A tangled web: assessing overlaps between energy and environmental policy instruments in place along electricity systems

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Abstract

A multiplicity of energy and environmental policy instruments is targeting stakeholders along electricity supply and demand, overlapping with each other. Although synergies between different policy instruments may exist, e.g. reducing acidification and climate change by reducing energy consumption, there may also be antagonisms. Such antagonisms arise not only within different environmental policy instruments but also with energy policy instruments. The fact that the development of policies and their implementation using specific instruments is often disconnected creates a need to better integrate overlapping policy instruments. This paper surveys such overlaps in policy instruments in EU energy and environmental policies regarding electricity systems, characterising their interactions. An approach for further assessment and analysis of overlaps and co-effects between policy instruments is presented. A short discussion on how trade-offs can be structured is made, as well as some notes on issues to be considered towards policy integration.

Introduction

Electricity pervades most industrial and service activities. Thus, policies affecting electricity systems condition economies and well being of populations. Presently there are a large number of energy and environmental policy instruments in place which overlap with each other in as much as they share policy targets. The same stakeholders along the electricity systems are targeted by many different policy instruments each aiming to steer their behaviour in a particular direction (Midttun & Koefod, 2003). In most cases the steering effects of the policy instruments are affected by the other instruments in place, i.e. the policy instruments have co-effects. These co-effects occur not only within the same policy field, but also between instruments of different policy fields.

For example, within the field of environmental policy, climate change policies implemented by reducing energy use, or by shifting from coal to gas, contribute to the effectiveness of acidification and air quality policies since they reduce acidifying, tropospheric ozone, chemicals and primary particulate matter emissions (RIVM *et al.*, 2001). On the other hand, emission limit values to air might conflict with emission limit values to water due to relocation of pollutants from air to water (or waste) following the implementation of end-of-pipe technology in chimneys. Examples of co-effects between environmental and energy policy instruments are the CO_2 charges for emissions reduction that are counteracted by the on-budget aids to subsidising oil and coal infrastructures, or the subsidies to renewable electricity generation counteracted by the restrictions of hydropower for water conservation purposes.

Naturally, the more policy instruments in place, the more the potential for overlaps, leading to more co-effects that might significantly reduce overall cost-effectiveness. Therefore, the fact that a large number of new policy instruments are being developed and implemented in OECD countries in order to curb CO_2 emissions (IEA, 2002; EU, 2001; EU 2003) adds relevance to the assessment of overlaps and co-effects between them.

This issue has been increasingly gaining the attention. It is widely acknowledged that the disarticulation of energy and environment policy instruments generates costs and inefficiencies that stretch already limited government budgets and hamper the efficiency and effectiveness of all policy instruments in place (Briassoulis, 2004; Greening and Bernow, 2004; RIVM *et al.*, 2001; EU Commission COM(2004) 394 final). Accordingly, policy makers are taking efforts to integrate environment and energy policy goals. The 1998 European Council in Cardiff formulated an initiative aiming to more effectively integrate environmental aspects into sector policy making, following the articles 2 and 6 of the Amsterdam Treaty of the European Union (EU). In 2001 the Council adopted environmental integration strategies in the energy area, among other (EU Commission SEC (2001)502, 2001).

This type of integration of policy goals is known as *Intrasectoral or Vertical* policy integration. It reflects an incrementalist attitude which mostly results in the addition of environmental goals to sector policies, without actual integration of the instruments and procedures (Briassoulis, 2004). Therefore, it is not surprising that little has actually been achieved (Coffey & Dom, 2004; EEB, 2003; Constantinescu and Janssen, 2003; EU Commission SEC(2001)502, 2001). It is necessary to move from vague statements on the integration of equally vague broad policy goals, to a more concrete integration at the level of the policy instruments, where the conflicts between different objectives are more acutely felt.

This paper tries to contribute to a better integration of energy and environmental policy instruments by providing an approach to assess overlaps and co-effects between instruments in place alongside electricity systems. This approach does not aim to assess the significance of the co-effects between instruments, but simply to contribute to a better framing of the problem. The paper starts by discussing the background for disarticulation within and between energy and environmental policy instruments. This is followed by a brief overview of the research done in this field. A characterisation of policy instruments is made to set the scene regarding the energy and environment policy instruments in place alongside electricity systems. Building on that, an approach to assess overlaps in policy instruments is then presented, and its application exemplified. Finally, a short discussion on how trade-offs can be structured is made, as well as some notes on issues to be considered towards policy integration.

Setting the scene

Why energy and environment policy instruments are not integrated

The fundamental motive for disarticulation between energy and environment policy instruments is the fact that the energy and environmental policies from which they originate are not coordinated since they have **different goals**. The ultimate goal of energy policies has been (and according to the International Energy Agency, will continue to be) to guarantee a large supply of competitively priced energy to foster economic development. The minimisation or mitigation of caused environmental impacts is a much secondary goal, if at all considered.

However, **environmental and energy policy instruments are mostly overlapping**, since both concern natural resources. Environmental policy instruments intrinsically condition electricity supply and demand by imposing restrictions to the use of natural resources (e.g. establishing land use restrictions or emission limit values) or by providing incentives to change the supply and demand profiles (e.g. creating a market for the emissions of CO_2 and thus an incentive for shifting or establishing environmental taxes on electricity). Energy policies also condition the fulfilment of environmental policy's goals. The liberalisation of the electricity markets leads to the decrease of electricity prices and thus reduces the incentives for energy saving (Vine *et al.*, 2003; Fuchs & Arentsen, 2002) that allow the minimisation of the environmental impacts associated to energy supply. The loss of control over technologies prevents public investment in environmentally preferably technologies.

