Energy efficiency through technical standards: a European approach to reduce market fragmentation and efficiency barriers

Wetenschappelijk ondersteuningsprogramma voor de normalisatie en technische regelgeving

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CONTENT

SUMMARY

In the past, technical standards have been analysed to reduce their potential role as market barrier for consumer and producer goods. The unified European market can not function properly with this type of market barriers and therefore a process of harmonisation and normalisation of technical standards coincided with the ongoing enlargement and economic deepening of the European Union.

Since the Kyoto Protocol, energy efficiency through technical standards became one of the many option to realise the greenhouse gas emissions reduction target. In this research project, we wanted to analyse how energy efficiency standards are currently integrated into climate policy and what role technical standards can play in the future development of European climate policy. Technical efficiency standards are currently developed by European and national regulators with a rather slow record of progress. A more dynamic view emerges with technical standards that are the subject of voluntary agreements between industry and regulators. In most voluntary agreements that relate to climate policy, the target is a relative reduction of energy use or emissions per unit produced. As with ‘conventional’ technical standards, these voluntary initiatives do not lead to absolute reductions of energy use or emissions. For the latter part of the analysis, we had to focus on the major developments in European environmental policy, such as the Integrated Pollution and Prevention Control (IPPC) Directive and the Integrated Product Policy (IPP) green paper. Both initiatives are no pure climate policy initiatives but they will play an important role in the further elaboration of climate policy in the EU.

The IPPC Directive will lead to a permit system for EU industry that is based on using Best Available Technologies (BAT). Firms that do not use BAT, risk to lose their operational permits. From 2008 on, this directive will fundamentally alter the use of technical regulation for industrial processes. Another consequence relates to future voluntary agreements; they will be transformed into agreements to use BAT.

In addition to the IPPC Directive, the IPP green paper will bring a policy perspective based on life cycle analysis (LCA). The environmental impact

during production as well as during consumption will be considered. Products for which the LCA-assessment turns out to be too negative will be banned from the market. The full implementation of IPP will reduce the relevance of technical standards for consumer goods (like refrigerators, …). The main conclusion from the above analysis is that the new climate policy instruments did not at all replace classical command and control regulation. The new instruments like voluntary agreements are based on technical standards and promising new developments of EU environmental policy indicate the future importance of technical regulation in EU environmental and climate policy.

The goal of this research project was to support policymaking so no technical products have been developed. The policy recommendations mainly deal with the role of technical regulation in broader policy frameworks to improve energy efficiency. The researchers to this project do not participate in working groups of normalisation organisations.

Key words: energy efficiency, technical standards, product regulation, economic instruments, IPPC

SAMENVATTING

Technische normen werden in het verleden vooral bestudeerd omwille van hun mogelijke rol als marktbarrière voor consumptie- en productiegoederen. De eengemaakte Europese binnenmarkt kan immers niet optimaal functioneren met dergelijke marktbarrières. Daarom ging een proces van harmonisatie en normalisatie samen met de uitbreiding en economische 'deepening' van de Europese Unie.

Sinds het Kyoto Protocol werd energie-efficiëntie door technische standaarden een van de vele opties ter reductie van de emissies van broeikasgassen. In dit onderzoeksproject wilden we nagaan hoe energie-efficiëntie standaarden momenteel geïntegreerd worden in het klimaatbeleid en welke rol technische standaarden kunnen spelen in de verdere ontwikkeling van het Europese klimaatbeleid. Technische efficiëntie standaarden worden momenteel ontwikkeld door Europese en nationale beleidsmakers maar de vooruitgang in deze materie is eerder traag. Een veel dynamischer beeld treedt op bij technische standaarden die de basis vormen van vrijwillige akkoorden tussen industrie en beleidsmakers. In de meeste van deze vrijwillige akkoorden binnen het klimaatbeleid is het doel een relatieve reductie van het energiegebruik of van de emissies per een eenheid product. Zoals bij 'conventionele' technische standaarden leiden deze vrijwillige initiatieven niet tot absolute reducties van energiegebruik of emissies.

Voor het tweede deel van de analyse dienden we vooral de belangrijkste ontwikkelingen in het Europese milieubeleid op te volgen, zoals de Integrated Pollution and Prevention Control (IPPC) Directieve en het groenboek over Integrated Production Policy (IPP). Beide initiatieven zijn geen zuivere klimaatinitiatieven maar zullen een belangrijke rol spelen in de verdere uitwerking van het Europese klimaatbeleid.

De IPPC Directieve zal leiden tot een vergunningssysteem voor de Europese industrie, dat gebaseerd is op Beste Beschikbare Technologieën (BBT). Bedrijven die niet produceren met deze BBT riskeren hun operationele vergunning kwijt te raken. Deze directieve wil vanaf 2008 het gebruik van technisch regulering voor industriële processen fundamenteel veranderen. Een ander gevolg heeft betrekking tot de toekomstige vrijwillige akkoorden;

deze zullen getransformeerd dienen te worden in akkoorden die BBT als standaard stellen.

Als aanvulling naast de IPPC Directieve brengt het IPP groenboek een perspectief dat is gebaseerd op levenscyclusanalyse (LCA). De ecologische impact gedurende zowel de productie als gedurende de consumptie van het goed zal in overweging genomen worden. Producten waarvoor de LCA-resultaten zeer negatief uitvallen zullen op termijn van de markt dienen te verdwijnen. De volledige implementatie van IPP zal de relevantie van technische standaarden voor consumptiegoederen (zoals koelkasten) sterk reduceren, of beter gesteld overbodig maken.

De belangrijkste conclusie van bovenvermelde analyse is dat nieuwe instrumenten voor het klimaatbeleid de klassieke ‘command and control’ instrumenten zeker niet verdringen. De nieuwe instrumenten zoals vrijwillige akkoorden zijn immers gebaseerd op technische standaarden en belangrijke nieuwe ontwikkelingen in het Europese milieubeleid wijzen duidelijk op een belangrijk aandeel van technische regulering in het toekomstige klimaatbeleid.

