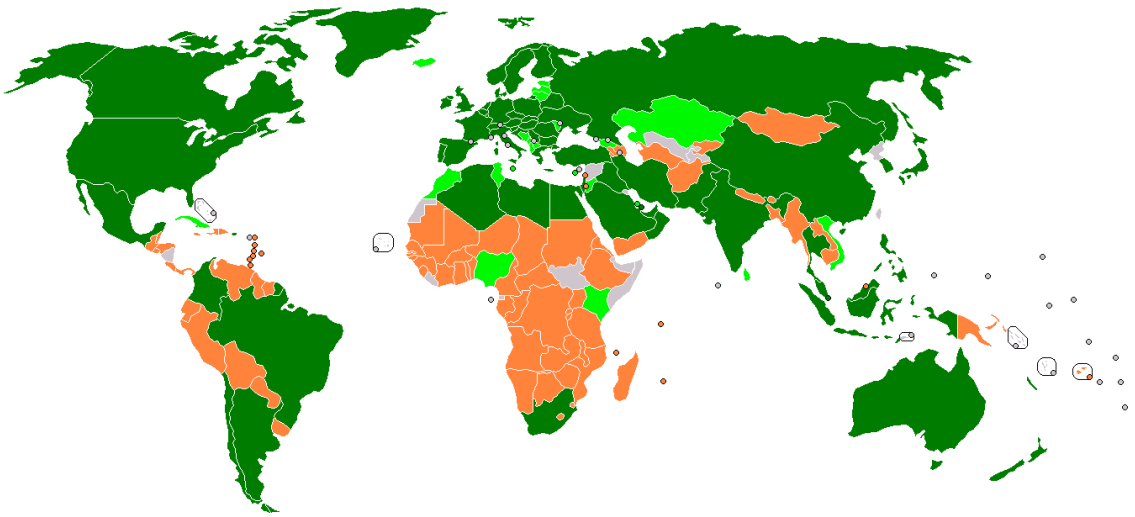

Figure 4. Full Members of IEC in green, Associate Members in light green, and Affiliates in red. It may be easier to list countries not associated with the IEC; the count is less than 10.

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