Besides this more normative cause, other **aspects of organisational and procedural nature** contribute to lack of integration of energy and environment policy instruments (Persson, 2004). Energy and environment are autonomous policy sectors that rely on separate specialised vertical organisations (Briassoulis, 2004), with divergent political objectives and interests. The procedures of these organisations further contribute to the disarticulation since there is lack of collaboration among them - from the supra-national level (e.g. the Directorates-General of the EU Commission) to national organisations, weak administrative coordination and low degree of consultation of national authorities (Robert *et al.*, 2001 in Briassoulis, 2004).

Not only public authorities have responsibilities in policy disarticulation. Different private lobby groups actively seek to influence political outcomes. Environmentalists and business lobbies have a prominent role in both formulation and implementation of policy instruments aiming to "*give voice to different aspects of environmental policy, making sure that all aspects are considered in the political trade off and reflected in the implemented policy*" (Aidt, 1998: 2). Therefore, lobbies intrinsically add entropy to the policy process hampering coordination of policy instruments. Lobbies also deliberately act towards the weakening/strengthening of policy instruments depending on how they perceive these to affect their interests. These deliberate actions might result in instruments that flagrantly counteract other, depending on the influence of their promoters over policy-makers.

On a more empirical/practical level, other motives for the occurrence of antagonistic co-effects in policy instruments are first the lack of awareness to the issue, and secondly the **lack of knowledge** on its impact on cost-effectiveness. This in turn is due to the very rapid pace of development and implementation of policies which does not include systematic policy evaluation practices. According to a study by the European Environmental Agency, there are currently more than 100 pieces of EU environmental legislation in place covering the entire spectrum of environmental problems. Of these, only 12% require Member-States (MS) to provide evaluative information on the effects of the implemented policy measures[1] (EEA, 2001).

Therefore, it is not surprising that although detailed analysis of individual effects of energy and environment policy instruments on certain sectors is being done[2], there is still a lack of systematic evaluation practices of individual policy instruments' effectiveness and efficiency (EEA, 2001, Vehma, 2004). Moreover, there is yet much to be done assessing the impacts on effectiveness caused by interactions between individual policy instruments or between combinations of policy instruments (Worrell and Price, 2001).

State of the art

Following the concerns about environmental policy integration previously mentioned, and the growing complexity of environmental policies, a new interest starts to develop in the study of the unintended effects of specific environmental and energy policy instruments. Different names are used for these: side-effects (Raadschelders *et al.*, 2003), spillovers (RIVM *et al.*, 2001), rebound effects (Muster, 1995), co-benefits or co-damages (Kleijn and van der Voet, 2002) or feedback effects (Worrell and Price, 2001). The studies in this area focus mainly on identifying the occurrence of specific unplanned effects of instruments and how much these will affect the respective environment/energy objectives, and not so much on understanding the mechanisms of interactions between the different policy instruments.

Some examples of studies of unintended effects of policy instruments are the work developed by RIVM et al. (2001) that performed repeated simulations of the DPSIR[3] chain combining cost-benefit analysis and integrated environmental assessment "*for a selection of policy packages with the aim of identifying the most cost-effective set of policy responses*" (*ibid.*:168) for all environmental problems. The White and Green Project (n.d.) used a technical-economic model to study the cost-effectiveness effects that the combination of white certificates, green certificates, CO_2 emissions trading and an energy tax might have. Uyterlinde & Jeeninga (1999) used a similar approach for evaluation of combinations of energy efficiency policy instruments in households.

All authors acknowledge the importance of coherently integrating different policy instruments (within environmental policies, within energy policies and between those two policy areas) and provide suggestions on how to do so within the scopes of their respective studies. However, in the three cases the approach is partial, considering either the environmental problems/themes and not the energy issues (RIVM *et al.* study) or a selection of a few of the policy instruments in place (the other two studies).

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[1] This corresponds to 13 EU directives and regulations on: integrated pollution prevention and control, lead in petrol, monitoring forest damage, air quality framework, screening for lead, contained use of genetically modified organisms, sewage sludge, titanium dioxide and nitrates emissions to water, habitats and species conservation, cohesion fund, rural development regulation and the greenhouse gas monitoring mechanism (EEA, 2001).

[2] Such as the studies on policy instruments to promote industry energy efficiency by Worrell and Price (2001); on household appliances by Menanteau (2003) or Boardman (2004); on support schemes for renewable electricity by Lauber (2004), or on energy taxes by Vehma (2004), to mention but a few.

[3] Driving Forces-Pressure-State-Impact-Response (DPSIR) (EEA, 1999).

Because, in all probability, the significance of overlaps in policy instruments increases with the number of instruments, overlaps should be firstly screened at a global level, such as the electricity system. This initial global screening allows for getting a more complete picture of all overlaps from which the more problematic can be singled out. To do so, however, it is necessary to evaluate and rank overlaps according to its impact on cost-effectiveness. Methodologies still have to be developed for this.

This paper considers a larger number of policy instruments from the two different policy fields and includes the different elements that constitute electricity systems. Moreover, an approach is developed to systematically assess overlaps and co-effects between instruments. This approach can be the starting point of a methodology for the quantification of impacts of co-effects of policy instruments.