Dit onderzoeksproject was beleidsondersteunend van opvatting zodat er dan ook geen technische producten werden ontwikkeld. De beleidsaanbevelingen situeren zich vooral rond de rol van technische regelgeving in het algemene beleid ter verbetering van de energie-efficiëntie. De uitvoerders van het onderzoeksproject maken geen deel van werkgroepen van normalisatie-instituten.

Trefwoorden: energie-efficiëntie, technische standaarden, productwetgeving, economische instrumenten, IPPC

RESUME

Dans le passé les normes techniques faisaient avant tout l'objet d'étude en tant que des entraves possibles du marché des biens de consommation et de production. Le Marché Commun ne peut en effet fonctionner de façon optimale avec de tels obstacles au marché. C'est pour cette raison qu'un processus d'harmonisation et de normalisation allait de pair avec l'extension et l'approfondissement économique de l'Union Européenne.

Depuis le Protocole de Kyoto l'efficience énergétique aux moyens de normes techniques est devenue une des multiples options pour la réduction des émissions de gaz à effet de serre. Dans ce projet de recherche nous avons voulu examiner comment les normes d'efficience énergétique sont intégrées, en ce moment, dans la politique climatique et quel pouvait être le rôle de ces normes techniques dans le développement poussé de la politique climatique européenne. Les normes d'efficience techniques sont actuellement développées par les responsables politiques européens et nationaux mais la progression dans cette matière est plutôt lente. Une image plus dynamique apparaît lorsque les normes techniques sont à la base des accords volontaires entre l'industrie et les responsables politiques. Dans la plupart de ces accords volontaires au sein de la politique climatique l'objectif recherché consiste en une réduction relative de la consommation énergétique ou des émissions gazeuses par unité de produit. Tout comme les normes techniques 'conventionnelles', ces initiatives volontaires ne mènent pas à des réductions absolues de la consommation énergétique ou des émissions.

Pour la deuxième partie de l'analyse nous avons dû suivre les développements les plus importants dans la politique européenne de l'environnement, comme la directive 'Integrated Pollution and Prevention Control (IPPC)' et le livre vert sur 'Integrated Production Policy (IPP)'. Ces deux initiatives ne sont pas des initiatives de climat sang pur mais joueront un rôle important dans le développement continu de la politique climatique européenne.

La directive IPPC mènera à un système d'autorisation pour l'industrie européenne basé sur les meilleures technologies disponibles (Best Available Technologies – BAT). Les entreprises n'appliquant pas cette norme (BAT)

dans leur production risquent de perdre leurs permis opérationnels. Cette directive veut changer fondamentalement l'usage de la régulation technique pour les processus industriels à partir de l'an 2008. Une autre conséquence se rapporte aux accords volontaires futurs ; ceux-ci devront être transformés en accords posant le BBT comme norme.
En complément de la directive IPPC le livre vert IPP apporte une perspective basée sur l'analyse du cycle de vie (life cycle analysis – LCA). L'impact écologique à travers la production ainsi que la consommation du bien sera pris en considération.
A terme, les produits dont les résultats LCA paraissent trop négatifs devront disparaître du marché. L'application totale de l'IPP réduira l'intérêt des normes techniques dans une mesure importante pour les produits de consommation (comme les réfrigérateurs) ou mieux encore, les rendront inutiles.
La conclusion la plus importante de l'analyse susmentionnée est que les nouveaux instruments pour la politique climatique n'éliminent certainement pas les instruments classiques de type « command and control ». Les nouveaux instruments comme les accords volontaires sont en effet basés sur des normes techniques et des nouveaux développements importants dans la politique européenne de l'environnement indiquent manifestement une part importante de la régulation technique dans la politique future de l'environnement.

Ce projet de recherche avait l'idée de soutenir la politique, il n'y a donc pas eu de développement de produits techniques. Les conseils politiques se situent surtout autour du rôle des réglementations techniques dans la politique générale pour l'amélioration de l'efficacité énergétique. Les exécuteurs du projet de recherche ne font pas partie des groupes de travail des instituts de normalisation.

Mots clef: l'efficience énergétique, régulation technique, régulation de produits, instruments économique, IPPC

1. INTRODUCTION

Since the 1997 Kyoto Protocol, all developed countries and a growing number of developing countries are considering various strategies and instruments to cope with the challenge of a possibly dramatic climate change. Private actors as well as some specific countries have set up an impressive number of climate policy initiatives and action programs in which new environmental policy instruments like voluntary agreements and emissions trading play a pivotal role. The focus on new instruments does not mean that there is no role for existing technical regulation like energy efficiency standards. For specific climate policy goals that are difficult to reach with other instruments like energy taxes, new and tougher technical standards have been developed or are currently considered. Standards are especially useful when consumers are not expected to react on price signals, e.g. when high household incomes reduce the necessity to closely monitor energy consumption.

Policy interest for technical standards in general has always been related to the possible market fragmentation as a result of new national standards. This is no surprise since one of the main economic goals of the European Union is the creation of one transparent market without internal barriers that shield European producers from specific national markets. For this purpose, a significant technical harmonisation effort took place in the past. The main focus of past harmonisation efforts was related to the creation of technical scale economies as a result of larger markets: when electronic devices can be used in every European country without expensive adaptations, costs can be reduced to the benefit of consumers. Another set of harmonisation efforts aimed at the creation of EU-wide safety and product warranty standards. The process of harmonisation is not yet finished and especially the future enlargement of the European Union will require additional efforts and broader structures.

In this research project, we wonder to what extent technical standards already have been used to reach another important goal next to preventing market fragmentation and the creation of technical economies of scale, namely that of climate policy. The reduction of greenhouse gas emissions from energy use became for each developed country a binding target since the Kyoto Protocol of December 1997. We wonder when technical standards are best used to reduce energy consumption and what is the future role of technical standards in climate policy. Finally, what are the expected interactions between future technical regulation and other instruments like voluntary agreements and emissions trading?

2. METHODOLOGY

To answer these research questions, we first outlined the use of technical standards in EU harmonisation policy; which institutions are involved at the European and national level, what is their actual role and what are expected developments? We then made an assessment of the role technical standards and higher energy efficiency levels can play to realise the goals of the Kyoto Protocol. This is by definition an incomplete analysis as the Kyoto Protocol makes it possible to use international flexibility instruments. This means that national emissions reductions efforts by setting ambitious technical standards for durable consumer goods likes electric appliances and vehicles, will be completed by international emissions trading (ET), joint implementation (JI) or the clean development mechanism (CDM). It is still unclear how important the latter instruments will become by the Kyoto commitment period (2008-2012). Anyway, improving the level of national energy efficiency will of course reduce the need for additional international instruments.

For the comparative analysis of climate policy instruments it was necessary to focus on two different instrument sets, namely voluntary agreements and emissions trading. The latter two instruments are especially in Europe already in use or considered for future use. As most analysts agree that the effective and adequate integration of different climate policy instruments will become essential for the coming decade, we decide to devote enough attention to this matter. This choice resulted in an analysis of recent European proposals to improve environmental and energy efficiency, next to an overview of decomposition tools that can be used to integrate various instruments like voluntary agreements, emissions trading and technical regulation. With a decomposition analysis, the real impact of energy efficiency investments in the change of total energy use of greenhouse gas emissions can be compared to the impact of other variables like structural and output changes. Our work resulted in the elaboration of a new technique that is especially suitable for decomposing emissions and energy use. With our perfect decomposition technique, it is possible to measure the unique contribution of technical regulation and its resulting energy efficiency investments in changes in national emissions patterns.

3. RESULTS

In this section, we present an overview of publications that are related to the research project or to specific aspects of it. We then proceed with a brief overview of the most important findings. This overview is structured as a research paper. Not every single aspect of the initial research proposal will be discussed in this overview. We focus on the most important developments and findings.

3.1 Publications

Albrecht, J. (2004). Voluntary agreements and technical regulation in the future development of EU climate policy, in Thalman, P. and Baranzini, A. (Eds). Voluntary Approaches in Climate Policy (Edward Elgar, Cheltenham, UK)

Albrecht, J. (Editor, 2002). Instruments for Climate Policy: Limited versus Unlimited Flexibility (Edward Elgar, Cheltenham, UK), ISBN 1 84064 759 0, 286 p

Albrecht, J. and François, D. (2002). Negotiated environmental agreements and CO2 emissions trading, in Ten Brink (Editor). Voluntary Environmental Agreements. Process, Practice and Future Use (Greenleaf Publishing, Sheffield), 327-340

De Clercq, M. (Editor, 2002). Negotiating Environmental Agreements in Europe. Critical Factors for Success (Edward Elgar, Cheltenham, UK), ISBN 1 84064 717 5

Albrecht, J., François, D. and Schoors, K. (2002). A Shapley decomposition of carbon emissions without residuals, *Energy Policy* (Elsevier Science Ltd), Vol. 30(9), 727-736

Albrecht, J. (2002). 2001: A Climate Policy Odyssey, MilieuPraktijk, januari - februari, Jaargang 4, Nr. 1

Albrecht, J. (2002). Technical potential for CO2 emissions reductions and the scope for subsidies, in Clinch, P., Schlegelmilch, K., Sprenger, R.-U. and Triebswetter, U. (Eds.) Greening the Budget. Budgetary Policies for Environmental Improvement (Edward Elgar Publications, Cheltenham), 195-212

Albrecht, J. and François, D. (2001). Voluntary Agreements with Emission Trading Options in Climate Policy, European Environment, Vol.11(4), pp. 185-196

Albrecht, J. (2001). 'Tradable CO2 permits for cars and trucks', in: *Journal of Cleaner Production*, Vol. 9(2), pp.179-189

3.2 Research overview: main developments and findings

It is a standard outcome of economic analysis that technical standards – part of the broad and wide group of command and control instruments – provide less flexibility and efficient reductions for economic operators than economic instruments like taxes or trading systems or voluntary agreements (VAs). Standards do not provide an incentive to operators to do more than required by the standard. Furthermore, equal standards for different operators may sound fair but can have a completely different impact on total costs for each operator when the costs of reducing environmental impacts are not equal. These disadvantages can explain why currently thousands of voluntary agreements with an environmental policy objective related to process efficiency exist in industrialized countries. Next to the advantage of more flexibility and efficiency, several other factors are always mentioned to explain this evolution; industry sees VAs as a means to prevent the enactment of new laws, new regulations and new green taxes; other stakeholders see VAs as an opportunity to play a more active role in environmental policy, and finally; governments use VAs when regulatory structures are not adapted to specific policy goals (Barde, 2002).

While each factor can be appealing, we found that only the third and the fourth factor are really essential in the context of climate policy. VAs can provide more flexibility only when command and control regulation like technical standards would require immediate process investments by industry without any transitional period. As improving the energy-efficiency of industrial installations is an on-going process that started in the aftermath of the 1970s oil shocks, it would be unthinkable to enact legislation that imposes spectacular technical improvements within a very short period. Furthermore, most actual technical efficiency standards focus on energy efficiency during the consumption of durable goods (like refrigerators, airconditioners, etc. and not during production. This is a logical choice since total energy use and greenhouse gas emissions are much more important during consumption than during production. We found that especially for vehicles, emissions during vehicle use can be more than hundred times emissions during production.

With respect to the other explanations for VAs, the enactment of new regulation and green taxes can be prevented by conventional strategies such as lobbying and stressing the possibly negative consequences of the new measures on international competitiveness and employment. When the latter argument is brought very convincingly, VAs are not needed to prevent new legislation.

As climate policy departs from the conventional setting of national policymakers vis-à-vis national industry, it is by nature very complex to integrate climate policy goals and instruments in existing legislation. Climate policy deals with the way the global community will try to make its energy use more sustainable. For this goal we need important behavioural changes from all stakeholders next to the development and international diffusion of new and more efficient technologies on an unprecedented scale. Implementing effective climate policy strategies is an important test for the ultimate goal of a Sustainable Development with more sustainable production and consumption patterns.