Tangled web – energy and environment policy instruments in place along electricity systems

This section presents an overview and characterisation of policy instruments both currently in place and that will be implemented within years, in order set the scene for the assessment of their overlaps and co-effects. Generic types of policy instruments in place across the EU were considered instead of specific policy instruments implemented in one particular country. This allows for a more complete overview of potential overlaps between different policy instruments without being restricted to the range of instruments implemented by specific governments. For the purpose of this overview transport was not considered particularly relevant and thus is not included. An exception might be electric trains and hybrid cars, but specific policy instruments for these are not covered at this point.

For the characterisation of the instruments, as presented in Figure 1 and in Appendix A, the following aspects are considered relevant since they give information on different levels of interaction between the instruments:

1. **Objective of the instrument**, which refers to the explicit objective of the instrument as stated in the documents that formulate it. This is usually not the same as the broader policy goal that led to the development of the instrument.
2. **Mechanism of instrument** used to steer behaviour (Command-and-control (CAC); economic/market-based and moral suasion and voluntary initiatives[4]).
3. **Target stakeholder(s)**, i.e. those whose behaviour the policy instruments primarily aims to steer, such as primary energy suppliers; electricity generators; transmitters; distributors & retail suppliers; appliances manufacturers and distributors; several types of consumers (household, services, industry), among other.
4. **Action according to the DPSIR framework**, as developed by the European Environmental Agency from the OECD Pressure-State-Response model. According to the adaptation made by RIVM *et al.* (2001), policy instruments can be part of macro-economic policy or sector specific when designed to reduce or eliminate the underlying causes of the problems, such as market failures[5] (acting at the level of the Driving forces); or be source-oriented (act at the level of the Pressures), effect-oriented (act at the level of the State of the environment) or curative (acting at the level of the Impacts).

Besides these aspects, the characterisation of instruments also considers the instrument's **place of intervention in the electricity system** (extraction of primary energy sources; electricity generation; electricity transmission; electricity distribution and end-use consumption, or at a more broad scale, supply or demand of electricity). Aspects related to the institutional dimension[6] are not explored here, although they are particularly relevant since one of the barriers to the integration of policy instruments is that the benefits might not be felt at sector level in the short-term and only at the top-government level (Persson, 2004).

Figure 1 presents the electricity system as considered for the purpose of this paper. The supply and demand sides are identified together with some of the energy and environment policy instruments. Each policy instrument is shown linked to the stakeholder(s) that it directly targets. Therefore, indirect effects over other stakeholders are not represented as this would make the picture even more complex. In the figure is also indicated the mechanism of the instrument and the type of action according to the DPSIR framework. A more complete characterisation of the policy instruments is presented in Appendix A.

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[4] This category includes a very broad range of instruments, from negotiated environmental agreements, self-auditing and voluntary disclosure, voluntary programmes and other education/information measures to enhance awareness.
[5] Other undelying causes besides market failure are missing markets, information gaps, policy inconsistency and implementation failure (RIVM, *et al.*, 2001).
[6] These refer to the co-ordination between the institution(s) responsible for design, implementation, monitoring and enforcement of the instruments, which can operate at different administrative levels, be it different sectors (e.g. energy, finance, transport, environment) or different hierarchic levels (i.e. EU, national, regional or local).

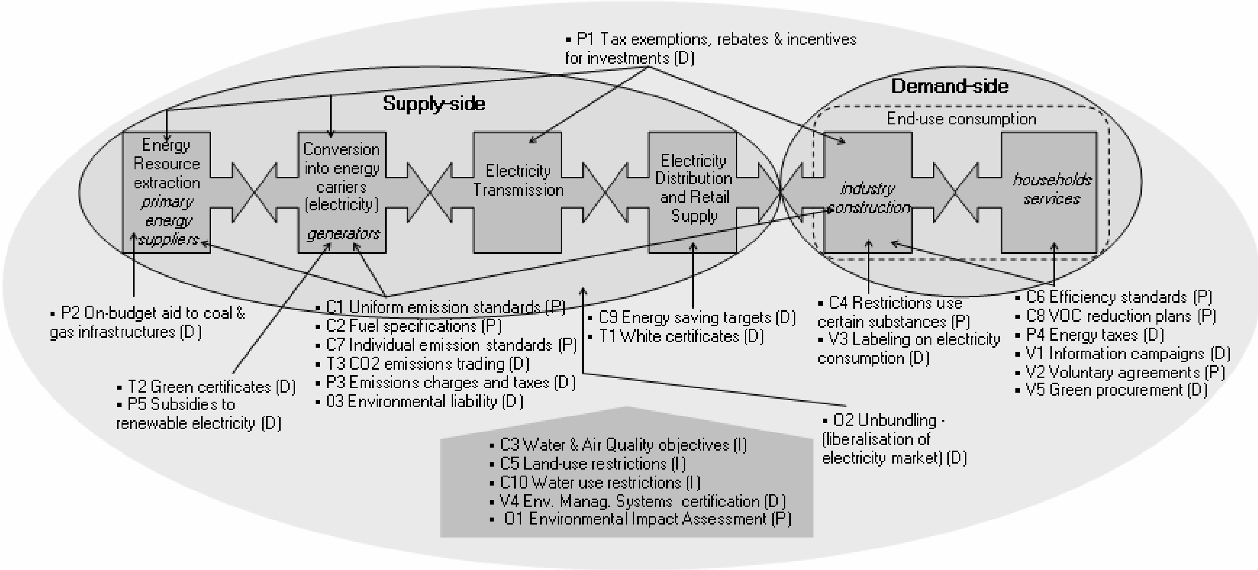

Figure 1 – Electricity system and some energy and environmental policy instruments in place*. Each instrument is identified with a letter and a number identical to the one used in Appendix A where a characterisation of instrument is presented. C – Command-and-Control; T – Tradable permits; P – price; V – moral suasion & voluntary and O – Other. The letter in between brackets indicates the type of action according to the DPSIR framework.*