The economic and environmental efficiency of technical standards, voluntary agreements and other climate policy instruments is subject of a growing body of research. It is difficult to come to general conclusions because there is no standard type of voluntary agreement that can be compared to the standard types of emissions trading, technical regulation or green taxes.

Technical standards share with VAs that they both have relative targets like a percentage reduction of energy use per unit produced or a specific reduction of energy use during use of the good. Just like energy or carbon dioxide (CO_2) taxes, absolute reductions in tonnes of CO_2-equivalent emissions cannot be guaranteed. When strong output growth more than compensates efficiency gains per unit produced and total emissions by the sector that faces stricter technical standards, higher absolute reductions by the other sectors in the economy or more use of international flexibility mechanisms will be needed to realize the national Kyoto reduction target. Emissions trading with an absolute cap on emissions is the only instrument that can guarantee fixed emissions reductions for the participating industries. Another advantage of emissions trading is its transparency: information on abatement costs should in principle be reflected in the permit prices. This price information can give an indication of the cost of climate policy objectives for the participating industries. This kind of information is not made public when new technical standards are imposed and is neither detectable with VAs.

Emissions trading has the disadvantage of setting up a complex new market that needs to operate under all circumstances. This is a real challenge, especially for countries without emissions trading experiences at the national level. It is often argued that technical standards and VAs do not need this type of bureaucracy and therefore offer inexpensive solutions for complex problems. This is not completely true. Negotiating a technical standard or a VA can be a relatively inexpensive process but without effective goal assessment, continuous monitoring and enforcement, the instrument will never be acceptable for many stakeholders. The cost of monitoring and enforcement can be relatively low for industries with homogenous firms that all use the same set of technologies. However, for industries with heterogeneous producers like specialty chemicals for which unique technologies are used, standard goal assessment and monitoring of targets will become very difficult. Given the asymmetrical nature of technical information at the company level, one can expect high and recurrent assessment costs for this type of industries.

The future role of technical standards and the integration of technical standards with VAs and emissions trading schemes will not exclusively be determined by theoretical considerations. Some important new approaches in European environmental policy will have direct and indirect consequences on both climate policy instruments. We first concentrate on the impact of the IPPC Directive is discussed. The EC Green paper on Integrated Product Policy is discussed later.

3.3 The impact of the IPPC Directive

With the Integrated Pollution Prevention and Control (IPPC) Directive of 1996 (Council Directive 96/61/EC), the European Union has a set of common rules on authorizing or permitting for industrial installations. Pollution from various point sources should be minimized by basing operational permits or authorizations for industrial installations on the concept of Best Available Technologies (BAT). “Integrated” in IPPC means that the permits must take into account the complete environmental performance of the plant, i.e. emissions into the air, water and soil, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, risk management, etc. The assessment of plant energy efficiency provides a clear link between the directive and climate policy goals. The directive will have important consequences for 30 industrial sectors and applies to all new installations as well as existing installations (EC, 2002a). Since the BAT concept can imply rather radical and hence expensive environmental improvements, a long transition period of eleven year has been granted. With respect to energy efficiency, the common level of effort provided by the IPPC Directive is a baseline or bottom line which European industries should not be able to go below (EC, 2002b). The IPPC Directive will lead to an EU-wide harmonization of the minimal level of industrial energy efficiency. Differences in technical process standards will no longer have the potential to disturb competition. According to the EC (2002b), this common level of effort for energy efficiency is not expected to be very problematic. The potential energy savings from the IPPC Directive are estimated by Haworth *et al*. (2000). In their survey, the authors identified potential energy savings options in processes covered by the IPPC Directive. They found a potential of 12-14% primary energy savings across the whole range of IPPC installations at a total capital cost of € 35 billion. Net-benefits of energy savings for industry were estimated at € 14 billion. From an economist's perspective, the high capital costs and low expected benefits explain why many sectors do not invest in possible energy savings. Implementing the IPPC requirement to invest in new technologies would not be a cost-effective strategy when in non-IPCC sectors or in other countries much less expensive options to reduce energy use are available.

The IPCC Directive with its focus on technical regulation is of course not designed as part of a climate policy strategy but will interfere with other climate policy instruments. There is a good chance that the end of the directive's transition period falls together with the negotiations on post-Kyoto emissions reductions targets. These future targets are expected to be a continuation of the actual targets for the period 1990-2012. Let us assume that the new target for the European Union by 2030 is a reduction of 30% compared to the 1990 level. With business as usual scenarios predicting a further increase of greenhouse gas emissions in the EU, the needed absolute reductions will be much more challenging (possible around 50% or even more). What is in this context the value of giving in 2010 an IPPC permit to an energy intensive company or industry? The permit is based on the technologies used in the company but it is very questionable whether even the best available technologies will lead to a 30% or 50% reduction of energy use in this company or industry. We can end up with a situation in which industries that first received a permit to operate because they use best available but expensive energy efficiency technologies become subject to climate policy programs that aim at further reductions of internal energy use or at buying permits for emissions in excess of predetermined allocations. When participating in emissions trading turns out to be very expensive for the IPPC permitted industries, one can even expect legal challenges to the trading scheme: why first give an authorization to produce with the best available technologies and then impose the participation in an expensive trading scheme? As an alternative to emissions trading, this possibility of legal conflicts as a result of double obligations will not rise with VAs. Of course, a high number of new VAs negotiated after IPPC implementation can be an indication of the availability of remaining energy efficiency improvements.

This IPPC Directive with its harmonisation of process energy efficiency standards has important implications for European VAs as well as for emissions trading within the European Union (EU). The interaction of technical standards with other instruments needs to be considered. At the end of the transition period for the directive that started in October 1999[1], the BAT concept will determine the technical standards for the largest industrial companies in the EU. This implies that future VAs with an emissions reduction target below the reductions that would result from the application of BAT, loose all relevance. The future assessment of the environmental effectiveness of VAs will not be limited to comparing actual and business-as-usual emissions; emissions in the VA also need to be lower than emissions under the BAT scenario. From 2010 on, the next generation of European VAs for climate policy will become BAT-VAs or technical standards voluntary agreements. As a result, technological process regulation will become more prominent in European environmental policy. This is a surprising conclusion in view of the enormous attention that is going to VAs and emissions trading.

The IPCC Directive also influenced the European proposal of EU-wide emissions trading. The proposal for emissions trading will also require changes in the IPCC Directive. In Annex III of the emissions trading proposal, we find that 'quantities of allowances to be allocated shall be consistent with the technological potential of installations to reduce emissions (EC, 2001a, p.34).' This criterion implies a technology-based emission permit allocation scheme according to the IPPC philosophy to use BAT as a tool to harmonize the environmental performance of European industry. For an emissions trading scheme, this type of allocation has important disadvantages. The efficiency of emissions trading depends on reliable information on future allocations of tradable credits to participants. Important investments in emissions reduction technologies or process changes are based on the difference between expected emissions under the business as usual scenario and allocated tradable permits. Expectations on future permit prices are essential in the decision to buy permits or to invest in abatement. Given the

[1] The 15 EU Member States needed to adjust their national legislation in line with the directive before the end of October 1999. In July 2002, several Member States still not confirmed to the European

prospect of a technology-based future allocation of tradable permits or credits, market behaviour of emissions trading participants will be significantly altered. Without the availability of new technologies to further reduce emissions, the future allocation will be higher than in the case with new technologies. The additional uncertainty can be an incentive to monitor technological innovations and invest in lobbying strategies to challenge the cost-effectiveness and environmental impact of these new technologies for the own industry or company. The technology-based future allocation that is the result of the IPPC Directive can significantly limit the expected benefits from emissions trading in the European Union.

As a result of the actual EU emissions trading proposal, the IPPC Directive will be amended to ensure that, where emissions of a greenhouse gas from an installation are covered by the emissions trading scheme, the IPPC permit relating to that installation does not set a limit on its emissions of that greenhouse gas. The European Commission acknowledges that this emissions limit would reduce the benefits of the emissions trading scheme (EC, 2002b). Enforcing BAT investments for industries that participate in emissions trading, also impacts their energy use and emissions.

The European Commission opted for an ambitious body of technology process standards and regulations that will be coordinated by a specific bureaucracy, the European IPPC Bureau. Other principal players will be licensing authorities in 15 EU countries, the Directorate-General Environment, Member States' and industry experts on BAT, environmental organisations and the public that will have access to all information. Since the IPPC Directive requires continuous technology monitoring and the diffusion of information, its operational costs will be relatively high. Setting process energy efficiency targets to be reached by each industry within a given period would be a much less expensive approach.

Furthermore, the 'IPPC approach' suggests that the contribution of industry to the goals of environmental policy should be limited to operating under specific technological constraints on global environmental impact. As will be further elaborated, this is a limited perspective that eliminates an important set of

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Commission that this has been done. The most serious delays have occurred in Ireland, Belgium (the Walloon region), Luxembourg, Spain and Greece (EC, 2002a).

incentives for technological innovations that can benefit other sectors (e.g. consumers).

3.4 Combining voluntary agreements, technical standards and emissions trading

With respect to the combination of climate policy instruments, the best way to integrate different instruments is still subject to discussion. Since many VAs focus on improving process efficiency, this type of voluntary technical regulation becomes a tool to diffuse stricter technical standards faster than under conventional harmonisation efforts.

In most actual emissions trading schemes or proposals, it is acknowledged that all possible interactions among instruments need to be considered but practical guidelines are mostly lacking. An exception is the UK system for emissions trading in which firms within a VA that aims at improving process energy efficiency can use emissions trading to help them fulfil their obligations. Firms with absolute caps in their process efficiency VA will be able to trade the credits that they generate when they perform above their baseline emissions target. This type of trading will have to operate retrospectively as the firm's true credit can only be measured at the end of the VA period (DETR, 2001). For companies in VAs with output-related efficiency targets – the 'unit' sector in the UK scheme-, any under- or over-achievement of output related targets will need to be converted to tradable allowances denominated in tonnes of CO_2-equivalent. This conversion will be based on each companies' output figures at the end of the compliance period. The amount of credits from output-related VAs will be restricted since strong output growth for the firms in the VA can lead to an absolute increase of emissions. Therefore a 'gateway mechanism' is established to ensure that there can be no net sale of allowances from sectors with output-related targets to the sectors with absolute targets. This type of sale would only be allowed to the extent that allowances had previously moved from the sector with absolute targets to the sectors with output-related targets. This gateway will be kept under review and will be closed in 2008 (DETR, 2001).

In the proposal of the European Commission, it is stated that 'almost all environmental agreements in place can be adapted to take account of the emergence of new elements, such as the introduction of an EC-wide emissions trading scheme (EC, 2001a, p.7).' The Commission suggests that the targets set under environmental agreements can serve as a useful basis for the allocation of allowances by Member States. How this type of allocation will allow to realise the national reduction targets in the Kyoto Protocol, is not mentioned. Furthermore, process efficiency VAs with relative targets should also be converted into tradable quantities of emissions in a given period. The Commission foresees that this conversion should be done by using output forecasts. In contrast to the UK approach, working with output forecasts will make it possible to trade credits before the end of the compliance period of the VA.

The UK as well as the EC scheme will integrate both instruments by creating additional bureaucratic structures next to the already very complex emissions trading market. With respect to the EC proposal, does it make sense to sell on the same market allowances that are the result from real emissions reductions next to credits that are based on emissions and output forecasts? It seems that two different commodities are sold. Even when one considers both credits as one homogenous commodity, the latter type of credit increases uncertainty on the market. What will happen when the forecasts later prove to be wrong and the credits should not have been sold? Who will pay for the price disturbances resulting from a too high supply level that influenced other market participants' decisions to sell or buy allowances or to abate emissions or not?