A total of 26 different generic types of instruments are or will be in place along electricity systems, creating a quite full picture. Even so, the instruments here depicted do not result from an exhaustive review and other specific policy instruments for waste management, transport, noise and accidents are not represented here. These 26 instruments are quite varied regarding mechanisms used and targeted stakeholders. Whereas most policy instruments target a specific stakeholder or groups of stakeholders, there are three environmental instruments (quality objectives, land and water use restrictions) that do not directly target any of the represented stakeholders and three instruments that are of a more transversal nature and directly affect all players (environmental impact assessment, environmental management systems and unbundling within the liberalisation of electricity market).

Both energy and environmental policy instruments are predominantly command-and-control (10 of the 26), but there are also quite a few (8) economic instruments (essentially subsidies). All stakeholders are targeted by a similar number of policy instruments, with the exception of electricity distributors and retail suppliers. Whereas instruments targeting household and services are essentially moral suasion and voluntary, other players have their behaviour steered mostly by command-and-control and economic mechanisms.

Assessing overlaps and co-effects between policy instruments

Concept of overlaps and of co-effects of policy instruments

The concepts mentioned before (side-effects, spillovers, rebound effects, co-benefits or co-damages or feedback effects) are used to refer to the unintended effects that the implementation of one or more policy instruments might bring upon other environmental or energy objectives. These concepts do not clearly link the affected environmental or energy objectives with the policy instruments designed to achieve them. This subtlety is important because to optimise overlaps in policy instruments already in place it is necessary to consider not only how environmental or energy policy objectives are affected, but also the formulation of the overlapping policy instruments.

Therefore, it is considered useful to clarify in this context of this paper the concepts of overlaps and co-effects of policy instruments. For the purpose of this paper, the relevance in overlaps of two or more policy instruments increases to the extent that they share the same target stakeholder and that their steering effects occur within related policy goals. Two policy instruments that steer the behaviour of totally different stakeholders and whose steering effects are not at all related (e.g. induce consumers to reduce alcohol intake, as part of health policy, and drive industry to implement energy efficiency measures, within energy policy) are of course not overlapping. However, if the stakeholders are different and the steering effects are closely related (e.g. induce households to reduce electricity consumption and drive industry to implement energy efficiency measures) there is a relevant overlap.

This overlap is even more relevant if different instruments steer the behaviour of the same target stakeholder. Those steering effects are likely to affect each other. For the purpose of this paper it can then be said that the policy instruments have co-effects, i.e. effects on each other felt at the level of its intended steering effects. The co-effects of policy instruments can be complementary (the steering effects of the instruments supply mutual needs or offset mutual lacks), synergetic (the combined steering effect of the policy instruments is greater than the sum of their individual effects) or antagonistic (the steering effect of one or more instrument counteracts the action of the other(s). This rationale of overlaps and co-effects in policy instruments is depicted in Figure 2.

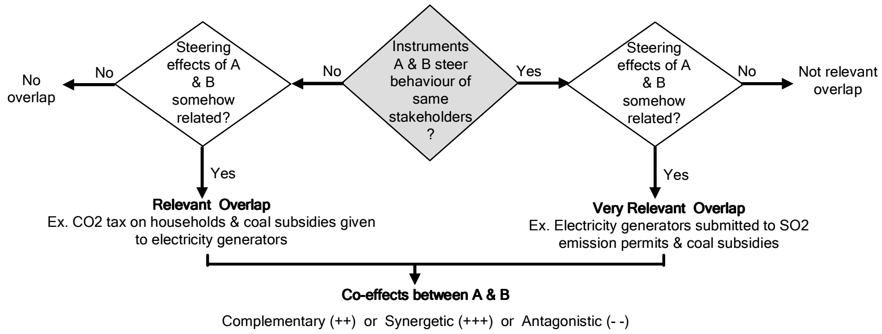

Figure 2 – Policy overlaps and co-effects in the context of this paper.

All policy instruments in Figure 1 have relevant or very relevant overlaps since they either target the same stakeholders or have steering effects felt within related policy goal.

Approach to assess overlaps and co-effects

The question to be answered when assessing co-effects of two or more policy instruments is to what extent and how their steering effects affect each other. To understand this, the objectives of the instruments, its mechanisms and the targeted stakeholders have to be looked upon, as follows:

1. A **screening** of the objectives of the different policy instruments is made to assess to what point are these overlapping (i.e. to what extent they steer related behaviour of same stakeholders).
2. The **objectives** of the different instruments are analysed to identify if they are complementary or antagonistic.
3. Their respective **mechanisms** are analysed to understand how well the instruments are coordinated. At this stage this can be done in simply two levels: a) no-coordination - the instruments do not acknowledge the existence of other or b) some coordination in the instruments (expressed as derogations or alterations in scope, among other).
4. Divergences in behaviour steered in same **stakeholders** are assessed.