3.4.1 Call option contracts

An alternative based on the functioning of markets for commodities consists of attributing a price for firms within process or technical efficiency VAs that want to access emissions trading markets. Emissions trading can be integrated as an option in VAs. Firms can choose whether or not to become a participant in emissions trading schemes. This option, formalized as a CO_2 allowance call option contract that can be traded, provides clear incentives for the firms in the VA to overcomply with the target of the VA. The option is a financial asset that can be traded. The holder of the option has access to the emissions trading market for a transaction that is specified in the option, e.g. to buy 1000 credits that allow the emission of 1000 tonnes of CO_2. Firms in a VA that fear for non-compliance at the end of the period of the VA can ensure access to emissions trading markets in advance by buying an option contract. Option contracts can be sold by firms inside VAs that think to overachieve the target. The option can be used in the future, probably at the end of an important set of VAs. The use of some type of 'standard VA' with a fixed period, e.g. 2002-2012, can support the use of the option mechanism. Reliable monitoring of achievements in the VA provides double benefits: the credibility of the VA is increased and the past efforts will be validated into the possibility to sell options and receive a market reward for overachievement. Furthermore, the option mechanism results in a market price for non-compliance with the target in the VA. With an example of five different firms, Albrecht and François (2001) further elaborate the potential of this type of option contract to link VAs to emissions trading schemes.

Once an emissions trading market is established, trading of derived products like the options for access is a relatively inexpensive addition. The mechanism can also be considered as a learning instrument for firms with VAs that will later fully participate in emissions trading.

3.4.2 Decomposition analysis for the conversion of VA targets

For simplicity, the proposed option mechanism assumes VAs with absolute reduction targets. A conversion of VAs with relative targets to absolute targets and options to sell could be based on the approach in the UK or EC emissions trading scheme. These conversion proposals are however to a large extent arbitrary. Better alternatives should start from the consideration that relative or absolute targets both require efforts made by the companies. These efforts will bring economic costs on the short and long run. The impact of the efforts will be determined by other factors that cannot be controlled by the individual companies. Final output changes depend on macro-economic conditions that aren't easy to forecast. Other factors that determine output changes are structural changes in the international economy, the arrival of new competitors with more performant products, changes in consumer preferences, changes in economic and trade policy (e.g. the liberalisation of the European energy and electricity market) and so on. As a result, the impact of internal energy efficiency investments largely depends on external factors. Technical standards and VAs with relative targets focus on internal measures while VAs with absolute targets indicate that external factors can be managed by the firms in the VA. Otherwise the industry would not commit itself to absolute reductions. When firms cannot control market forces – a typical condition for perfect competition, the most preferred theoretical market situation in economic textbooks- what is the rationale behind imposing absolute reduction targets for process efficiency VAs?

An alternative is to focus on the contribution of internal measures in the total change of greenhouse gas emissions. Methods for decomposition analysis[2] over various factors provide this type of information. Results from decomposition analysis can answer questions like what would be the level of total emissions *without* internal energy efficiency improvements. Even when total emissions increased, internal measures could have partly reduced emissions or could at least have avoided additional emissions. With a decomposition analysis, it can be shown that some firms with an absolute VA target can reduce emissions without investing in internal efficiency improvements because of an output reduction. Alternatively, decomposing an increase of total emissions can uncover spectacular internal energy efficiency improvements realized by firms with relative VA targets. Avoided emissions as a result of internal measures could be the start of a more acceptable and fair allocation mechanism. Unfortunately, the information requirements for this type of analysis – especially in terms of confidential data like product mixes and technologies used- are problematic.

The use of the terms output reduction or output change does not suggest that this type of analysis is only relevant in a production environment. The same relationships are valid when explaining for example residential greenhouse gas emissions or residential energy use, measured by *e.g.* total energy use by

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[2] An overview of decomposition methodologies can be found in Ang and Zhang (2000).

all households. Driving forces behind total energy use will then be the increasing number of households (output effect) or the changing preferences towards larger houses that consume by definition more energy than smaller houses (structural effect).

3.4.3 Decomposition analysis and the link with other instruments

With the imposition of absolute targets, VAs can discriminate among firms that differ in their sensitivity for external factors. The same discrimination holds when VAs with relative targets need to be converted although a decomposition analysis can provide reliable information on real efforts. Emissions trading with an absolute cap does not have this complexity. However, the initial allocation of emission credits can be associated with possible discrimination of specific firms and industries. A grandfathering allocation procedure will favour firms with high emissions and without past efforts to reduce emissions, while firms that strongly invested in reducing energy use and emissions will only have expensive reduction options left. This is not the optimal situation. The alternative of auctioning permits also has drawbacks. A hybrid allocation system with a partly grandfathered, partly auctioned allocation can have theoretical advantages but risks to further increase the complexity of trading systems. Once again, decomposition analysis can provide essential information. Why not allocate emission rights to the firms that have the best record of past internal reduction efforts – not to confuse with the change in total emissions- and limit the allocation to firms that did nothing? A general use of decomposition analysis in allocation schemes would also facilitate the integration of VAs into emissions trading schemes. Real emissions reduction efforts delivered in both institutional settings can be compared.

3.5 Technical regulation, voluntary agreements, emissions trading and the future of climate policy

So far, technical standards, process VAs as well as emissions trading seem to reduce climate policy to an absolute or relative emission reduction target for energy-intensive industries. The reduction target of each industry can differ or can be identical to the national reduction target as agreed in the Kyoto Protocol. The latter 'linear' approach does not lead to the most cost-effective reduction strategy. The marginal emission reduction costs can strongly differ between industries. Regardless of the type of reduction target for each industry, this limited view on climate policy is not necessarily in line with the long term goal of improving the sustainability of production and consumption patterns as stated in the Rio Declaration. Can we reduce global emissions by focusing on targets for a limited number of industries in a limited number of countries? In the EU, the majority of greenhouse gas emissions is originated outside industry. However, clear reduction targets for households, road transport and the service sectors are rarely discussed, especially not by politicians with the turbulent fuel tax protests of September 2000 in Europe on their mind[3].

Policymakers that want to end this stalemated situation should consider that the responsibility of industry is not limited to emissions during industrial production. Energy use by households, in transport and in the service sector (that includes public administration) is the result of technologies, economic structures and institutions that have been developed by industry and legislators in order to meet articulated and non-articulated customers demands. A large part of these structures is the result of specific regulation (e.g. building codes, housing policy, transportation and communication policy, …). Products flow through these structures. Consumption and production goods from industry will be used in other sectors where they lead to energy use and emissions. If we consider the example of air conditioning equipment

[3] Energy taxes on heating oil and transport fuels are already very high in Europe. In September 2000, truckers in Britain, France and Belgium blocked roads, ports and oil refineries. In France and Britain

for buildings, VAs and other instruments like emissions trading will only focus on emissions during the production of air conditioners. They can induce technological innovations that reduce energy use during this production phase. It is however quite obvious that everyone who buys an air conditioner will increase his residential energy use compared to the situation without the air conditioner. As with refrigerators and freezers, there are significant differences in energy efficiency between air conditioners during the consumption phase. These differences can be attributed to different technical standards but this does not need to be the case.

Current types of VAs and proposals for emissions trading do not provide incentives to firms that invest in energy savings during the consumption phase. The impact of this type of incentives can be very important for all consumption and capital goods that need energy when used. Buyers of energy-consuming goods will not automatically opt for more efficient and more expensive airconditioners because of the higher initial investment costs and high implicit discount factors for future energy savings. Sutherland (2000) comes to the conclusion that discount rates for household investments are mostly between 20 and 30% and that high family incomes are associated with lower discount rates. Dixit and Pindyck (1994) use the irreversibility argument to explain why high discount rates characterize rational decision making.

The attractivity of the more efficient air conditioners can be increased by taxing the least efficient types, by giving subsidies for buying the most efficient types or by agreeing to ban the least efficient types from the market. The first option is very interesting when the producers of the most efficient types can easily increase output at profitable conditions without price implications. Otherwise consumer surplus is lost. The second option is the most expensive solution and agreeing on a ban needs a representative platform where producers can discuss this option with legislators.

Finally, the current focus in VAs and emissions trading with challenging emission reduction targets in the production phase can detract investment funds from research to improve the energy efficiency during the consumption phase.

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there was a fuel shortage at the pumps and opinion surveys showed widespread public support for reductions in the taxes on gasoline and diesel (Mitchell and Dolun, 2001).

The example of the air conditioner illustrates that focusing on reduction targets for specific sectors is not enough. We should adopt a ‘horizontal product perspective (HPP)’; a product leaves a specific company to be used in different sectors because of the institutional framework that makes this product attractive. The owner of a house will buy an air conditioner because this product is priced below his willingness to pay. If the regulator had imposed other building codes with much stricter insulation and material requirements that make air conditioning equipment unnecessary, the owner would not be willing to pay for the air conditioner and the producer would need to seek other markets or develop other products. The difference between this ‘horizontal product perspective’ and various types of life cycle assessments (LCA) is the involvement of the regulator[4]. In the future development of climate policy, the regulator should make choices markets cannot make; what type of production and consumption patterns should be pursued in the coming decades? When climate policy is taken seriously, some product categories will be banned from the market or replaced by more efficient types. Clear guidelines for the shape of future consumption and production patterns need to be discussed and developed at the appropriate platforms. The best instrument for this goal is product regulation that is the result of an agreement between all involved stakeholders. We can use the term voluntary product regulation to stress the difference with existing product regulation or efficiency standards. Voluntary agreements can play an important role in agreeing on this type of product regulation. There is already a number of VAs on product regulation. A good example is the ACEA[5] Voluntary Agreement (Zapfel, 2002). This agreement is however the result of negotiations between the regulator and car manufacturers. This is not the ideal stakeholder platform with consumers, suppliers, independent experts, NGOs, …

[4] An LCA is a tool to compare the total environmental impact of different products. Industries decide themselves how to use these results for future production options. Regulators do not prescribe how to interpret the results of LCAs : clear environmental targets are currently lacking.

[5] The agreement between the European Commission and the European Automobile Manufacturers’ Association (ACEA) was approved in 1995. The main result of the agreement is the reduction of average CO_2 emissions to 120 g/km for newly registered cars by 2005. An intermediate target for 2003 is 170 g/km.

The instrument of voluntary product regulation supported by VAs is one of the possible operational translations of the recent European proposals for an Integrated Product Policy (IPP). This will be discussed in the next section.

A long transitional period is essential to gain experience with voluntary product regulation and to introduce the desired changes in production and consumption patterns.

The ongoing experiences with process VAs can be essential for streamlining the stakeholder consultation process in matters like long term economic changes. So although existing VAs solely focus on improving energy efficiency, their consultation process with numerous stakeholders is probably the best platform to discuss challenging options like which products should be replaced by completely different types within a decade. A first step to transform VAs into voluntary product regulation can consist of balancing investments in product redesigns leading to future emissions reductions to investments in immediate reductions of emissions. The former option will reduce emissions in the consumer sectors while the latter only considers emissions during production. A balance is needed because not all industries have the financial means to internally reduce emissions and simultaneously develop the sustainable consumption goods for the future.

Voluntary product regulation will require a shift in the conventional use of command and control regulation. A long learning process with monitoring organisations and commitment from many governmental departments will be essential. There are some clear benefits from voluntary product regulation.

1. Market uncertainty is significantly reduced when the environmental characteristics (*e.g.* energy use) of preferred products of the future are clearly defined. When some manufacturers currently need to make a choice between an inefficient but low-cost electronic appliance and a very efficient but more expensive type, stable energy price expectations and the absence of measures that reward energy efficiency during the consumption phase can make the inefficient type the most profitable choice. With the involvement of the company in a process of voluntary product regulation, the manufacturer knows what level of efficiency will be

required in the future and what the willingness to pay by future consumers can be.