This approach does not consider the effects of the implemented policy instruments, since it only concerns the instruments' design. Therefore, it cannot be used to assess the relevance (on cost-effectiveness) of the co-effects between policy instruments, but only to assist in a better understanding of how are instruments related to each other and in identifying priority areas for further analysis.

Considering the objectives explicitly stated (to the possible degree) of the characterised policy instruments, 13 more or less different objectives are identified (Table 1). Of these, four objectives (of 13 mainly command-and-control instruments) clearly are within broad environmental policy goals since they reduce emissions, environmental damage or impacts, three objectives (of three instruments) are clearly within energy/economy policy goals.

However, most of the objectives of the reviewed instruments (six objectives of 10 instruments) contribute both to broad energy and policy goals. It is not straightforward to separate energy and environmental policy instruments, but groups or clusters of complementary policy instruments objectives can be made:

- *Environmental Cluster* - policy instruments with objectives 1 to 4 (reduce emissions, minimise risk, impacts and improve overall performance) clearly overlap each other and, to a lesser extent are complementary with objective 7 (internalise environmental costs);
- *End-use efficiency cluster* - policy instruments with objectives 5 and 6 which are complementary (Increase end-use energy efficiency and awareness end-use energy efficiency);
- *Efficient supply cluster* - policy instruments with objectives 12 and 13 (Improve efficiency of electricity supply, price gains & quality of service and provide affordable electricity);
- *Secure supply cluster* - objective 11 (promote security of supply) which overlaps with objective 10 (increase electricity generated from renewable sources).

The screening of objectives allows stating that there are some complementarities between the environmental and end-use efficiency clusters, and between the end-use efficiency and secure supply clusters. On the contrary, there are antagonisms between the environmental and efficient supply clusters.

Table 1. Policy instruments objectives

#	Objective of reviewed policy instruments	Policy instruments	Contribution to broad policy goals	
			Energy/economy	Environment
1	Reduce emissions	C1, C2, C4, C7, C8, T3		✓
2	Minimise risk of environmental damage	C3, C10, O3, O1		✓
3	Minimise environmental impacts	C5, V6		✓
4	Improve overall (environmental) performance	V4		✓
5	Increase end-use energy efficiency	C6, C9, T1, V2, V3	✓	✓
6	Increase awareness for end-use energy efficiency	V1	✓	✓
7	Internalise environmental costs	P3, P4	✓	✓
8	Cover cost of policy instruments	P3, P4	✓	
9	Raise revenues	P3, P4	✓	
10	Increase electricity generated from renewable sources	T2, P5	✓	✓
11	Promote security of energy supply	P1, P2	✓	
12	Improve efficiency of electricity supply, price gains & quality of service	O2	✓	
13	Provide affordable energy	P1, P2	✓	

Table 2 exemplifies the application of the above mentioned approach to a few of the characterised instruments. The co-effect for each pair of instruments are assessed by determining if their objectives (as presented in Table 1) are complementary (+) or antagonistic (-); if there is (+) or not (0) coordination between its mechanisms and if the steering effects of the instruments are complementary (+) or antagonistic (-).

Table 2. Assessment of co-effects of energy and environment policy instruments

Policy instrument	C7 IPPC	T3 CO_2 trade	P5 Refits	C6 Eff. Targets	P1 Tax exemptions	P2 On budget aid
C7 Individual emission standards IPPC		++ objectives + mechanisms + effect	+ objectives + mechanisms + effect	+ objectives + mechanism 0 effect	- objectives 0 mechanism - effect	- objectives 0 mechanism - effect
T3 CO_2 emission trading			+ objectives 0 mechanisms + effect	+ objectives 0 mechanisms + effect	- objectives 0 mechanisms - effect	- objectives 0 mechanisms - effect
P5 Subsidies to renewable electricity REFITS				+ objectives 0 mechanisms 0 effect	+ objectives 0 mechanisms - effect	- objectives 0 mechanisms - effect
C6 Efficiency Targets					+ objectives 0 mechanisms - effect	+ objectives 0 mechanisms 0 effect
P1 Tax exemptions on fossil fuels						+ objectives + mechanisms + effect
P2 On-budget aid to coal & gas industry						

For example, both emission standards within IPPC and the CO_2 emissions trading have emission reduction as an objective (++). IPPC permits should not consider CO_2 emissions of the plants within the scope of the CO_2 emission trading Directive, showing some coordination of the two instruments (+). Finally, both instruments steer stakeholders towards emission reduction. CO_2 emissions trading and energy efficiency targets applicable to industry have complementary (but not the same) objectives (+). However, the CO_2 emissions trading Directive does not establish a link with existing energy efficiency legislation (-). Coordination of the mechanisms of the two instruments might or not occur depending if the different national allocation plans adopt benchmarking as one of the allocation criteria. Nonetheless, the steering effects of the two different instruments lead to reduced energy consumption. On the contrary, the steering effects of tax exemptions on fossil fuels are likely to counteract the incentives to save energy (-) although both instruments (P1 and C6) contribute to the objective of promoting the security of energy supply (+).

By performing such a generic assessment to the characterised policy instruments in place it is possible to systematically identify the types of co-effects between them. This can be an essential first step in the development of a methodology to quantify its impact in cost-effectiveness of the instruments in place.

Towards integration of energy and environment policy instruments

Due to human limitations in understanding all the dimensions of complex problems (as to achieve sustainable electricity systems) it is not realistic to expect that policies can develop perfectly coordinated instruments capable of successfully addressing all social, economic and environmental problems. The step-by-step policy making approach, handling one issue at a time is in many cases the best possible solution. In fact, one cannot talk about the relevance of policy integration if there are not several elements to integrate. It is only because we have now achieved a more mature state in environmental and energy policy making that integration can become a concern.

Looking back to the times of implementation of the reviewed policy instruments, one can realise that they were implemented over a long time-frame (approximately 30 years) and the more recent ones seem better coordinated, mostly due to the great umbrella of climate change policy. Climate change policies seem to be the ideal meeting point between energy and other environmental policies, or at least for demand-side energy and environmental policies. Nonetheless, there is still large room for improvement in achieving commitments between these two areas as there are still many different policy objectives (see Table 1). Moreover, climate change is but one of the environmental problems to be dealt with. For other environmental problems this intrinsic drive for integration might not apply, such as conservation of biodiversity.

Structuring trade-offs

In such cases where there are quite different policy goals, the optimisation of co-effects of the policy instruments and development of a unitary integrated policy is not possible or even desirable. Horizontal integration[7], or the integration of policy instruments of different sectors inevitably brings out the issue of trade-offs, since the different components to integrate usually do not have the same weights and there is the risk that the output of integration will only be a dilution (Liberatore (1997), in Persson (2004:14)).

Not only is it necessary to assess the trade-offs between two different policy instruments (A), but also between having them separate versus their integration (B) (Figure 3). For this it is necessary to make a simplification to two things to be traded any one time. But even if it is possible to isolate just two policy goals and two costs of these policies involved, with two simple policy instruments; there is not one numeraire available to express different non-market effects. Reflecting this, the approaches to structure trade-offs in policy integration are mostly quite vague and generic. For instance, Collier (1994), in Persson (2004:13) suggests that the ideal approach for structuring such trade-offs would be to use the Pareto optimality[8] as criterion to do so, but he also acknowledges that due to lack of knowledge this is not feasible in practice and thus a set of criteria could be used. The literature for policy integration essentially focuses on criteria to assess if policies are integrated and not on how to actually integrate policy instruments already in place (Persson, 2004).

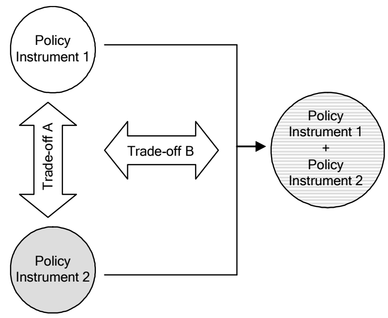

Figure 3 – Trade-offs to be structured

A starting point for a set of criteria to integrate energy and environment policy instruments could be to consider an approach similar to the one of the Water Framework Directive. Different water uses have to be combined, some of which are conflicting among each other such as ecological protection and drinking water supply. For uses that

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[7] *Intersectoral or horizontal* policy integration refers "*to the establishments of relationships among policies with respect to a given issue (e.g. environmental protection) or to several interlinked issues (…). This approach is increasingly recognised as more effective* [than intrasectoral policy integration] *but is much more difficult to implement since it requires the negotiation of trade-offs*." (Briassoulis, 2004).

[8] In a Pareto optimal solution it is not possible make one person better without making another person worse off. In multi-criteria situations, as is the case, this can be translated as to make an improvement in one of the considered criteria without damaging at least one other criteria. In other words, a solution can be considered Pareto optimal if "there is no other solution that performs at least as well on every criteria and strictly better on at least one criteria".

"*adversely affect the status of water but which are considered essential*" derogations from the requirement to achieve good status are provided "*so long as all appropriate mitigation measures are taken*" (Environment DG, 2004). In cases where the water quality damaging activity is open to alternative approaches (similar to the case of power generation where other means of power generation can be used), derogations are provided, but subject to three conditions: "*i) that the alternatives are technically impossible, ii) that they are prohibitively expensive, or iii) that they produce a worse overall environmental result*" (*ibid.*). The question, of course, is how to deal with the somewhat subjective nature of these conditions.

Finally, for further structuring of trade-offs it is necessary to increase the objectivity of the criteria to use, which can only be done if there is more information on the functioning of co-effects of policy instruments and on their quantitative impacts on overall effectiveness and efficiency.

Improving the current policy making

The fact that currently there is disarticulation between policy instruments does not mean that policy approaches should follow one single line. Authors seen to agree that a package of diversified policy instruments integrated into coherent policy packages can be more effective. However, if these several policy instruments are not seen as part of one unified policy and its co-effects are not dealt with, its effectiveness and efficiency will surely be reduced (White & Green, n.d.; Uyterlinde and Jeeninga, 1999; Worrell and Price, 2001; Boardman, 2004).

The difficulty is that the policy making process is too complex to ensure that this is always done, especially since there is lack of supporting methodologies and tools. In the policy integration literature much can be found on the necessary steps for policy integration (normative, organisational and procedural). However, these suggestions are more directed towards the integration of policies than of policy instruments. As a starting point to gain insights into concrete suggestion for the integration of policy instruments it seems to be more useful to look into the many analyses of individual instruments made, despite the fact that these intrinsically result from a non-integrated approach and thus provide limited input towards the development of a generic policy framework.