2. When minimum levels of technical efficiency become a precondition for future market access, technological innovations that reduce energy use by consumers become essential for maintaining access to the richest consumer markets. Innovations to reduce the production cost of inefficient types are not rewarded anymore. R&D budgets will be more in line with sustainability goals.
3. The evaluation of the environmental effectiveness of the new legislation is straightforward: the new products meet the standards or not.

3.6 The European goal of Integrated Product Policy

In February 2001, the European Commission adopted a Green Paper on an Integrated Product Policy (IPP). The central objective of IPP is to improve the environmental performance of a broad range of products throughout their life cycle. The ideas in the communication are put forward to stimulate public discussion on the prospects for greening products and the appropriate tools to reach this goal. The rationale for IPP is the large untapped potential to improve the environmental impact of a broad range of products and services (EC, 2001b). Possible instruments for IPP are economic instruments based on the price mechanism, producer responsibility, eco-labels, environmental declarations, public procurement, product information, eco-design guidelines, standards and product panels (EC, 2001b).

For Commissioner Margot Wallström (2000), IPP with its focus on different environmental media and isolated stages of the product life cycle like energy use during product use, could prove a powerful complement to traditional environmental policy making. With respect to the implementation level of IPP, Wallström aims to apply voluntary economic or regulatory instruments with a shared responsibility for all relevant stakeholders. Key challenges are gaining experience, the integration of IPP in different policy areas and new types of stakeholder involvement (Wallström, 2000).

The business community supports the IPP approach as a contribution to Sustainable Development. An advantage of IPP is its use for long term business planning and the incentives for continuous innovation. Key concepts for the implementation of IPP will be integrated environmental management, effective voluntary initiatives of business and industry, shared responsibility, respect for market forces and consistency (Kleibeuker, 2001).

Several European companies already use practices that are very close to the ambitions of IPP. A good example is the EcoEco Savings tool developed by Electrolux. This tool calculates energy savings of households from buying a very efficient Electrolux household appliance (Electrolux, 2001). Given the experience with the slow integration of the IPPC Directive in the national legislations of Member States and a long transitional phase to implement the new IPP legislation, it will probably take a long time before a comprehensive IPP strategy will be a reality in the EU.

One of the options to speed up this implementation process is making use of existing experiences with voluntary agreements.

3.7 IPPC + IPP + VAs = voluntary product regulation?

The IPPC Directive and the IPP approach can become powerful tools to develop a complete European body of legislation that covers production processes as well as the complete environmental impact of consumption and production goods. The IPP approach makes it possible to reduce emissions in other sectors than in the producing industries. In comparison to the IPPC Directive, the IPP perspective is much broader and not limited to the production phase. With IPP, products with a production process that has important negative impacts on the environment will disappear from the market unless they have more than compensating environmental benefits during the consumption phase. Consequently, the successful implementation of future IPP legislation will reduce the importance of IPPC.

The IPPC Directive will complicate the establishment of a well-functioning emissions trading market once the authorization system is applied in all Member States. Another consequence is the requirement to compare the targets of VAs with possible emissions reductions when using BAT. This will improve the assessments of the environmental effectiveness of VAs. The lack of a uniform assessment tool is one of the critical points in the actual debate on VAs. Doing better than with the use of best available technologies is of course a real challenge. Only with changes in product mixes or with efforts to reduce emissions during other phases than the production phase, it will be possible to meet this challenge. As a result, the IPPC Directive will make industries with VAs opt for the already discussed horizontal product perspective or more conventional applications of life cycle assessments.

3.8 Conclusions

Technical standards received a lot of attention for their possible market fragmentation impact. Their role as a market barrier in the unified European market is currently less prominent than in the preceding decades. The growing importance of climate policy did influence the interest in technical standards. Energy efficiency standards are especially useful for reducing energy demand from electronic appliances, vehicles and heating equipment. Efficiency standards can also be used to reduce industrial energy use. The latter option is frequently integrated in voluntary agreements, one of the most popular instruments for climate policy in Europe.

Voluntary agreements and emissions trading need to be integrated in a policy framework that already consists of command and control regulation and other economic instruments like taxes and charges. The optimal use of each new instrument in the European Union not only depends on theoretical arguments but will also be determined by some important regulatory initiatives like the Integrated Pollution and Prevention Control (IPPC) Directive and the Green Paper on an Integrated Product Policy (IPP). The IPPC Directive will lead to the general use of Best Available Technologies in process installations while the IPP approach is based on a life cycle assessment that includes environmental impacts during the consumption phase. The IPPC Directive implies that future VAs will have a reduction target that is more ambitious than the reduction from implementing Best Available Technologies. As it is not obvious to do better than with best available technologies, VAs that look further than reducing emissions in the own industry or sector will be important in the future. This new type of VAs will also consider emissions reductions in the sectors that use or consume the produced products. The IPP approach will be introduced in VAs as a natural consequence from implementing the IPPC Directive. When process VAs and emissions trading are used next to each other, tools to integrate both instruments are needed. Conversion options from the UK and EC proposals for emissions trading need to be considered, next to institutional innovations, *e.g.* a call option contract.

A final conclusion is that VAs with efficiency standards will play an important but different role in the future of European climate policy. VAs can help to operationalize the goals of IPP and offer a unique stakeholders' discussion platform that will be essential to define the targets of voluntary product regulation. The latter is needed as an important step to more sustainable production and consumption patterns.

4. Valorisation

See list of publications in section 3.1. Currently, new publications are prepared that relate to similar subject. We consider especially the integration of different policy instruments as an essential research subject for the coming years.

5. Balance and perspectives

It is difficult to assess the merits of a research project that is based on a rapidly changing international political environment such as climate policy and technical standards. One of the findings of our work is that a long-term perspective can provide insights and perspectives but there are no guarantees for the path of future developments. A recommendation for future research would be to concentrate on the specific dynamics that surround each political environment. An institutional analysis of policy instruments would be an interesting option.

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