On a different level, and because the role of public policy has been recurrently discussed in relation to the liberalisation of electricity markets, it is relevant to state here that to minimise conflicts in policy instruments, governments should have a strong role in policy development and implementation sending out clear signals to stakeholders (this view is shared by many authors, such as Boardman, 2004; Wuppertal, et al., 2000; Uyterlinde and Jeeninga, 1999). Not only that, but also governments should pay more attention to the signals sent by the stakeholders to 1) minimise distortion of policy goals due to lobbying (at policy development level), and 2) ensure stability at policy implementation level.

Conclusions

This paper clarifies the concept of overlaps of two or more policy instruments by establishing a relation between the relevance of overlaps and the extent to which: 1) target stakeholder are shared, and 2) their steering effects occur within related policy goals. If there are relevant overlaps in policy instruments co-effects between them will occur, i.e. effects on each other felt at the level of its intended steering effects. These can be complementary, synergetic or antagonistic. An approach is presented to systematically assess overlaps and co-effects of policy instruments at the levels of its objectives, mechanisms and targeted stakeholders.

The overview of energy and environment policy instruments in place along electricity systems shows that indeed a tangled web of policies exists, sometimes pushing towards complementary objectives but most of the times clearly antagonistic. The seemingly most relevant conflicts are between hidden subsidies provided to energy supply infrastructures and environmental command-and-control regulation. Although there are policy instruments acting both on the supply and the demand side, this does not lead to integration of supply and demand-side policy instruments. Due to lack of information on analysis of policy instruments it is not possible at this stage to assess the relevance of the identified co-effects regarding overall efficiency, effectiveness and equity. More work is needed on methodologies for the qualitative and quantitative assessment of co-effects of policy instruments. The approach to assess co-effect presented in this paper concerns the interactions between policy instruments and therefore is limited to only two of the components of the policy process (the policy instruments and actors or stakeholders). The other components - objects, goals and the structures and procedures – are not approached here. It has to be noted that to achieve policy integration it is not enough to simply secure the integration of its instruments, because the effects of the policy instruments are dependent of the context and thus of all the other components of the policy process. Nonetheless integration at level of the policy instruments is a good starting point towards the integration of the policy processes in all its components.

Appendix A

Table 3. Overview of some energy and environment policy instruments in place along electricity systems

#	Policy Instrument/Mechanism	Objective of the instrument [a]	Target stakeholder [b]	DPSIR	Responsible for implementation & implementation date [c]	Supply / demand	Example
	Command and Control						
C1	Uniform emission standards (air, water & soil)	Reduce emissions by setting uniform emission limit values per sector/activity	Industry & services (primary energy suppliers & generators are covered by IPPC)	Pressure	Environmental agency 1970 (air) & 1975 (water)	Supply & Demand	NO_x, SO_2, VOC, particles, metals, P, NO_3, organic pollutants among other – several Directives
C2	Fuel[9] specifications	Reduce emissions to air	Industry, electricity generators, primary energy suppliers	Pressure	Energy agency 1975	Supply & Demand	S content in heavy fuel oil - Directive 99/32
C3	Water & air quality objectives	Minimise risk of environmental damage	_	Impact	Environmental agency 1975 (water) & 1980 (air)	Supply & Demand	NO_x, SO_2, O_3, Pb, particles, benzene, CO, metals, pesticides, micro organisms, among other-Directives 99/30, 00/69, 02/3, 76/160, 98/83
C4	Restrictions of use of certain substances / products	Reduce emissions by decreasing use of substances	Industry (manufacturers of products using such substances), although other stakeholders that use products have to adapt	Pressure	Economy/ industry agency 1976	Supply & Demand	O_3 depleting substances - Regulation 3093/94, F-gases – COM (2003)492, biocidal products-Directive 98/08, VOC in paint &varnish-Directive 04/42
C5	Land use restrictions	Minimise environmental impacts by restricting access	All	Impact	Municipalities, regional and national authorities 1979	Supply & Demand	Natura 2000 network – Directives 79/409 & 92/43; national action in all member states
C6	Efficiency Standards	Increase end-use energy efficiency in buildings, household appliances and industrial processes	Builders & industry (manufacturers of appliances & other)	Pressure	Energy Agency 1996	Demand	Directives 92/42, 96/57, 00/55 (household appliances), 02/91(buildings), Proposal for Eco-design framework in Energy-using products-COM(2003) 453, national regulation in Portugal & Sweden
C7	Individual emission standards – IPPC permits	Reduce emissions by setting individual emission limit values based on Best Available Techniques	Industry, electricity generators, primary energy suppliers	Pressure	Environmental agency 1999	Supply & Demand	Directive 96/61
C8	Emission reduction plans	Reduce emissions by implementing individual reduction plans	Industry & services that use solvents above certain limits	Pressure	Environmental agency 2001	Demand	Directive 99/13 for VOC emissions

[9] Since transportation is not included in the scope of this paper the lead content of petrol and sulfur content of diesel are not considered in the table.Although these fuels are used by other sectors than transport, the quantities are not relevant when compared to other fuels.

#	Policy Instrument/Mechanism	Objective of the instrument [a]	Target stakeholder [b]	DPSIR	Responsible for implementation & implementation date [c]	Supply / demand	Example
C9	Energy saving targets	Ensure more efficient end-use of energy by imposing annual energy saving standards	Member States (ensure action by retail suppliers / distributors)	Driving Forces	Energy agency 2004-2006	Supply (?)	Proposal for Directive on the promotion of End-use efficiency and energy services- COM (2003)739 final
C10	Water use restrictions	Minimise risk of environmental damage	_	Impact	Environmental agency 2008	Supply & Demand	Water Framework Directive 02/60
	Economic/Market based						
	Tradable permits/quotas						
T1	White Certificates	Increase end-use energy efficiency by issuing mandatory targets for improvements combined with tradable titles	Energy distribution companies (that implement activities in Industry, services & households)	Driving forces	Energy agency and distributors of gas and electricity 2002	Supply (?)	UK Energy Efficiency Certificate Trading & Italy Energy Efficient Titles
T2	Green Certificates	Increase electricity generated from renewable sources by issuing mandatory targets combined with tradable titles	Electricity generators	Driving forces	Energy agency 2001	Supply	Belgium, Italy, Netherlands, Sweden, UK
T3	CO_2 emission trading	Reduce emissions	Industry, electricity generators, primary energy suppliers	Driving forces	Environmental agency 2005	Supply & Demand	Directive 2003/87
	Price						
P1	Tax exemptions, rebates and incentives for investments	Promote economic development; security of energy supply	Industry, electricity generators, primary energy suppliers	Driving forces	Finance ministries 1970's	Supply & Demand	DK abolished payment of royalties on gas and oil production; tax exemptions provided to less profitable NL gas fields.
P2	On-budget aid to the coal & gas industry infrastructures	Promote regional economic development; security of supply & lower emissions (for gas)	Coal & Gas Industry	Driving forces	Finance ministries & EU 1990's	Supply	Denmark, Greece, Ireland and Spain have provided state aid to the gas infrastructure, Germany supports domestic coal mining
P3	Emissions charges and taxes	Reduce emissions by internalisation of env costs; cover cost of policies & raise revenues	Industry, electricity generators, primary energy suppliers	Driving forces	Finance ministries 1992	Supply & Demand	NO_x charge in SE & tax in DK, SO_2 tax in SE, CO_2 tax in FI & DK
P4	Energy taxes	Reduce environmental damage by internalisation of env. costs, cover cost of policies & raise revenues	Consumers (industry but mainly services & households)	Driving forces	Finance & environmental 1997 (electricity in FI) 2001 (UK levy)	Demand	Directive 03/96, UK climate change levy, electricity consumption tax in FI; combined energy & CO_2 tax in NL
P5	Subsidies to renewable electricity or from CHP	Increase electricity generated from renewable sources or combined heat and power production	Electricity generators	Driving forces	Electricity regulator 2001	Supply	Portugal, Denmark, Germany, Spain use different approaches as feed-in tariffs; obligation to purchase & competitive tender
	Moral suasion and voluntary initiatives						

#	Policy Instrument/Mechanism	Objective of the instrument [a]	Target stakeholder [b]	DPSIR	Responsible for implementation & implementation date [c]	Supply / demand	Example
V1	Information campaigns	Increase awareness (typically for increasing end-use energy efficiency)	All, most usually households & services	Driving forces	Energy agencies, municipalities & retail suppliers 1970's	Demand	Off, really off? In Germany; DK info on electricity bills and many more at national level; EU level Public Awareness Campaign for Energy Sustainable Europe
V2	Voluntary agreements	Increase end-use energy efficiency	Industry & services	Pressure	Energy agency 1990's	Demand	NL Energy Covenants; also in DK, DE, FR, SE, IR, SP; EU Green light Programme; The European Motor Challenge Programme, Energy Star Programme, EU stand-by initiative
V3	Labelling on electricity consumption	Increase end-use energy efficiency by providing information on electricity consumption	Manufacturers of appliances	Driving forces	Energy Agency 1992	Demand	Directives 92/75, 94/02, 95/03, 95/12, 96/60, 97/17, 98/11, 02/40, 03/66
V4	Certification of environmental management systems	Improve overall environmental performance	All	Driving forces	Certification organisations 1993	Supply & Demand	EU Regulation 761/2001 (EMAS) ISO 14001 standards
V5	Green procurement	Reduce environmental impacts all al levels by taking into account environmental criteria when procuring goods, services <u>or</u> work	All consumers	Driving forces	1980's (some Member States), 2004 (EU public procurement), 2006-2012 (EU proposal)	Demand	Directives 04/17 & 04/18 for EU public procurement, Proposal for Directive on the promotion of End-use efficiency and energy services-COM (2003)739 final
	Other						
O1	Environmental impact assessment	Minimise environmental impacts by imposing minimisation/mitigation measures	Industry, electricity generators, primary energy suppliers	Pressure	Environmental agency 1985	Supply & Demand	Directive 91/11
O2	Unbundling (Liberalisation of electricity market)	Improve efficiency of electricity supply, price gains & quality of service	Electricity companies: Generators, transmission, distribution & retail supply	Driving forces	Energy agency, electricity regulator 2004	Supply & Demand	Directive 03/54
O3	Environmental liability	Prevent and remedy environmental damage by creating obligation to bear the cost of preventive and remedial action	Industry, electricity generators, primary energy suppliers	Driving forces	Environmental agency 2007	Supply & Demand	Directive 04/35

[a] The objective refers to the explicit objective of the policy instrument. [b] Refers to the stakeholders that are directly targeted, i.e. those whose behaviour the policy instruments primarily aims to steer and thus does not consider the indirect effects over other stakeholders. [c] Year of first implementation of such type of instrument across the EU

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